History of Greenway network planning in China and their megacities

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Abstract
With the spread of the sustainable development concept and the construction of ecological cities, many Chinese megacities have formed their Greenway network system. This study analyses the history of urban Greenways in China through an abundant literature review. It summarizes four aspects of Greenway development: The Greenway concept changing process, Greenway route selection methods, Greenway construction in four megacities, and post-occupancy evaluation research about Greenway. Firstly, we summarize the changing process of the Greenway concept in China in different periods. Analysis shows that the Greenway concept change process is closely related to the implementation policies in China. Research also reveals the relevant leading policies during China's Greenways development history. Secondly, it introduces the changes in Greenway route selection methods from the Olmsted period to recent years in China and other countries with corresponding cases. To view how they influence each other as knowledge spreads. In the third part of this study, we choose four typical megacities as examples, visualize the distribution of greenways, present the construction status of greenway networks now, and summarize the development of their current situation. In addition, the study collected 2098 comments on Ctrip from 2024 to 2017 to analyze visitors' opinions about these greenways. Finally, the study reviews the development process of the POE of Greenway in China, summarizes the popular research methods, and shares the unique perspective researchers are now using. The development of Greenway network is of great significance to improving the quality of human settlements and alleviating megacities common problems. With the application and research of big data, China's Greenway construction is developing toward human-oriented perception while keeping the detailed study of natural factors.

Keywords
greenway, megacities, development history, central-district

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INTRODUCTION

With the rapid development of China's urbanization and the expansion of cities, China has formed 10 megacities with a permanent urban population of more than 10 million. In these high-density megacities, the central urban area is often the most densely populated, with the most severe air pollution and lacking urban public activity space. Urban Greenways, as essential urban functional spaces integrating recreation, ecology, transportation, and culture, are of great significance in alleviating the "big city diseases" such as traffic congestion, living environment problems, and ecological environment deterioration in these megacities.

A widely recognized concept of the Greenway is that the ‘green’ in ‘Greenway’ came from ‘greenbelt’ and the ‘way’ from ‘parkway.’ This supports the use of ‘Greenway’ to describe linear public open space in rural or urban areas (Little, 1995). Greenways are also recognized as networks of land containing linear elements that are planned, designed, and managed for multiple purposes including ecological, recreational, cultural, aesthetic, or other purposes compatible with the concept of sustainable land use (Ahern, 1995) In the mid-19th century, the famous landscape architect F. Olmsted planned the first Greenway, “Emerald Necklace” in Boston, and the Greenway system planning was loved by the surrounding residents and widely concerned by researchers.

At the beginning of the 21st century, the concept of Greenways was officially introduced in China. Since then, China has conducted planning research and construction practices in Zhejiang, Guangdong, and other regions. With the development of cities, the construction of Greenway systems in China has achieved fruitful results. Many cities and areas have formed their own Greenway network system. However, few studies have sorted out the change and development process of Greenway concepts and route selection methods in China. Therefore, from the development history perspective, this study sorted out the changes in the Greenway construction concept, Greenway routes selection method, typical Greenway construction case occupancy evaluation (POE) of Greenways. Also, the study selected the central urban areas of four typical Chinese megacities, Beijing, Wuhan, Chongqing, and Shenzhen, as research samples for comparative study. Try to summarize the development process of Greenways in China, the influence of foreign Greenway route selection concepts on China’s Greenway construction, and the current situation of Greenway network construction in high-density megacities.
forest belts for farmland protection. In 1978, the construction of the Three-North Shelter Forest Program(三北防护林工程) started. In the early 1990s, the Shelter Forest system around Beijing and Tianjin, the shelterbelt system in the middle and upper reaches of the Yangtze River, and the coastal Shelter Forest System were initially planned. In 1998, the National Ecological Environment Construction Plan(全国生态环境建设规划) set off a nationwide greening movement, and so far, ten ecological protection forest systems have been launched.

1998–2015 THE EXPLORATORY PERIOD OF GREENWAY PLANNING PRACTICE

During this period, the specific policy of Greenway construction was not formed nationwide. Still, some areas have begun to actively explore the planning and practice of Greenways and gradually realize the transformation from “conceptual Greenways” to “actual construction Greenways.” Scholars gradually spread the ecological and social benefits of Greenway network development in this period. In January 2010, the Guangdong Provincial Department of Housing and Urban-Rural Development issued the master plan for the Pearl River Delta Greenway network. This is the first systematic greenway network system planning in China. From that time, Guangdong took the lead in building a regional greenway totaling about 1690km in the Pearl River Delta region in about three years. In 2012, “Built Beautiful China”(建设美丽中国) was proposed. In the same year, The 18th National Congress of the CPC included ecological civilization in the “Five-in-one overall plan”(五位一体) which refers to the five-sphere integration of economic, political, cultural, social, and ecological progress. In 2013, The State Council proposed “Opinions on Strengthening Urban Infrastructure Construction” to strengthen the planning and construction of Greenways and green corridors in combination with urban and rural environmental improvement, urban village transformation, and ecological restoration of abandoned sites. With the development of times, national policies are paying more and more attention to Greenway planning and ecological development.

