A STUDY OF TECTONIC CULTURE AND TECHNOLOGY OF RELIGIOUS MASONRY ARCHITECTURE IN WUHAN

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ABSTRACT

Western style masonry architecture had been much promoted because of western influences since the mid-nineteenth century, and the well preserved Griffith Church in Wuhan was a representative to investigate its tectonic culture and technology. While the various masonry methods applied in its brick wall, its door and window openings, and its main structure, were largely western in nature, the Chinese or the local methods were incorporated where appropriate. This shows that the tectonic culture and technology of contemporary religious masonry architecture in China could not be fully understand without a consideration of the Chinese architectural tradition and the social context. Also, with respect to construction technology and spatial expression, Griffith Church could provide invaluable lessons in the exploration of construction potential and architectural treatment of the brick masonry.

Key words: Tectonic culture and technology, Masonry architecture, Griffith Churth

1. INTRODUCTION

Brick is a common building material and plays an important role in the design and construction of masonry architecture. As it is well known that Chinese traditional architecture was of a wooden structure (Guo, 2000; Li, 2003), it is interesting to investigate Chinese masonry architecture in bricks which had been much promoted because of western influences since the First Opium War (1840-1842) in the mid-nineteenth century when China was forced to open its door to foreign trade. In this process, many treaty ports were opened in strategic coastal and riverside locations, and Wuhan was one of the most important treaty ports, where some western style masonry architecture was established. Among these, church, a kind of religious architecture, became popular for preaching purposes of missionaries. While some other architectural types that emerged in contemporary treaty ports have been extensively explored, there is much scope in the study of religious architecture (Johnston, 1996; Cheng, 2008; Guo, 2009; Tong, 2011), particularly in respect of the issue of building material and its tectonic culture and technology (Hackett, 2014; Jung, 2013). This study sets out to make up this deficiency.

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The concept of 'tectonic' is the theoretical basis for this study. According to Kenneth Frampton, 'tectonic' should be understood as the technological aspect in construction and the way to create meaningful spaces or places (Frampton, 1995). It should be noted that in architectural history, innovation and advances in these two aspects often brought forth new architectural forms or expressions. As such, this study of the tectonic culture and technology of masonry architecture is not only about architectural aesthetics or style, but also about the integration of building process and architects' design aspirations. It concerns the construction potential and architectural expression of the brick material, and therefore fundamentally the essence of architecture and construction.

2. THE GRIFFITH CHURCH

The churches in Wuhan from the mid-nineteenth century were almost western style masonry architecture. But they were regretfully almost not well preserved. Some of them were torn down, some became derelict and abandoned, and some others were subjected to functional change, which resulted in damages in various degrees.

Among them, Griffith Church is the best preserved. Built in 1880, it was the principal church of the London Missionary Society in central China. It was originally the Flower Mansion, located on Jianghan Road at the juncture of the British Concession and the Chinese community. It was moved to Yunqiao Road (now Huangshi Road) in 1931, and in order to commemorate Griffith John (1831-1912), the earliest Christian missionary in central China, was renamed Griffith Church. The church was built with plain brick wall, and its window openings were largely made with pointed arches. With a floor area of 1,191 square meters, it was the biggest church in Wuhan with a seating capacity for 1,000 people. The church was renamed Rongguang Church in December 1951, closed during the Cultural Revolution (1966-1976), and not re-opened until November 1980. It has now become a popular place for Christian activities and regularly receives 1,000 or so people per day.

3. THE BRICK WALL: THE FUNCTIONAL AND THE SPIRITUAL

The bricks used in the construction of Griffith Church were all red ones imported from the West, with a standard dimension of 250 millimetres in length, 120 millimetres in width, and 70 millimetres in height. In Griffith Church, door or window openings, arches, pilasters, and cornices, were all made with such standard bricks. Most of the bricks were arranged in cross bond, the so-called 'English style', which was popularly implemented for its simple and easy manipulation. Besides cross bond, there was also Gothic masonry method, the so-called plum style (figure 1, 2).

