

Exploration of the Planning and Design of Intelligent Ecological Park Under the Background of Carbon Neutrality -- takes Chongqing Lijia “Baiyun Lake Park Planning and Design” as an example

Jiao Hou

Chongqing Metropolitan College of Science and Technology, Yongchuan, Chongqing 402160

Abstract: Under the background of China's goal of achieving carbon peak by 2030 and carbon neutralization by 2060, green space, as an indispensable role, plays a key role. As an important part of urban green space system, parks play a positive role in ecological protection, enrichment of citizens' life, beautification of the environment and carbon neutralization. Looking at China's park design, the ecological greening part occupies a very important position. However, with the rapid development of China's science and technology, science and technology are constantly integrating into our life. As a characteristic mountain city, Chongqing's urban park construction is developing rapidly, and Lijia has become one of the most changeable areas in Chongqing and a highland for the concentration and Realization of various policies, From Lijia Town, Lijia high-end business gathering area, Lijia international business tourism city, and Lijia smart city proposed at the smart Expo, the planning has been continuously upgraded to realize the three-level jump of regional value. The main task of this study is to explore how Baiyun Lake Park, which occupies the core position of Chongqing Science and technology center Lijia business gathering area, perfectly integrates people, ecology and intelligent technology, and even how to build it into a window representing the development level of Chongqing and the image quality of Liangjiang New Area, and what exploration has been made in the relationship between carbon neutralization and the park, The purpose is to provide some guidance and reference for the smart ecological park under the background of carbon neutralization.

Keywords: Carbon neutrality; 2.0 smart ecological park; Integration and symbiosis; Chongqing Baiyun Lake Park; Carbon effect index

1. Introduction

Taking Chongqing Baiyun Lake Park as an example, this paper explores the construction of smart ecological park under the background of "double carbon".

1.1 Carbon neutralization background overview

Before carbon neutralization, it is necessary to reach the carbon peak. China promises that CO₂ emissions will not increase before 2030, and will slowly decrease after reaching the peak. By 2060, CO₂ emissions should be offset by various means such as rational planning and layout of green space, energy conservation and emission reduction, so as to realize carbon neutralization^[1].

Advocating energy conservation and emission reduction is an important measure to achieve the two-carbon goal^[2].

As an important part of urban green infrastructure construction, the park has become an important implementation means for many provinces and cities in sponge city construction, green building promotion, urban double repair, urban organic renewal and ecological garden city construction during the 13th Five Year Plan period. However, the construction of smart ecological park under the background of carbon neutralization is still in the exploratory stage.

1.2 Overview of smart ecological park

In order to meet the people's growing demand for a better life, improve and optimize the living environment, and under the background of the latest carbon neutralization, vigorously building urban ecological parks has attracted extensive attention. "Ecological sustainability" will be the technical concept of park design at present and in the future, and it will be the development trend of park design in the future. However, with the development of intelligence, smart Ecological Park^[3] has gradually sprung up. The implementation of the national strategy of "scientific and technological innovation driven development" has slowly integrated smart technology into every large and small city. As the "green

lung" of the city, ecological park brings infinite vitality to the city. When smart technology is combined with ecology, it will trigger infinite new energy and fun. "Smart ecological park" is a new trend leading smart city life. The emergence of more and more "smart ecological parks" can enable more and more people to feel nature from life, understand the sustainable development of science and technology and ecology, and personally experience the infinite beauty of life brought by smart science and technology. However, so far, There is no clear definition of smart ecological park. Therefore, this paper takes Chongqing Baiyun Lake Park as the carrier to explore the possibility of 2.0 smart ecological park under the background of carbon neutralization.

2. 2.0 exploration of smart ecological park

1.0 traditional parks (Figure 1) are mainly for viewing and recreation, with strong limitations and single interaction, and basically do not consider the relationship between carbon absorption and carbon emission; The author believes that 2.0 smart ecological park can integrate "wisdom" into the landscape as an emerging driving force and take the ecological park as the carrier, so as to induce new social behavior and outdoor lifestyle (Figure 2), gradually make the carbon absorption in the park greater than or equal to the carbon emission, increase the carbon sink, and finally make people, ecology and "wisdom" coexist harmoniously.

