

Research on the Protection and Reconstruction of the Landscape Heritage Based on Digital Reduction Technology

—Taking AD1837 as an Example of the Huangci Bridge in Qing Dynasty in Nanning, Guangxi

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Abstract—This paper is based on digital reduction technology and from the perspective of ancient bridge protection and the surrounding environment landscape reconstruction, putting forward to the methods of landscape heritage protection and reconstruction. And the second through the field investigation, this paper analyzes current situation of the Huangci Bridge ontology and the surrounding environment, the problems can roughly be divided into three categories, and then summarize and put forward the corresponding solutions. The article finally through the establishment of the model to the emperor gave bridge garden heritage. Lastly, through the establishment of the model, the paper presents the reconstruction design of the heritage and the surrounding environment of the Huangci Bridge Landscape and summarizes the methods of reconstruction for the same type's protection and reconstruction reference.

Keywords—Huangci Bridge; landscape heritage; reconstruction

I. FOREWORD

“A river spawned a flourishing street.” This is how the local people praised the Xinjiang market street. More than 170 years ago, in the riverfront of today's Xinjiang county, Yongning district, Nanning, Guangxi province, businessmen clustered, formed the thriving Xinjiang market. The bridge, the quay, the salt shops, the hotels and the stables, all together, painted the Huangci bridge a splendid picture. To promote its traditional culture and national spirit, the local government developed a unique historical and landscape heritage, radiates from the Huangci Bridge and the Xinjiang Grand Quay, that is rife of special features of its own. This article, through a systematic analysis of the Huangci Bridge, the Xinjiang Grand Quay and their peripheral buildings and environment, attempt to revive the prosperity of the Huangci Bridge historical and landscape heritage.

Huangci Bridge historical landscape heritage is located in the north of Xinjiang Street, Xinjiang county, 32 kilometers southeast of downtown of Nanning City. The bridge was built in 1837, the 17th year of the reign of Daoguang Emperor, Qing Dynasty. It was then reconstructed in 1987 by the local

government. In 1989, the local government of Yongning county pronounced the Huangci Bridge as Protected Cultural Relic Unit of Yongning county. The government later decided to rebuild the historical quay of an ancient salt route and rename it Xinjiang Grand Quay. In 2009, the bridge was announced to be a Protected Cultural Relic Unit of Nanning city. Its Protected Area extends outwards 20 meters of the bridge's perimeters, and the Development Control Area extends outwards 100 meters of the bridge's perimeters. Huangci bridge is 60 meters long, 8 meters wide and 14 meters high. It is a typical official style stone arch bridge of Qing dynasty. The value of Huangci Bridge have high value of historical, artistic, scientific and social.

II. ANALYSIS OF THE STATUS QUO

The Huangci historical landscape heritage includes material entities, material space, surrounding area and the overall layout within the protected zone and the development control area. Nevertheless, the Huangci Bridge and Xinjiang Grand Quay suffer from some problems, which can be categorized under three types, namely, structural safety, integrity, and historical continuity.

III. STRUCTURAL SAFETY

A. The Structural Issues of the Huangci Bridge

The bridge was reconstructed from curved arch bridge to flat arch bridge in 1987. Ostensibly, brackets (beam) and beams were added to the bridge to enforce its structural integrity, but these actually damaged the structure of original design. Furthermore, the new bridge's design did not incorporate a scientific drainage system, caused the bridge to be eroded by rainwater as it sits in a rainy area. Year after year, the bridge deck became rough, the bridge body is covered with moss, and the load-bearing wall of the west arch even has a 1 cm wide, 800 cm high crack, which seriously affects the integrity and durability of the structure (Figure 1).

