

## **Timber Use in the Chinese Gardens and Architecture**

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### **Abstract**

Chinese civilization originated in the middle and lower reaches of the Yellow River – the area that is featured by distinctive four seasons and dense forests. The unique natural and climate conditions nurture the famous Chinese philosophy-Taoism, as well as its unique timber constructions. Traditional Chinese timber constructions have experienced thousands of years' of development. During this process, timber has become a favored material by the Chinese people and used widely. However, with recent economic and population growth, forest resources are decreasing, and the timber constructions can be rarely seen as timber is mainly used for non-structural industrial uses, instead. Thanks to the development of science and technology, wood products now can be manufactured with better physical properties that can last longer and be applied in a broader scope.

**Key word:** Timber Traditional Chinese architecture Five Elements

Chinese civilization originated in the Yellow River basin. The vast plain on the basin once had fertile soil, rivers, and dense forest in the ancient times. Rich wood resource provided people fine building materials. Meanwhile, it created the world famous traditional Chinese timber constructions.

### **1 Reasons why timber constructions appear and become mainstream in China**

Timber, one of the oldest building materials, has been used for thousands of years. Why our ancestors choose timber as the building materials? There are several points in the industry.

First, in the ancient times, the weather and geographical condition is suitable for growing plants in the Yellow River basin. The dense forest and river here make it easy to get raw materials and transport them. Timber becomes the first choice to build houses because it is lighter and more easily to cut and process.

Second, the Chinese philosophy- Taoism believes in the unity of man and nature, and yin-yang and five elements. It believes that the basic substances that compose the world are metal, wood, water, fire and soil, and each of them corresponds to one of the five directions—west, east, north, south and central. Soil represents Central on behalf of the load of all earth things and soil would have a high status. Chinese ancient buildings are often built above tall soil units. Such as Caocao's construction in the Three Kingdoms period, which is famous for poetry and famous Dongjak are built on the high platform. Ming and Qing Imperial Palace in Beijing, the hall is built on the "earth" shaped triple white marble on the platform. Behalf of the state of the Altar also adopt "colored earth" symbol. five elements of wood represent east and symbol of spring and vitality; while Gold acting on behalf of the West and a symbol of force and punishment to kill; water, fire for the intangible thing, therefore, the five elements represent the most advocates of the five substances, only "soil" and "wood" is the most suitable for the construction of housing people live. Therefore, the basic materials of the Chinese ancient architecture are "soil and timber". People live in the space surrounded by the "wood" hosted by the "soil". The yin and yang concept stresses the contrast with the conversion of the things, a tree thanks to the available material become into the pillars of the construction of Buildings, after the use of a number of years decadent gradually come into the soil which the Taoists emphasized the negative yin yang, again and again with endless process.

Third, both Taoism and Confucianism—another Chinese traditional philosophy—emphasize this life. All the buildings for people, places, government offices, houses, temples, are mainly made from wood. Timber structure buildings can be easily build, remove and renovate, just conform to the idea of emphasize this life but not eternal.

## **2 The development of timber constructions in ancient China**

Like birds' perch on the trees and beasts live in the caves, the ancient Chinese first settled in caves with wood roofs. Then the progress of technology and experience brought out pillars and beams, and later formed an integrated structure system.

The main structures of ancient Chinese timber constructions are post-and-lintel construction, column-and-tie construction and well railing construction. The first one is most widely used among the three.

The carrying beam post-and-lintel construction was added to Liang in the column and the beam also lifts the short columns with and beams also known as the stacked beam type. This framework of the roof weight by rafters, purlins, beams, columns, spread to basis. The post-and-lintel construction frame has been existed in the late Spring and Autumn Period and thanks to improvement which gradually formed a complete set of practices. See the first image is unearthed in the Eastern Han Dynasty, Chengdu, Sichuan courtyard brick, it has been developed until the Tang Dynasty and emerge of the hall and hall are two types to create a French hall Buddha Temple, Wutai, in Shanxi province.

Chuan Dou-style timber frame column along the depth direction of the housing, but more dense between column spacing, column directly under the weight of the purlins, without the overhead of carrying beam through each column and several layers of "Chuan Fang" and composed of a bundle of architecture. Chuan Dou-style is characterized by smaller column and "Chuan Fang" columns in series with the purlin direct hold on the stigma along the purlin direction, and then the bucket Fang columns in series to form an overall framework. In contrast, Chuan Dou-style timber frame materials with strong integrity, but the columns arranged in dense, only when the little indoor spatial scales (such as room, miscellaneous house) to use. But post-and-lintel construction frame can be used to span a larger beam in order to reduce the number of columns to obtain a larger indoor space; It is suitable for the construction of palaces, temples, etc. Chuan Dou-style timber frame no later than the Han dynasty is already quite mature and spread to the present. Now is common to use wooden structures in the southern China.

Wells dry wooden structure logs (or square timber) made of stacked pile structure, most of the logs by simple processing with vertical and horizontal stack to form a rectangular space. This structure not only in China can be seen but also in the forest-rich countries. As early as three thousand years ago in China the Shang Dynasty tombs found that the well was dry wooden coffin (that was sets of coffins) using. Yunnan in the Han Dynasty found objects ornamentation also can be seen this structure. According to records, the Han Dynasty in the palace garden has a tall well stem floor.

