

Tourism Culture in Luoshui Town, Shifang, Deyang City from the Perspective of Engineering Design

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Abstract: Luoshui Town in Shifang has a beautiful natural environment and a long history and culture, which is a protected area listed as a famous historical and cultural town. A large number of cultural relics and historic sites are here, such as Li Bing mausoleum, Da Peng Temple, Da Wang Temple, Houcheng Zhi, Chuanzhu Temple, Mosque, Yang Family Ancestral Hall, and Li Bing's numerous relics of water control and immortality ascension. The vast majority of tourism introductions are about the legend of Li Bing and the comparison between the Luoshui irrigation project and the Dujiangyan irrigation project, but little research has been done from the perspective of engineering design. To explore the tourism culture of Luoshui town from the perspective of engineering design, the Daoluo water conservancy project in Shifang was studied through a literature search, field investigation, and semi-aerial geophysical prospecting. By comparing its design concept and design form with the Dujiangyan irrigation project, the design characteristics of the Luoshui water conservancy project in Shifang, Deyang were excavated. At the same time, combined with the cultural relics around the water conservancy project, it was judged that the water conservancy project was likely to be built by Li Bing, and Li Bing was also likely to die in Shifang to a large extent.

Keywords: Li Bing; Luoshui town; Hydraulic engineering; Design concept; Tourism culture

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1. Introduction

Luoshui Town in Shifang has a beautiful natural environment and a long history and culture, which is a protected area listed as a famous historical and cultural town. A large number of cultural relics and historic sites are there, such as Li Bing mausoleum, Da Peng Temple, Da Wang Temple, Houcheng Zhi, Chuanzhu Temple, Mosque, Yang Family

Ancestral Hall, and Li Bing’s numerous relics of water control and immortality ascension. The vast majority of tourism introductions are about the legend of Li Bing and the comparison between the Luoshui, Shifang irrigation project, and Dujiangyan irrigation project, but little research has been done from the perspective of engineering design. To explore the tourism culture of Luoshui Town from the perspective of engineering design, the authors plan to conduct research and discussion from the perspective of the design concept of the irrigation project and the authenticity of the irrigation project built by Li Bing.

Li Bing (about 302–235 B.C.) was appointed as governor of Shu Prefecture by King Zhao of Qin from 256–251 B.C.^[1] During this period, Li Bing, in line with the Taoist ideas of “Tao follows nature” and “harmony between man and nature”, and based on investigating and understanding the causes of floods caused by the Minshan river system, built many irrigation projects in the Minjiang River Basin and Tuojiang River Basin. In addition to Dujiangyan, Li Bing also presided over the construction of other irrigation projects. Such as “When guiding the Luoshui River to flow through the mountains, the Luoshui River may emerge as a waterfall, passing through Shifang and Pidou before branching into a separate river.”; “Crossing the Shixi River in the south of the Yangtze River”; “Li Bing further connected the Zawu-Wenjing Rivers, and after passing through Linqiong, the river divided at Mengxi, flowing into the Baimu River.”; “Dividing the Yangmo River from the dike” and so on^[2-4]. Among them, the Dujiangyan hydraulic engineering project built by him and his son in his early years and the hydraulic engineering project built by him by diverting the Luoshui River and clearing the mountain pass in Shifang in his later years are the most famous.

2. Daoluo water conservancy project and its design concept

Li Bing managed water control in Shifang by “diverting the Luoshui River and clearing the mountain pass.” He carved through rocks to widen the ancient waterfall opening and dredged the Luoshui River. In the downstream from the waterfall, he excavated Baihe (Crane) Lake, and then, based on a careful assessment of the terrain, constructed a flat dam to establish the Luokou Weir. On this foundation, he built three weirs (**Figure 1**): the upper weir was called Zhu Weir, the middle section of the weir was called Li Weir, and the left section was known as Fire-burnt Weir, which enters the territory of Mianzhu^[5]. 70% of water flows to Shifang while 30% water flows to Mianzhu. This scientific management turned counties like Shifang and Mianzhu abundant in fish and rice with guaranteed harvests regardless of drought or flood, while also effectively mitigating the damage caused by flooding to the forest vegetation and rural farmlands along the banks of the Luoshui River.



Figure 1. A realistic picture of the Daoluo Project (Quoted from: Li Bing and Shifang)

2.1. Governance Process

The record in Records of the Huayang Region: Shu Chronicles states: “(Li Bing) also diverted the Luoshui River to clear the mountain pass. The Luoshui River either emerged from the waterfall outlet, flowing through Shifang, Pidou, and joining another river and converging at Dadu in Xindu.” This record indicates that after completing the Dujiangyan hydraulic engineering project, Li Bing came to Shefang to divert the Luoshui River, clear the mountain pass, and manage the Tuojiang River.

The Li Bing Shifang Luoshui River Diversion Project involved two main components: the excavation of the waterfall outlet and the dredging of the Luoshui River bed. The waterfall outlet, located at today’s Gaojingguan (elevated scenery), its mountain landscape and water flow are similar to the Baoping Mouth of the Dujiangyan hydraulic engineering project. The excavation of the Baoku Mouth involved opening another canal at Gaojingguan Pass, which primarily shows benefit during the dry seasons of winter and spring to ensure water supply for areas south of the Luoshui River, including Shifang and Guanghan. This canal was anciently known as “Luopeng” or “Luoyan” and is now called Zhulihuoyan Weir (**Figure 2**). The term “Daoluotong Mountain” refers to the excavation through Zhangshan, the front range of the Longmen Mountains at Gaojingguan Pass, which obstructed the flow of the Luoshui River, and the dredging of obstacles that hindered the discharge of the Luoshui River into the Tuojiang River.