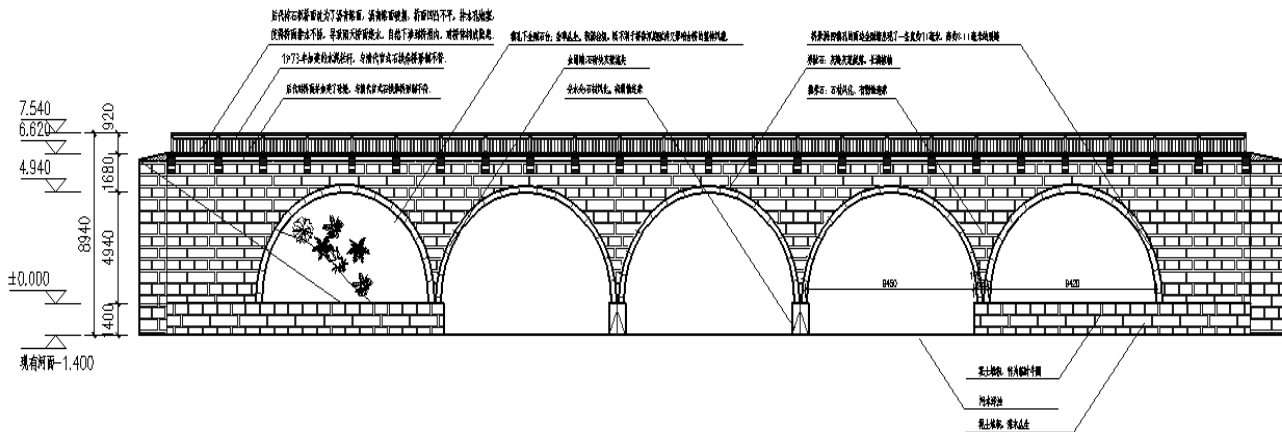


FIGURE 1. THE PRESENT SITUATION SURVEY MAP OF THE HUANGCI BRIDGE

B. The Structural Issues of Xinjiang Grand Quay

The Xinjiang Grand Quay was renovated in 1995, over 30 steps of cascading brick stairs stretches from the road to the river. This design made the part of the quay which is in the same section with the opening of the east arch of the bridge higher than the (water) level under that arch, which in turn affected the flood discharging capacity of the east arch opening during the wet season.

C. Problems with the Surrounding Area

The banks of the river are made of soil. Mud and vegetation are flooded into the river during wet seasons. This elevated river bed and silt up the stream, and thus water level rises and river flow becomes impeded. In addition, there is no mound between the road. These factors all cause potential safety hazards to the Huangci Bridge historical and landscape heritage.

D. Integrity

It is learnt by referring relevant documents and interviewing local elderly residents, in building the original bridge, the original bridge railings (now reconstructed as cement railings) and the gazebo for the stele (now reconstructed as a terrace and the plaque with inscription attached to a short all) were not built in accordance to the original design, due to funding shortage and social instability. In addition, the detention/retention basin was overgrown with weeds and piled with garbage, which spoiled the view of the bridge and damages its flood discharge capacity, especially during wet seasons. The natural banks of the river are made of soil, with no revetments built. During wet seasons, mud, garbage and vegetation are flooded into the river, causing river bed to elevate and silting up the river. All of these negatively affect the Huangci Bridge historical and landscape heritage's coordinated integrity.

IV. RESTORATION METHODS

A. Structural Safety

The structural safety of the Huangci Bridge and the Xinjiang Grand Quay should be first made sure before it is attempted to revive the landscape.

The Huangci bridge itself could be, by structural analyses based on information gleaned from investigations and surveys, restored with the curvy horizontal design. The original design ensures a combination of scientific overall structure and elegant curves. Meanwhile, consolidate the foundations, mend the cracks and fissures. For small cracks, the unique local pointing technique to fill with mortar; apply epoxy on wider cracks, and therefore ensures the principle of "restoring the old as the old" (Figure2).

Regarding the Grand Quay, choose local stones, rebuild the stairs on the east opening, to enhance the flood discharge capacity of the east opening and make it parallel to the river bank, which makes the middle platform of the quay as high as the water level of the east opening.

On top of that, build revetments in line with local terrain, clean away garbage in the openings and surrounding area and silt mud on river bed. Plant vegetation by the traditional Chinese garden design, and renovate the drainage ditch with local stone material. Add traffic barriers between the bridge and roads. Fundamentally solve drainage, consolidate the structure, and enable all basic functions.

The restoration of structural safety is the foundation for achieving the coordinated integration and inheritance and continuation. Its restoration has its own uniqueness, as different measures are applied to different objects.

