

Research on Urban Greenway Planning and Design Strategy

-- Taking Shenzhen Greenway as an Example

Dewei Zhou *

Tianjin Urban Construction Design Institute Co., LTD. South China branch, Shenzhen, Guangdong, China

* Corresponding author Email: 3512658109@qq.com

Abstract: Nowadays, green travel and low-carbon travel have become more and more popular, green environmental protection has become an important part of sustainable development, people have the pursuit of higher quality of life and better transportation needs. This paper first expounds the design of urban greenway slow traffic system, greenway design strategy and greenway usage rule and strategy, and then studies the planning and design of urban greenway in Shenzhen, studies the overall planning and design layout of greenway, helps Shenzhen plan and build Livable park city, and accumulates experience for improving urban greenway planning. Study and explore the planning and design strategy of urban greenway, improve the humanistic design concept of walking environment, and provide basis and reference for building high-quality urban greenway planning and design.

Keywords: Urban Greenway; Planning and Design Strategy; Shenzhen.

1. Introduction

Nowadays, green travel and low-carbon travel have become more and more popular, green environmental protection has become an important part of sustainable development, and people have the need to pursue higher quality of life and better transportation. Urban greenway needs to meet people's demand for path environment, and different residents' choice of travel mode affects the quality of urban environment and living standard. Greenway has become an urban development trend due to its various functions and cost saving advantages. Greenway planning and design can help promote the construction of urban ecological humanities and improve the urban ecological environment. The study of urban greenway planning and design and strategy is of great significance and reference value for the construction of ecologically livable cities, the improvement of urban quality and the improvement of people's living environment.

2. Green Lane Slow Traffic System Design

Modern cities emphasize ecological harmony, beauty and livable, and pay attention to people's happiness and travel modes. The city focuses on the planning of slow traffic network, which not only meets the needs of short-distance transportation, but also connects with environment-friendly transportation means such as cycling, bus, subway and light rail to achieve convenient travel and transfer of medium and long-distance transportation, which can effectively alleviate urban diseases, slow down car congestion, improve the ecological environment, improve traffic safety, and increase traffic travel rate and efficiency.

2.1. Green Entrance Planning

Each section of the urban greenway has an entrance and exit, and the second entrance and exit need to coordinate

accessibility and traffic service, and the number is more. Urban greenway planning and design should coordinate the design of non-motorized roads, sidewalks or scenic highways connecting municipal roads or scenic highways.

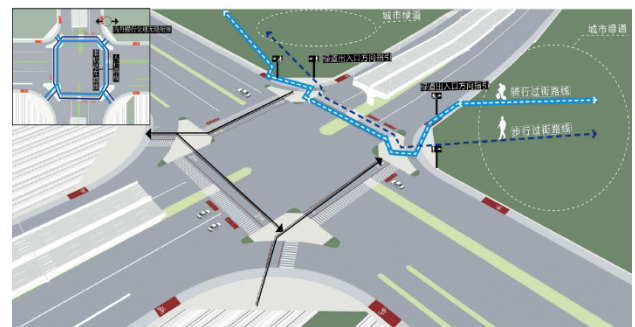


Figure 1. Road map of Greenway crossing

2.2. Slow Traffic System Design

The running path and riding way are the first class greenway, and the pavement is colored permeable concrete, so as to distinguish it from other roads, and carry out the marking and sign design.

The riding road pays attention to continuity, the one-way width of the road is 2~2.5m, the two-way width is 4~5m, and the special rest area is arranged along the road, and the running path and walking path are arranged as a whole.

The running path is the same, and the ground is designed with running signs. Starting and rest areas, signs and public facilities will be arranged along the route. The width of the running path is 1.5~2m in one direction, 3~4m in both directions, and the overall layout of the riding and walking ways along the way.

The promenade is paved with permeable bricks, scattered with wooden trestle and splice, and the whole section is equipped with barrier-free design; Promenade can go to any venue at will, and coordinate the layout of cycling lanes and promenades along the way.

The design concept of the landscape bridge is based on the four dimensions of structural performance, architectural culture, environmental coordination and experience diversity. The slope of the bridge should be slow, and motor vehicles should be prohibited. Other greenways should be arranged and connected along the way.

3. Urban Greenway Design Strategy

3.1. Comfort

Greenway construction needs to meet the laws of nature and the needs of production and life, leisure and entertainment, reflecting the people-oriented and harmonious coexistence of nature. The spatial and temporal planning and design based on ecological green strategy must always reflect the multi-dimensional characteristics of harmonious coexistence between nature and humanity.

