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A Review of Research on Bamboo Wood Composite Structures

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Abstract: As one of the industries most closely related to human social life, the construction industry is beginning to transform towards green buildings and intelligent construction in the context of the new era. Bamboo and wood, as natural biomass materials, have excellent mechanical properties and convenient material extraction, which will help them occupy a place in the future construction industry. The mechanical properties, bonding performance, and deformation performance of bamboo and wood materials are similar, and they can jointly bear forces under load, with consistent deformation. The combination of bamboo and wood provides an environmentally friendly choice for construction. By combining bamboo with excellent mechanical properties and rapidly growing economic tree species, bamboo wood composite materials can not only achieve better mechanical properties, but also effectively improve structural quality and achieve efficient utilization of green building materials. Therefore, this article combines the existing national conditions of green resources in China and the current research status of bamboo and wood structures.

Keywords: Bamboo; Wood; Bamboo Wood Composite.

1. Introduction

Bamboo and wood are natural green building materials. China has a long history of bamboo and wood structure architecture. Since the 21st century, with the rapid development of China's national economy, the concept of sustainable development has gradually penetrated people's hearts, and people's demands for health and livability have become increasingly strong. The country has successively proposed development strategies for green buildings and prefabricated buildings. Taking the "14th Five Year Plan for Building Energy Conservation and Green Building Development" as an example, by 2025, the energy-saving renovation area of existing buildings in China will reach 350 million square kilometers, the construction area of ultra-low energy consumption and low zero energy consumption buildings will reach 50 million square meters, and the proportion of prefabricated buildings in urban new construction will reach 30%. Obviously, the development of modern bamboo and wood structures in China has ushered in a dawn.

Bamboo and wood are the only natural green building materials [1], and bamboo and wood structures are recognized as green building structures. Wood absorbs carbon dioxide and releases oxygen during its growth process; According to statistics, for every 1m3 of tree growth on average, it can absorb 1 ton of carbon dioxide and release about 727kg of oxygen. Wood has outstanding carbon sequestration effects; Bamboo material is a very typical ecological material, taken from nature, belonging to nature, forming a harmonious cycle, with many characteristics such as aesthetics, artistry, and environmental protection. The process of bamboo and wood growth is also a process of beautifying the environment. Bamboo and wood buildings can coexist harmoniously with people, regulate indoor temperature, humidity, and carbon dioxide concentration, alleviate fatigue and mental stress, and meet the development needs of ecological livability. The bamboo and wood components are manufactured in the factory and assembled on site, fully meeting the basic requirements of installation style construction. Therefore, developing the bamboo industry structure is one of the important ways for China to achieve green development, ecological livability, and socio-economic development. Many European countries are confused about the widespread use of renewable materials in the construction process, and the Russian Federation is also seeking to improve the energy efficiency of structures and materials, while not ignoring the load-bearing capacity and durability of structures [2]. At present, glued wood and glued bamboo have been applied in civil engineering structures, especially in industrialized countries abroad where glued wood structures are widely used. As the main form of modern bamboo structures, glued bamboo originated in China and has already formed a certain influence internationally. Developing structural components composed of wood and bamboo, and implementing their application in civil engineering structures, can fully utilize the advantages of bamboo and wood, and provide various energy-saving, environmentally friendly, aesthetically pleasing, mechanically good, lightweight, and practical structural components for the engineering community.

At present, there is little research on glued bamboo wood composite components both domestically and internationally. Generally, engineering bamboo and engineering wood are glued separately as structural components, such as glued wood, rotary cut laminated wood (LVL), orthogonal glued wood, Glubam glued bamboo, etc. This project uses a composite component made of glued bamboo and rotary cut board glued wood as the object of stress performance research. Rotary cut board glued wood (LVL) is an engineering wood product made by laminating veneer along a certain texture direction and hot pressing bonding. It has the advantages of high raw material utilization, uniform material, high strength, and good dimensional stability. Bamboo also has the characteristics of fast growth, high yield, and excellent mechanical properties.

