

Removed, rebuilt and new timber arch bridges in China

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ABSTRACT: China timber arch bridge is a unique bridge structure in the world, in which the main arch ring is woven from longitudinal and transverse straight logs. This type bridge has been designated as China national cultural heritage, and its construction technique was inscribed onto the Urgent Safeguarding List of Intangible Cultural Heritage of Humanity by UNESCO in 2008. In recent years, many ancient timber arch bridges have been removed due to engineering construction such as hydropower station or rebuilt after destroyed by fire or with serious deterioration. At the same time, some new timber arch bridges have also been built by various reasons. In this paper, some removed, rebuilt and new timber arch bridges in China are presented and evaluated.

1 INTRODUCTION

China timber arch bridge is a unique bridge structure in the world, in which the main arch ring is woven from longitudinal and transverse straight logs. Many ancient timber arch bridges survive in the mountain area in north Fujian Province and south Zhejiang Province, where the communication and transportation condition is poor and the cultural is not influenced seriously in modern time. However, for long time this heritage architectures had not been properly maintained, protected, and many of them have been destroyed by fire, blows, floods, decay of wood material as well as replaced by modern bridges. Today the China timber arch bridge has been designated as China national cultural heritage, and its construction technique was inscribed onto the Urgent Safeguarding List of Intangible Cultural Heritage of Humanity by UNESCO in 2008.

In recent years, in order to preserve this cultural heritage, some ancient timber arch bridges have been removed due to engineering construction such as hydropower station, or rebuilt after destroyed by fire or serious deterioration. At the same time, some new timber arch bridges have also been built in China by various reasons such as to record the traditional construction technique, make the succession of its from old generation to young generation, or just to make a scence for tourist. Among these removed, rebuilt or new timber arch bridges, some of them are successful but other ones have some problems. In this paper, some such bridges are introduced and analyzed as case studies.

2 REMOVED BRIDGES

The mountainous area in north Fujian Province and south Zhejiang Province, where many ancient timber arch bridges survived, is undeveloped area with plenty water power energy. Today in order to develop the economic, many hydropower stations are beeing constructed, which is the main reason to remove the ancient timber arch bridges.

2.1 *Jinzaio Bridge*

The Jinzaio Bridge is the third long timber arch bridg in Pingnan County, Fujian Province. The quondam Jinzaio Bridge shown in Fig.1(a) was built in 1808 and rebuilt in 1948. It is 41.7m in total length with a single span of 32.5m and a width of 4.8m. It located in the south of the

village of Jitou village, crossed the Jinzao brook. It had 12m level difference from the deck to water surface. The abutments were made by granite stone. The bridge had 15 lounge houses and 64 pillars with a single-eaved roof, serviced as a shrine. The bridge was very beautiful, surrounding with tall trees and rugged mountains on both sides. The bridge has been recorded in the Cultural Heritage Unit of County in 2001.

In order to build a new hydropower station, the Jinzao Bridge was removed in 2005, from the original site to the new place, where is beside of the secondary roads in Pingnan County crossing over the Yingji brook, as shown in Fig.1.b. The new bridge locates in a very precipitous gorge and the can service as a good sightseeing. However, there is no road connecting to this bridge at the other side, see Fig.1.c. In other words, this bridge has lost its communication function in the new site. Moreover, it is far away from the village, the bridge also can not pay other functions as other timber arch bridges in this area, like a gathering place for villagers, resting place for travellers. And the shrine of idols in the central of the bridge has been covered by heavy dust with few people use it (Fig.1 d).