2015–2020 THE RISE OF GREENWAY PLANNING GUIDANCE BY POLICY AND STANDARDS

In this period, the status and importance of Greenway construction increased significantly, and the construction concept of ecological priority, systematism, and connectivity was established through policy guidance. In 2016, the Ministry of Housing and Urban-Rural Development issued the “Guidelines for Greenway Planning and Design” to clarify the construction standards of Greenways at the national level and guide the planning and design of Greenways across the country. In 2017, the 19th National Congress of the Communist Party of China (十九大) proposed establishing and practicing that “Lucid waters and lush mountains are invaluable assets.” (绿水青山就是金山银山) This concept provides theoretical guidance for the construction of China’s ecological civilization. Subsequently, “Urban repair and ecological restoration work”(城市双修) has been carried out in Hainan. In May of the same year, the “13th Five-Year Plan”(全国城市市政基础设施建设十三五规划) for the construction of National Urban Municipal Infrastructure took the construction of Greenways as a key project. It proposed the goal of adding 20,000 kilometers of Greenways by 2020.
2020-2023 SCIENTIFIC AND SYSTEMATIC GREENWAY PLANNING PERIOD

After nearly 20 years of exploration, China has issued specific Greenway spatial planning and construction standards. Greenway construction has risen from the short-term practice of local governments to extensive practice. It has been formally incorporated into the institutional framework of China's planning system. June 2021 According to the “Community Living Circle Planning Technical Guideline Standard(社区生活圈规划技术指南)” the Greenway will be used as a component of a high-density slow traffic network and green open space network12. In June 2021, The State Council proposed in the “Guiding Opinions on Scientific Greening”(关于科学绿化的指导意见) to enhance the systematic and collaborative nature of urban and rural green Spaces, build a Greenway network, and realize the connection of urban and rural green Spaces. In October of the same year, the CPC Central Committee and The State Council pointed out at the regional level that we need to promote Greenway development in urban and rural areas and cooperate to build regional ecological networks. As for Greenway systems in urban areas, we need to scientifically formulate urban slow travel system planning and build bicycle lanes and Greenways. The release of this policy indicates that China's Greenway construction policy is developing toward regional link networking.

HISTORY OF GREENWAY ROUTE SELECTION METHOD

1869-1998 INITIAL DEVELOPMENT PERIOD OF ROUTE SELECTION METHOD

Greenway route selection method analyses are designed to identify and measure the suitability of potential sites for Greenway development. In the early stage of route selection, Landscape architects made choices by overlaying hand-drawn maps with different reference factors. Then, on this basis, Ian Lennox Mc Harg proposed the “layer cake phenomenon,” which reveals the interaction pattern of the landscape and develops the process analysis map, ordering the stratified map in chronological order, with the original part containing rocks and then superimposing water, soil, vegetation, etc. The method opened up the classical method of Greenway route selection research. This method later influenced China's Greenway route selection method and was widely cited by relevant scholars. Later on, the advent of GIS technology greatly improved this method.