2. Research Status of Rotary Cut Laminated Wood (LVL) at Home and Abroad

Spin cut laminated wood [3] (also known as single-layer laminated wood), Laminated Veneer Lumber, LVL, abbreviated as LVL, originated in North America in the 1970s and has since been widely used in North America and Europe. LVL is an engineering wood product made by laminating veneers with a certain thickness (3-6 mm) along a certain texture direction and bonding them through weather resistant adhesive hot pressing. Europe divides LVL into LVL-P and LVL-C based on the grouping method of veneers. Among them, LVL-P veneers are all arranged in a longitudinal pattern, while about 20% of LVL-C veneers are arranged in a transverse pattern. Unless otherwise specified, LVL generally refers to LVL-P. LVL-C is an orthogonal glued panel product with lower grain strength and stiffness than LVL-P. However, due to the transverse assembly of some single boards, it also has certain transverse strength, stiffness, connection ductility, and dimensional stability. Compared with engineered wood such as orthogonal laminated wood (CLT) and laminated laminated wood (Glulam), the size of LVL is not limited by the size of raw materials, and it can fully and efficiently utilize small diameter grades and short materials to meet the strength and stiffness requirements of the structure. Compared with solid wood, LVL production process can effectively remove natural defects in wood, and has advantages such as uniform material, high strength, and good dimensional stability, which can meet the construction requirements of wood structures, bridges, and other engineering fields. In addition, LVL has a high degree of prefabrication, making it easy for post processing such as drilling, cutting, and installation, and can be used in modern prefabricated wooden structures.

At present, there is slightly less research on LVL as a structural component both domestically and internationally. Among them, more research is focused on bending components and finite element numerical simulation of LVL components. The research level of LVL compression components is slightly lower than that of LVL bending components. The following will introduce them in sequence.

Masaeli Mahyar et al[4]. used finite element analysis to explain the interaction between bolts and wood under different loading scenarios and bolt arrangements, and predicted the interaction behavior of bolt connections and self tapping screw connections. We discussed the structural response and failure modes under various connection combinations, and developed interaction curves and expressions. In addition, Duriot Robin[5] compared the mechanical properties of Douglas fir heartwood LVL with Norwegian spruce (Norwegian spruce Kerto/S) structural materials, mainly to understand the main mechanical properties of Douglas fir heartwood LVL. At the same time, Kim Tan Khai et al.[6] evaluated the static bending performance of the structural dimensions of Malaysian tropical broad-leaved trees Heritage spp. and Pometrics spp. According to the four point bending test, evaluate the influence of loading direction on the bending specimen in parallel and perpendicular to the wood grain direction.

Francisco J. Rescalvo[7] conducted beam bending tests to investigate the flexural performance of fiber-reinforced composite (FRP) reinforced LVL (Laminated Veneer Lumber) beams. The variables included wood type (Douglas fir or poplar), reinforcement type (bidirectional carbon, unidirectional carbon or basalt), Veneer mass, and Veneer orientation (straight or edge) in the beam. The test results showed that unidirectional carbon provided a significant improvement (for the flat layer, the elastic modulus increased by more than 40%, and the maximum stress increased by more than 20%, for both types of wood). In addition, Wanzhao Li et al.[8] made poplar LVL layers to inspect single board lathes, including lathe inward inspection (TLLT), lathe outward inspection (LTTL), and one layer lathe outward inspection (LTLT). Measure the macroscopic compressive strength of the specimen using a universal testing machine. Regular recording of changes in microstructure using X-ray CT shows that the compressive strength of LTLT is significantly higher than that of LTTL and TLLT type LVL. Micha ł Marcin Bakalarz et al.[9] conducted experimental studies on the flexural performance of reinforced wooden beams using full-size beam components made of 45 × 200 × 3400 mm single-layer laminated wood (LVL). Two carbon fiber reinforced polymer (CFRP) reinforcement lines were glued into a rectangle at the bottom of the component using a two-component epoxy resin (0.62% reinforcement ratio). The test results indicate that the failure mode of reinforced components varies greatly, manifested as tension, compression, or lateral torsional buckling. The strain readings indicate that the compression characteristics of the single panel are more utilized in the specimens reinforced with carbon laminates.

Ali Awaludin et al.[10] evaluated the bending performance of non prismatic beams made of laminated veneer lumber (LVL) by developing finite element algorithms that can be implemented in MATLAB software. This algorithm is capable of simulating different values of elastic modulus in tension and compression, as typically seen in wood. The Hill yield criterion and related flow rules were used in the calculation. And numerical results were compared with experimental data from a previous study, which used three non prismatic (conical) beams with a length of 4000 millimeters and cross-sectional dimensions of 200 millimeters by 200 millimeters at one end and 200 millimeters by 400 millimeters at the other end. The finite element analysis results indicate that after plastic deformation of the outermost compressed fiber, the tensile side of the beam fails, leading to its failure. This phenomenon has also been observed in previous research tests.