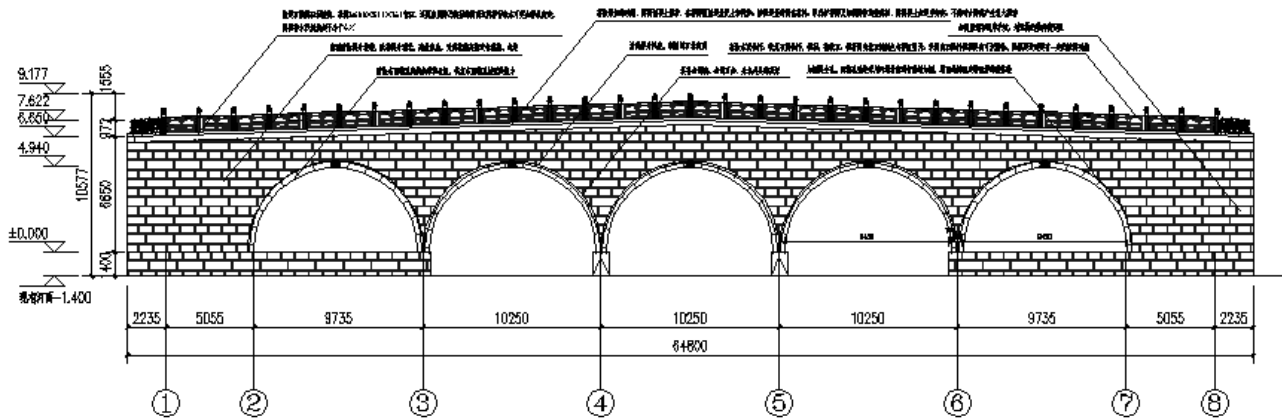


FIGURE II. THE FACADE REAPPEAR DESIGN OF THE HUANGCI BRIDGE

B. Integrity

About the restoration of overall coordination, firstly each material element should be perfected. Next, it is essential to control every step from the philosophy of design to construction technique. Based on extraction of original philosophy of design and historical information, the railing and stele pavilion need to be completed. Since there is no record of the original design, the design of the pattern of the railing should accord with the pattern of traditional official bridges and at the same time apply local elements and decoration technique to represent its historical locality. The stele gazebo can be built on its old location on the terrace with a hexagonal tented roof, which unifies practicality with aesthetics.

Secondly, the creation of building space and surrounding environment should be based on the actual buildings. The Xinjiang Grand Quay is an indispensable part to the whole landscape, a newly designed and constructed quay. After the reformation, the quay would be made more spatially comfortable, and the river would also appear to be more intimate to viewers. The bridge, the quay, the stele gazebo, the revetments, the houses and surrounding vegetation would conform into an integrated landscape.

C. Continuity

The restoration of the continuity is based on analysis of value, to transcend structural safety and integrity. It is the excavation, restructuring and sensible presentation of the material entities, material space and surrounding areas.

As shown in figure 2, the Huangci bridge spans over the river and extends to the villages on its two ends. The houses on both sides of the bridge serve as finishes to the landscape. The Xinjiang Grand Quay connects the horizon to the surface of the water. The stele gazebo links the aforementioned two spaces. Vegetation on the two banks is like a thread run through the bridge, the quay, the stele gazebo and residential houses along

the river. The finishing touches to this restoration plan are in the stele gazebo, it will attract people to stop in here and read the stele to the history of the Landscape while enjoying the intoxicating view.

D. Summary of Restoration Methods

The restoration of the historical cultural landscape has its own complexity and uniqueness. There are four parts of the material system of the landscape: 1) artificial elements – actual buildings; 2) the space—the empty place; 3) the natural elements – the surrounding environment; 4) the overall pattern, which is the entity that unifies artificial and natural elements. Through survey of historical documentations and analysis and comparison, this article used a concrete example to discuss and summarize the restoration of urban historical and cultural landscapes.

First, we have analyzed the material buildings of the landscape. A historical and cultural landscape is a landscape, it should comprise several material elements, such as terrain, landform, buildings, the water body, vegetation and etc. And “historical” and “cultural” means the landscape carries historical and cultural information. The restoration of these landscapes should start with protecting these elements, and at the same time innovatively utilize them, not just simply making the landscape to appear again.

Secondly, on top of protecting the material buildings of the landscape, the material space, the surrounding environment and the overall pattern need to be preserved and revived too.

