Ecological Reflection on the Current Development of Mainland China's Urban Waterfront: a Case of Wuhan

In the 21st century, urban waterfront construction is a hot issue of mainland China's urban development. Wuhan, as a city in the middle of China and with rich water resources, has been actively promoting its waterfront development since the great flood in 1998, and provides a representative case for research.

1. Development of Wuhan waterfront after 1998

Abundant freshwater resource is the most important ecological element of Wuhan. Located in the southeast of Hubei Province known as "the province with thousand lakes", Wuhan has the unique city pattern of three towns including Hankou, Hanyang and Wuchang, where the Yangtze River and the Han River join up. In addition, Wuhan is called as "the city with hundred lakes". There are 166 large and small lakes both in the city and its immediate surrounding metropolitan area. Among these lakes, the best known is East Lake, the largest city lake of China.

During the 20th century, Wuhan riverside region had experienced three times of great flood and the process from prosperity to declination caused by the breakdown of water transport. In the great flood of 1931, three towns of Wuhan were inundated due to the floodwall burst, resulting in huge losses. So the main development of Wuhan riverside region was the construction of the floodwall after the establishment of PR China, and then the city successfully resisted the great floods in 1954 and in 1998.

Since 1999, the development of Wuhan waterfront has entered a new period. The waterfront areas have revitalized through three phases of rapid development in the last 12 years, and became the core of Wuhan city ecosystem.

1.1 Phase I : 1999~2001 , Flood control works

In the first three years, the development theme of Wuhan waterfront has continued the old one of the flood control. The main works of this phase are reinforcement of those flood control projects and the urban design of city waterfront. It is noteworthy that these works were focused on the key dangerous section surrounding the junction of the Yangtze River and the Han River, the regions called as Nan An Zui and Longwang Temple. The main projects have the followings:

By 2000, the buildings and obstacles within the floodwall of Nan An Zui were removed.

In 2001, the comprehensive treatment project of Longwang Temple had finished and opened to the public as the memorial park of flood control and for river views. (Fig.1)

In 2001, the international urban design competition of Nan An Zui was held. Six programs was provided for both experts and citizens to select. But no one of them was implemented. (Fig.2)

Fig.1 relievo of Longwang Temple

Fig.2 Nan An Zui's riverside

Fig.3-4 Hankou's Riverside Park

1.2 Phase // : 2002~2006 , Riverside parks of "Two Rivers Four Banks"

In the second phase, the waterfront development had paid attention to the function transformation of the riverside area. The four banks along the Yangtze River and the Han River were built successively as city open spaces for the public, generally called as the project of "Two Rivers Four Banks". At present, it has built riverside parks with the length of more than

20 kilometer, the biggest riverside park of China. The main projects have the followings:

In 2002, the residential buildings within the floodwall of the Yangtze River in Hanyang were removed by blasting.

From 2001 to 2006, the construction of Hankou's Riverside Park with the length of 7 kilometer was fully completed through three stages work. (Fig.3-4)

In the end of 2003, Wuchang's Riverside Park was built.

In 2006, Hanyang's Riverside Park was built.

From 2002 to 2006, the construction of Qintai Cultural Arts Center, located on Moon Lake, as well as the riverside area were completed.

1.3 Phase /// : 2005~today , Wetlands and water network

Since 2005, the city government of Wuhan has begun to stress on the ecological reconstruction of city lakes. Through building parks and protected areas of wetland as well as constructing water networks by connecting city lakes with rivers, the government plans to make Wuhan "the city of wetlands" in the future. The main projects have the followings:

In 2001, the national wetland park of Jinyin Lake had been built.

In 2005, the water network project of six lakes in Hanyang started up.

In 2006, the reconstruction of Liberation Park as city wetland had been completed. (Fig.5-6)

In 2008, the water network project of Big Jinyin Lake, which will connect with seven lakes of Hankou, was begun.

In 2009, the ecological water network project of Big East Lake, which will connect with six lakes of Wuchang , was begun.

