

Research status and prospect analysis of recombined bamboo-cold-formed thin-walled steel composite columns

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Abstract

This paper introduces the advantages and characteristics of cold-formed thin-walled steel and reconstituted bamboo respectively, analyzes their application and development, and studies the development status of cold-formed thin-walled steel-reconstituted bamboo composite column. Under the background of sustainable development in China, this structure will have a broader application scope and development situation.

Keywords

Cold-formed thin-walled steel, recombined bamboo, composite column, sustainable development.

1. Research and development of recombinant bamboo

Over the years, the supply of superior quality wood materials, especially hardwood, has been decreasing, and the market price has been increasing. As a result, the conflict between supply and demand in this kind of material market is aggravated. In order to deal with this conflict, bamboo restructuring [1] came into being by using the convenient bamboo resources in southern China.

1.1. Advantages and characteristics of recombinant bamboo

Recombinant bamboo has many advantages as an environmentally friendly building material [2-3]:

(1) Recombined bamboo is light, high strength and excellent mechanical properties. Under the same load, the weight of recombined bamboo is lighter than that of other wood, so building a house can minimize the self-weight of the building and bear the load in the construction industry [4-5].

(2) The recombined bamboo has excellent seismic capacity, excellent toughness and good elasticity and plasticity. In earthquake-prone areas, the use of this material can greatly reduce the damage to building structures caused by earthquakes and increase the safety factor of buildings.

(3) The recombined bamboo has the advantages of convenient raw materials, low price and short growth cycle. Bamboo in southern China is rich in raw materials, has strong renewable ability, is easy to grow, is easily degraded by nature and does not pollute the environment.

(4) Factory processing can be carried out, and on-site assembly can be connected, thus reducing the construction period and speeding up the construction period.

1.2. Application and development of recombinant bamboo

The tensile and compressive strength of bamboo is very high, not to mention the strength of recombined bamboo. The house with recombined bamboo as load-bearing component is very firm and durable. Although recombined bamboo is a new wood material, its strength is much higher than that of concrete, and it is expected to become the main building material for future houses.

At the same time, with the rise of ideas such as "green" and "Lucid waters and lush mountains are invaluable assets", more and more people are pursuing green and low-carbon home life. Therefore, it is the general trend to develop green industries and green projects, which provides a huge market for our bamboo and wood enterprises to develop energy-saving and low-carbon new building materials.

2. Research and development of cold-formed thin-walled steel

In recent years, the strategic goal of national sustainable development has been put forward, and green and recyclable use has become advocated by the state. As a booming building material, cold-formed thin-walled steel has many advantages [6-8]:

2.1. Advantages and characteristics of cold-formed thin-walled steel

Cold-formed thin-walled steel has the following advantages:

(1) Cold-formed thin-walled steel has small dead weight, high bearing capacity and large overall stiffness. Compared with the traditional building structure, its dead weight can be reduced by 20~30%, and the cross-sectional size of the structure is obviously reduced, thus reducing the production cost. Cold-formed thin-walled steel has good ductility, so the overall seismic grade is high. In addition, there is less demand for building foundation, which is very obvious in soft soil areas [9].

(2) The production cycle of cold-formed thin-walled steel members is short, which can be processed in the workshop and directly spliced and installed on site, effectively improving the construction progress, so that the project can be put into operation as soon as possible.

(3) The section is cost-effective and can be recycled continuously. The correct component section with the most efficient stress distribution can be built according to the actual construction requirements, and it can be recycled according to the call of the national sustainable development strategy.

(4) The strength limit of cold-formed thin-walled steel structures is relatively high. Cold-formed thin-walled steel structures are produced by cold-bending treatment of materials, which will produce cold-bending effect in the treatment process, mainly in the increase of yield strength of bent parts [10].

2.2. Application and development of cold-formed thin-walled steel

In general, cold-formed thin-walled steel refers to building steel or strip steel, which is bent into different types and styles of steel at room temperature. It has excellent thermal ductility and structural characteristics, and is now widely used in buildings [11-12], such as purlins, beams, frames, building envelope structures, etc., while the thickness of cold-formed thin-walled steel is generally made up of 1.5mm-6mm strip steel and steel plates. Because the number of cold-formed thin-walled steel members is relatively small, it is relatively simple in design, manufacture and construction. In addition, because of its large steel utilization rate, the amount of steel used is also relatively economical. Splicing C-shaped and U-shaped single-limb sections into different multi-limb split-section columns with self-tapping screws and other connecting parts has gradually become an important load-bearing component of cold-formed thin-walled steel structures [13-15].

3. Research status of steel-bamboo composite

In order to improve the ultimate bearing capacity of cold-formed thin-walled steel columns, cold-formed thin-walled steel and recombined bamboo are combined into three kinds of composite special-shaped columns, namely L-shaped steel-bamboo composite special-shaped columns, T-shaped steel-bamboo composite special-shaped columns and cross-shaped steel-bamboo composite special-shaped columns. The axial compression tests are carried out on the three components, and their mechanical properties are analyzed by theory and modeling, and the feasibility is verified by experiments, which can be applied to the high-rise construction of light steel villas.

4. Conclusion

Under the background of China's sustainable development, steel structure building has set off a wave in China, but a key reason that restricts the progress of steel structure is the stability of steel structure, and cold-formed thin-walled steel members are prone to buckling, instability and damage. By combining cold-formed thin-walled steel members with bamboo, the bearing capacity of members can be achieved with minimum steel consumption, which meets the requirements of green and energy-saving buildings and has practical guiding significance for engineering. It is of great significance to change the traditional housing construction mode in China and promote the modern scientific and technological housing, which will promote the progress of industrialized housing. The steel-bamboo composite special-shaped column structure will connect the beautiful building, the flexibility of use function and the reasonable mechanical performance of the building structure, providing a good living environment for the majority of residents. In the future, China's construction industry will surely enter a brand-new period of progress, and this structure will surely have a broader scope of use and development situation.

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