

Research on the Development and Application of Masonry Arch Coupon Structure in China Ancient Academy Building

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Abstract

During the development process of over a thousand years, ancient Chinese academies have formed various types. According to their service objects, they can be divided into family academies, rural academies, local academies in prefectures and counties, royal academies, ethnic minority academies, and church academies. It can be said that the application of arch technology in ancient Chinese architecture is very extensive. The arch technology first appeared in the Lianghe River Basin in 4000 BC, and later was widely used and developed in Indian and Roman architecture. The application of arches in ancient China appeared relatively late and gradually formed in the early Western Han Dynasty. In this regard, this article discusses the development of brick and stone arch structures in ancient Chinese academy architecture. From the perspective of the ultimate function of the academy, the lecture hall should be the most important, most able to demonstrate the value of the academy, and is real. Brick and stone arch technology has perfected the architectural idea of harmony and unity with nature, forming a complete set of architectural spatial patterns, forming a gradually climaxing sequence of environmental spaces, successfully creating a strong environmental atmosphere of respecting teachers and learning, and becoming a valuable historical heritage in ancient educational architecture.

Keywords

Masonry arch structure; Ancient China; Academy buildings; Development and Application.

1. INTRODUCTION

Some people say that academies are not only the cultural name card of China, but also the name card of a specific region's culture and art. The emergence of academies has brought about significant changes in the history of ancient education, forming a new pattern of parallel development of official schools, private schools, and academies [1]. The three have become a tripod, promoting the development and prosperity of ancient culture and education. Others say that if you want to understand ancient Chinese education or culture, you should investigate ancient Chinese academies. As a private education institution, academies inherit and derive from private schools in the pre Qin Dynasty and elite schools in the Han Dynasty. During the development process of over a thousand years, academies have formed various types. According to their service objects, they can be divided into family academies, rural academies, prefectural and county local academies, imperial academies, ethnic minority academies, and church academies. The academy integrates book collection, sacrifice, teaching, and research. Its development has been influenced by official learning and Zen Buddhism. After thousands of years of trials and hardships, it has promoted the development of ancient Chinese culture and

education, and can be regarded as a wonder in the history of ancient Chinese culture and education.

Due to different types of architecture, there are also slight differences in the form of arches. For example, ancient Roman architecture was mainly characterized by semicircular arches; Gothic architecture uses pointed arches; The arches of Islamic architecture are very rich, such as pointed, horseshoe, arch, trilobal, compound, and bell shaped [2]. As a building structure, arches not only have a good vertical load-bearing function, but also have a significant role in expanding space and decorative beautification. This article discusses the development of brick and stone arch structures in ancient Chinese academy buildings. The arch, also known as a voucher hole, a circle, or a voucher, is a circular arc shaped architectural structure [3]. Prior to the application of reinforced concrete structures by the French architect Le Corbusier in the early 20th century, large span buildings that were not suitable for timber beam framing were generally constructed using several wedge-shaped masonry blocks arranged along a predetermined arc, and the shed was framed into a larger space below, which is known as a masonry arch. This spatial structure not only encloses the surrounding environment, but also supports the roof structure. Arch technology first appeared in the two river basins in 4000 BC, and later was widely used and developed in Indian and Roman architecture [4]. The application of arches in ancient China appeared relatively late and underwent several development processes, including hollow brick beams and slabs, pointed arches, and folded arches, which gradually formed in the early Western Han Dynasty.

2. THE ORIGIN OF MASONRY ARCH COUPON IN CHINA ANCIENT ACADEMY BUILDING

Arch ticket technology once got unprecedented development in ancient Rome, and became the most remarkable feature and achievement of ancient Roman architecture, which had a great influence on later European architecture. In ancient China, because the wooden frame structure system has always been the mainstream of architecture, although the masonry arch coupon technology appeared at the latest in the Han Dynasty, it was not widely used as in western architecture [5]. In this paper, the application of masonry arch coupons to the ancient academy buildings in China was discussed. As a cultural undertaking pursued by scholars in China, the academy gained prominence, and it also reflected the desire of scholars to improve their cultural quality. Academies, especially the family academies and rural academies, are numerous and widely distributed, which have undertaken the task of popularizing education in ancient China society and become the main channel to promote Confucian cultural awareness and concepts. The Tang Academy, whose main function is to collect books and proofread books, is different from the private academy, which mainly gathers disciples to give lectures.