1998-2012 ROUTE SELECTION METHOD IS GRADUALLY ENRICHED

After 1997, the growth rate of Greenway-related papers increased rapidly. In 2004, Fábos J G summarized the five-step method of Greenway planning, proposed a comprehensive Greenway vision planning method for Greenways with different construction purposes, and proposed linking all types of Greenways at the regional level. This method provides a theoretical basis for the subsequent Greenway network planning. In 2004, Ashley Conine and others expanded the evaluation factors of Greenway route selection, including potential demand range and accessibility of service facilities from the perspective of demand-supply. During this period, foreign route selection methods began to be introduced into China, impacting China's Greenway development theory. The selection method mainly focuses on land suitability assessment. In 2005, Yu Kongjian proposed the concept of landscape Security Pattern (景观安全格局) and analyzed landscape Security Patterns in China on a large scale.
<table>
<thead>
<tr>
<th>Time</th>
<th>Guiding policies</th>
<th>Construction content</th>
<th>Research and construction focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950s</td>
<td>Farmland protection forest</td>
<td>Farmers themselves build protective forest belts around their farmland</td>
<td>Soil and water conservation, wind and sand prevention, regulation of agricultural climate, etc</td>
</tr>
<tr>
<td>1978</td>
<td>The 'Three North' shelter forest</td>
<td>Building protective forests in the northwest, northeast, and north of China</td>
<td></td>
</tr>
<tr>
<td>After 1990</td>
<td>Protection forest system</td>
<td>Construct 10 major protective forest systems, including the protective forest system around Beijing and Tianjin, the protective forest system in the middle and upper reaches of the Yangtze River, and the coastal protective forest system.</td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>Notice on Issuing the National Ecological Environment Construction Plan</td>
<td>Vigorously carry out tree planting and grass planting</td>
<td>Planting trees and grass on land suitable for greening</td>
</tr>
<tr>
<td>2000</td>
<td>Notice on Further Promoting the Construction of National Green Channels</td>
<td>Greening and beautification along highways, railways, rivers, and embankments</td>
<td>The main function should be to prevent wind consolidation, and beautify the environment.</td>
</tr>
<tr>
<td>2013</td>
<td>Opinions on Strengthening Urban Infrastructure Construction</td>
<td>Intensify planning and construction efforts for Greenways, Greenways, and other green corridors.</td>
<td>Improve the ecological landscape indicator system and promote the construction of ecological landscape cities.</td>
</tr>
<tr>
<td>2016</td>
<td>Several Opinions on Further Strengthening the Management of Urban Planning and Construction</td>
<td>Optimize the layout of urban green spaces, build a Greenway system, connect green spaces inside and outside the city, and introduce ecological elements into the urban area.</td>
<td>Restore the natural ecology of the city.</td>
</tr>
<tr>
<td>2016</td>
<td>Greenway Planning and Design Guidelines</td>
<td>Clarify Greenway construction standards nationally and guide Greenway planning and design in various regions.</td>
<td>Leisure and fitness, green travel, ecological protection, society and culture, tourism and economy</td>
</tr>
<tr>
<td>2017</td>
<td>The 13th Five-Year Plan for National Urban Municipal Infrastructure Construction¹</td>
<td>Strengthen greening around cities and urban agglomerations, promote Greenway construction, and build a network system of urban and rural Greenways.</td>
<td>Make Greenway construction a key project and propose the goal of adding 20000 kilometers of Greenways by 2020</td>
</tr>
<tr>
<td>2020</td>
<td>Guidelines for the Compilation of Urban Land and Space Master Plan</td>
<td>Build a slow traffic system with system security, combined with streets and blue-green networks, to build a Greenway system connecting the city and suburbs</td>
<td>Incorporate urban and rural Greenways into other planning documents.</td>
</tr>
<tr>
<td>2021</td>
<td>Guiding Opinions on Scientific Greening</td>
<td>Building a Greenway network to achieve connectivity between urban and rural green spaces</td>
<td>Enhance the systematicity and synergy of urban and rural green spaces.</td>
</tr>
<tr>
<td>2021</td>
<td>Technical Guidelines for Community Life Circle Planning</td>
<td>Building a high-density slow traffic network consisting of urban roads, Greenways, streets and alleys, public passages, etc., relying on a 15-minute community living circle, Building a green open space network with balanced coverage and a combination of points, lines, and surfaces, relying on various types of park green spaces, affiliated green spaces, Greenways, small and micro public spaces, etc</td>
<td>The chronic system and open space system connectivity network between Greenways and the 15-minute community living circle</td>
</tr>
<tr>
<td>2021</td>
<td>Opinions on Promoting Green Development in Urban and Rural Construction</td>
<td>&quot;Collaborative construction of regional ecological networks and Greenway systems&quot; at the regional level, and &quot;tailored construction of bicycle lanes and Greenways&quot; within urban areas</td>
<td>Improving the regional ecological environment and scientifically formulating urban slow traffic system planning</td>
</tr>
</tbody>
</table>

Table 1. Table of Changes in the Construction Concept of Urban Greenways
In 2011, Zhuang Rong introduced the route selection method of the greenway network based on ecological conservation in the Pearl River Delta region. During this period, Greenway network theories were also being spread across China.

2012-2020 FURTHER EXPANSION OF INFLUENCING FACTORS OF GREENWAY ROUTE SELECTION

After 2012, the research on route selection related to Greenways began to be gradually enriched. According to the statistics on CNKI from 2012 to 2020, research in this field shows a fluctuating upward trend. The number of articles published in 2020 reached its peak. The factors that researchers consider are also starting to diversify. In 2013, scholars Hu Jianhuang and Dai Fei summarized a set of planning procedures and methods for constructing urban Greenway networks in China, which provided a theoretical basis for planning green island networks in typical cities. In 2015, Li Fangzheng et al. studied the travel rules of the urban population based on bus card data. They introduced relevant travel distribution density, travel destination, and other indicators into the analysis and evaluation of Greenway route selection in a pioneering way.