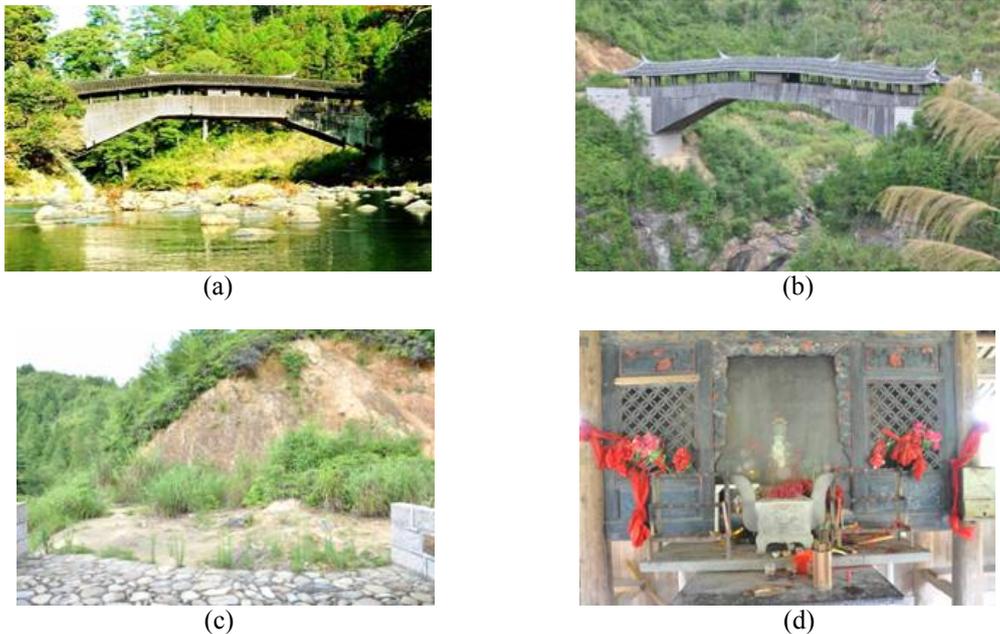


Figure 1: The Jinzao Bridge: (a) The quondam Jinzao Bridge, (b)The reconstructed Jinzao Bridge in another place, (c)The side of the reconstructed bridge, (d)The shrine in the reconstructed bridge

2.2 Zhangkeng Bridge and the Changlaixi Bridge

The Zhangkeng Bridge (Fig.2.a) and the Changlaixi Bridge(Fig.3.a) located in Shouning County, have the same destiny with the Jinzao Bridge. The two bridges been melted into the daily life of the local people, serving not only as a way for communication, but also a place for entertainment and folk activities. However, these two local people's sweetheart bridges have been removed to new sites where there is no road connecting to them just as the Jinzao Bridge, as shown in Fig.2.b and Fig.3.b. As cultural relic, they are removed to strange sites, stand there lonely all the time without travellers walking through them, without local people sharing good time with them. It is hard for us to say this preserving of a cultural relic is that we predicted to.

3 REBUILT BRIDGES

For some very famous and valuable timber arch bridges disappeared in the past time or destroyed by fire or flood in recent, rebuilding is necessary. Here are two examples.



Figure 2 : Zhangkeng Bridge: (a) The quondam Zhangkeng Bridge, (b) The reconstructed Bridge



Figure 3 : Changlaixi Bridge: (a) The quondam Changlaixi Bridge, (b) The reconstructed bridge

3.1 Baixiang Bridge

The Baixiang Bridge was first built in Song Dynasty, located in the only road linking Pingnan to Ningde and Fuan, which was called as “ancient path for salt and tea” in ancient time. The bridge crosses the Baiyang Creek in a deep gorge, steep banks and large difference level from the deck to the water make the bridge as “the first precipitous bridge in south of the Yangtze River”, see Fig. 4.a.

The bridge was been preserved and maintained better than the others for a long time. Many monuments (Fig. 4.b) on the east side of the bridge recorded repaired and rebuild history of the bridge in its hundred years life. The recent repaired was conducted in 2002. On the west side of the bridge, there are dedicated trees as construction materials for repaired and rebuild.

Unfortunately, only one month after the bridge listed into China National Cultural Heritage in May, 2006 it was destroyed by fire in 27 June.

Due to the important Cultural relic research value, and the path is the main traffic for the villagers, the Baixiang Brige will be rebuilt in situ in 2010. Now the design of the bridge has finished, which copy the original bridge in records. The bridge will be built strictly by the traditional technique by the famous masters. The two abutments will be employed for the new bridge after simple strengthening, the superstructure will have a single span of 40m and 4.5m wide, with a level difference of 23m from the deck to water surface, as the original one.

3.2 Shuanglong Bridge

The original Shuanglong (double dragons) Bridge was built in 1862 and destroyed by fire before 1949. In 2005, a new Shuanglong Bridge was rebuilt in Baishuiyang, a beauty spot of Pingnan, where there is a super large flat rock bed lies on the river.