The thickness of the walls of Griffith Church was varied in different part of the building. It was normally 250 millimetres thick, but it might be 380 or 520

millimetres thick at door or window openings, pilasters or constructional columns. The latter treatment largely showed a functional concern about the safety of the building structures, and in some other instances an aesthetic concern about the effect of the façade. But more importantly, since the church was built to serve Christians and hold religious activities, it was clear that the intention was to follow the church style in the West in order to meet religious purposes and in this case the spiritual end.

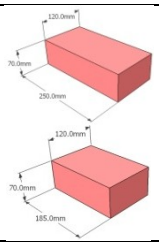
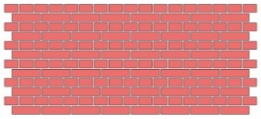
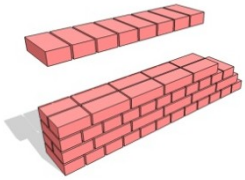
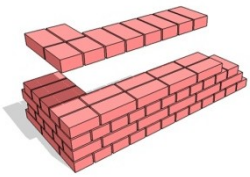
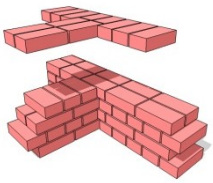
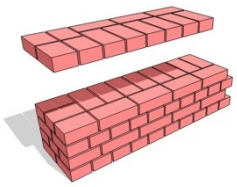
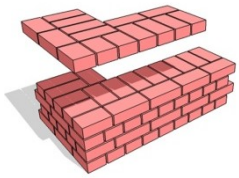
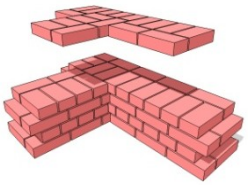
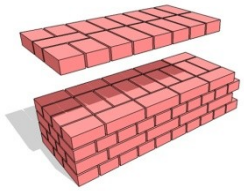
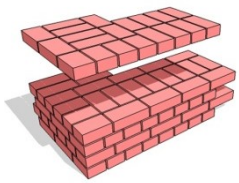
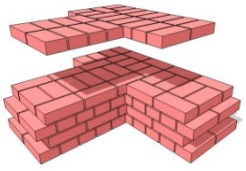
Cross bond	The normal dimensions of the brick	The effect of the façade
This was the normal masonry method in Wuhan churches. İt was of some grandeur visual quality and greatly influenced masonry architecture in Wuhan.		
The masonry of a single wall	The masonry at the corner	The masonry of a T-shaped wall
		
		
		

Figure 1. Cross bond in the construction of Griffith Church
Source: drawing author.

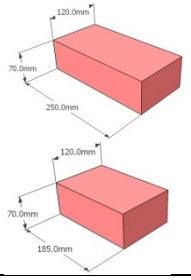
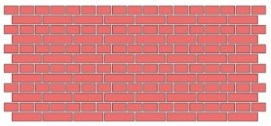
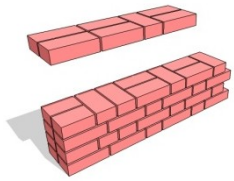
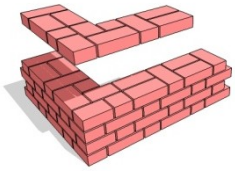
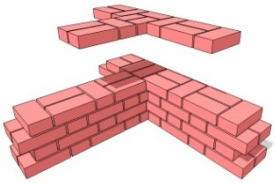
Gothic masonry method	The normal dimensions of the brick	The effect of the façade
With this masonry method, it was easy to produce colour variations in brick walls. The method was also popular in the construction of residential architecture in Wuhan.		
The masonry of a single wall	The masonry at the corner	The masonry of a T-shaped wall
		

Figure 2. Gothic masonry method in the construction of Griffith Church
Source: drawing author.