The route selection of greenway construction in central urban areas faces different land use diversity from that in nature. Its planning layout is related to the land use pattern, road network system, population density, and other factors. In 2016, Zhou Conghui evaluated the route selection potential of the central urban area through three indicators: intensity of recreation demand, recreation attraction, and suitability of Greenway construction, and customized the route selection layout plan of the central urban area of Dongying City with the evaluation results, alternatives are also provided for different aiming. In 2020, Chen Xixi et al. used the use data from shared bicycles and the entropy method to establish an evaluation system for the utilization potential of green space nodes and tried to use this method to search key green space link nodes within the city, obtain the road heat of bicycle use through the track data of shared bicycles, and extract the current linear green space corridor. This method includes data on the shared bicycle business that has arisen in China in recent years, further enriching the route selection ideas of Greenways in central urban areas.

2020-2024 ROUTE SELECTION METHOD COMBINED BIG DATA ANALYSIS

With the development of Internet services and information technology, the application of big data enables researchers to use crowd activity trajectory data such as public bicycle use data and urban public service facility POI. Dai Fei et al. planned and analyzed Greenway route selection in Wuhan based on urban POI point data and the service range of service facilities combined with visual sensitivity analysis. They introduced visual sensitivity and POI interest points into the study of Greenway route selection in a pioneering way.

In general, the route selection methods of Greenways in central urban areas show diversified development, and scholars have begun to study the route selection of Greenways from the aspects of residents’ behavior and perception of the city. Instead of only focusing on the interaction of environmental factors in the past, the research object has gradually shifted to human behavior and needs. Big data is widely used for analysis and research to provide data support for route selection.
<table>
<thead>
<tr>
<th>Year</th>
<th>Author</th>
<th>Route selection method</th>
<th>Important Evaluation Factor</th>
<th>Application case</th>
</tr>
</thead>
<tbody>
<tr>
<td>1869</td>
<td>Frederick Law Olmsted, Charles Eliot</td>
<td>Link city parks and coastal views</td>
<td>Soil, revetment ecological benefits, urban landscape elements, coastal landscape etc</td>
<td>Boston Park System/ Emerald Necklace</td>
</tr>
<tr>
<td>1987</td>
<td>Ian Lennox McHarg</td>
<td>Layer Cake Representation of Phenomena</td>
<td>Natural geographical factors, social value factors, etc</td>
<td>Bronx River Parkway, New York</td>
</tr>
<tr>
<td>1998</td>
<td>William Miller, Michael G. Collins, Frederick R. Steiner, Edward Cook</td>
<td>Expert interviews, public surveys, Suitability analysis</td>
<td>Ecological environment type, slope, water body, distance from humans (wildlife habitat), land use, development pressure, landscape elements, green space coverage, population density, water quality, surface water, erosion control, etc</td>
<td>Prescott Valley, AZ, USA</td>
</tr>
<tr>
<td>2001</td>
<td>Yu kongjian Li Dihua, Chao Luomeng</td>
<td>Urban ecological infrastructure construction</td>
<td>Native habitat system natural form of the coast combination of shelterbelt forest system and green space system, etc</td>
<td>/</td>
</tr>
<tr>
<td>2004</td>
<td>Ashley Conine, Wei–Ning Xiang b, Jeff Young c, David Whitley</td>
<td>Seven-step route selection method</td>
<td>Evaluation of potential demand scope, evaluation of potential connection supply, greenway land suitability assessment, accessibility assessment, greenway scope demarcation, and alignment of multiple options, etc</td>
<td>Concord, North Carolina</td>
</tr>
<tr>
<td>2006</td>
<td>Alessandro toccolini, Natalia Fumagalli, Giulio Senes</td>
<td>Four-step route selection method</td>
<td>Current landscape resources, existing greenway network, linear historical landscape elements, etc</td>
<td>The Lambro River Valley Greenways System</td>
</tr>
<tr>
<td>2013</td>
<td>Hu jianshuang Dai fei</td>
<td>Greenway planning procedures and methods based on Chinese cities</td>
<td>Natural elements, artificial elements, historical and cultural elements, urban construction materials, etc</td>
<td>/</td>
</tr>
<tr>
<td>2015</td>
<td>Li fangzheng Li wanyi, Lixiong</td>
<td>Bus card route selection method</td>
<td>Bus travel distribution density, travel destination, urban land, etc</td>
<td>Beijing Center District</td>
</tr>
<tr>
<td>2015</td>
<td>Wang min Jia jianling, Zhang junlei</td>
<td>Suitability evaluation method</td>
<td>Ecological location, ecological sensitivity, land use type, landscape resource distribution, boundary characteristics, accessibility, etc</td>
<td>Xiamen City Haicang District Greenway</td>
</tr>
<tr>
<td>2016</td>
<td>Zhou conghui</td>
<td>Greenway route selection potential in central city based on quantitative evaluation</td>
<td>Green ecological type, historical and cultural facilities, road section type, road and green belt width, population density</td>
<td>Dongying City Central City Greenway Network Plan</td>
</tr>
<tr>
<td>2018</td>
<td>Luo kun</td>
<td>Cost Distance Model based on the &quot;Source- Sink&quot; theory</td>
<td>Park green space, river system, historical culture, cultural and sports facilities, commercial facilities, rail transit, etc., landscape style roads, boulevards, etc</td>
<td>Greenway, Xuhi District, Shanghai</td>
</tr>
<tr>
<td>2019</td>
<td>Chen xixi, Li Liang</td>
<td>Route Selection Method based on Shared Bicycles</td>
<td>Park green space distribution map, protected green space distribution, etc, shared bike track data, urban shared bike road use, shared bike space heat, etc</td>
<td>Haidian District, Beijing City Cycling Greenway</td>
</tr>
<tr>
<td>2020</td>
<td>Dai Fei, Yang Chao, Xu ya, Chen Ming, Pei Ziyi</td>
<td>Route Selection method based on POI data</td>
<td>POI points service range; road network cost weighted distance, visual sensitivity</td>
<td>Wuhan Hanyang District green way</td>
</tr>
</tbody>
</table>

