

**Landscape Design Method of the Urban
Waterfront Slow-motility Space**

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1. Research Background

1.1. The redevelopment of urban waterfront space

In the context of the leisure era, the city has gradually changed from a manufacturing-type economic structure to a service-oriented economic structure. As a very dynamic economic and social carrier in the city and an attractive environmental carrier, the waterfront area is becoming a hotspot of planning and design and urban construction in the world. Its development not only brings many opportunities for shaping the future economy, environment and culture of the city, but also provides a rare opportunity for the city to fully express its unique style. In this area, leisure and entertainment, sightseeing, cultural preservation, and experience ecology have gradually become the main development orientation of the city's waterfront (Fig 1).



Fig 1 The development of waterfront

1.2. Transformation of urban travel patterns

The widespread use of automobiles has brought a series of negative effects such as traffic congestion and environmental pollution to the city. Many cities have begun to rationally think about the rationality of car-centric urban transportation development models. Many European cities have proposed various "no car" programs. Compared with cars, walking and cycling and other slow-motility modes have low travel costs, low resource consumption, and low green carbon. It can not only improve the urban problems such as traffic congestion, air pollution, resource consumption, but also help people to relieve their mood and improve their physical and mental health. Therefore, encourage slow-motility traffic modes and establish a low-carbon and green traffic mode that is guided by "slow-motility + public transportation" and become a new idea for urban transport planning.

1.3. Transformation in the concept of health

With the acceleration of urbanization, more and more people live in cities, and various resources in cities are becoming scarcer. The rapid development of the city has also changed people's lifestyle and mental state. Crowded living spaces, dependence on motor vehicles, and modern lifestyles far from the natural environment have made residents

more and more health problems, and the health of the population is threatened. The ultimate source of many health problems comes from the influence of physical and social environment. The environment has a more universal impact on health than human behavior. The Transformation in the concept of health has led to a shift in the resolution of health problems from a medical model to a social model. In this context, waterfront areas with unique natural resources are an important part of health promotion initiatives.

2. The analysis of related concepts

2.1. Concept Definition of Slow-motility traffic

There are many ways to express slow-motility traffic. Non-Motorized transport (NMT) is a conventional term, including walking, cycling, jogging and roller skating. NMT focuses on the classification of vehicles and is therefore mostly used in transportation planning. Pedestrians & cycling (P&C) is a combination of pedestrian traffic and bicycle traffic. Compared to NMT, there are only two modes of transportation. Human Powered Mobility is basically the same as NMT, and it is a transportation method that uses manpower as a mobile force. Soft Mobility, which includes bicycles, pedestrians, skateboards, roller

skating and other forms of transportation, first appeared in the report of the Swiss Ministry of Environment, Transport, Energy and Communications (DETEC). In addition to the meaning of transportation, it also contains a green and sustainable meaning, and also includes stops that occur during the tour. It is more suitable for the environmental characteristics of the waterfront. Similar words include Low-traffic, soft traffic, and so on¹.

Slow-motility transportation usually refers to a transportation that is powered by human power². The main features of slow-motility transportation include: average travel speed is low, generally not more than 15km/h, walking speed is distributed in 0.5m/s - 2.16m/s, bicycle speed is generally 10km/h. The distance traveled by slow-motility transportation is also relatively short, generally less than 3km. Slow-motility transportation is free, flexible and pollution-free, and it also has the effect of exercising. It is a green way of travel.

¹ Rosa Anna La Rocca, Soft Mobility and Urban Transformation, Journal of Land Use, Mobility and Environment 2, 2010.04

² Shanghai Municipal Government. Shanghai Metropolitan Transport White Paper [M]. Shanghai: Shanghai People's Publishing House, 2002

2.2. Concept Definition of Urban Waterfront slow-motility Space

The waterfront slow-motility space is different from the general urban road that simply provides transportation functions. It has a combination of leisure, fitness, and sightseeing functions. The urban waterfront slow-motility space proposed in this paper refers to: A public space for users to perform slow activities, which is in the spatial scope of urban waterfront, distributed along the urban water system, connecting various waterfront green spaces, parks and plazas and with relatively complete supporting service facilities.