In addition, Records of the Huayang Region: Shu Chronicles states that “Mianshui River flows out of Ziyan Mountain, enters Luoshui through Mianzhu, flows eastward through Zizhong, and meets Jiangyang, irrigating rice fields and moistening crops. Therefore, the Shu people call Pi Fan “Gao Fu” (richness) and Mianluo “Jin Wo” (fertile).

This sentence illustrates that while Li Bing led the Luotong Mountain, he also managed the Mianshui River, making it a “fertile land” for irrigating farmland and benefiting the people, turning floods into water conservancy, and promoting the reputation of the Chengdu Plain as the “Land of Abundance.”

2.2. Governance Plan and Characteristics

For the Luoshui project, according to the actual situation, the water diversion is different from that of the Dujiangyan irrigation project’s 40% and 60% proportions [6]. The proportions are 30% and 70%, 30% to Mianzhu, and 70% to Shifang (**Figure 2**). The reason is that Mianzhu has the Mianyuan River, whose water volume can also provide water for Mianzhu. The fundamental reason lies in the scientific calculation of water consumption.



Figure 2. The realistic picture of the 30% and 70% proportions in the Luoshui Project

“Deep lear the shoal” actually does not mean that the sand is scoured very deep because if it is scoured too deep and the water inflow is too large, it will cause floods; The water is too shallow and the inflow is insufficient, making it difficult to ensure irrigation. Therefore, it actually refers to dredging the sand in the riverbed to a moderate depth during annual maintenance. When Li Bing was harnessing the Dujiangyan Irrigation Project, he came up with the idea of

burying an auspicious animal stone rhinoceros under the river bed. If the stone rhinoceros is slightly obvious, the depth is moderate. The same goes for the Luoshui Project, and to this day there is still a place name for the Chenxi River between Shifang and Guanghan.

When the water flow is scattered, the direction is chaotic, and there is no river channel, it is necessary to open a channel in the sandbar at an appropriate position in the riverbed to divert water and ensure smooth flow, which can reduce flood disasters. When managing rivers, it is also necessary to correctly handle the dialectical relationship between “bend” and “straight.” Due to the water flow scouring the convex bank at bends, the result is that the convex bank gradually collapses into the river. Therefore, according to the water potential, the water flow on the opposite beach corner should be intercepted to transform the water flow from curved to straight. The advantage of using this method to manage rivers and ditches is that the river is smooth and easy for drifters to navigate. At the same time, sand and stones are not easily stagnant, which can reduce the amount of excavation work. The Luoshui Project adopts the approach of strengthening the protection at the bay corner (**Figure 3**) and striving to make the river as smooth as possible when dealing with this issue.



Figure 3. A realistic view of strengthening bay corner protection and smooth river diversion in the Luoshui project

The method of guiding Luotong Mountain is based on records and legends, which involves adapting to local conditions, using locally sourced materials, and using fire and water stimulation techniques. That is, through labor, the people organized river workers to pile up wood at the foot of the mountain, burn the mountain, cause the mountain to crack and relax when exposed to heat, stimulate the flow of water, break through the mountain, and lead out the river water gap. To this day, there are still wind tunnel and fire tunnel sites in Gaojingguan, suspected to be remnants from the initial construction of Luokou Weir. This formed the ancient waterfall mouth of Gaojingguan, formerly known as “Luokou Weir.”

2.3. Unfinished Luoshui project

Based on our on-site investigation, the authors believe that it is possible for Li Bing to pass away in Shifang. The reason is that his design concept of “pulling the heart at the right moment and cutting the corner at the right moment” was not fully reflected in the Luoshui project in Shifang, or rather half of it was reflected. The real-life picture of the Luoshui Project strengthening bay corner protection and smooth river diversion shown in **Figure 3** indicates that in this project, the diversion design concept for the 7-minute water volume in Shifang was based on the principle of “pumping at the right corner and cutting at the bay corner.” However, the 3-minute water volume heading towards Mianzhu did not achieve the completion of this design concept (**Figure 4**). As shown in the picture, if the 3-fen water heading towards Mianzhu is excavated from the position indicated by the arrow, it should be more in line with the design concept of Li Bing’s water conservancy project. From the on-site situation, the mountain is not very high, and the surface layer

of Quaternary deposits is covered with mudstone. From the perspective of lithology, it is not difficult to excavate the mountain at this location. The reason for not completing it may be that Li Bing has passed away.



Figure 4. Suspected unfinished work

3. Conclusion

From the comparison between the design concept and design form and the Dujiangyan Irrigation Project Water Conservancy Project, combined with the cultural relics around the water conservancy project Dawang Temple (for Li Bing), Erwang Temple (for Li Bing's son), Li Bing's tomb, etc., which is judged that the Luoshui water conservancy project is very likely to be built for Li Bing, and Li Bing is also very likely to die in Shifang. Li Bing's contributions to water management in Shifang and Mianzhu are invaluable, bringing blessings to future generations. In line with the Taoist ideology of "following nature" and "harmony between man and nature", he respects and conforms to nature, and focuses on "unblock and smooth" in water control. Like Dujiangyan Irrigation Project, he also makes full use of the terrain conditions to build diversion dikes without dams to divert water, effectively preventing floods from ravaging the Shifang Plain, promoting the development of agricultural civilization and urban construction of Shifang and Mianzhu, improving the ecological environment of Shifang, Mianzhu mountainous areas and plains, and making Shifang and Mianzhu become well-known rich and land of plenty.

Therefore, the Li Bing culture in Luoshui Town can deepen its historical and practical significance from the perspective of engineering design, enhance tourists' cultural confidence in ancient Chinese science, and strengthen national pride.

Disclosure statement

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