Table 1. Greenway route selection method chronological table
CONSTRUCTION PROCESS OF HIGH-DENSITY URBAN GREENWAY NETWORK IN FOUR MEGACITIES

Megacity greenways are often made up of multiple projects built at different times and by different implementing agencies. However, few studies have yet to sort out the distribution of the overall greenway system in different megacity cities in China, especially in their central-district. According to the existing official data, this study visualized the distribution of greenways in four Chinese megacities to present the construction status of Greenway network now. Data sources include: “Beijing Greenway Construction Overall Plan (2013-2017)”, “Wuhan Greenway System Plan2012”, “Special Planning Plan for Mountain City Trail in Chongqing’s Main Urban Area 2011”, “Shenzhen Greenway Network Special Plan (2010-2020)” and another supplementary database.

SHENZHEN

In 2009, the publishing of “General Planning Outline of the Pearl River Delta Greenway Network in Guangdong Province”(珠江三角洲绿道网总体规划纲要) opened the prelude to the large-scale, legalized, and normalized planning and construction of Greenways in China. According to “Shenzhen Greenway Network Special Plan 2010-2020” (深圳市绿道网专项规划) in 2011, The urban greenway is divided into three types: coastal style greenway, mountain greenway, and urban vitality greenway, with a total length of about 500km. At present, the total length of greenways has reached 2843 km. Among them, the coastal style greenway takes the 15km coastline of Shenzhen Bay as the line, connecting Sea World, Shekou Area, Shenzhen Bay-Houhai Headquarters Economic Zone, Overseas Chinese Town Inner Lake, Mangrove Park and Futian Mangrove National Nature Reserve, etc., forming a continuous coastal urban living and leisure function place.

From the view of the development process, Shenzhen’s Greenway construction has experienced two stages. The first stage (2010-2020) focuses on the construction of The three-scale Greenway network system, which focuses on “quantitative growth”; the second stage (2021-2035) focuses on detailed guidelines for Greenway construction and pays more attention to the “quality improvement” of the Greenway system. Shenzhen’s leading role in constructing and managing high-density urban Greenways has become a good practice example for other cities.

As for Greenway management, the Shenzhen Municipal Government issued the “Shenzhen Greenway Management Measures” (深圳市绿道管理办法) in 2012, which clarified the responsibilities of various departments in the process of Greenway planning and construction, management, including maintenance and supervision of Shenzhen Greenway. Shenzhen's green network system has formed continuously improved operation management systems. During the construction period, the construction leading group office takes the lead in the construction process. After the construction is completed, Greenway management combines territorial construction management, park organization management, tourism company management, and real estate developer management in different segments for later management and operation. In 2022, the Shenzhen Municipal Bureau of Urban Management issued the “Shenzhen Greenway Network Special Plan (2021-2035) ”, which aims to improve the quality of Greenway construction from the perspective of the whole area and all elements and play.
Since 2011, under the influence of the construction of the Pearl River Delta Greenway network, China’s Beijing, Shanghai, Fujian, Zhejiang, Sichuan, Hubei, Hunan, and other provinces have learned from the experience of Guangdong to carry out Greenway construction, and the trend of Greenway construction has begun nationwide.

