

Design of Waterfront Slow Traffic Space based on Walkability Experience

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Abstract

This paper investigates the design of the slow traffic system in Shenzhen Bay Park, and analyzes the basic factors affecting the walkability of the waterfront slow traffic space from the three aspects of the environment, road and guide system. It is concluded that the waterfront slow space should meet the design elements of walkability. On the one hand, it can comprehensively interpret the design of walkable waterfront slow space, and on the other hand, it can provide a new direction for the waterfront slow space research.

Keywords

Walkability; Waterfront space; Slow traffic space; Shenzhen Bay.

1. Related Review

1.1. Waterfront Belt Park

Waterfront belt park green space refers to the belt park green space built adjacent to the urban water system (such as rivers, lakes, oceans, etc.). [1] According to the conditions of different water systems, it can be divided into three types: riverside, lakeside and coastal. According to the spatial relationship between the park and the water body, it can be divided into ribbon parks on both sides of the water body and ribbon parks on one side of the water body. The Shenzhen Bay Park studied in this study belongs to the coastal belt park green space on one side of the water body. Waterfront space is a specific space area in a city with water resources, and the waterfront slow traffic space is an important linear space in the urban waterfront area. In modern life, the waterfront slow traffic space not only helps to alleviate the urban traffic problems, but also is an important space for activities and rest for the urban people. Its width is generally larger than the general walking path, which not only meets the basic traffic, but also provides space for the activities of people, forming a more complex and special linear structure space, so as to interact with the waterfront and the surrounding environment.

1.2. "Walkable"

Walkability indicates the spatial proximity between the destination and destination and the convenience of walking between two points. [2] The walking process includes the starting and ending points and path, which are the starting place and destination of walking traffic. The type and spatial distribution determine the possibility of walking travel, while the environmental factors in the walking path have an important impact on the convenience and comfort of travel. [3] Walking road construction has become one of the ways to improve urban sustainable development. "Walkability" is directly related to the waterfront space quality of a city, so it has gradually become an important factor that must be carefully considered in the design of waterfront slow space. Although the concept of "walkability" is currently frequently used in different research areas, there is no unified definition because the concept itself involves various objective and subjective factors, coupled with differences in the respective evaluation perspectives. Although the interpretation is relatively broad, it already includes subjective and objective factors. From the perspective of urban research, the concept of walkability is

expanded to "the support of urban environment for walking and walkers' evaluation of walking experience in the environment"[4]. In the more detailed research and analysis, some scholars simplified the concept to "to what extent the built environment of a city helps the area to walk, access to business and public services, and commuting"[5].

2. Overview of the Slow Traffic System of Shenzhen Bay Park

2.1. Overview

Shenzhen Bay Park was built in 1999, and an eight-year design was completed in 2007. It is the closest coastal zone to Shenzhen urban area, and will highlight the urban characteristics of Shenzhen. Shenzhen Bay Park carries a variety of activities such as leisure, fitness and sightseeing, but also shows the infinite vitality and sports spirit of Shenzhen, meets the various needs of the city, citizens and tourists, and has become a real name card of Shenzhen.

Shenzhen Bay Park is located at the southernmost point of the junction between Futian District and Nanshan District in Shenzhen, starting from the Mangrove Nature Reserve in the east to the west of the Shenzhen-Hong Kong Cross-sea Bridge in the west, Binhai Avenue in the north and Shenzhen Bay in the south, and far from the Hong Kong Mipu Nature Reserve. See Figure 3-1. The park is about 15 km long and has a total area of about 108 hm². It is the only open and concentrated coastal sightseeing belt in Shenzhen city.[6]

2.2. Climate

Shenzhen is located south of the Tropic of Cancer, and has a subtropical Marine climate with mild climate, abundant rainfall and long sunshine time. Summer has no heat, for up to six months. Spring and autumn and winter three seasons of warm climate, no cold worries. The average annual air temperature is 22.3°C, with a maximum temperature of 36.6°C, a minimum temperature of 1.4°C, and a frost-free period of 355 days. The annual sunshine is 2060 hours. The rainy season is from May to September, and the average annual rainfall is 1,924.7 mm. There are occasional typhoons in summer and autumn, but blocked by mountains, directly hit the city about two years. With the prevailing east wind throughout the year, southeast wind in summer and northeast wind in winter, the annual average sunshine is 2060 hours.