The improvement and perfection of facilities is the improvement and perfection of public service facilities, reflecting the comfort and humanization of the greenway environment. Happiness and mental relaxation are reflected in safety facilities, rest facilities, lighting facilities, etc.

3.2. Consistency

Because the body function of the greenway for movement is a continuous process, people do not want to be blocked by motor vehicles and traffic lights, and the greenway can ensure the continuity of motion state and behavior. Continuity of walking ability In order to meet the need of behavior continuity, the continuity of walking environment path ensures the continuity of behavior.

The walking path system is independent and organically connected, which can ensure the continuity of the path, and connect the walking path concentration area with the spatial walking system, and the hiking path selection is suitable for the hiking frequency.

3.3. Landscape Characteristics

When using the greenway, people will choose the ecological environment with high quality and better landscape quality, and tend to improve the ecological environment and public facilities. They always have a trend of good walkability and landscape quality in the city, and a trend of urbanization for urban green Spaces, parks, landscape lakes, monuments, historical buildings and other good natural landscapes.

4. Study on the Rules and Strategies of Greenway Use

4.1. Study on the Rule of Greenway Use

This section studies the use preference and activity degree (simplified as use intensity), activity type and age differentiation law of urban greenway, and analyzes the spatio-temporal rule of greenway use, activity habit, preference and intensity, use time (working day/non-working day), age, use intensity, activity type and habit and other differences. The study focuses on the characteristics of greenway use intensity and habit difference during peak periods. In order to study the relationship between different sections of greenway and usage intensity, peak index (PI) and peak congestion index (PCI) are introduced in this paper, and greenway flow is analyzed. The definition and equation of greenway peak index are as follows:

Define the unit 10-minute flow rate as Q_i , where i is the greenway segment($i=1,2,3\dots$), j is time($j=1,2,3\dots$).

Definition:

$$Q_{i,max} = \max\{Q_{i,1}, Q_{i,2}, Q_{i,3}, \dots, Q_{i,3}\} \quad (1)$$

The formula of greenway peak index is thus derived as follows:

$$PI_i = Q_{i,max} / \left(\frac{\sum_{i=1}^{13} \sum_{j=1}^{17} Q_{ij}}{17 \times 13} \right) \quad (2)$$

In the formula, the larger the PI value is, the larger the traffic of greenway per unit 10 minutes and the obvious peak; otherwise, the smaller the traffic of greenway.

The equation of greenway peak congestion index is:

$$PCI_i = Q_{i,max} / w_i \left(\frac{1}{13} \sum_{i=1}^{13} Q_{i,max} \right) \quad (3)$$

Where w_i is the weight of different greenway segments i , the larger the PCI value, the higher the degree of greenway activity; otherwise, the lower the degree of greenway activity.

Where the weight:

$$w = \frac{A_i}{L_i} \div \text{Min}\left(\frac{A_i}{L_i}\right) \quad (4)$$

Where A_i is the area of greenway segment i , and L_i is the length of greenway segment i . The weights of different greenway segments are related to the area and length of the greenway.

4.2. Study on Spatial and Temporal Rules of Residents' Greenway Travel

Time pattern: After investigation, research and analysis, the pedestrian flow on greenways shows regular changes, with middle-aged and young people being the main body of transportation. Non-working days > working days, and the peak hours are similar, with the peak at 8-9 pm at night. The flow of people on urban greenways is regular, and control and guidance can also be carried out.

The main activities of the greenway are walking, cycling and running, and the order is walking > cycling > running > Viewing > Roller skating > Stall > Fishing. Walking accounted for more than half of the total, and walking, cycling and running accounted for a very high proportion of three types of activities (95% on working days and 98% on non-working days). Running and cycling tend to be more evening (9.30pm to 10.30pm).

Recreational and pass-through greenways peak at 8 to 9:30 p.m., landmark greenways peak at 8 to 10 p.m., and potential greenways peak at 7:30 to 8 p.m.

4.3. Greenway Design Strategy Research

Greenway design strategy: space composition and design elements, giving full consideration to human and natural needs. The greenway is planned with vegetation, street lights, safety facilities, barrier-free access, municipal public facilities and various service facilities.