The bridge has three spans with a total length of 66m and 4.5m wide, rebuilt after the original one by photo and records. The new bridge (Fig.5) connect the two side of the river, not only provide a convened communication for the tourists, but also is a good place for them to take pictures of Baishuiyang and the Wulaofeng (five peaks like five old men), to have a cup of tea with friends, to rest and enjoy time for playing Chinese Chess and so on.

Although the bridge is quite new, however it was built strictly by the traditional technique by the famous masters, retaining the traditional culture and folk custom of in China timber arch bridge. Moreover, there are some elegant couplets in the beam and serviced as a shrine for visitor. So the reconstructed Shuanglong Bridge is full of vigor and vitality.



Figure 4 : The Baixiang Bridge: (a) The quondam Baixiang Bridge, (b) The monuments

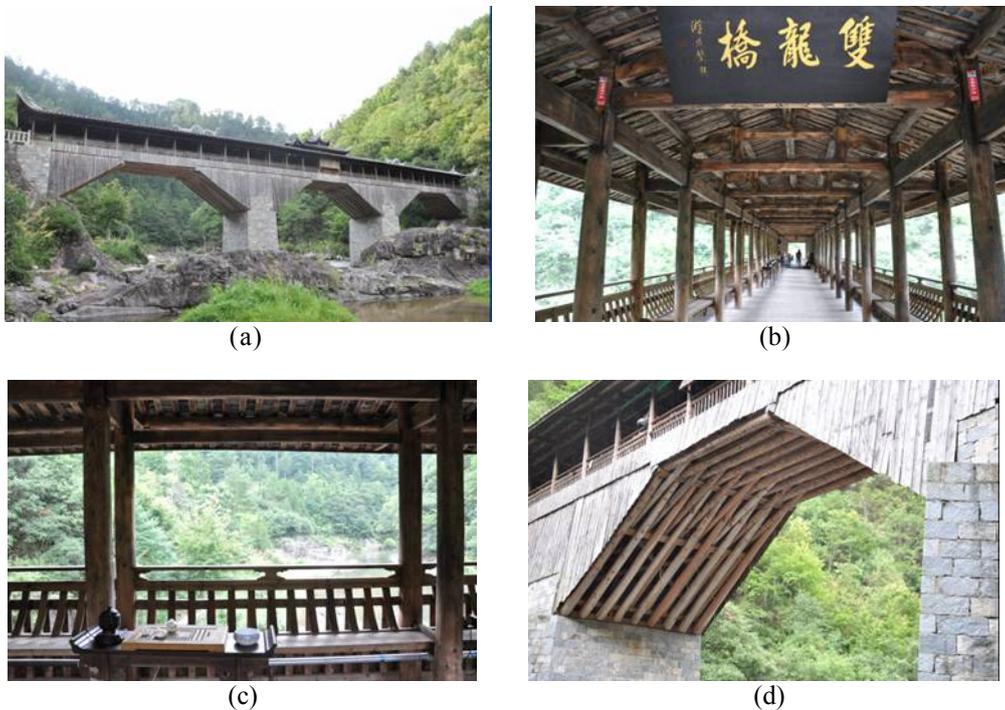


Figure 5 : Shuanglong Bridge: (a) General view, (b)The entrance of the bridge, (c) Inside the covered house, (d) Up view of the arch

4 NEW TIMBER ARCH BRIDGE

For a long time (since 1960s to the end of the last century), no new timber arch bridges were built in China. However, with the recognition of this precious cultural heritage and unique bridge structure, some new timber arch bridges have being built at present. As we known, there are two major types of timber arch bridges in China, one is the ancient Biahe Rainbow Bridge which only can be find in the records, and the other is the extant Fujian-Zhejiang timber arch bridges (Yan and Chen, 2007), though both of them are woven from longitudinal and transverse straight logs but have some difference in structures. Both of these two types have been adopted in the new timber arch bridges.

4.1 New Baihe Rainbow Bridges

The bridges show in Fig. 6 are two new Baihe Rainbow timber arch bridges. Fig. 6a is the photo of the Pu Qing Bridge in the town of Jinze, Shanghai (Carla Ceraldi and Ennio Russo Ermolli 2004), it is 16.8m long and 4m wide. It was built by traditional construction technique without centring. Lots of lions and tigers are carved on the both side of the transverse bracings, giving a beautiful configuration, reflexing Chinese traditional folk arts and architectures. The Fig. 6b shows the other timber arch bridge in the West Lake of Hangzhou City, not only serve as a bridge in a path but also as a landscape in the scene.