**BEIJING**

In 2013, the Beijing Municipal Development and Reform Commission (NDRC) issued the “Overall Plan for the Construction of Beijing Greenway 2013-2017” (北京市级绿道建设总体方案). The overall distribution presents “three rings, three wings, and multiple corridors type” (三环、三翼、多廊) layout. Including 28 major greenway lines with a total length of more than 1,200 km. Among them, the central urban greenway includes the Second Ring Greenway (二环绿道), the Three Mountains and Five Gardens Greenway (三山五园), and the Yuanbo Greenway (园博绿道). Greenways are closely distributed along water systems, green spaces, and links to popular Public Spaces inside the city. In the following two years, the Beijing Municipal Department issued the “Measures for the Management of Beijing Greenway 2015 北京市绿道管理办法” and a series of policies also. These policies not only promoted the process of Greenway construction but also provided an institutional guarantee for the management and supervision of Greenways in the later stage.

![Fig. 2. Layout of four megacities greenways](image-url)
The period from 2013 to 2015 was the peak of Greenway construction in the central urban area of Beijing. In 2014, a Greenway in the central district of Beijing started to connect many parks and historic sites. By 2017, Beijing had built 710 kilometers of Greenways, of which 500 km are within the scope of the central urban area. One of the most famous is the construction of the “Three Mountains and Five Gardens” (三山五园) greenway, which is located in the west of Beijing and also the first demonstration project of the Beijing Greenway. The “Three Mountains” refer to the Xiangshan Mountain (香山), the Yuquan Mountain (玉泉山), and the Longevity Mountain (万寿山), and the “Five Gardens” refer to the Jingming Garden (静明园), the Jingyi Garden (静宜园), the Qingyi Garden (清漪园) (the Summer Palace), and the nearby Changchun Garden (畅春园) and the Old Summer Palace (圆明园). This greenway’s total length is 36.09 km. The line was completed in October 2014, connecting 13 parks and green spaces west of Beijing. In 2023, the Special Plan for Beijing’s Greenway System (2023-2035) will further guide Beijing to build a connected, comfortable, modern, and convenient Greenway system.

**WUHAN**

Wuhan Municipal Commission of Planning and Natural Resources organized the “Wuhan Greenway System Planning in 2012” (武汉市绿道系统规划). The overall structure of the Greenway network is “one center, six wedges, and ten belts.” The planned total length of the Greenway is 2200 kilometers, which includes 450 kilometers of urban Greenway located in the center-district of the city. The distribution of Greenways in downtown Wuhan echoes the ecological pattern of “two rivers confluence, lakes and wetlands dense” in Wuhan. A continuous and perfect Greenway distribution pattern forms on the Yangtze and Han rivers.
A good connection is formed with the green space on both sides of the river, creating a good walking or cycling environment for the users of the Greenway. In addition, Greenways are built around lakes and parks in the city, and together with the Greenway along the river, they form a relatively Greenway framework.

Under the guidance of this plan, the Lion Mountain Greenway (狮子山绿道) was completed in 2015. the construction of 30km Zhanggongdi Greenway (张公堤绿道) and the first phase of the East Lake Greenway (东湖绿道) was completed in 2016, and the second phase of the East Lake Greenway (东湖绿道) was completed in 2017. The East Lake Greenway is an important part of the Wuhan Greenway system, connecting popular Public Spaces such as universities, cultural centers, lakes, hills, and suburbs. The construction of the third phase will be completed in 2024, and the connection with the first and second phases will be realized.

CHONGQING

The planning and construction of the Chongqing Greenway began in 2018. Greenway’s systematic development and construction in Chongqing is challenging because Chongqing is a mountainous city with great terrain changes. The plan divides Greenways into three types: street, riverside, and mountain forest, and it constructs a network of 60 Greenways with a length of about 1207km. Among them, the City Wall Trail (环城墙步道), Shaxi Trail (沙磁步道), Panxi River Trail (盘溪河步道), and Gele Mountain Trail (歌乐山步道) have been completed and put into use now. Gele Mountain hiking trail is mainly distributed in Gele Mountain Forest Park, Shapingba, Chongqing, a hot spot for citizens to relax.

COMPARISON SUMMARY OF TYPICAL CITIES

These megacity Greenways share some commonalities: Firstly, Greenways in central urban areas link various types of open public Spaces. The planning goal is often to integrate overall landscape resources in the region. Secondly, from the perspective of ecosystem protection, Greenways connects the surrounding rivers, animals, plants, and other ecological resources to a certain extent. In addition, the construction of Greenways in central urban areas considers the connectivity of Non-motorized Traffic and, more importantly, the impact on the flow of people and natural organisms. Each city’s Greenway construction has its own characteristics.