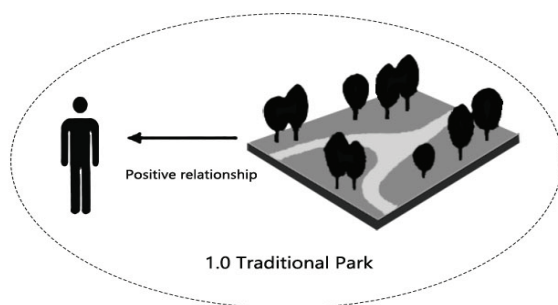


Figure1 1.0 traditional park

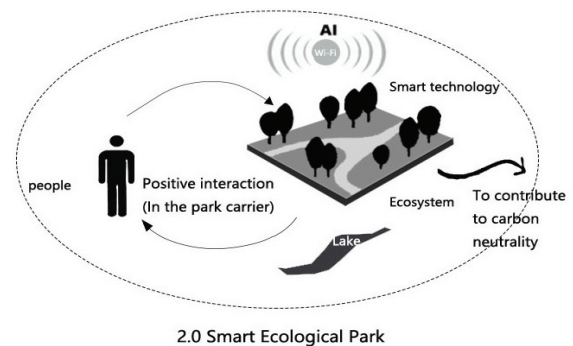


Figure2 2.0 smart ecological park

3. Project Overview

The project is located in Lijia business gathering area of Chongqing north new area, adjacent to Jialing River, and is an important part of Lijia.

3.1 Ecological status of Baiyun Lake Park

Baiyun Lake Park near the mountain and the river is rich in natural resources. There are Baiyun Lake ecological water system and ecological green space in the base. The total area of Lake normal water level in the base is 75000 square meters. The maximum distance from north to south is 468m and the maximum distance from east to west is 1318m; The base is surrounded by hills and mountains, with rich spatial forms, which is composed of slope land, dense forest land, vertical coastline and gentle slope lawn space. The terrain in the north of the site is higher than that in the south, and the surrounding slopes towards the Central Lake area, forming an overall terrain of high, medium and low around. However, the current vegetation type in the park site is single, mainly secondary forests, most of which are secondary *Broussonetia papyrifera*, *Robinia pseudoacacia* forest and tufted shrubs. A small amount of native vegetation is distributed in spots, mainly *Lauraceae* and *Fagaceae*.

There is ecological, but not ecological enough, but also makes the ecological characteristics of Baiyun Lake Park are not outstanding enough.

3.2 Current situation of intelligent technology in Baiyun Lake Park

With the development in recent years, Lijia has become one of the most changed regions in Chongqing and a highland for the concentration and Realization of various policies. Baiyun Lake is located in the core area of Lijia, so there are very superior scientific, technological and economic resources around Baiyun Lake.

With such a superior geographical location, how should we use its scientific and technological resources?

3.3 Carbon emission status of Baiyun Lake Park

- (1) There are many high-tech industrial zones around, with large industrial emissions;
- (2) There are many municipal roads outside the site, with mixed vehicles and large traffic carbon emission;
- (3) Lack of awareness of carbon reduction and environmental protection among surrounding people;
- (4) The plants in the site have no reasonable plant configuration, which is messy and has insufficient carbon absorption capacity.

4. Baiyun Lake Park positioning

4.1 Source of Inspiration

The inspiration of this design comes from the preliminary analysis of the base environment of the park. Taking the two municipal roads close to Baiyun Lake Park as the boundary, the main regional environment around the park can be divided into North and south parts. In the north is the regional environment dominated by natural ecology; The south is a regional environment dominated by smart technology. Based on this regional environment, the design intends to take the park as a transition area between the two environments. It aims to highlight the different characteristics of the two environments, realize the integration of the two environments at the same time, and achieve the integration of the other bank and intertwined habitats.

Integration of the environment: "intersection" state, by creating two landscape styles of smart technology and ecology, ensure that the two styles have their own characteristics, and realize the transition and integration of the two attributes in the same park. Based on the analysis of the surrounding environment, the spatial pattern of the park is divided into three parts: central transition zone, smart technology interface and natural environment interface, which are connected by a "corridor to realize the transition and integration between different environmental characteristics", so as to create an inclusive circle.

Symbiosis of life: in the "connected" state, human beings and wild animals and plants respect each other, tolerate and coexist with each other, and allow interaction, but the two do not interfere with each other's living state and habitat. By creating a continuous traffic loop, an ecological long profile of symbiosis and coexistence between human and wild animals and plants is formed to ensure that the two are in a state of "no interference and contact", so as to realize the harmonious unity of human activities and the survival and habitat of animals and plants.

