

Discussion on the Landscape Design of Urban Parks Under the Background of ' Double Carbon '

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Abstract: In view of the landscape design under the background of ' double carbon ', the requirements and principles of practicing ' double carbon ' action are put forward in the planning stage. Based on the existing problems of urban parks and the design idea of ' low carbon ', this study puts forward some design ideas such as carbon emission reduction, carbon substitution, carbon storage and carbon cycle, in order to provide reference value for landscape designers in urban park landscape design.

Keywords: Double carbon background, Urban park, Landscape design, Low carbon.

1. Introduction

On September 22, 2020, China formally proposed the goal of achieving carbon peak by 2030 and carbon neutrality by 2060 at the 75th United Nations General Assembly. This is a major measure to fully implement the General Secretary's thought on ecological civilization. It is also China's commitment to the world's " double carbon " goal to building the community of common destiny for all mankind; In recent years, the Central Committee of the Communist Party of China and the State Council issued a series of opinions and action plans. Such as *Guidance of the General Office of the State Council on Scientific Greening*, *Opinions on the complete and accurate implementation of the new development concept to do a good job in carbon peak carbon neutralization*, *Opinions on promoting green development of urban and rural construction*, *Carbon peak action plan before 2030* and so on. [1] Landscape design based on the background of ' double carbon '. This series of policies have been introduced one after another, and people have begun to realize the importance of protecting the environment. In order to achieve the important goal of " double carbon, " China will spare no effort. As a landscape architect, you must also act. Landscape engineering consumes a lot of resources, but compared with other projects, it has many functions, such as ecological green natural carbon sink, reducing carbon emissions, alleviating urban heat island effect, reducing the overall energy consumption of the city, guiding environmental protection transportation, publicity and education. It is necessary to integrate the concept of low carbon into the landscape construction, and strive to obtain the maximum comprehensive benefits with the least investment. [2] As an important part of urban landscape planning, park design is closely related to people's life. How to practice the requirements of " double carbon " action and how to carry out low carbon design is a question worth pondering.

2. Problems Existing in The Original Landscape of Urban Parks

There are a series of problems in the landscape design of urban parks. For example, in the design of low-carbon urban

parks, designers are forced by interests or improper analysis of the local status quo, insufficient consideration, resulting in a lot of waste of materials in the landscape design process, increasing carbon emissions, and causing certain pollution to the environment. In the process of project design, the maximum low carbon index is not put forward for the project. The accumulation of 1m³ of trees can absorb about 1.83tCO₂ and release 1.62tO₂. The reasonable carbon reduction target and low carbon plan can effectively guide the implementation and later operation of the project. For the implementation of the project, it should be repeatedly studied and scrutinized to select the most appropriate design scheme. In the later implementation process, the project should not be easily denied, resulting in a huge waste of resources. At the same time, after the end of construction, regular maintenance and management should be carried out regularly to reduce material costs and save resources. In some areas, blind construction and transformation of the original ecological environment have destroyed the original ecological community and natural landscape. Ecological restoration should be taken to minimize the disturbance to the original ecology. In the process of landscape design, plant planting and collocation do not pay attention to the growth habits and characteristics of organisms, resulting in heterogeneous inhibition effect and alien growth effect.

3. Practice the Requirements and Principles of Double Carbon

3.1. Practice requirements

China's "14th Five-Year Plan" has pushed " promoting the construction of ecological civilization " to a new height. It gives every garden worker the responsibility and obligation to take the design concepts of ecology, environmental protection, energy conservation and low carbon as the basic requirements and criteria of landscape design engineering. The design concept and design elements of urban parks should take into account the functions of ecological carbon sink and carbon emission reduction. Combined with the geographical location of the project, a reasonable design scheme should be formulated to effectively alleviate the heat island effect and reduce the overall energy consumption of the city.

3.2. Practice principles

3.2.1. Ecological principle

The ecological principle under the background of double carbon is the content that needs to be fully considered in landscape design. The state promotes energy conservation and low carbon, and the relationship between low carbon and ecology is very close. Low-carbon life cannot be separated from green natural carbon sinks. In the design of urban parks, carbon neutral ecological theme parks include functional areas such as woodlands and wetlands that can build people's quiet rest. They not only have the function of viewing and resting, but also have the function of ecological carbon sinks. We do not change the original ecosystem and environment of the project as much as possible, do not change the original biological species and plant communities, follow the principle of minimum intervention, and improve the landscape design effect. The first is to save energy and reduce the waste of resources; the second is to build an ecological system with self-healing function to reduce the impact of human beings on the balance of the ecosystem. In the design, workers should improve the energy efficiency of natural ecosystems as much as possible to achieve the purpose of energy recycling, such as carbon cycle. Follow the 'low intervention, low consumption, low maintenance, low emissions, low cost' ecological concept to enhance the effect of landscape design. [3]