Necmi Kahraman et. al. [11] conducted diagonal compression tests on the prepared specimens to study the stability performance of curved laminated wood components. The difference in maximum diagonal compressive strength between beech laminated board and oak laminated board is not statistically significant, and most low strength samples are composed of laminated pine wood.

Gao Lili et al.[12] fabricated 21 LVL composite columns with different spacing of nail and bolt connections, and conducted axial compression tests on them. Through experimental data and bearing capacity calculation analysis, it was found that the nail spacing of 60mm effectively constrained the LVL composite columns, and the ultimate test bearing capacity exceeded the calculated bearing capacity by nearly 5%. Therefore, with a reasonable determination of the safety factor, bolted LVL composite columns can be used for the design of axial compression members. Similarly, Dong Guoqing et al.[13] studied the bending performance of adhesive LVL laminated beams, including 20 Italian poplar LVL beams, 3 Chinese fir LVL beams, and 6 original wood beams. The focus was on studying the failure forms, failure mechanisms, and ultimate flexural bearing capacity of flexural components. Explored the effects of veneer thickness, flexural component volume, and LVL tensile strength on the flexural strength of flexural components; And an analysis was conducted on the relationship between the bending stiffness of LVL flexural components and the number of layers in the cross-sectional laminates. The experimental results show that LVL bending components have significantly improved strength and stiffness compared to sawn timber, which can significantly improve the structural performance of wood and increase its utilization rate. In addition, Li Shihong et al.[14] made a batch of test columns using fast-growing poplar LVL and reinforced them with carbon fiber cloth hoops. They conducted axial compression tests and selected a reasonable column section form through the experiment. The results indicate that the use of carbon fiber cloth hoops can improve the bearing capacity and ductility of poplar LVL columns.

For the first time, Liu Yinan et al[15]. tested the properties of different specifications of poplar veneer laminated timber through full-scale testing, and analyzed the effects of experimental methods and specimen size on the mechanical properties of poplar veneer laminated timber, such as static bending strength, elastic modulus, compressive strength, and tensile strength. The test results show that the width of the poplar veneer laminated timber specimen has a significant impact on the material's performance. The wider the width, the more defects appear in the specimen, and the lower the performance.

The research on LVL material properties is also a focus. Wang Xiaoqing et al.[16] conducted this study under laboratory conditions, using poplar veneer and bamboo curtain as the main raw materials, water-soluble low molecular weight phenolic resin as the adhesive, to prepare bamboo wood composite reinforced laminated veneer; Establishing the relationship between material properties and process factors using six variables: thickness of poplar veneer, resin concentration, compression rate, grouping method, hot pressing time, and hot pressing temperature, and identifying the optimal process parameters for preparation; At the same time, the coating performance of the material was studied.

Liu Hongwei et al.[17] formed a composite beam with I-shaped cross-section by combining laminated veneer lumber (LVL) and cold-formed thin-walled steel through structural adhesive. The shear span ratio, web and flange LVL thickness of the composite beam were used as parameters to conduct shear performance tests on 9 steel-LVL composite I-shaped beams. The failure phenomena, failure modes, stress changes, and deflection development under different loads were observed, and the influencing factors of shear bearing capacity were analyzed in depth. A calculation method for the mid span deflection and shear bearing capacity of the composite beam was proposed. The test results showed that the overall working performance of the steel-LVL composite I-shaped beam was good, and the combination effect was significant.

Liang Xingyu et al.[18] aimed to improve the technical content and added value level of domestic laminated veneer lumber (LVL) products by designing and manufacturing I-beams of the same specification using Yiyang LVL of the same batch A and B grade, which have been dynamically graded by elastic modulus mass, and conducting mechanical performance studies on them. The average elastic moduli of specimens A and B were 13.16 GPa and 11.09 GPa, respectively; And the performance tests of compressive bearing capacity and shear bearing capacity were carried out on the I-beam specimens. The conclusion indicates that the average compressive and shear bearing capacity of I-beams manufactured with A and B grade LVL flanges meet the design requirements. Among them, the average compressive and shear bearing capacity of I-beams manufactured with A grade LVL flanges are better than those manufactured with B grade LVL flanges.