4. THE DOOR AND WINDOW OPENINGS: THE IMPORTED AND THE LOCAL

There were two masonry methods for the door and window openings of Griffith Church, the flat arch and the pointed one. While the flat arch could be found in Chinese traditional architecture, the pointed one was a clear characteristic of Gothic architecture in the West. This thus showed a mixture of the Chinese architectural culture and that of the West in contemporary masonry architecture of Wuhan. It seemed that the tectonic logic of the flat arch was contradictory to that of brick masonry. But due to the bonding role of mortar, the wall itself could maintain an appropriate structural strength, and as a result the flat arch does not need to sustain the weight of the wall above them. As such, the flat arch only needs to sustain the weight itself, and the bonding strength of mortar is enough to achieve this. Thus while the flat arch seemingly violate the tectonic logic, they actually demonstrate a unique tectonic characteristic of brick masonry. This kind of treatment could be found in today's brick buildings, but the walls are often equipped with reinforcing bars in order to ensure structural strength. This is a direct result of the development of architectural technologies, and also a result of local building acts and codes.

The pointed arches of the door or window openings of Griffith Church were made through multi-layer brick masonry. The number of layers was determined by the position or importance of the door or the window, the visual effect, or the desired spatial characteristic. This brick masonry is very much like the corbelled arch in

traditional Chinese architecture. While the two are of similarity in masonry method, their masonry purposes and effects are clearly different (figure 3).

Figure 3. The brick masonry of the door or window openings of Griffith Church
Source: drawing author.

5. THE MAIN STRUCTURE: TWO DIFFERENT TECTONIC EXPRESSIONS

The main structure of Griffith Church is a brick-wood one, which was the earliest construction technique imported from the West (Tong, 2011). This structure often comprises a combination of load bearing brick wall, arch, and wooden beans. It should be noted that the application of red bricks and arches, and the masonry method of cross bond, as demonstrated in Griffith Church, marked the introduction of such structure.

With two different materials, there are two different tectonic expressions in Griffith Church. Its vertical load bearing element is brick columns, and the horizontal load bearing element is wooden truss with a span of 15 meters. The construction of brick columns is similar to that of pilaster in modern frame structure. It is attached to the building envelope of brick walls with regular spans, whilst protruding from the walls. There are brackets on top of the brick columns to support the wooden truss. In order to ensure the strength of the whole structure, horizontal steel pulling cables are

added to the wooden truss. The two tectonic expressions not only show distinguished tectonic characteristic, but also the difference of historical contexts which the material embodied (figure 4).

Figure 4. The main structure of Griffith Church
Source: photo author.

6. CONCLUSION

This study of brick masonry of Griffith Church shows a significant change of tectonic culture and technology in Chinese architecture that was traditionally of a wooden structure, due to the western influences since the mid-nineteenth century. While the various masonry methods were largely western in nature, the Chinese or the local ones were incorporated where appropriate. This showed a much needed adaptation to the specific Chinese circumstances in the church's construction. Thus while the western influences were crucial in its construction, the tectonic culture and technology of contemporary religious masonry architecture could not be fully understand without an examination of the Chinese architectural tradition and the social context.

As for the tectonic culture, this study mainly concerns about construction technology and spatial expression. As shown in Griffith Church, different masonry methods brought about different spatial qualities, and there was a subtle connection between the technological approach and cultural connotations. While this demonstrated the necessity of a more careful reading of the church, it highlights an interesting research perspective for contemporary Chinese architecture in general.

On the other hand, different tectonic logic of the same material or different construction materials would bring about varied visual quality and architectural experiences. The former was manifested in the effect of cross bond and that of Gothic masonry method, and also in the different width of the walls, door and window openings in different part of the church for functional or spiritual purposes. The latter could be exemplified by the combination of the brick-wood structure and

the steel cable feature. As such, the case of Griffith Church could provide invaluable lessons in the exploration of construction potential and architectural treatment of the brick masonry.

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