Fig.5-6 Liberation Park

2. Successful experience of Wuhan waterfront development

In general, the development of Wuhan waterfront areas during the last 12 years has been favorable and sustainable, relying on the positive evolution of its core concept and the construction of demonstrative projects.

2.1 Positive evolution of core concept

Although the time of last 12 years was just a short period with rapid change in the development process, the city government of Wuhan actively updated the development core concept of waterfront areas from the technical level to the social level and then to the ecological aspect in time.

In the early phase of the last decade, the waterfront development was implemented basically in accordance with the original development strategy, which emphasized on the security support for flood control. The floodwall reinforcement and the riverside renovation through technical means were the main works.

The development theme of the mid phase in the last decade is the building of waterfront recreational facilities, which is critical to the change of development goals. On the one hand, the construction of riverside park effectively explores waterfront areas' social value, and establishes a good interaction between waterfront areas and the public; on the other hand, the development of riverside open space reveals the important role of water landscape in creation of a livable city, and strengthens the waterfront region's public property.

However, there is a tendency of over-commercialization in the development of the waterfront recreational facilities. In order to avoid this problem and achieve the sustainable development, it is necessary to make a friendly ecological environment. More importantly, the creation of friendly ecological environment requires that the waterfront development cannot be limited on some sites or a river bank but to be implemented in a system. And that is why the development of Wuhan waterfront focuses on wetland system and water network now.

2.2 Construction of demonstrative projects

In the past 12 years, each phase of Wuhan waterfront development has one or two representative projects, which were implemented successfully and get a good effect of use. Their demonstrative forces give the strong support for the waterfront areas' sustainable development.

(1) Phase □ : 1999~2001

There are two demonstrative projects in this phase:

One is the comprehensive treatment project of Longwang Temple, the first one of Wuhan

popular riverside places. The landscape design of this project integrates memorial with intimacy, and provides an excellent river view.

The other is the urban design competition of Nan An Zui, the first international design competition of Wuhan. Although none of the competition programs is implemented, this competition provides a good sample for competition organization as well as public participation.

(2) Phase II：2002~2006

Hankou's Riverside Park is the demonstrative project of this phase. It is the biggest riverside park of China with the length of more than 7km as well as with the area of about 1.6 million square meters. Its comprehensive and detailed design of landscape as well as activities is often used as a sample in the following construction of Hanyang's and Wuchang's Riverside Parks. In addition, this park has greatly improved the shortage problem of green leisure space in old city of Hankou. At present, Hankou's Riverside Park has become the new landmark of Wuhan as well as one of the most popular tourist attractions.

(3) Phase III：2005~today

In the third phase, the demonstrative project is the reconstruction of Liberation Park, an artificial wetland park built according to the advice of foreign experts. This park after its transformation has become the most popular city park of Wuhan, which convincingly proves that even in dense urban center area, a natural and comfortable public space with few artifacts can be created.

3. Problems of Wuhan waterfront development

Wuhan waterfront areas have produced significant changes both in their form and in their function during the past 12 years. These changes are mainly caused by the rapid urban development. In this process, Wuhan not only gains some valuable successful experience but also encounters some problems. From an ecological point of view, there are two problems that require attention: identity illegibility and form simplification.

3.1 Identity illegibility

This problem is mainly reflected in the following aspects:

(1) Lack of distinctive orientation

The city government of Wuhan has presented sequentially two concepts, "Two Rivers Four Banks" and "the City of Wetlands", which are both ordinary and easy to be similar with others. For example, Two River New Area of Chongqing has the same theme as "Two Rivers Four Banks" and is more famous than Wuhan waterfront.

(2) Lack of the unitary characteristic

For example, the three towns of Wuhan all have the similar project of water network connecting several city lakes while they all implement their own project by their individual ways, which results actually in the confusion of multi-aspect such as title，theme and content.

(3) Lack of distinctive design.