5. Research on Greenway Planning and Design in Shenzhen City

5.1. Overview and Requirements

5.1.1. Current Situation Overview

The greenway network in Shenzhen has been basically completed, with a total length of about 3000 kilometers. It has been achieved that cycling takes 10-15 minutes to reach the urban greenway and half an hour to reach the provincial greenway. Nearly 100 post stations have been built, including 25 first level post stations and 75 second level post stations. Build 20-30 high-quality greenways. Relevant regulations and technical guidelines have been formulated and introduced, and the management system for greenway construction is sound.

The key issues to be addressed in this planning and design research are: 1) Space: The greenway network connecting mountains and seas needs to be improved; 2) Function: Greenway composite function and experience need to be improved; 3) Characteristic: It is urgent to strengthen cultural characteristics and brand demonstration; 4) Management: The refined construction and management of greenways need to be strengthened.

5.1.2. Requirement Analysis

According to a public opinion survey, citizens have a prominent demand for getting close to mountain and sea greenways, improving greenway service facilities, and hoping to strengthen greenway characteristics, scene experiences, and event organization. Specifically, as follows:

(1) Facility improvement: Nearly 60% of citizens hope to improve the cultural, entertainment, and sports facilities on the greenway, and more than half of citizens hope to add shading and rain blocking facilities along the way to enrich cultural, tourism, commercial, and municipal public facilities.

(2) Construction and management of green corridor system: 75% of citizens hope to increase the shading effect of trees along the line, and hope to increase the variety of vegetation such as flowers and fragrance.

(3) Main feedback: Long distance, inconvenient access, insufficient supporting facilities for greenways, poor connectivity of greenways, single service functions of greenways, too few scenic spots along the route, insufficient attraction, and insufficient road comfort along the greenway.

(4) Experience preference and intensity: 60% of citizens hope to bring interesting scenic experiences; 58% of citizens hope to bring a happy sports experience.

(5) Activity habits: 76% leisure walking, 56% fitness exercise, 55% close to nature, 37% sightseeing, 13% travel needs.

5.2. Research on Greenway Planning and Design in Shenzhen

5.2.1. Shenzhen Greenway Design Concept

The planning of greenways in Shenzhen must implement the national ecological civilization concept. The Shenzhen greenway network planning guides the establishment of a three-level greenway network system. With the increase in completion volume, the planning will pay more attention to the precise and refined guidance of spatial planning, and focus on the improvement of quality. In order to scientifically coordinate and guide the city's greenway planning and construction work, relevant departments in Shenzhen have organized the preparation of a special plan for the greenway

network in Shenzhen. The greenway planning and design should respect the authenticity of the harmonious coexistence of natural ecology and culture, the principle of putting people first, and the fundamental nature of traffic safety, in order to help Shenzhen build a beautiful and livable park city.

5.2.2. Shenzhen Greenway Planning and Design

1) System composition and target vision

Greenway is an ecological space that connects humans and nature in harmonious coexistence, serving multiple functions including ecological conservation, leisure tourism, health and fitness, green travel, cultural services, science education, and socio-economic development.

Greenway consists of three major systems and different elements. The three major systems are the walking path system, green corridor system, and supporting facilities system. The constituent elements include pedestrian paths, cycling paths, jogging paths, slow lanes, municipal public facilities, signage facilities, various service facilities, etc.

Shenzhen's greenway corresponds to the requirements of the new era and new development, expands the connotation of greenways, realizes the integration of multiple planning and layout of greenways, and achieves the overall goal of reaching the beautiful city of Blue Bay on the green spine and enjoying the outdoor paradise of mountains and seas.

2) Overall structure

Constructing a framework of one ridge, one belt, and twenty corridors: 1) One ridge: a natural and wild mountain ridge with lush veins; 2) Belt: Vibrant and resilient coastal blue belt; 3) Twenty corridors: a landscape green corridor that blends blue and green.

3) Global Weaving Network

The city of mountains and seas integrates a comprehensive greenway network: 1) Building a natural and traceless mountain hiking experience system; 2) Build a coastal sightseeing experience system that connects mountains and seas; 3) Building a convenient and comfortable urban leisure experience system; 4) Weave an interconnected global greenway network.

Building an Outdoor Experience System for the City of Mountains and Seas: Combining three major categories, a city-wide outdoor experience system for the city of Mountains and Seas will be constructed, namely the Mountain Hiking Experience System, the Coastal Sightseeing Experience System, and the Urban Leisure Experience System.