3. Research content

3.1. Research content

The content of this study includes three parts: landscape perception analysis, design experience and design method summary and landscape evaluation system, including the following points:

1) Combine the relevant theoretical and practical results of waterfront landscape and slow-motility space, and explore the relationship between urban waterfront landscape and leisure slow-motility system, and summarize the landscape design factors and influencing factors of

waterfront slow-motility space.

2) Analyze the landscape characteristics of the waterfront area and the interaction between the landscape and human behavior and psychology; study the activity characteristics and demand levels of the slow-motility people; around the sensory perception, spatial perception, risk perceive and conduct research on emotional perception and other aspects, and comprehensively understand and grasp the landscape perception of the waterfront slow-motility space.

3) Collect and organize excellent waterfront development cases, such as the construction of the Chicago Riverwalk Expansion, the landscape reconstruction along the Thames River in London, the construction of the bicycle lane around Taiwan, and the design of the Shanghai World Expo Riverside Greenland and Suzhou Creek, analyzing the reasons for its success and the perception of landscape designed for reference.

4) Propose the landscape design method of urban waterfront slow-motility space from three aspects: Organization of the functional structure, organization of the path and view and Organization of the space sequence.

3.2. Research framework

The preliminary research framework for this study is drafted as follows (Fig 2):

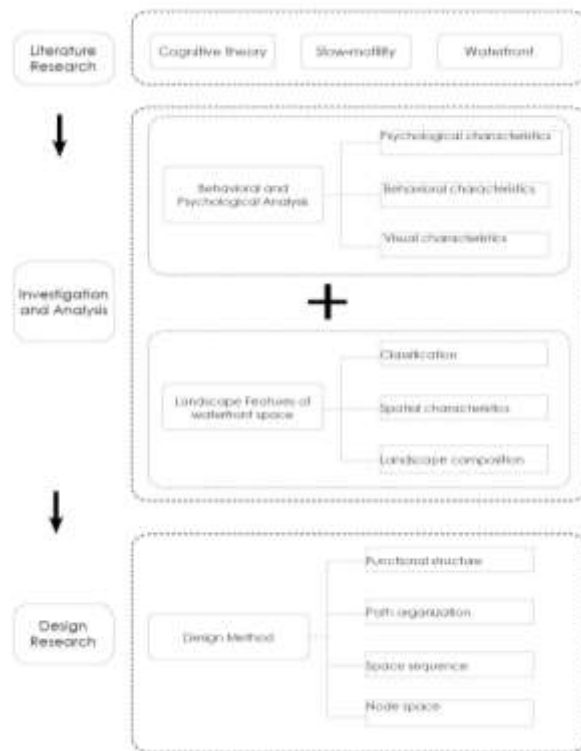


Fig 2 The research framework

4. Thesis 1

The design of the slow-motility space needs to be based on the slow-mover's functional requirements of the space and the perception process of the landscape.

There is a lot of interaction between behavior and space. Whether move or stop, people get psychological perception most from visual information, and the perception will drive next action, and gradually form an overall impression of the waterfront landscape. Therefore, the slow-motility space is not only a riverside walkway with traffic functions, but also a dynamic landscape space that focuses on artistic conception and spatial fun. This paper summarizes and analyzes the related theories of slow-motility behavior from the three aspects.