ONLINE COMMENTS ABOUT GREENWAY NETWORK IN FOUR MEGACITIES

This study collected 2098 comments about greenways and related scenic spots in four megacities on Ctrip (携程旅行网) from 2017 to 2024. The study aimed to analyze the opinions of visitors by using the TF-IDF and lexical network analysis methods. The majority of comments expressed users’ love for the greenways, with only a few complaints. Some disgruntled comments mentioned “holidays” and “overcrowding.”
SHENZHEN

A total number of 848 comments have been collected, including Shenzhen Bay Park （深圳湾公园） and Shenzhen Mangrove Reserve（深圳红树林保护区） in Shenzhen. In the reviews of Shenzhen Greenway, “pretty good” is the critical comment word, and the relevant evaluation words also include “satisfactory,” “great,” “superior,” and so on, expressing the user’s high recognition of the relevant scenic spots. Time-related words include “autumn,” “after dinner,” “daily,” and “holiday.” Indicate that these places are also hot holiday visiting spots. Words related to crowd types, including “children” and “friends and relatives,” mean that visitors include children and family groups. From the lexical association network map, there is a strong correlation between “park,” “mangrove,” “Shenzhen Bay,” “walk,” “bicycle,” and “nature reserve.” It could be inferred that the cycling and walking activities of the coastal greenway in Shenzhen are the activities that participants often carry out in this scene.

BEIJING

Comments about Beijing’s greenway network including San Shan Wu Yuan (三山五园), Yingcheng Jiandu waterfront Greenway (营城建都滨水绿道), Second Ring Road Greenway (二环城市绿道), Liangshui River Park Greenway (凉水河公园绿道), and Olympic Forest Park greenway (奥林匹克森林公园绿道) were analyzed, totaling 126 reviews. The TF-IDF analysis revealed that “Recreational walking” is an important activity in Beijing’s greenways, with related words such as “physical exercise,” “walking,” and “gathering” also being significant. This suggests that many visitors prefer to walk and exercise in these green spaces. In terms of timing, the analysis showed that “noon,” “At nightfall,” and “evening” are the peak hours for visitors to the greenways.

WUHAN

Wuhan East Lake Greenway(东湖绿道), Houguanhu Wetland Park (后官湖湿地公园), Jiangtan Sports Park（江滩体育公园）, a total of 170 comments was collected. In the comments on Wuhan Greenway, “camp” is a crucial word, and its related environmental adjectives also include water-related words such as “mountains and water,” “sparkling,” and “beautiful,” which also reflects the characteristics of the bonding of Wuhan Greenway and water. From the perspective of time-related words, “early morning,” “festival period,” “sunset,” and other words appear more frequently. As for the possible activities, “leisure activities,” “swimming,” “morning exercise,” and “walking” appear more frequent than other words. From the lexical association network map,'East Lake “and” greenway” riding “produced a strong correlation. It shows that more users of the greenway in Wuhan use it for cycling, exercise, and leisure walking.

CHONGQING

A total of 954 comments were collected about the Chongqing Greenway network, which includes Chongqing Bijin Park（重庆碧津公园）, Nanshan Scenic Area, and Mountain（南山步道）City Walk（山城步道）. In the comments of Chongqing Greenway, “morning and evening” is a more important word, and its related time words also include “morning,” “after
dinner,” and “often go,” indicating that Greenway has become one of the common choices for people to relax and after dinner walk. From the perspective of activity type, words such as “climbing up and down,” “walking,” and “exercise” appear more frequently. Indicate Chongqing’s exceptional topographic condition. As the lexical network analysis result shows, “Nanshan,” “walking path,” “night view,” “boardwalk,” “scenic spot,” “scenery,” and other words are highly correlated, which means that the night scene here has become one of the choices of the city night tour, which many users love.

DEVELOPMENT OF GREENWAY NETWORK POE RESEARCH

2009-2015 SURVEY AS THE MAIN POE RESEARCH METHOD

Under the Guangdong Zhujiang Delta Greenway network construction background, scholars have begun researching the Greenway after its completion. Research and evaluation of the Greenway system started to be carried out during this period. In this stage, the questionnaire investigation was considered an important method in POE research. For example, Wu Junyu-studies the users' behavior and usage needs of the Greenway system by questionnaire in Ze-ngcheng(增城)City, Guangzhou, obtains the post-occupancy evaluation(POE) of the Greenway in the research section, research proposes strategies and optimization suggestions based on the evaluation result. Lu Feihong et al. conducted a quantitative analysis of the evaluation of Greenway users’ use satisfaction through a questionnaire. Greenway user’s experiences and behavior are the focus of researchers in this field.