2.3. Ambitus

In terms of transportation, there are 13 bus stations within 1,000 meters near the Shenzhen Bay Park. The 10 stations are on the boundary of Shenzhen Bay Park, namely Binhai Avenue and Wanghai Road, and need to reach the park by overpass, underpass or sidewalk; Metro Line 2, Line 11 connects Shenzhen Bay Park, reaching Shenzhen Bay Park, the easternmost subway station, the southernmost subway station, and several subway stations in the middle.

3. Walkability and Slow Traffic Space Environment

The waterfront trail environment should first ensure that walkers feel comfortable while walking. The factors affecting the comfort are various, including the material environment of the trail, and the cultural and artistic atmosphere, as well as the landscape and people's activities along the way. Firstly, the key points of pedestrian waterfront footpath space design are analyzed from the three nodes of traffic, landscape and public facilities.

3.1. Step Space Environment Traffic Node

There are 9 km-long greenways in the park, and the slow traffic network organically connects Shenzhen Bay Park with the maritime world, Window of the world and other areas. Through the field investigation of Shenzhen Bay Park, the Shenzhen Bay Park road route is basically defined. In general, the use of the slow traffic system in the park is mainly walking, cycling and

running. The waterfront footpath near the residential business district has an obvious division between the pedestrian road and the bicycle road. The road surface is smooth and other sections cannot pass bicycles, but it is actually a way of mixing people and cars. The secondary garden road is mainly the garden bridge and the forest footpath. The whole park is composed of four types of road systems: ① near the beach is the climax footpath, near the sea, ② is the 7 m wide coastal footpath above the climax trail, the main recreational footpath in the park, ③ winding, creating a good riding experience; ④ between the bicycle path and the coastal walk, mainly 1.5 m wide granite step. Shenzhen is located in the south of the Tropic of Cancer, which is a subtropical Marine climate with mild climate, abundant rainfall and long sunshine time.. Therefore, some sidewalks, shaded automatic pedestrian walkways and waterfront sea viewing walkways can provide walkers with a variety of options for people to feel different travel experiences.

3.2. Step Space Environment Landscape Node

High-quality landscape environment is the feature of urban waterfront green road slow space different from other slow space types, and is also a key factor to meet the comfort and freedom of pedestrians.

3.2.1. Space Characteristics

The biggest feature of the space design of Shenzhen Bay Park is that a number of semicircular green spaces with different themes are added along the coastline, which reduces the length of the length of the park coastline and creates a series of unique theme Spaces, which enriches the types of tour activities and meets the needs of different slow traffic subjects. From east to west to south, six bays are formed: Mangrove Wetland Bay, OCT Inner Bay, Nanshan Inner Bay, Dongjiaotou Bridge Bay, Shekou Fishing Port Bay and Maritime World Leisure Bay. Shenzhen Bay Park extends north from Shekou to Shenzhen Bay Bridge, and turns east at the Shahe West Interchange. The Shenzhen Bay coastal leisure belt is divided into three areas: A, B and C, covering an area of about 108.07 hectares. On the 9.06 km coastline of the coastal leisure belt, there are 13 regional parks with different themes, all of which are connected together by a perfect walking and bicycle system.

Table 1. Shenzhen Bay Park Node (Source: Self-painted)

sector	theme park	Scenic spot characteristics
A sector	The Mangrove Waterfront Ecological Park	One of the main entrances, mangrove has 194 species of birds and more than 240 species of characteristic native plants, including a large number of mangrove plants. The green space rate in the park has reached more than 90%, forming a regional characteristic landscape with subtropical vegetation as the main body.
	China Bay reading sea square	Yuehai Square is located in the middle of Shenzhen Bay, with unique geographical advantages. It is the best place to enjoy the sea view in Shenzhen Bay Park, and it is also the closest scenic spot to the mangroves.
	Sea rhyme garden	Haiyun Park is mainly micro-terrain, woodland and lawn space. A wide walking path divides the park into two Spaces, east and west, and brings the slow traffic to the main walking avenue. The surrounding woodland and lawns create a comfortable and comfortable leisure space.
	Egret slope	Egret slope consists of slope grass, mountain top square and two leisure platforms embedded in the mountain.
	North Bay heron port	One of the main entrance, Shenzhen bay park one of the most popular attractions, is also one of the main entrance of the park, is located in the east island, central is can hydrophilic steps, horizons, visitors can stay