Fu Haiyan et al.[19] designed LVL components assembled in a "vertical horizontal vertical" manner to improve the deformation resistance of laminated veneer lumber (LVL) wood composite doors, and conducted performance testing on the components and wooden door products. The results show that the new type of "vertical horizontal vertical" LVL components have stronger uniformity when subjected to forces on parallel and vertical panels, and their overall mechanical properties are significantly better than ordinary LVL components. The horizontal shear strength, static bending strength, and elastic modulus of the wooden composite door leaf made from them are 28%, 14%, and 11% higher than ordinary wooden composite door leaves, respectively.

Zhong Wei et al.[20] used a composite material of glass fiber cloth and carbon fiber cloth, as well as a step-by-step hot pressing method to enhance the mechanical properties of poplar veneer laminated timber. They studied the laying position of glass fiber cloth and carbon fiber cloth composite materials and the influence of step-by-step hot pressing method on the mechanical properties of poplar veneer laminated timber. The results show that both reinforcement methods have significant effects on the static flexural strength (MOR) and elastic modulus (MOE) of poplar veneer laminated timber. Zhou Chao et al.[21] measured a series of mechanical properties such as compressive strength, compressive modulus of elasticity, tensile strength, tensile modulus of elasticity, as well as shear strength, density, and moisture content of LVL specimens made of poplar wood, in order to understand the material characteristics of LVL made of poplar wood and lay the foundation for further research on the performance of LVL full-size wooden columns.

Shan Liang et al.[22] conducted structural performance tests on compression members using fast-growing poplar wood from northern Jiangsu as the raw material for LVL components. And tested the moisture content, compressive strength along the grain, and horizontal shear strength, with a focus on studying the failure mode, failure mechanism, and compressive ultimate bearing capacity of column compression components. Compared with domestic and foreign standards, the feasibility of using fast-growing poplar wood as a structural component has been verified. The results showed that compared with sawn timber, the compressed components made of rotary cut plywood significantly improved the stiffness and strength of poplar wood material. By making wood, the structural performance can be improved and the utilization rate of wood can be increased.

For the axial compression test of glued laminated timber columns, Zeng Dan et al.[23] learned that current research on fast-growing larch glued laminated timber columns in China is mainly limited to short columns. In order to study the axial compression mechanical properties of medium and long columns, five groups of glued laminated timber columns with different slenderness ratios were tested and studied, analyzing the changes in vertical strain, lateral strain, lateral displacement, and ultimate bearing capacity with the slenderness ratio, and exploring the failure mode and mechanism of long columns. The experimental results show that as the slenderness ratio increases, the ultimate bearing capacity of glued laminated wood columns gradually decreases, and gradually transitions from strength failure to instability failure.

3. Current Research Status of Glued Bamboo at Home and Abroad

Bamboo has the characteristics of fast growth, high yield, and excellent mechanical properties. Bamboo engineering materials can be dismantled, migrated, and replaced at any time, making it convenient for regeneration and utilization, which is in line with the concept of sustainable development. Research on bamboo at home and abroad has reached a new height. Under the leadership of international bamboo and rattan organizations, top structural engineering scientists at home and abroad have participated in the research of engineering bamboo. The current research status of engineering bamboo at home and abroad is as follows:

Z Li et al.[24] tested two types of glued bamboo beams made from different pre treated bamboo boards. One type of micelle sample is made of 2mm thick thin layer bamboo strips, while the other type is made of 5-6mm thick layer bamboo strips. The test results of full-size beams indicate that rubber beams have elastic brittleness, similar to typical wood based beams. B. Shan et al.[25] applied the non-destructive ultrasonic testing method of concrete to the quality inspection of cold pressed adhesive lines in adhesive layer bamboo (adhesive line) components, with a focus on using non-destructive ultrasonic testing to assess the gap filling ability of the adhesive and the defect threshold of the adhesive line. W. K[26] such as conducted 72 compression buckling tests on structural bamboo to study the compressive buckling performance of bamboo with different structures. Through experimental research, a structural bamboo column buckling limit state design method based on improved aspect ratio was established, and careful calibration was carried out based on experimental data. The results indicate that for long columns, the average model factors of this design method under natural and humid conditions are 1.63 and 1.86, respectively. In addition, Hai tao Li et al.[27] studied the compressive performance of 24 laminated bamboo specimens from three different growth sites, with cross-sections of 100 mm and 100 mm for each sample, respectively. The load strain and load displacement relationships were obtained through compression tests, and the failure modes, compressive strength, and elastic modulus of all specimens were reported in detail. The results indicate that the average compressive strength increases with the increase of the height of the growing part, and the change in compressive strength also increases with the increase of the height of the growing part. Meanwhile, Michael J. Richard et al.[28] studied the element buckling ability of single and multi stem bamboo columns, tested four single stem columns to obtain their capacity, and conducted comparative tests to determine the behavior of short pin end conditions. Then three multiple columns were tested to investigate the ultimate capacity and buckling behavior of these elements. S. C. Zhou[29] conducted axial compression tests on two groups of 45 Glubam glued bamboo columns with different aspect ratios to study the compressive properties of glued bamboo columns. The experimental results indicate that the main failure mode of short columns is strength failure, while slender columns typically exhibit buckling failure. The comparison between the experimental results and the column design curves in the Chinese and European American wood structure design specifications indicates that all specifications can provide sufficient conservative predictions for the experimental results.

Xie Yazi et al.[30] conducted axial compression tests on 6 groups of 18 specimens with different slenderness ratios to investigate the axial compression performance of bamboo composite columns under lateral compression. They analyzed the relationship between their bearing capacity, strain, lateral displacement, axial displacement, and slenderness ratio, and explored the failure modes of specimens with different slenderness ratios. The results indicate that the stress process of the lateral pressure bamboo integrated timber column has gone through elastic, elastic-plastic, and failure stages. With the increase of the aspect ratio, it transitions from material strength failure to instability failure, and the material failure has obvious ductile properties. The experimental results were compared and analyzed with the calculation results of current specifications, and a formula for calculating the axial compressive bearing capacity of bamboo composite columns under lateral compression was proposed. The calculated values were in good agreement with the experimental values. Li Qihang et al.[31] conducted shear performance tests on 14 bamboo wood glued rectangular beams using the shear span ratio λ and the beam assembly method as parameters. They analyzed the failure process, failure mechanism, deformation, and bearing capacity, studied the influencing factors on the shear performance of glued beams, and proposed a calculation formula for the shear bearing capacity of glued beams. The research results indicate that bamboo wood laminated beams have outstanding overall performance, good shear resistance, and can maximize the mechanical properties of the material. Li Tianyu et al.[32] proposed an assembled composite connector with screw wrapped reactive powder concrete (RPC) to address the performance shortcomings of existing groove connectors and pin connectors. The experimental results show that the outsourcing RPC layer has a significant contribution to the shear performance of composite connectors, and the anti slip stiffness and shear bearing capacity increase with the increase of the outsourcing RPC thickness; The most important factor affecting the shear performance of connectors is the outer diameter of the connector, not the diameter of the screw; Composite connectors have both high stiffness and high ductility, and are suitable for assembly construction. Four point bending tests were conducted on two prefabricated glued bamboo concrete composite (BCC) beams using composite connectors. The results showed that the prefabricated BCC beams exhibited partial composite effects during the bending process, and the composite connectors near the ends produced significant shear deformation, making the composite beams have obvious signs of failure before failure. The vertical pull-out construction measures of the composite connectors are reliable; Setting up a lightweight aggregate concrete composite layer can significantly improve the bending stiffness and bearing capacity of BCC beams while effectively controlling their own weight.