2015-2020 POE RESEARCH METHODS DIVERSIFIED DURING DEVELOPMENT

In this period, research on Greenway assessment was widely carried out, and there was more diversity in research objects and methods. Research objects are no longer limited to a single city but expanded from a specific area to multiple scales and cities. For example, Zhang Haiye extracted a total of 2,721 effective evaluation records of ten Greenways in Guangdong, Sichuan, Jiangsu, Zhejiang, and other provinces, analyzed the characteristics and demand of Greenway users, and summarized three kinds of user portraits, and put forward targeted suggestions on the quality improvement of Greenways. At this stage, researchers began to pay attention to Greenways at various levels. For example, Chi Wenxiu and Lin Guangsi et al. took a representative community Greenway in Guangzhou as an example. They investigated the user’s usage patterns and their evaluation of the importance of different built environment elements through questionnaires. The factors of the built environment studied in this period are more comprehensive. As for research methods, some studies began to explore more diversified investigation methods. For example, He Hui et al., based on the SD method, conducted a study on the perception and evaluation of the riding environment on the East Lake Greenway in Wuhan. Instead of using a survey, some studies take the environmental dimension as the entry point to evaluate the impact of environmental factors and their influences on users’ feelings and behaviors through direct observation. The aspects of Greenway research are gradually enriched, and the research Angle is more diversified than before.
2020–2023 MULTI-SOURCE DATA
AND INTELLIGENT TECHNIQUES IMPROVE RESEARCH ACCURACY

With the support of new technologies, Greenway evaluation is no longer limited to single questionnaire survey data, multi-source data, and various analysis models for more scientific, accurate evaluation are now available. These studies promote the progress of Greenway evaluation technology and provide a more powerful scientific basis for Greenway construction and management. Some studies evaluated the Greenway through the impact of built environmental factors and the intensity of Greenway use. Taking the central urban area of Beijing as an example, Qiu Cailin et al. conducted regression analysis using trajectory data to reveal the spatial effects of built environment factors on Greenway use intensity through a spatial metrology model. Other studies start from users’ perceptions and evaluate the Greenway environment’s effect on users. Xie Bo et al. investigated the residents around the East Lake Greenway in Wuhan to explore the impact of urban Greenway intervention on the mental health of residents in the surrounding communities. More detailed research continues to emerge. Researchers began to analyze and decompose human perception in detail to make more accurate assessments. Greenway research gradually transformed into a comprehensive system involving multi-scale research objects and diversified assessment methods.

6. CONCLUSION

It can be seen that the change process of the Greenway concept is closely related to the implementation policies in China. Early Greenway construction is closely related to natural disasters such as wind, floods, desertification, etc. Greenways are an important way to protect farmland and fields. During this period, fewer factors were considered for recreational activities. With the development of modern landscape ecology and the introduction of foreign Greenway research and route selection methods, scholars began to realize the importance of ecological infrastructure. With the advocacy of ecological development, China began to build the urban Greenway system and carried out pilot construction in the Pearl River Delta region. In recent years, with the continuous improvement of Greenway construction status and the promotion of the degree of construction, national policy has gradually advocated the coordinated development of urban and rural ecological networks and Greenway systems. Promote the improvement of urban and rural ecological environments and plan low-carbon systems in big cities simultaneously.

The Greenway route selection research development process shows that Mc Harg’s “layer cake Phenomenon” has played a guiding role in China's Greenway route selection. Chinese scholars have carried out continuous innovation and exploration of this method in combination with the current situation of Chinese cities. In recent years, more and more scholars have begun to pay more attention to human behaviors in megacities. Relevant studies use data on human activity, such as bicycle travel and POI interest point data, to research Greenway route selection. Greenway route selection has gradually developed from focusing on environmental factors and their interaction to integrating human activities and perceptions.
China's Greenway network planning in China and their megacities

China's Greenway has great potential, and many aspects still need to be improved. Each city has its own development pace. Among them, Shenzhen's Greenway network system has formed a relatively complete three-level Greenway system and a unique management system. Wuhan City Greenway, combined with its own pattern of natural resources, the construction of high-quality urban tourist attractions. Beijing's urban Greenway system has launched 20 characteristic cycling routes, promoting low-carbon travel in the city and easing the problem of regional traffic congestion. Chongqing Urban Greenway provides a digital publicity guide, which offers a good interactive system for urban cultural publicity and citizen leisure.

China's researchers have already carried out different POE research from various perspectives, especially in megacities. As for research methods, the research on the evaluation of Greenways no longer relies only on questionnaires or single survey data. Researchers try to use more scientific and comprehensive evaluation methods through multi-source data and multiple analysis models. As for user activities and perception evaluation, there is also a trend of accurate evaluation in specific aspects. With the application and research of big data, China's Greenway construction is developing toward fine human-oriented perception while retaining a detailed study of natural factors. In general, the construction of Greenway networks in China's megacities has made some achievements. However, green network system research still has a long way to go, and further research and exploration are needed in construction and management.

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IMAGE SOURCES

Table 1: The table is made by the author

Table 2: The table is made by the author

Figure 1: Author drawing According to related statistics

Figure 2: Author drawing According to related statistics

ENDNOTES

html.


35. Alessandro Toccolini, Natalia Fumagalli, and Giulio Senes, “Greenways planning in Italy: the Lambro
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