		here to enjoy the beautiful Shenzhen bay scenery, on both sides of the forest rest square and view the sea pier, west side can swim objective birds, planted lush vegetation around heron port, pleasant environment.
	bhit	Xiaoxia Mountain is designed and transformed on the basis of the original site, and a viewing and shading site is added on the top of the mountain. In terms of vegetation planting, in order to express the good meaning of good luck and happiness, mainly happy tree, rain tree, carefree tree and fuwood, with some cloud fragrance plant matching scheme.
B sector	Universiade torch stage	Shenzhen's third landmark urban landscape landmark
	Flow of huashan	With the title of "flower clusters", to create a curved flower bed flowing along the mountain, arranged a number of curved flower beds covering the grass slope to the sea, each flower bed planted a single variety of flowers, each season has different varieties of flowers in full bloom, is a good place to take photos.
C sector	The moon valley	One of the main entrance, the crescent valley by the center of the circular lawn and the mountain around the become, can stop the cold northeast wind in winter, can enjoy the comfortable southeast wind in summer, and can block the noise of traffic, form a warm winter and cool summer, quiet and comfortable leisure activity space, is a good place for picnic and games.
	Sunrise theater	With the Valley of "Art" as the theme, the open-air theater is built according to local conditions. After entering the main entrance, the performance theater goes up to the top of the mountain. The spatial structure is similar to the crescent valley, with the performance venue in the middle, located in a semicircular water lily pool, and the sloping grass facing the sea on three sides as a stand. During holidays, Shenzhen Bay Grassland Music Festival and other activities are often held here, which has become one of the most dynamic and charming scenic spots in Shenzhen Bay Park.
	Tidal wetland	Touch the tide ebb and flow personally, closely watch the plant season changes. The park is adjacent to Wanghai Road in the west, and there is a small wetland pool in the middle of the pool. There is a garden bridge above the pool, in which tourists can walk through their own way, increasing the fun of the tour.
	Wedding square	With wedding and celebration as the theme, often held large-scale activities, its core location is a circular square, square on both sides of a series of large and small photos and assembly space, park to wedding and celebration as the design theme, attracted a lot of couples to take wedding photos, Shenzhen bay park regularly collective wedding, Shenzhen bay park more a romantic feelings.
	View the sea stack bridge	The best view of the cross-sea-Shenzhen-Hong Kong Bridge.
	Sea breeze sports park	One of the main entrances, the activity site is open and flat, and the popular home for healthy people. The park has three rectangular activity venues as well as a ball activity venue. Rectangular activity venue activity form is not limited, the activity content is rich, very popular with children and parents. Ball venues are basketball, volleyball and tennis, which are more popular with teenagers and adults.

3.2.2. Ecological Characteristics

On the one hand, as an important part of mangrove wetland ecosystem, it undertakes the ecological task of wetland ecosystem and provides survival conditions and shelter for wildlife; on the other hand, as artificial reclamation and salt water, its ecosystem is very sensitive and fragile. The high density of vegetation coverage rate of Shenzhen Bay Park makes the region have a good ability to resist natural disasters, become an important barrier for urban disaster prevention, effectively guarantee the ecological security of the urban waterfront, and is an important part of the urban ecological security pattern [7].

3.3. Trail Space Environment Node of Public Facilities

The treatment of humanized infrastructure in Shenzhen Bay Park is particularly prominent. There are many landscape areas in the park, including grassland, forest and outdoor theater, playground, books, etc., matching landscape facilities such as public toilets, basins, square lights, sign system, rest pavilions, lounge, seats, protective railings, water springs and so on, fully meet the needs of public entertainment and leisure, and on the details processing using humanized auxiliary facilities to meet the needs of special people. (Figure 1.)