4) Natural Greenway

Improving the ecological function and quality of greenways: 1) Coordinating greenway construction and ecological protection; 2) Weaving and repairing the ecological network of regional connectivity; 3) Restoration of biologically friendly natural green corridors; 4) Build urban greenways that are close to nature.

Based on the comprehensive resource conditions, policy requirements, and ecological assessment of the city, the ecological space is divided into greenway prohibited construction areas, restricted construction areas, and controlled construction areas, with a focus on proposing greenway construction guidelines from the trail system, green corridor system, service facilities, and greenway control areas.

5) Healthy Path

Building a diverse and enjoyable greenway lifestyle for all ages: 1) Implementing age friendly design; 2) Building a healthy walking path system; 3) Improve the composite function of greenways; 4) Undertake diverse sports events

and activities.

6) Charm Enjoyment Path

Building the brand characteristics of Pengcheng is thousands of miles away: 1) Constructing a cultural characteristic loop; 2) Construct 100 high-quality greenways; 3) Build a Shenzhen greenway brand.

7) Smart Greenway

Promote the refinement and intelligent management of greenways: 1) Build a smart greenway platform; 2) Strengthen smart services and experiences.

8) Planning, design, and construction implementation guarantee

(1) Improve the collaborative construction mechanism: 1) Collaborative construction at the level of urban agglomerations, 2) Dual track linkage between urban and rural areas, 3) Horizontal collaborative cooperation among various departments, 4) Coordinated implementation of construction at the district level.

(2) Innovative diversified investment mechanism: Establish a diversified investment mechanism with government investment as the mainstay and social participation. Innovate greenway investment and financing policies, raise funds through multiple channels, and promote greenway implementation.

(3) Strengthen greenway management: clarify the responsible parties, improve the level of greenway management and maintenance, strengthen safety management and emergency rescue, and consolidate the achievements of construction. Actively explore market-oriented and industrialized operation and management models for greenways, explore ecological value transformation paths, and ensure sustainable development.

(4) Promote public participation: 1) Strengthen greenway promotion and establish information channels through new media platforms; 2) Develop local characteristic greenway promotional materials; 3) Regularly hold greenway themed events, competitions, and community activities; 4) Establish a sound mechanism for public participation in planning and implementation supervision.

5.2.3. Park City on Greenway

Shenzhen connects the entire ecological space with greenways, linking human history and citizen life, shuttling through natural mountains and seas, and perceiving cultural landscapes. Realize the connectivity of mountains and seas,

rivers and lakes, cities and gardens, and scenic spots, forming a vibrant green network like urban ligaments.

People walk and learn in nature, get close to nature between buildings, and enjoy the comfort of greenways at the entrance. Children can play safely, the elderly can continue to move smoothly, and all ages can share the fun of cycling, jogging, and hiking, building a rich greenway life together. In the future, Shenzhen will build a park city on greenways.

6. Summary

The article first elaborates on the design of the slow traffic system for urban greenways, greenway design strategies, and the rules and strategies for greenway use. Then, it conducts research on the planning and design of urban greenways in Shenzhen, studying the comprehensive planning and design layout of greenways, and helping Shenzhen to plan and construct a beautiful and livable park city, accumulating experience for improving urban greenway planning; Research and explore urban greenway planning and design strategies, improve pedestrian friendly environment and humanistic design concepts, and provide basis and reference for creating high-quality urban greenway planning and design.

References

- [1] Y.C.Wang, J.K.Shen, Z.W.Peng, W.N.Xiang. Service optimization of green infrastructure ecosystem for urban growth [J]. Chinese landscape architecture, 2008,34 (10): 45-49.
- [2] Y. Xu, Y.P.Zhang, W.N.Wang, J.L.Su. Study on the planning characteristics and use factors of sports parks from the perspective of healthy city [J]. Chinese landscape architecture, 2008,34 (05): 71-75.
- [3] Dang, A.R., Jian, X., Biao, T.: Research progress of the application of big data in china's urban planning. China City Plan. Rev. 24, 24-30 (2015). (in Chinese)
- [4] Song, W.J., Wang, L.Z.: Geographic spatiotemporal big data correlation analysis via the Hilbert-Huang transformation. J. Comput. Syst. Sci. 89 (2017). (in Chinese)
- [5] Guo, L., Li, Z.: Understanding travel destination from structured tourism blogs. In: Proceeding of 2015 Wuhan International Conference on e-Business, pp. 144-151 (2015). (in Chinese)