For example, floodwalls of Wuhan are generally three meters higher than the road surface because the city average elevation is less than that of defensible flood. So that is resulted in such a phenomenon that pedestrians cannot see river while they near river. However, it is disappointed that the design of elevated viewing platform on the top of floodwall, which is often used at present, still cannot resolve thoroughly the problem of blocked pedestrians' sight.

3.2 Form simplification

This problem is mainly reflected in the following aspects:

(1) Simplified design

One example is the design of riverside park in three towns. As mentioned above, Hankou's Riverside Park is the demonstrative project as well as the sample in the following construction of Hanyang's and Wuchang's Riverside Parks. So to some extent, Hanyang's and Wuchang's Riverside Parks can be regarded as the simplified version of Hankou's Riverside Park. But among three towns' riversides, there are many differences in the riverside form, water level, transportation accessibility, users, functions and so on. Because of the neglect of those differences, Hanyang's and Wuchang's Riverside Parks are not so popular as Hankou's Riverside Park. (Fig.7)

Fig.7 Wuchang's riverside *Fig.8 slope of Longwang Temple*

(2) Simplified engineering

One example is the abuse of artificial concrete revetment of slope regardless of the situation. This impermeable slope will increase soil erosion and cause serious environmental problems. (Fig.8)

(3) Simplified development model

At present, most projects of Wuhan waterfront take the overall large-scale development model which causes fast and large change. Simplified development model will not only create monotonous urban landscape but also damage the balance of social-ecological system and reduce the energy of life. In addition, simplified development model may lead to the functional homogeneity such as the situation on both sides of the Yangtze River, where many high-end residential buildings with the same type are arranged, affecting the openness and popularity of the riverside park to a certain extent.

4. Suggestion

As mentioned above, the city government of Wuhan now has defined the strategy of ecological improvement in the development of urban waterfront. So in view of ecological development, it is suggested that in the future, Wuhan waterfront areas' construction should go on from two aspects: one is the multi-system symbiotic layout planning and various activity design, based on Wuhan's hot climate feature in summer; and the other is the diversification of function combination and development patterns, for the balance of social ecology.

4.1 Design based on climate feature

Wuhan is known as one of China's "four furnaces". Its hot climate in summer is one of the most distinctive urban features and same as the Yellow Crane Tower. Therefore, if the design of Wuhan waterfront could take weather conditions into consideration, it will not only promote the improvement of the ecosystem and also get rid of identity illegibility previously mentioned.

(1) Multi-system symbiotic layout planning

Wuhan's hot summer weather is due to the city's special geographical environment. On the one hand, rich water resources produce large evaporation, resulting in humid and muggy air; on the other hand, the mountains surrounding the city of Wuhan block the wind crossing, resulting in the summer with less wind. So the effective cooling method is to increase air convection in order to get good ventilation.

Based on the above analysis, we can construct the multi-system symbiotic layout by adding some radial and penetrable ecological corridors (waterways or greenways) into the existing water network.

(2) Various activity design

In addition to by some cooling methods, the improvement of the living comfort in summer

can be obtained by some activities producing psychological pleasure, such as water activities. At present, many recreational facilities in waterfront area cannot touch the water. Therefore, we can increase the fun and comfort through designing various activities which could interact with water.

4.2 Diversification strategy

Optimization of urban ecosystem does not only refer to elements of nature, but also include social and human ecosystem. A good ecosystem depends on diversity of the population, reflected in the urban ecosystem, which called for diversification. Diversification strategy includes the function combination, design techniques and development patterns, and other aspects.

(1) Function combination

The function combination should not only reflect the business or market requirements but also maintain an appropriate social equity. The appropriate combination of functions will contribute to environmental protection as well as the formation of a diverse population.

(2) Design technique

In the design, we should select the appropriate techniques according to the features of different sites. For example, steep and narrow riverside of Wuchang is not suitable for public recreational activities. However, small and high towers for viewing are more appropriate.

(3) Development pattern

In addition to the common overall large-scale development model, we should allow and support the sporadic small-scale development mostly organized by individuals. With a certain self-organizing and self-discipline, this development model causes slow changes and contributes to the formation of small intimate spaces and historic preservation.

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