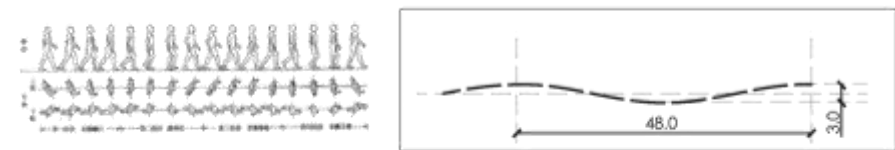


Fig 3 Human wavy walking characteristics³

³ Japanese Architecture Society, Japanese Architectural Design Data Integration (Human Space) [M], Tianjin University Press, 2007

The psychological perception part is based on Jan Gehl's theory. The behavioral characteristics part includes walking, stop and stay and riding behavior. When a person walks in nature, the traveling route is not a strict straight line, but with a tendency to fluctuate with a certain curvature (Fig 3). Therefore, the path with a certain curvature is better for walking. The visual characteristics part includes five parts, namely visual field analysis, viewpoint analysis, line of sight analysis, vision analysis, visual perception.

5. Thesis 2

The waterfront space has many different types according to scales, surrounding environment function, and the relationship between water and city. As a place for recreational activities and open space, the waterfront has common spatial characteristics, namely reachability, continuity and possibility of staying. These three attributes are also the landscape design principles and goals of slow-motility space.

6. Thesis 3

The slow-motility space is the link between the open space and the activity place in the waterfront area. Therefore, the organization of functional structure is one of the key points of landscape design. The

specific structural forms of waterfront slow-motility space include axis-band-point, axis-band, axis-point, axis-zone mode. Each mode is suitable for waterfront with different width.

① Axis: including the real axis and the virtual axis, the real axis refers to the traffic axis, including the walking and bicycle lanes inside the waterfront area, and the virtual axis refers to the channel itself and the structural axis or the sight corridor.

② Spot: the gathering point of the crowd, and it is also the point of interest and visual attraction in the slow-motility process, including the riverside landscape nodes and activities, highlights and so on.

③ Belt: refers to the leisure green space dominated by plant landscape, filling the middle area between the axis and the axis or the axis and the spot. It is mainly composed of plants and small landscape nodes, which is a viewing experience belt.

6.1. Axis-belt-spot structure

The axis-belt-spot structure is suitable for waterfront with a width of 50-200m, mainly in the park or in the suburbs. In the Landscape Design of Qian Lake Park in Yanzhou, a belt was designed around the water and connect different activity space.

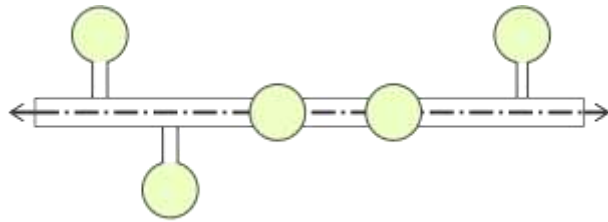


Fig 5 Axis - belt – spot mode functional structure



Fig 6 Landscape Design of Qian Lake Park

6.2. Belt – spot mode

The belt – spot structure is Suitable for waterfront areas with a width of 30-100m, mainly along the river that pass through the city. In the landscape design of Baisha River in Weifang venues are scattered in the linear space in the form of spot or belt.



Fig 7 Belt – spot mode functional structure



Fig 8 Landscape Design of Baisha River in Weifang

6.3. Axis-spot mode

The axis-spot structure is suitable for waterfront areas with a width of 30-50m, mainly near the city residential area. The Landscape Design of Chaoxi Lake in Rushan is a combination of riverside trails and rest squares, forming a continuous chain of open spaces.

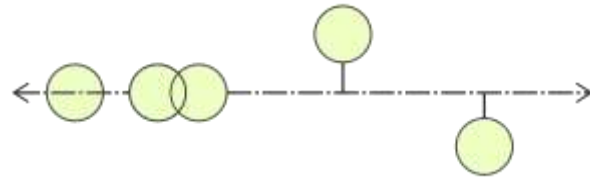


Fig 9 Axis-spot mode functional structure



Fig 10 Landscape Design of Chaoxi Lake and Lake around road in Rushan

6.4. Axis- belt mode

The axis- belt structure is suitable for waterfront areas with a width of 10 -30m, most in the city center. Landscape Design of the Bund Flood Control Wall in Shanghai is a combination of riverside trails and rest points.