A major feature of the structure of the Chinese wood is brackets. Bracket is on the columns and beams junction from layers stuck arched bearing members. Brackets appearance made the roof can be with a greater degree of overhang so as to forming a beautiful roof contour. Two thousand years ago preserved artifacts of the Warring States era can already see the image of the early brackets. Brackets in the Tang Dynasty enjoyed development and then with the provisions of the folk may not be used. The evolution of the brackets can be seen as an important symbol of Chinese traditional wood frame construction shape and also to identify an important basis for building era of the ancient wooden architecture. Brackets' evolution in general can be divided into three stages. The first phase is the Western Zhou to the Northern and Southern Dynasties. At this point, the stigma of brackets was not links to each other and even as an independent load-bearing component. The second phase was the Tang Dynasty to the Yuan Dynasty. Then the brackets were no longer isolated components of the supporting frame or cornice, but an inseparable part of level in the framework. The third phase of the Ming Dynasty to the Qing dynasty. The brackets development was no longer play maintaining architecture integrity role. Its use of materials and scale is much narrower than the Song-style.

A number of characteristics of the structural system and architectural forms of ancient Chinese architecture to the Han Dynasty had been basically formed. Chinese ancient wooden structures in addition to widely used in palaces, temples, houses and other low-rise buildings, but also used to build multi-storey or high-level Chong building Court. Which can be seen a lot of carved architectural pattern of the story unearthed relics in the Warring States period, multi-storey pavilion since the Qin and Han Dynasty, an increase in the construction of the Northern Dynasties pavilion-style pagoda very popular and the most notably construction of the North Wei Xiping Yongning Temple in Luoyang. The height of the tower in the ancient records was more than forty Zhang (approximately 133 meters). Showing the level achieved by the wooden structure technology. Existing high-level wooden structure in kind and the released of Jiata Buddha Palace Temple in Shanxi built in 1056 (Ying County Wooden Pagoda) as representative. Since the completion to the moment was over 900 years and had experienced several earthquakes test and remained still stand.

The wooden structure of the skilled construction technology and timber processing experience economic prosperity, they generated a lot of beautiful buildings and gardens. Landscape architecture in the garden usually by the form of wooden structure - Pavilion, platform, floor, pavilion, bridge, House, Villa, Temple and the form of a wealth landscape architecture which add infinite charm to artificial garden natural landscape.

### **3 The development of timber constructions in modern China**

Timber has become a favored material by the Chinese people and used widely after a  
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long period. Yet the long-term logging has reduced the amount of large diameter class wood that is suitable for construction. To build the Imperial Palace, people in the Ming Dynasty search wood in virgin forest in Sichuan, Guangxi, Yunnan and Guizhou Provinces. Until the Qing Dynasty, the former royal special Phoebe shearer can be hardly found. In early Kangxi period, when rebuilding the Taihe Palace, the columns in the main hall is made from Manchu yellow pine, covered with spliced pieces of Phoebe shearer.

The situation is the same in folk areas. Large diameter class wood with high quality become fewer and fewer. Most fine wood is used to make furniture and decorations. Many mansions are made from similar wood but with worth performance. Ordinary houses start to use bricks instead. The division of bricks and timber usage begins from the Qing Dynasty. Kaiyuan Temple in Suzhou is a famous brick building in this period. Meanwhile, the peak of furniture design- furniture in Ming Dynasty appears. Chinese historic gardens show unity and harmony with the delicate wooden furniture.

In 1824, a British named Joseph Aspdin invented cement. Later in 1865, French gardener Joseph Monier invented reinforced concrete. Until early 20<sup>th</sup> century, some buildings designed by European designers in Shanghai, such as Asia Building, Shanghai Club and East Wind Hotel, totally or partly used reinforced concrete structure.

Because of the urban development, population increase, woodland reduction and invention of new building materials, timber has been used less and less in our daily lives. Things also happen in landscape architecture for more and more reinforced concrete has taken place of timber.

People have been exploring the antiseptic and panel processing technology over the years. In the 1830s, two patents promoted the industrialization of wood antiseptic— one is Moll's creosote antiseptic, the other is Bethel's full-cell process. The antiseptic technology extended the service life of timber and improved its weather resistance, and reduced the damage by corrosion and worms.

Chinese has used timber to make houses, furniture and decorations for thousands of years. As timber becomes a favored material by the Chinese people, the vast forest has shrunk, and many rare woods vanished. Thanks to the natural forest resources protection project, most of the natural forest and secondary forest areas have prohibited logging. Timber import is the only way to make up the shortage of wood.

#### **4 The advantages of timber**

Compared to other building materials, timber has following advantages:

(1) Compared to steel and concrete, timber is one of the green materials for trees can improve natural environment during the growth.

(2) Timber has low thermal conductivity and performs well in heat insulation. An experience shows that a 150mm thick timber structure wall has the same heat-retaining capacity with a 610mm thick brick wall, and timber constructions can save energy of 50%—70% compared to concrete structure. Timber can both comfort and feast people with its low thermal conductivity and natural wood grain.

(3) Timber is light in weight and short in building period. Timber structure can use fabricated construction which has a stronger adaptation to weather. Besides, winter construction is unconstrained for timber adapts to low-temperature operation.

(4) Being a renewable resource, timber is much better than masonry concrete and steel structure in energy consumption, emission of greenhouse gases, air and water pollution, and development of ecological response. After removing, the left materials can do a secondary operation expediently.

(5) The progress of high- performance synthetic resin glue, fire retardant, antiseptic, rotary-cut technology has improved the fire resistance and durability of wood, and save the material at the same time. Making all kinds of weather-resistant structural boards becomes available.

## **5 Conclusions**

Timber has carved deeply both in Chinese architectural history and every individual's mind. However, the long-term immoderate logging destroyed forest, vegetation and ecological environment, and almost made timber disappear from the stage of architecture. With the development of new technology, timber has returned with a brand new look. We are looking forward to timber- the beloved building material- will shine again.