3.2.2. Principle of adaptation to local conditions

The principle of adapting to local conditions originally refers to planting suitable trees according to the actual situation of the land, and now it also refers to formulating appropriate methods according to the actual situation. Combined with the natural ecological environment of the area where the city park is located, plant planting and reasonable landscaping techniques are adopted according to the ecological concept. In the landscape design of urban parks, the local terrain and the existing ecological environment should be fully protected, and wetland rest parks, natural oxygen bar parks, sports parks, low-carbon science and technology parks and art parks should be created. On the premise of reducing human intervention, maximize the utilization rate of natural ecological environment, improve the utilization rate of land resources and energy, reduce carbon emissions, achieve low-carbon quantitative indicators, and achieve the principle of adapting to local conditions. [4]

3.2.3. Humanistic principle

The principle of humanization is to respect the local historical and cultural background, including the historical situation of biogeography history, human history and natural biological development. In the process of urban ecological theme park design, we should follow the local principles, adjust measures to local conditions, fully consider the regional culture and surrounding environment of the project site, and rationally use plants and related construction materials according to the ecological environment characteristics and topographic features of the project site. Design, as far as possible to protect and make good use of local plants. The design concept and humanistic elements are perfectly integrated. The local cultural history and culture are unique to the local characteristics, which are closely related to the living habits of the local people. In order to improve the utilization rate of the park and reduce the waste rate of resources such as plants, the local cultural history and culture should be respected as much as possible. [5][8]

3.2.4. Sustainable development principles

The design of urban parks in landscape design should follow the principle of sustainable development. The garden plants, garden sketches and building materials in the design should use local local resources as much as possible. It not only has local characteristics, but also helps to reduce transportation and construction costs and achieve energy conservation and emission reduction. The role also realizes the low-carbon design concept. After the project is completed, it strengthens the maintenance and management in the later period, increases the service life of the hard landscape and protects the healthy growth of the soft landscape. In the process of construction, we try to select renewable and degradable low-carbon materials, which reduces the self-regulation burden of the ecosystem and better reflects the regulation ability of the ecosystem itself. And predict the next 10 years, 20 years landscape design area will be how to plan for the broader background, realize the principle of sustainable development. [9]

4. Practice the Design Idea of Double Carbon

The five elements of landscape design are landscape terrain, plants, buildings, squares and roads and garden sketches. Among them, landscape terrain and plants are soft landscape, which refers to the living and natural composition of landscape composition. Soft landscape is an important way to fix carbon and release oxygen in landscape. Hard landscapes are inanimate and man-made, such as buildings, squares and roads, and garden sketches such as rockeries and pools. Practicing the concept of low-carbon design in urban park design. [10] I put forward my design ideas from the following four aspects (Fig.1) :



Figure 1. General plan of urban parks practicing dual carbon

The project is located on the north side of the west square in front of the Chengdu East Railway Station in Sichuan Province, China. The south of Jinmahe Road in the east of Jinxiu Avenue, the west of Longquanshan Road, and the north of Longmenshan Road are about 3.5 hectares. The transition area between the 'inner circle' and the 'middle circle' planned in the core area of the new station.



Figure 2. Location analysis diagram of the project

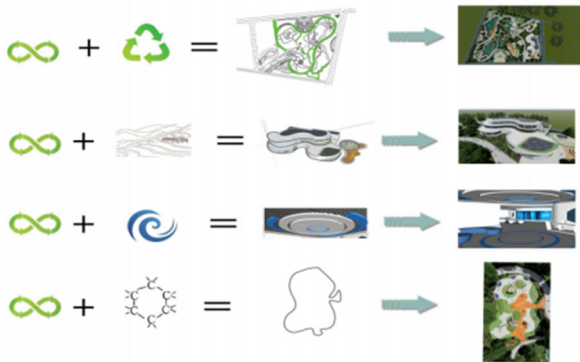


Figure 3. Design concept of the project

4.1. Carbon emission reduction design ideas

Carbon emission reduction is to reduce CO₂ emissions. For some areas that have not yet been replaced, reducing emissions, saving energy and improving energy efficiency have become the main ways. Urban park landscape design belongs to infrastructure construction, which can reduce the emission of 'black carbon' from the source of design.