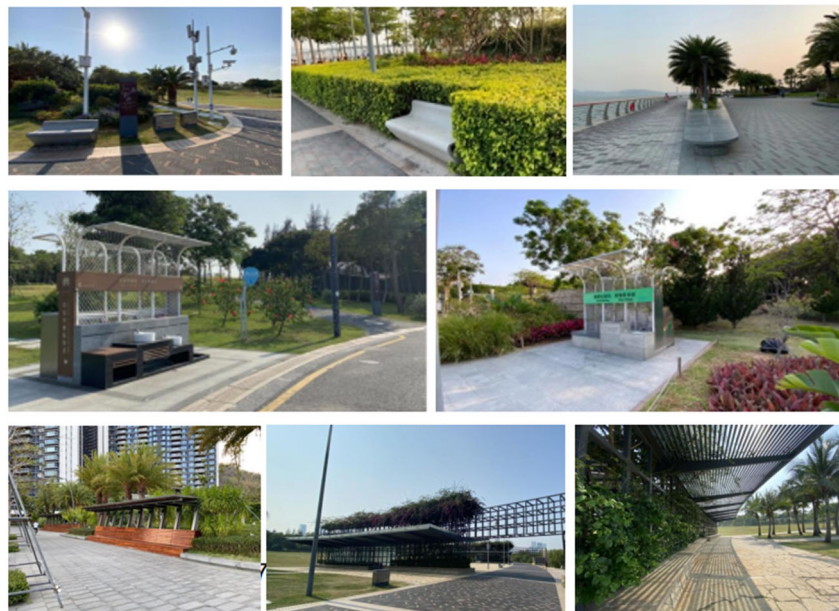


Figure 1. Public facilities

3.3.1. Seats

The rest chairs and stools in the park are very dense, providing a large number of chairs and stools for visitors to rest, and the tree pool, flower beds also widen the edge, so that the flower bed and tree pool has not only become a feasible ornamental scenery, but also become a usable rest facilities. When the flow of people is not very large, visitors in the park can still more easily find rest chairs and stools. Most of the chairs and stools in the park have a back, high comfort, with the back of the garden chairs are more suitable for their long rest, reading newspapers.

3.3.2. Garbage Can

The dustbin is novel in form, which is integrated with the sink, which is convenient for users to clean. It is also for tourists to clean the sand. The design is reasonable and humanized, but the number is relatively small.

3.3.3. Pavilion

Shenzhen Bay Park has set up more pavilions, corridors and scaffolding that can shelter from wind and rain, so that visitors can take shelter from the rain, and visitors can also play chess, poker, singing and other recreational activities in these facilities.

4. Three, Walking Ability and Slow Space Road

4.1. Horizontal Space

Long-term studies have shown that when the distance to an open space, for example, drops beyond 30 meters. [8] Therefore, when people walk in a slow walking space, the actual walking distance may be beyond the preset distance of accessibility, and it will become more tired as the walking distance increases. Thus, the Danish architect Jan Gail [9] It was proposed that people' "acceptable walking distance" is a variable.

People are the main body of slow traffic activities, and their physiological and psychological effects make different environments have very different psychological effects on travel. Simple and straight walking roads will make people feel boring and boring. Paving is an important part of Shenzhen Bay Park, which not only divides square space, street space, waterfront space, scenic space and scenic area, through graphic design of pavement, material selection and color collocation, the pavement design, which looks like the arrow shape of Shenzhen Bay Park is cross shape, which can feel gentle and enjoy the scenery.

4.2. Vertical Space

The change of the ground height of the slow traffic space will have a certain impact on the slow traffic. The survey shows that when the ground height difference is large, it is more attractive to pedestrians. Similarly, when faced with steps and ramps, ramps because the walking pace is not much affected and the ramps are more wheelchair friendly to use. Shenzhen Bay adopts curve design in line with the characteristics of ocean flow curve formed convex space can form a continuous, rich and changeable viewing effect to form a comprehensive recreational active shoreline. The path types of Shenzhen Bay Park are natural revetment, gravel revetment, parallel curve path, single waterside structure, local path amplification, concave space, hydrophilic platform, waterside step square and linear step square. (Figure 2.)