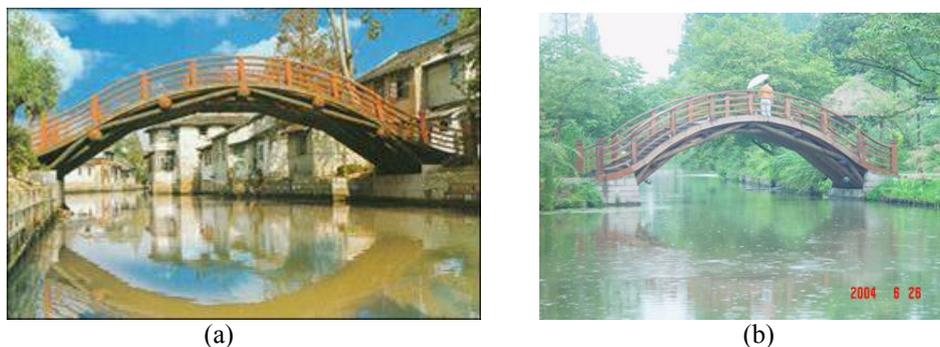


Figure 6 : Two New Baihe Rainbow Bridges: (a) Puqing Bridge, (b) A bridge in West Lake in Hangzhou

4.2 Newly Fujian-Zhejiang timber arch bridges

4.2.1 The Huayang timber arch bridge

Fig.7 is the Huayang Bridge in Shunchang, Fujian Province. It located in the gate of the Huayang beauty spot, is an imitation from the extant Fujian-Zhejiang timber arch bridge, designed by Huangcheng Tang, a famous bridge expert in China. The bridge was built by Duoqing Zheng and Duoxiong Zheng (who is representative heir of the traditional construction technology of the timber arch bridge of international the Non-material Culture heritage) with the tradition technology in 2005. The bridge was opened in 1 October, 2007. The bridge is not only a landscape but also the main traffic line and the place to rest for the traveller in the Huayang beauty spot.

4.2.2 The Shijin timber arch bridge

Shijin Bridge is located in Pingnan County, Fujian Province (Fig. 8). It is 12m long, with single span of 10m, built by Huang Chuncai (who is also a representative heir of the traditional construction technology of the timber arch bridge of international the Non-material Culture heritage) and two of his sons. The bridge perhaps is the smallest timber arch bridge in China.

During its construction by the traditional construction technique with traditional construction tools, the workers in traditional suits played also the folk-custom activities for building a new bridge. The “discovery program”of the China Central TV Station (CCTV) made a vedio record of the construction of this bridge as a part of the vedio film to UNESCO for declaring “the Non-material Culture heritage project of the traditional construction technology of the timber arch bridge”.

Besides the above mentioned new bridge, some false timber arch bridges also been built in parks or other places for business. Fig.7 is such a bridge in a garden in Kaifeng, Henan Province. The bridge built follows the famous painting “Chhing-Ming Shang Ho Thu”, from which the timber arch bridge in China was recorded in drawing. However, it is not a real timber arch bridge, because it is not built by timber but by reinforced concrete.



Figure 7: The Huayang Bridge: (a) General view, (b) Up view of the arch



Figure 8: Shijin Bridge: (a) The Shijin Bridge, (b) Install the main arch rib, (c) Raising of the ridgepole

5 CONCLUSION

The timber arch bridge is one essence of traditional architectures in China and part of the precious cultural heritage handed down from the ancient people. It is a commonly recognized habit that regular maintenance should be done on timber arch bridges (including the reconstruction) in China. As case studies, some removed, rebuilt or new timber arch bridges have been introduced in this paper.

For the three removed bridges introduced in this paper, the structures have been recorded carefully in details and the original structure members were utilized in the new bridges. The bridges were rebuilt by the traditional construction techniques. From the point view of structure techniques, they have been built successfully. However, a bridge is a functional structure. It is not a good solution for them to be built in a place without communication function, far away from the village. This should cause attention in the future when a historic timber arch bridge must be removed.

As for the rebuilt or new timber arch bridges, most of them were built strictly to copy the traditional structures as well as the architectures, constructed by the traditional techniques by timber arch craftsmen and masters. However, it should be avoided to build a false timber arch bridge for business just copying its appearance but not the real structure, material and construction technique.

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