Liu Changhao et al.[33] conducted eccentric compression tests on glued bamboo columns with different eccentricities. The research results indicate that for different eccentrically compressed column specimens, the ultimate failure is due to the first fiber fracture on the tensile side near the mid span; As the initial eccentricity increases, the ultimate load of the specimen decreases, and the lateral deformation of the specimen increases under the same load; During the bending deformation process, the lateral deflection curve of the specimen basically conforms to the sine half wave curve, and the average strain of the mid span section of the column basically follows a linear distribution, which is consistent with the assumption of a flat section; At the same time, a suggested calculation formula for the ultimate bearing capacity of laminated bamboo columns under eccentric compression was provided, and the calculation results were in good agreement with the experimental results. Lv Xiaohong[34] introduced the axial compression tests of glued laminated bamboo columns under different slenderness ratios, and compared and analyzed the test results with the theoretical results of wood structure design in GB 50005-2003 "Code for Design of Wood Structures" and the United States "National Design Specification for Wood Construction", and proposed some suggestions for the design of glued laminated bamboo columns. Sujie et al. established a finite element analysis model of glued bamboo wood beams using ABAQUS, analyzing the bending performance of glued bamboo wood beams from the aspects of bamboo board layout position, bamboo board quantity, and beam section height. The analysis results were compared and analyzed with experimental results. The results show that the bearing capacity of glued bamboo wood beams is 31.4% to 133.3% higher than that of pure eucalyptus LVL beams; The simulated values of glued bamboo wood beams are in good agreement with the experimental values; The bending stiffness of glued bamboo wood beams is significantly improved compared to eucalyptus LVL beams; For the same cross-section with different bamboo board arrangements, the stiffness of placing one layer of bamboo board above and below the beam is significantly greater than that of placing one layer of bamboo board at the bottom of the beam; The arrangement of bamboo boards with the same section height is different. As the height of the beam section increases, the bending stiffness of the beam increases significantly; The beam cross-section is the same, and the more bamboo boards are arranged at the bottom, the less significant the increase in beam stiffness.

4. Current Status of Research on Bamboo Wood Composite Structures

Based on the relatively small forest area and the fact that wood is in a long growth period in China, wood cannot meet the demand of the construction market. On the contrary, China is the world's largest producer of bamboo, accounting for 1/5 to 1/4 of the world's total bamboo forest. At the same time, bamboo has advantages such as fast growth. Therefore, according to the concept of "replacing wood with bamboo", using bamboo resources in China's building structures can achieve high practical value and environmental benefits. Bamboo wood composite structure is a natural biomass composite structure that utilizes bamboo with excellent mechanical properties and rapidly growing economic tree species to bond and laminate through different assembly methods, resulting in better mechanical properties. It can fully utilize the material characteristics of bamboo and wood. In the 21st century, Xiao Yan et al.[35] combined the CLT orthogonal assembly concept and further proposed the orthogonal glued bamboo wood structure (also known as orthogonal or staggered glued bamboo wood, abbreviated as CLBT), and conducted research and experimental verification on the mechanical performance of CLBT components such as beams, slabs, and columns[36].

The bamboo wood composite structure conforms to the development trend of green buildings in China. Although it has not been widely promoted in practical engineering, more research is focused on the mechanical performance of bamboo wood composite structures. Chinese scholars have conducted a series of studies on the bending performance, shear performance, and compression performance of bamboo wood composite structures.

For the bending performance of bamboo wood composite structures, Liu Hong et al.[37] found that pasting bamboo laminated wood on the upper and lower parts of LVL bending members increased the ultimate bearing capacity of the specimens by 10% to 50%. And derive a formula for calculating the ultimate bearing capacity of bamboo wood composite beams. Research by Leng Yubing et al.[38] has shown that the load-bearing capacity and deformation performance of wood beams bonded with recombinant bamboo and spruce are better than those bonded with pure spruce. Regarding the shear performance of bamboo wood composite structures, Zhu Qiwei[39] found that a new type of bamboo wood composite beam was formed by bonding bamboo laminated timber and Northeast larch LVL as raw materials. The main failure mode in the bending shear test was shear failure, similar to short beam shear failure. The shear failure process of bamboo wood composite beams was accurately simulated using ABAQUS. Regarding the compressive performance of bamboo wood composite columns, Yang Xiaobo [40] found that the bearing capacity of bamboo wood composite hollow columns increased by 20.1% compared to hollow glued wood columns, indicating that bamboo veneer has a strengthening effect on wooden columns. According to domestic wood structure design specifications, the compressive stability coefficient of bamboo wood composite hollow columns was calculated to be 1.08, which is higher than that of hollow glued wood columns.

5. Summary

For the research on LVL and engineering bamboo by domestic and foreign scholars, there is detailed reference data for the bending component test of LVL, while there is slightly less research on the compression component test; For engineering bamboo, there have been experimental studies on the strength failure of short columns and the buckling failure of medium and long columns. However, there is particularly little research on bamboo wood composite components, so more efforts are needed to study bamboo wood composite components. Bamboo and wood are not separated. By exploring the improvement of strength, stiffness, and stability in the stress performance of bamboo wood composite components, it will have better development prospects for the promotion and application of bamboo and wood as green and environmentally friendly materials.

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