Fig 11 Axis- belt mode functional structure



Fig 12 Landscape Design of the Bund Flood Control Wall in Shanghai

It is necessary to take the function as the leading factor, comprehensively measure the width of the riverside green space, the service population, the nature of the surrounding land, etc., and select the appropriate structural form to organize the order of the slow-motility space.

7. Thesis 4

The continuous space experience formed by this order guides people's movement direction, stimulates people's emotions, and finally forms the rambler's overall feeling of the waterfront space. The waterfront space usually is linear, and can be subdivided into three organizational modes. Each mode can form a space sequence with rhythm changes.

7.1. Tandem mode spatial sequence

Tandem mode spatial sequence is suitable for riverside green space with compact land, high water level and line of sight along the river side. A main traffic axis runs through the whole, and the node space is connected one by one in the direction of the river. The landscape design of the riverside road in Changxing has the tandem mode. The walkway along the river likes an axis connected five activity venues. The contrast, penetration and interpenetration of the space on the axis

formed a rhythm sequence.

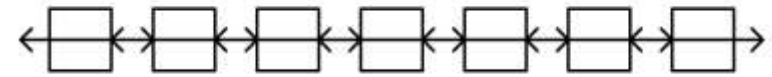


Fig 13 Tandem mode Spatial sequence

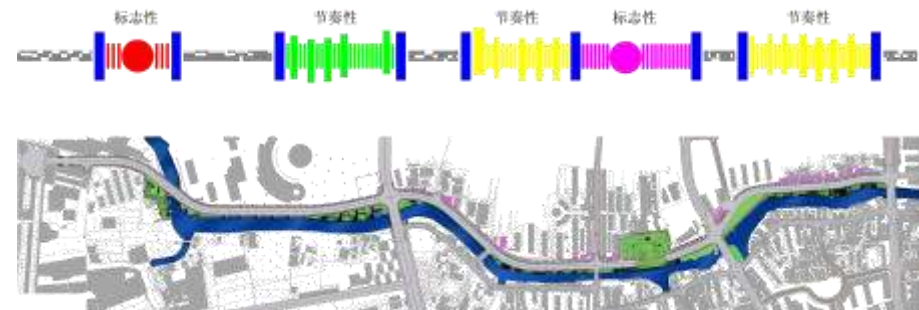


Fig 14 The Spatial sequence of the riverside road landscape design in Changxing

7.2. Parallel mode Spatial sequence

Parallel mode Spatial sequence is suitable for the waterfront space with a slightly larger green space. It adds a horizontal spatial sequence on the basis of tandem mode spatial sequence, and can create a plurality of small-scale open spaces and combine with the linear space to form a rich space sequence. The Bund flood control wall landscape space sequence is organized by linear space as the dominant and partially

interspersed with square nodes. The linear space has two parts, one is a wide walkway along the river and the other part is several continuous rest spaces along the walkway.

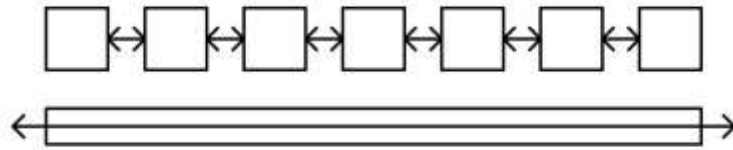


Fig 15 Parallel mode Spatial sequence



Fig 16 Landscape Design of the Bund Flood Control Wall in Shanghai

7.3 Compound mode spatial sequence

The compound mode spatial sequence adds the longitudinal spatial sequence relative to the parallel mode. It can more directly connect with surrounding buildings, squares, and road spaces, and quickly introduce people into the riverside walk space. The Liuwu River is located in Xiajin County, and it runs through the entire city. The landscape design project includes the riverside green belt and three riverside parks. The waterfront was built to be a green belt with a walkway inside, and the three riverside parks connected between the waterfront and the city, formed a compound spatial sequence.

