A Beautiful Wind-rain Bridge in China

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Summary

The paper made an on-the-spot investigation of a time-honored and well-preserved wind-rain bridge located in Changfeng Village, Xinhua County, Hunan Province which has a history of one hundred and fifty-five years and is still in service. By analyzing and measuring in detail the structural composition, component materials and sizes of the bridge, this paper summarized craftiness and scientific nature of its construction technology, and simplified its structural system from the perspective of bridge composition and analyzed the mechanical rationality of its structural system from the perspective of mechanics; and analyzed the partial and whole gracefulness of the wind-rain bridge from the perspective of bridge aesthetics; and analyzed functional diversity of the bridge from the perspective of humanity, and finally introduced the existing diseases and gave appropriate suggestions to solve these diseases.

Keywords: Wind-rain bridge, structural composition, structural system, functional diversity, gracefulness.

Abstract

As China's world-renowned ancient bridge form, wind-rain Bridge has a long history. It cuts holes in different sizes of woods with a chisel and joins these woods together with a tenon instead of a nail or a rivet, and is criss-cross but no mistake in overall structure and known as one of the world's top ten most incredible bridges. It is composed of overhanging beams, transverse sleepers, beams, bridge decks, roof beams, cross ledgers, lifting ledgers, lumbar eaves, principal columns, attached columns, short columns, double pitch roofs, purlins, plank rafters, wooden seats, Chinese-style titles(*Fig.1)*.

Fig.1: Structure of Changfeng wind-rain bridge

However,the researches about the wind-rain bridge are less and only involve the aspects of cultural significance and the protection of cultural relics. The paper made an on-the-spot investigation of a time-honored and well-preserved wind-rain bridge located in Changfeng Village and analysed the material and size of the main structure. Then analysed the unique bridge span system from the perspective of mechanics(*Fig.2)*and graceful structure of the bridge gallery. from the perspective of bridge aesthetics(*Fig.3)*.

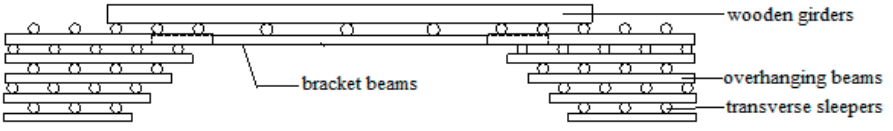

Fig.2:The diagram of wind-rain bridge span system

Fig.3: The bridge gallery

Experiencing the erosion of the wind and rain for a long time, the Changfeng wind-rain bridge is still standing quietly in the river year after year.

As an architecture emerged in closed natural environment.Its uniqueness embody firstly in architectural characteristics.The architectural position not only consider fengshui, but also consider the coordination with the surrounding environment and create a good village landscape; Uniqueness of its structure embody in that the whole structure is constructed with woods,using different woods depending on the mechanical characteristics of different components, having made full use of the advantages of natural objects;Constructors adopted the stable semi-girder support which picks out layer by layer to decrease the span and facilitate the erection of wooden girders;The bridge gallery uses beams, columns, ledgers together into an lifting beam timber frame which is stable and flexible; The function is complete,it not only is the traffic arteries links between villages, but also provides entertainment venues for the people, what's more it's the faith of the local villagers.Its beautiful appearance reflects the proportion, symmetry, rhythm, repetition, alternation,space level and other practices of bridge aesthetics. The shape is simple and elegant while the structure is unique.It has high scientific and socio-cultural values and its unique structure and ingenious construction standards are worthy to learn and inherit.

There are a large number of similar ancient bridges in the land of China and they all are the crystallization of the wisdom of our ancestors.With the development of the modern bridge technology we should also pay more attention to the excavation, inheritance and protection of these ancient bridges.