In addition, the value analysis of the constituent components is also crucial (table 3). Only deeply analyze the value of the historical and cultural landscape can combine the constituent elements.

TABLE I. ANALYSIS OF CONSTITUENT ELEMENTS OF THE HISTORICAL AND CULTURAL LANDSCAPE

Macro Elements	Micro Elements	Analysis of Value	Restoration Method
Material Substance	Material subjects' elements: terrain and landform, water body, buildings, vegetation	historical Value: historical events, historical figures, local building traditions	Restore its authenticity, identifiability, continuity, integrity and etc.
Material Space	Spatial elements Surrounded and defined by material objects such as space form, Space composition and etc.	Artistic value: artistic creation, aesthetic taste, artistic styles, specific eras, typical styles, religious faiths	Restoration of space texture and loci features and etc.
Surroundings	Natural environment and artificial elements such as mountains and rivers, views and vegetation.	Scientific value: creation achievements (achievements during the process and after the creation process), technological achievements	Methods including preservation, transformation, renovation, restoration, reconstruction, and rebuilding.
	Human activities and natural environment interact under certain geographical and historical conditions, to form an overall pattern and order, such as spatial structure and landscape structure.	Cultural value: ethnic culture, local cultures and customs, ethos, religious culture, intangible culture	Methods include preserving the relations between natural and artificial elements. For example, typical buildings, special space (to respect the spatial layout, preserve the overall pattern, style and structural relations
Overall pattern			

Based on the analysis of the constitution and value of the landscape, it can be drawn that a historical and cultural landscape is virtually an intersection between relic buildings and surrounding environment. The restoration of the historical and Cultural Landscape is the combination between the protection of relic buildings and the reformation and utilization of surrounding environment. The method of the restoration of the historical and Cultural Landscape should also comply with the methods of relic building protection and the reformation of surrounding environment.

V. CONCLUSION

Given the fast progress of urbanization, we should tend to historical and cultural landscapes and value their protection and restoration, as they are not only the necessary part of the development of a city, but also a prerequisite for the continuity of the unique texture of a city(Figure3、 4). Hopefully, the methods summarized in this article may offer some theoretical assistance to research on regional historical and cultural landscapes. Meanwhile, it can provide some restoration methods for other historical and cultural landscapes of the same type.

We are greatly grateful to the great amount of support from the Nanning Administration of Press and Television and the Government of Xinjiang County that we have received. The methods presented in this article are merely the viewpoints of the authors and are in need of further improvements. However, hopefully some lessons can be drawn from it for other researchers.



FIGURE III. THE REAPPEAR DESIGN OF THE BUILDING LANDSCAPE AND ENVIRONMENT



FIGURE IV. THE REAPPEAR DESIGN OF THE BUILDING LANDSCAPE AND ENVIRONMENT No.2

REFERENCES

- [1] Xuezheng Jia On the Status Quo and Solution to China's Ancient Bridges' Preservation [J] Shanxi Architecture 2011.35-37
- [2] Beijing Research Institute of Ancient Architecture. Beijing Ancient Architecture Culture Series –Bridges and Pagodas [M]. Beijing: Beijing Art and Photography Publishing House, 2014.
- [3] Dake Liu.The Ancient Architecture of China with Stones and Tiles [M]. China Architecture & Building Press, 2008.
- [4] Heping Li, Jing Xiao. The protection and utilization of urban historical and cultural resources [M]. Science Press, 2014.
- [5] Nanning Evening News, 2013.
- [6] CHUN Qing, TANG Ye-zheng, PAN Jian-wu, Dong Yun-hong. Research on conservation of Jin Hu Bridge, a Stone arch bridge built in the Ming Dynasty [J] . Sci ConservArchaeol, 2016, 28(3): 65-72.

- [7] XIANG Yi-qiang, LI Qiu-ping, LUO Guan-zhou. Series of historical stone arch bridge structures in shaoxing and protection strategy [J] . J Jiangnan Univ (Nat Sci Ed). 2010, 9(5): 563-566.
- [8] LI Guang, TANG Li, SONG Hai-bo. Research on the protection and repair of main structure for Hehe bridge [J] . Ind Construct, 2011, (Suppl): 809-812, 844.