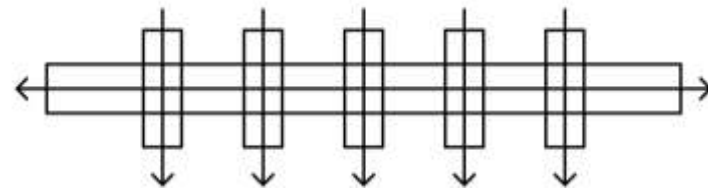


Fig 17 Compound Spatial sequence

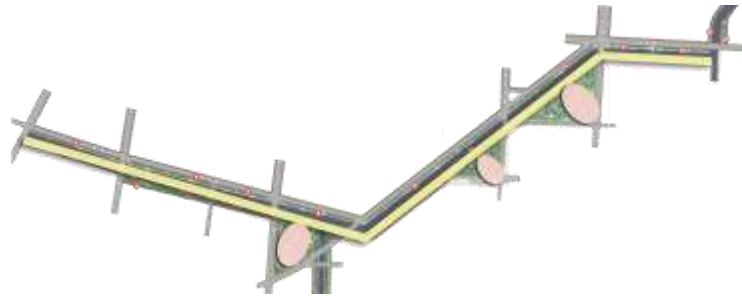


Fig 18 The structural analysis of Liuwu River landscape

7.4. Methods of organizing spatial sequences

1) Spatial contrast and slight difference

Contrast and slight difference are the main ways in which spatial sequences can change. These two methods can be combined to organize the spatial sequence and form the effect of diverse and unified dynamic space.

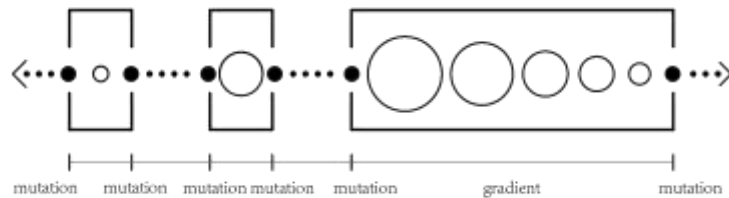


Fig 19 Gradient and mutation diagram

2) Space transition and convergence

Space convergence and transition are needed to improve continuity, while promoting a sense of rhythm. In the Shiliupu District Urban design project, slop paths and green space were used to break the observatory's boundary, allowing the space to extend along the path and merge with the surrounding space.



Fig 20 The roof walkway of Shiliupu district in Shanghai

3) Creation of the artistic conception

Creation of the artistic conception is an approach to organize the spatial

sequences from the perspective of the “site spirit”. Usually, image symbol can be used to express the history or tradition. In the Landscape Design of Baisha River in Weifang, the kite and paper-cut were used as an image symbol of sculpture. Narrative landscape sequence approach also can be used to create the artistic conception, such as use the historical plots in a continuous space to form an experiential order.



Fig 21 Image symbols used in the Landscape Design of Baisha River in Weifang

8. Thesis 5

The path organization of the waterfront slow-motility space is both a traffic organization with slow motility behavior and an organization of viewpoint and sight lines. Specific design methods include: Enhance landscape perception with dynamic views, Guide the direction of

motion by path, Organize paths base on visions.

8.1 Guide the direction of motion by path

The shape of the path space with a sense of direction can guide the direction of motion. There are several ways to define the path space. It can be defined by using flower beds or benches as boundaries, or by different colors in pavement, or by the boundary line directly.