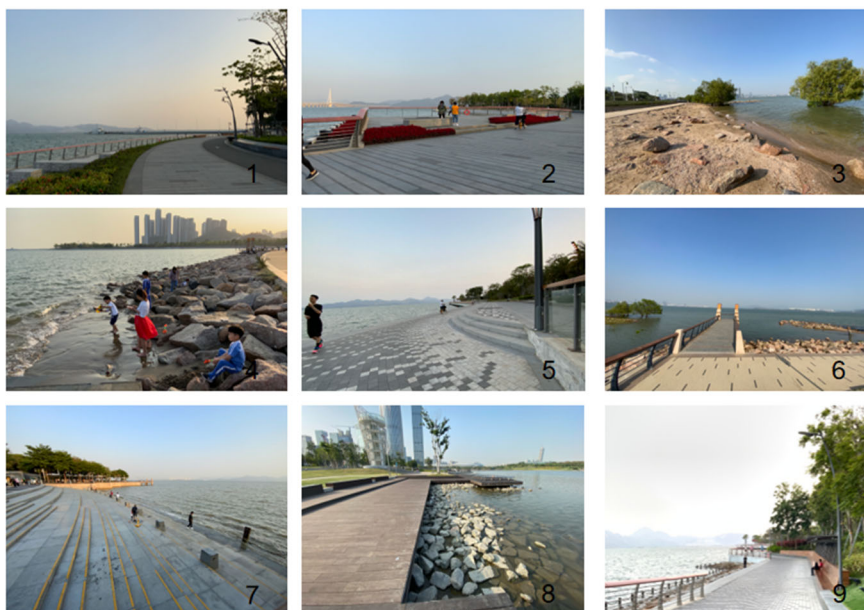


Figure 2. Shenzhen Bay Park path

4.2.1. Parallel Curve Path

The overall arrangement of curves will make people feel smooth, let people think of natural rivers, terrain, etc., with a strong psychological implication. In the coastal landscape design, the parallel curves can form a very coordinated relationship with the riparian lines.

4.2.2. Path Local Amplification

Break up at the node of the longer waterfront route, enlarge the local path, and also match the structures, seats, railings and so on to form an open view for stopping, rest and viewing.

4.2.3. Natural Revetment

The plant community of natural revetment has the function of containing water storage and air purification, which can form a microclimate in the plant coverage area and improve the ecological environment around the water body. Therefore, the natural revetment should be the main spatial type of the waterfront area.

4.2.4. Gravel Bank Protection

Gravel is permeable and breathable, conducive to the growth of plants and plants and microorganisms, and plastic shape strong, can shape a variety of shapes and texture.

4.2.5. Waterside Step Square

The ladder revetment can ensure that people are stable and balanced when moving at different heights, so that people can move up and down, walk vertically and squat.

4.2.6. Water-friendly Platform

The path elongates along the radial direction, probes out of the water surface, combined with pavement, facilities, etc. Wharf space, fishing space, water square, groups of adjacent water structures and other residence space, deep into the water, so that the land and water direct dialogue.

4.2.7. Line-shape Step Square

The commonly used space treatment technique is in the form of steps to treat and digest the height difference of the water and land interface, and the use of linear step square is a good way to deal with when the space is narrow

4.2.8. Endavit Space

A space for the water body to actively talk with the shore.

4.2.9. A Single Waterside Structure

A sheltered space near the water for a stay and rest.

5. Walkability and Slow Traffic Space Guide System

Maslow [10] In his demand theory, he points out that "safety demand" is the primary demand above the most basic physiological needs of human beings, so the safety of slow traffic space is the primary concern of pedestrians. The guide system of slow traffic space is like behavior rules and information symbols, providing a guarantee for the convenience and safety of travel. The identification system along the slow traffic system of Shenzhen Bay Park is relatively perfect, there are three main problems: ① Binhai Walk has relatively few signs, the number and density of the main road signs should indicate the distance and direction of the nearest service facilities; ② climax walk is basically invisible, it is recommended to enhance the guidance; ③ adds the map signs, the pedestrian body to avoid getting lost in the park.

6. Conclusion

Walking is a normal way of travel in waterfront slow space, so walkability has also become a standard to measure slow space. Many designers in the waterfront slow traffic space planning and design, do not really put the pedestrian walking feeling in an important position, but just pay attention to the pursuit of the perfect embodiment of the form. Design is people-oriented, and the pedestrian walking experience should be placed in the first place of design.

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