There are two views in academic circles about the origin of ancient masonry arch voucher technology in China: one is local, and the other is western. The former thinks that masonry arch voucher technology evolved from beam-slab hollow brick tombs since the Warring States Period; The latter thought that it was influenced by Central Asian vault technology after Zhang Qian sent to the Western Regions. On the basis of collecting books and proofreading books, Lizheng Academy and Jixian Academy in Tang Dynasty added functions such as consulting, consulting, reading and lecturing. It is used for the imperial court to publish and compile classics, proofread books, collect talents, wait on reading and lecturing, undertake the purpose and plan, write a statement to be made, distinguish the grand ceremony of the country, and prepare consultants to deal with the doubts of historical records [6]. At this point, as a private gathering of disciples to tell books, the college education's function as "a place for scholars to study" has begun to take shape. Although its scale is small and unstable, it laid the foundation

for the development of academy education after the Song Dynasty and played a unique role in the development of ancient academy buildings in China.

3. THE DEVELOPMENT AND APPLICATION SCOPE OF BRICK AND STONE ARCHES IN ANCIENT CHINESE ACADEMY ARCHITECTURE

3.1. The characteristics of brick and stone arches in the location and environment of ancient Chinese academies

In ancient China, social life attached great importance to education and the selection of literati, so the construction of academies was highly valued. The environmental location of the academy has always been regarded as a symbol of "rejuvenating the local context" and "rejuvenating humanity", and is generally determined by officials, gentry, scholars, and feng shui scholars. Therefore, it is deeply influenced by traditional feng shui theories and the landscape culture of the Wei and Jin dynasties. This article attempts to study the characteristics of brick and stone arches in the location and environment of ancient Chinese academies. Arches are a kind of architectural structure, which is a combination of arches and arches, also known as bond holes and bond holes. They are a span structure system formed by using block masonry and lateral pressure generated by mutual compression between blocks. [7-8]. The site selection of ancient academies attached great importance to environmental quality and the impact of environmental landscapes on humanity. By the Ming and Qing dynasties, the symbol of the scale and grade of buildings had become the number of coupons and volts used, and the form of five coupons and five volts was used in the highest grade buildings. At this time, the arch structure had been widely used in other buildings. It should be noted that from the middle of the Tang Dynasty to the Five Dynasties, it was the founding period of Chinese academies, which were outside of official schools and above private initiation. Although the number is small, the scale is different, and there is no customization yet, it has formed the embryonic form of the construction of the academy, which has had a profound social impact.

In order to enhance the integrity of the arch and convert the tensile and bending forces into pressure, brick masonry with multiple passes forms a tubular arch side by side. A layer of brick or stone is laid on the steep brick arch along with the shape of the pass, and the arches are interconnected to further strengthen the structure of the arch. Taking the Songyang Academy as an example, as shown in Figure 1, the architectural layout of the Songyang Academy maintains the architectural layout of the Qing Dynasty. Most of the original academy's buildings have been dilapidated, and there are now over 500 halls and corridors, covering an area of 10084.4 square meters, 78.6 meters wide from east to west, and 128.3 meters long from south to north. The central axis building is divided into five courtyards, from south to north, followed by the main gate, the first sanctuary, the lecture hall, the Daotong Temple, and the library. Confucius and the four major disciples are worshipped in the Temple of the Ancestor, and the Taoist Temple houses the statues of Duke of Zhou, Dayu, and Emperor Yao. The library was originally a study for storing Confucian classics. Behind the lecture hall, there is Pan Chi, a place where Confucian disciples come back to miss the great master Confucius. The supporting rooms on both sides of the central axis are all flush gable roof style buildings, including Chengzhu Temple, Lize Hall, Boyue Room, and Stele Gallery. There are 108 of 26 Qing Dynasty buildings preserved.



Figure 1. Architectural pattern of Songyang Academy

For private colleges, the government gives funds and subsidies for land property to strengthen economic supervision; The mountain chief must be approved by the government before he can take up his post. In fact, the government has strengthened the monitoring of running private colleges. After Tai Chi College, academies from all over the country are constantly emerging. The garden landscape of the academy is relaxed and lively. As a supplement to traditional teaching, it provides a place for "traveling in the mountains" and an opportunity for "amusement" learning. In a relaxed and natural environment, it is conducive to cultivating students to learn from life and nature.