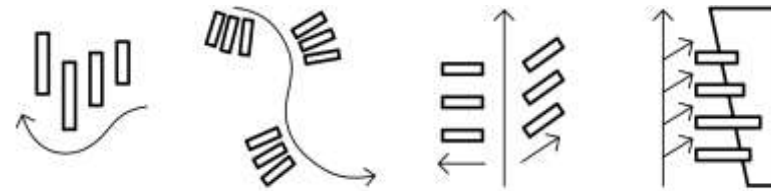


Fig 22 Borders guide the direction of walking

8.2 Deep the sight lines or the path by landscape walls

Landscape walls can be used to deep the sight lines or the path. The depth progression of the line of sight means a person's line of sight crosses different spatial divisions in depth at a certain viewpoint. Deep progress of path means the same view, with the change of the viewpoint caused by the approach of the route, forming a variety of viewing distance.



Fig 23 The landscape wall in Qian Lake Park in Yanzhou

8.3 Dynamic observation perspective

The observation perspective includes a horizontal perspective and a vertical perspective. Dynamic observation perspective is also a good way to organize the path and sight lines. In the urban design proposal of Shiliupu district in Shanghai, the roof of the building is designed as a walking path, and the roofs of different heights are connected by slopes, provide visitors with a variety of viewing platforms, increased their perception of the landscape.

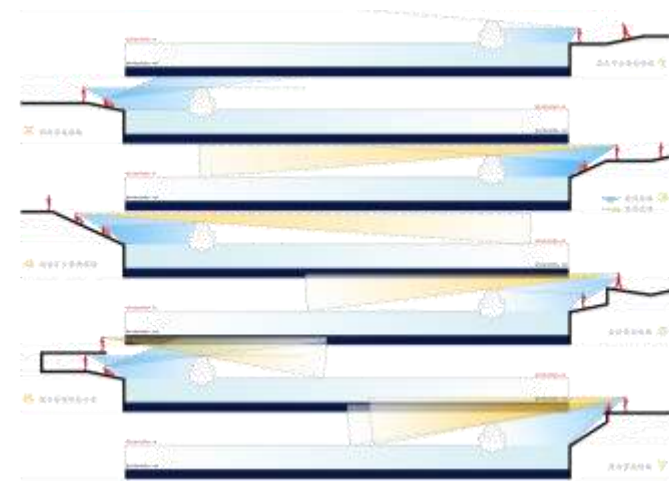


Fig 24 Diverse viewing line of sight in Shiliupu district

9. Landscape Design of Riverside Road in Changxing

Changxing County is located in Huzhou City, Zhejiang Province, close to Taihu Lake. The Riverside Road is located in the east and north part of the city. The river flows into Changxing Port and eventually flows into Taihu Lake. The river is 14-30 meters wide and has a design length of 3 kilometers. The waterfront area is relatively narrow, most are less than 10 meters wide. The height difference between the river and the riverside avenue is about 1.5 meters.

9.1 Design concept

The design concept is based on the analysis of the history and culture of Changxing county, such as tea culture and wuyue culture.

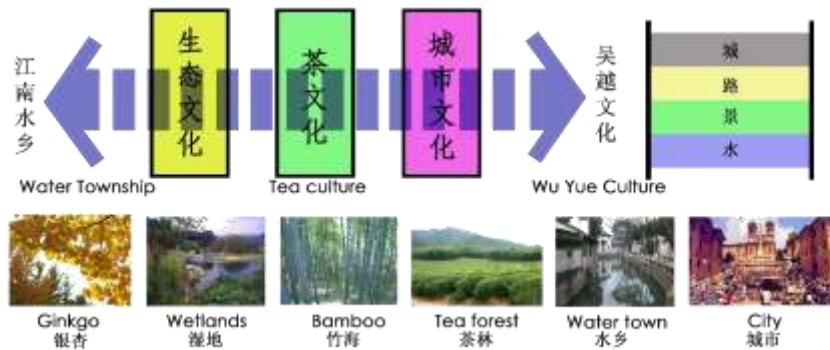


Fig 25 Design Concept analysis

9.2 Function organization

The width of the riverside space is less than 10m, with several parts more than 30m, so the axis-spot mode will be the suitable functional structure.