4.1.1. Reduce energy consumption

Before the design of the project, we should fully understand the ecological environment of the region, ensure that the design scheme retains the original environment as much as possible, and only carry out landscape transformation and ecological restoration in a small part of the ecological environment is destroyed or the energy consumption is large, which can reduce energy consumption, reduce carbon emissions, and save the management costs of later projects. At the same time, it conforms to the on-site landform, reduces mechanical operations, reduces the carbon footprint, and sets up bicycle stations and low-carbon transportation tourism in the park. The city park bulletin board can place some slogans and stories about promoting the use of new energy. We can also use environmental protection materials to build new energy science and technology museums, display and experience new energy products, and promote new energy related enterprises. In the process of vegetation planting, cactus plants can be used, with less water absorption and strong environmental purification ability. At the same time, in the process of planting, plants such as trees and shrubs with strong CO₂ absorption can be used to convert a large amount of CO₂ into O₂. [11]

4.1.2. Reducing waste of resources

In the landscape design of urban parks, we should try to avoid the use of non-renewable resources and reduce the waste of renewable resources. In the natural landscape design, the use of renewable resources such as wind energy, water energy and geothermal energy is often used. [12]

4.1.3. Increase waste transformation and utilization

In addition to the consumption of energy, the reuse of waste should be strengthened to maximize the renewable potential of waste materials. There will be a lot of dead branches and fallen leaves during the maintenance of the park. These are transported to the crushing bucket for powder (graffiti art composting bucket) crushing to produce natural organic fertilizer, avoiding incineration and landfill, increasing the reuse of waste and reducing CO₂ emissions.

4.2. The design idea of carbon substitution

Carbon substitution is to replace traditional fossil energy with clean energy. The alternative forms of energy are electricity, heat or hydrogen. In the landscape design of urban parks, energy-saving street lamps can be used for lighting; the green roof garden is used on the building surface of the hard landscape of the park, and the roof uses green energy-saving materials such as solar photovoltaic panels; in the design of urban parks, windmill gardens can be designed for power generation, and the collected rainwater can be pumped to the roof of buildings or other areas that need irrigation. The energy consumed by street lamps and science and technology museums can be replaced by clean energy. In terms of facilities, alternative building materials are used instead of concrete. [13]

4.3. Design ideas of carbon sequestration

Carbon sequestration is to isolate carbon from the atmospheric carbon cycle and store it in other forms by means of science and technology after collecting CO₂ in the place where carbon emissions are concentrated. In the landscape design of urban parks, the design of rainforest world and natural oxygen bar is adopted. The park site reduces soil interference, uses biomass carbon, replaces lawns with shrubs, increases wetlands, water bodies, and grasslands to expand the planting area of plants (large grassland leisure places, landscape sketches with waste transformation for people to take pictures). In addition, fine silicate can be added to the soil to accelerate the formation of carbonate. Sowing nitrogen-fixing plant seeds and microorganisms to repair slightly polluted soil. The recommended tree species for forest afforestation are 21 species such as Sweet gum, *Sapindus mukorossi* and *Koelreuteria paniculata*. It is recommended that 18 kinds of plants with strong CO₂ absorption, such as *Sapium sebiferum*, *Acer mono* and *Ginkgo biloba*, should be planted in urban parks to increase the diversity of biological species and apply organic fertilizer to achieve the effect of carbon sequestration. [14]

4.4. The design idea of carbon cycle

The carbon cycle is the use of chemical and biological means to achieve the absorption of CO₂ in the atmosphere and make this part of CO₂ work. It mainly includes artificial carbon conversion and forest carbon sink. Artificial carbon conversion refers to the conversion of CO₂ into useful chemicals or fuels by chemical or biological means. Forest carbon sink refers to the absorption and fixation of CO₂ in the atmosphere by plants through photosynthesis in vegetation and soil to reduce the concentration of CO₂ in the atmosphere. [15]

4.4.1. Plant collocation

Under the background of double carbon, the landscape design of urban parks needs to consider the carbon sink capacity of various plants, and the plants with strong carbon

sink capacity in central China are listed below. (Table 1)

Table 1. Plants with strong carbon sink capacity (Central China)