4.2 Overall design strategy

According to the design theme of "Cross-strait integration", the park is divided into "two boundaries and one belt" (smart technology interface, natural environment interface and central transition zone). Combined with the characteristics of the interface and the current situation of the base site, important design nodes of the park are preliminarily proposed. These nodes are distributed along the main road and form multiple clusters in a more centralized way. While ensuring the uniqueness of each cluster, So that it can reflect the characteristics of the interface and form a full integration circle. Because each group is distributed along the main road, it is like a "link" to connect the interface between smart technology and the natural environment, so as to form a continuous and harmonious symbiosis ring, and finally form a complete "integration" and "symbiosis" system, striving to gradually achieve carbon absorption greater than or equal to carbon emission.

4.3 Park positioning

Based on the current situation and analysis, Chongqing Baiyun Lake Park is an important part of Lijia. It is not only the image window of Chongqing, but also the crystallization of the collision between "ecology" and "wisdom". It is a human link, characterized by superior geographical location and unique natural features. It is a 2.0 smart ecological park under the background of carbon neutralization integrating sightseeing, leisure, fitness and Popular Science.

4.4 Carbon strategy

- (1) Building green buildings and structures;
- (2) Rational layout of plant landscape and carbon sequestration by ecological plants;
- (3) Combination of Inner Lake waterscape and sponge city planning strategy;
- (4) Adopt green square;
- (5) Set up new energy parking lot;
- (6) Set up new energy waste station;
- (7) Build Baiyun Lake Park app to intelligently monitor carbon emissions and collect carbon data;
- (8) Organize Park carbon reduction points activities to publicize and encourage artificial carbon reduction.

4.5 Carbon effect measurement

Compare and evaluate 5 core indicators such as per capita carbon emissions. Considering the carbon neutralization background, the carbon source indicators of the scheme after adopting the carbon strategy are significantly lower than the reference value before not considered, while the carbon sink indicators are significantly higher than the reference value of the benchmark scenario, and the low-carbon effect is obvious. Compared with the set low-carbon reference value, various indicators of the low-carbon scheme also meet the standard, especially the per capita carbon emission, per capita carbon consumption, green space carbon sink index and other indicators are significantly better than the reference value. See Table 1 for details.

Table 1 comprehensive evaluation of carbon effect of Baiyun Lake Park under the background of carbon strategy

ore indicators	formula	unit	original value	Value after adopting carbon strategy (2060)
Carbon emissions per capita	$RC=T_1/R/N/1000$ Where: RC-Carbon emissions per capita, T_1 -Total carbon sources in the full life cycle, R - number of users of the park, N - the calculated length of the park product life cycle in this paper, taking 40 years.	kg/person·a	1074.13	643.37
Average carbon emissions from land	$USCE= T_1/S/N$ Where: use - average carbon emission, T_1 - total carbon source in the whole life cycle, S - total land area of park products, N - the product life cycle of the park is calculated in this paper, taking 40 years.	t/hm ₂ . a	703.29	415.87
Average carbon uptake by land	$USCA= T_2/S/N$ Where: USCA -average carbon consumption, T_2 - total carbon sink in the whole life cycle, S- total land area of park products, N - the product life cycle of the park is calculated in this paper, taking 40 years.	tCO ₂ /hm ₂ . a	50.65	77.74
Comprehensive carbon exchange rate	$R=T_2/T_1\times 100\%$ Where: R -comprehensive carbon exchange rate, T_2 - total carbon sink in the whole life cycle, T_1 - total carbon source in the whole life cycle.	%	6.06	13.25
Green carbon sink index	$GSI=GC/900\times 100$ Where: GSI - green space carbon sequestration index, also known as CO ₂ absorption index, that is, the absorption amount of green CO ₂ per unit area, This paper only calculates the carbon sink level of green space within the red line of park land, excluding the green carbon sink in the periphery. GC - 40 year CO ₂ fixed amount of greening system per unit green area.	—	83.28	124.71

5. Conclusion

The design concept has also been recognized by the Yuanye Cup International College Students Competition and won the honor award. In the context of carbon neutralization, people, ecology and intelligent technology are not incompatible with each other, but can "integrate" and "symbiosis" under reasonable treatment means and strategies, so as to achieve the state of "you have me and I have you", and "you or you, I or I" do not interfere with each other. The calculation results show that the smart ecological park scheme prepared under the carbon neutralization scenario can better implement various low-carbon policies of the landscape industry and realize the healthy development of low-carbon in the whole life cycle.

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About author: Jiao Hou, born on March 8, 1987, female, Han, native (from Jingzhou City Gong'an County, Hubei), degree (master's degree), professional title (National first-class registered cost engineer, Landscape Engineer), mainly engaged in Landscape Planning Research.