9.3 Space sequence design

The spatial sequence of this site is the tandem mode. The walkway

along the river likes an axis connected five activity avenues one by one.

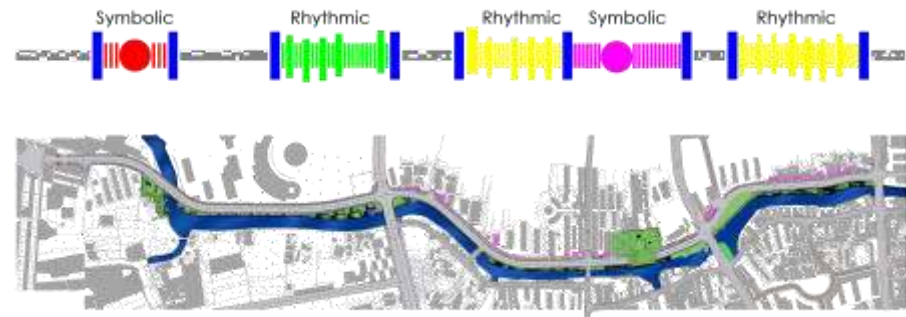


Fig 26 Space sequence analysis

9.4 Design of the node space

The riverside green space is relatively narrow, most are less than 10 meters wide. There are also several wide areas in the site, which are the key parts of the design.

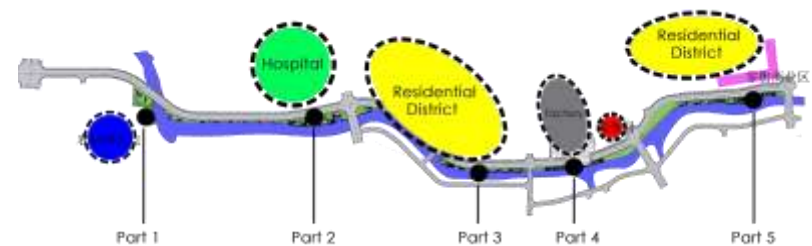


Fig 27 Surrounding environment and 5 parts analysis

Part 1: The land is located at the turning point of the river and is the opposite of the river. Therefore, it is considered to construct a city activity center to form a landmark building.

Part 2: The design is mainly focused on concentrated green space, equipped with activity squares, spatial division through the landscape wall, forming the artistic conception of “garden” and highlighting the landmark role of the ancient ginkgo tree.



Fig 28 Plan of Part 2

Part 3: A landscape tower was set up at the corner of the river, as the commanding heights of the space.

Part 4: An open space formed after the relocation of the factory arranges recreational facilities. Vertically, the waterfront, the road and

the activity square are integrated into one.



Fig 29 Site plan of part 3

Part 5: The flow of people is strong, requires more activity space and waterscape. Through the design of the landscape pavilion, the sense of order and rhythm of the space is enhanced.

9.5 Design of the landscape furniture

Landscape structures and street furniture are an important part of the design, especially the landscape tower. As a landmark, it is an important factor in people's “psychological map” about the river landscape and even the urban landscape.

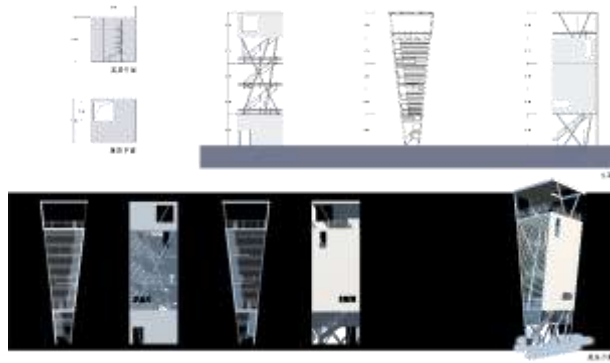


Fig 30 Design of the Landscape tower

9.6 Real picture after the construction



Fig 31 The view of part 2



Fig 32 The view of pavilion



Fig 33 The night view of the river

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