Category	Variety
Aiphyllium	cinnamomum caphora、 Hibiscus mutabilis L、 Magnolia grandiflora L、 Eriobotrya japonica (Thunb.) Lindl.、 Ligustrum compactum 、 Cedrus deodara (Roxb.) G. Don etc. Salix babylonica L.、 Salixbabylonica、 Ulmus pumila L.、 Celtis koraiensis Nakai 、 Zelkova schneideriana Hand.-Mazz.、 Sapium sebiferum (Linn.) Roxb、 Robinia pseudoacacia Linn、 Sophora japonica Linn、 Camptotheca acuminata Decne、 Platanus acerifolia (Aiton) Willd、 Diospyros abyssinica、 Koelreuteria paniculata Laxm、 Broussonetia papyrifera (L.) L'Hér. ex Vent、 Pistacia chinensis Bunge、 Ailanthus altissima (Mill.) Swingle、 Ginkgo biloba L、 Liriodendron chinense、 Pterocarya stenoptera 、 Sapindus saponaria L.、 Aesculus chinensis Bunge 、 Albizia julibrissin Durazz.、 Yulania denudata (Desr.) D. L. Fu、 Prunus cerasifera Ehrhar f、 Malus halliana Koehne、 Lagerstroemia indica L.、 Prunus mume etc.
Evergreen woody plants	Nerium oleander L、 Viburnum odoratissimum Ker Gawl. 、 Buddleja lindleyana Fortune 、 Hibiscus mutabilis L. 、 Prunus persica Batsch. var. duplex Rehd、 v、 Osmanthus fragrans (Thunb.) Lour、 Myrica rubra (Lour.) S. et Zucc 、 Cercis chinensis Bunge 、 Hibiscus syriacus L、 Photinia serratifolia (Desf.) Kalkman、 Rosa multiflora、 Buxus megistophylla H. Lév、 Chaenomeles speciosa、 Chimonanthuspraecox(linn.)Link.、 Edgeworthia chrysantha Lindl.etc.
High bush	Pittosporumtobira、 Pyracantha fortuneana (Maxim.) Li、 Forsythia viridissima Lindl.、 Loropetalum chinense var. rubrum Yieh、 Nandina domestica Thunb、 Ligustrum × vicaryi Rehder、 Hypericum monogynum L.etc.
dwarf shrub	Various types of bamboo (such as Phyllostachys edulis 、 Bambusa multiplex (Lour.) Raeusch. ex Schult. 'Fernleaf' R. A. Young .etc.)
Bamboo plant	Hydrangea macrophylla、 IristectorumMaxim、 Iris pseudacorus
ground cover	Aloe .etc.
evergreen herbs	

In the landscape design, in addition to following the principle of space design and ornamental, the urban greening area should be expanded as much as possible, and the plants with the strongest carbon sink capacity among the native tree

species should be planted.The design formula is 'evergreen arbor forest>deciduous arbor forest> Chinese fir forest>shrub forest, which is called carbon sequestration biological chain. '

Table 2. Carbon sequestration capacity of main community types in patchy green space(t·hm²·a⁻¹)

Type	Vergreen woody plants	Mixed deciduous forest	Deciduous needle-leaf forest	Deciduous broadleaved forest
Maximum carbon sequestration capacity	8.636	6.39	2.4	8.53
Minimum carbon sequestration capacity	6.96	3.905	2.4	8.53

The more complex the community structure in the process of plant design and collocation,the stronger the carbon sequestration capacity it has.The flaky green space community includes the vegetation structure of the combination of tree, shrub and herb layers ; in general, evergreen and deciduous mixed forests have stronger carbon sequestration capacity than evergreen arbor forests or deciduous forests. It means that the higher the diversity of vegetation in the environment, the more complex the composition, the more layers, the stronger the total carbon sequestration capacity of plants, the richer the species of vegetation, and the stronger the carbon sequestration capacity. Through these studies, we can better guide the plant configuration in the process of urban park landscape design. With the landscape configuration method of ' high and low combination, scattered and complete ' of trees, shrubs and grasses, combined with the ornamental principle of plants, the carbon sequestration capacity of greening places is improved while constructing beautiful landscape functional areas.[16]

4.4.2. Design aspects

Wetland can speed up the water cycle, enhance plant transpiration, and can be used in urban park landscape design. At the same time, in order to increase the green area, the roof garden can be designed on the roof of the building, and the side of the building adopts vertical greening, such as climbing tigers, morning glory and other well-maintained plants. At the same time, the greenhouse flower hall can be designed to display ornamental flowers and plants in the greenhouse for everyone to watch popular science and take home planting. At the same time, greenhouse can absorb human emissions of CO² and so on.

5. Conclusion

Under the background of double carbon, the design concept of ' low carbon ' has been widely used in landscape design. As the most important near-natural ecological space in the city, urban parks create green natural carbon sinks with the design concepts of carbon emission reduction, carbon substitution, carbon sequestration and carbon cycle through reasonable

planning and design of urban park landscape design. It reduces a lot of greenhouse gases for the city and improves people's living environment and air quality.[17-19]

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