3.2. Application of Brick and Stone Arches in Ancient Chinese Academy Architecture

The experience and teaching methods of running a college are precious legacies in China's educational treasure trove, providing useful references for the development of modern higher education. Ancient Chinese academies originated in the Tang Dynasty and went through the Song, Yuan, Ming, and Qing dynasties. They not only made positive contributions to ancient Chinese culture and education, but also laid the foundation for the development of modern education. Ancient Chinese academies also underwent a development process from a wooden frame structure to a brick and stone structure, while ancient Chinese academies used arch technology more widely, such as the Songyang Academy, which also used brick arches. The founders of the academy invariably chose to run a school in a quiet and beautiful environment, allowing students to immerse themselves in a beautiful environment and be nurtured by beauty. This is a conscious attempt to incorporate the beauty of nature into the academy and make it an integral part of aesthetic education [10]. This is consistent with the use of materials and structures in ancient Chinese academy buildings, so more robust and fire-resistant brick and stone arches have gradually been promoted.

As shown in Figure 2, the gate of Songyang Academy is a three bay ovoid ridge roof style flush gable roof building. Under the eaves, there was originally a plaque with the words "high mountains stand still" and "winding paths lead to seclusion", and on the front of the door, there were four large characters: "Songyang Academy". Gold characters on a black background are simple and generous. The original plaque was the calligraphy treasure of Su Dongpo, a great calligrapher of the Song Dynasty, and is now the model book of the contemporary calligrapher of the Song Dynasty. The couplets made by Emperor Qianlong of the Qing Dynasty in the 15th year of Qianlong's reign hang on the front eaves columns on both sides of the gate. The couplet briefly explains the geographical location and surrounding beauty of the Zhongyue Songshan

and Songyang Academy. After entering the gate, there is a convex courtyard, forming two gates, which are the prelude to the academy.



Figure 2. Gate of Songyang Academy

Brick and stone arch coupons in the ancient academy buildings in China have spatially interpreted the spiritual connotation of "Academy Culture" and become its material carrier. The excellent traditional educational ideas in "Academy Culture" should be inherited and continued today, and should be grasped and embodied in the design of ancient academy buildings in China. After a long-term development of academy buildings, masonry arch technology has perfected the architectural idea of harmony and unity with nature, formed a complete set of architectural space system, formed a gradual climax of the environmental space sequence, and successfully created a strong environmental atmosphere of respecting teachers and attaching importance to learning, which has become a valuable historical heritage in ancient educational buildings.

Official learning is monopolized by the government and belongs to the privilege of the ruling class, and there are bound to be various restrictions to serve the imperial examination. As a stepping stone, even classes are not taught, the relationship between teachers and students is weak, and it is often influenced by political situation and personnel, and it is fashionable and obsolete. The Qing government ordered the reform of the academy, which set off a wave of reform in various places. By the twenty-eighth year of Guangxu, most provinces had basically realized the requirement of transforming academies into schools. At this point, the ancient academy, which lasted for more than a thousand years in the history of ancient education in China, was finally replaced by a new school.

4. CONCLUSIONS

Objectively speaking, ancient Chinese academy architecture did not achieve significant achievements in brick and stone arch technology, but it does not mean that our ancestors lacked wisdom, but rather the result of a rational choice. Architectural history shows that cultural choices made Chinese and Western architecture distinctive and achieved remarkable achievements. The group layout of ancient Chinese academy buildings is usually composed of a courtyard with one or more entrances, and has an obvious central axis. From the perspective of the relationship between the various parts, the gatehouses, lecture halls, library towers, and ancestral halls are generally arranged in order along the central axis. The use of brick and stone

arch technology began with the brick pagoda in the Wei and Jin Dynasties, and was used for arch bridges in the Eastern Han Dynasty. It was used in the Song Dynasty to build city walls and water gates, and later in the Southern Song Dynasty to build city gate caves. In the early Ming Dynasty, houses built with tubular arches appeared. The application of arches in ancient China appeared relatively late and underwent several development processes, including hollow brick beams and slabs, pointed arches, and folded arches, which gradually formed in the early Western Han Dynasty. It can be said that the arch technology is widely used in ancient Chinese architecture. In this regard, this article discusses the development of brick and stone arch structures in ancient Chinese academy architecture. From the perspective of the ultimate function of the academy, the lecture hall should be the most important, most able to demonstrate the value of the academy, and is real. Therefore, as a college that cultivates gentlemen and sages, and a college that cultivates polite and moral gentlemen, the priority in architectural design and apprenticeship cultivation is the issue of etiquette.

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