

Landscape Design Practice of "Ecological Restoration and Cultural Inheritance" in Industrial Heritage Site Renewal

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Abstract: Against the backdrop of urban transformation, development, and industrial restructuring, a significant number of industrial sites face the challenge of adaptive reuse. Guided by the core concept of integrating ecological restoration with cultural heritage, this paper analyzes typical case studies, including the Changchun Water Culture Ecological Park and the Zoucheng Ferroalloy 1971 Industrial Site Park in Jinling. It explores the practical approaches of landscape architecture in the regeneration of industrial sites, focusing on spatial revitalization, functional reprogramming, and ecological reconstruction. The study elaborates on innovative methodologies and proposes design strategies under the guidance of the "minimum intervention principle," aiming to provide theoretical support and practical references for the sustainable development of industrial sites.

1. Introduction

As important carriers of urban development history, industrial sites bear profound historical, cultural value and unique spatial memory. With industrial relocation and adjustments to urban functions, a vast number of these sites face abandonment and idleness. This situation not only leads to a waste of land resources but may also cause environmental pollution. Consequently, how to achieve the sustainable reuse of industrial sites by revitalizing the environment through ecological restoration, while preserving the industrial cultural heritage, has become a critical in contemporary urban regeneration.

2. Theoretical Basis and Value Orientation for Industrial Site Redevelopment

The key to redeveloping industrial heritage lies in striking a balance between preservation and development, facilitating an organic integration of historical value and contemporary utility ^[1]. Theoretically, the transformation of industrial relics must adhere to the fundamental principles of "comprehensive preservation, appropriate development, and suitable adaptive reuse." On one hand, it is essential to maintain the historical authenticity and integrity of the industrial heritage; on the other hand, the transformation must align with the practical needs of urban development. In this process, ecological restoration and cultural inheritance mutually reinforce each other, jointly contributing to the creation of sustainable urban spaces. Ecological restoration introduces the concept of green development to industrial sites and enhances environmental quality, while cultural inheritance ensures the continuity of the urban context, strengthening the space's identity and sense of belonging.

The redevelopment practice of the Changchun Water Culture Ecological Park fully exemplifies this philosophy. Based on the former First Water Filtration Plant from the Puppets Manchuria period, this project protects the legacy of 80 years of water supply culture. Simultaneously, it utilizes ecological restoration methods to transform 30 hectares of land in the city center into ecological green space. By organically integrating industrial relics with natural landscapes and incorporating elements of culture, art, and fashion creativity, the project has successfully achieved a transition from an enclosed industrial compound to an open public space, becoming a vital asset for citizens' leisure life.

3. The Necessity of Integrating "Ecological Restoration + Cultural Inheritance" in Landscape Design for Industrial Site Redevelopment

The practice of landscape design integrating "ecological restoration + cultural inheritance" is manifested in specific operations across four key dimensions. These practical pathways are interconnected and mutually supportive, collectively constructing a comprehensive framework for the redevelopment of industrial sites. Among them, the symbolic representation of industrial elements through landscape serves as the core means of cultural inheritance, laying the foundation for the continuation of the historical context throughout the entire transformation practice.

3.1 The Practical Demand of Urban Transition and Development

With the accelerated pace of economic restructuring and industrial upgrading in China, a large number of traditional industrial enterprises have been relocated, leaving behind numerous abandoned industrial sites. These sites, often occupying core urban locations and holding significant strategic value, frequently face environmental challenges such as soil contamination and aging infrastructure. The transformation of these industrial sites into urban green open spaces through the "ecological restoration + cultural inheritance" landscape design approach stems from the practical demands of urban transition. This approach effectively addresses issues of land resource scarcity, enhances urban environmental quality, and meets the needs of sustainable urban development.

3.2 The Imperative for Ecological Environment Restoration

Industrial sites, due to long-term production activities, have often caused varying degrees of environmental pollution, including soil heavy metal contamination, groundwater pollution, and air pollution, posing potential threats to the surrounding ecological environment and residents' health. Ecological restoration through landscape design not only effectively improves environmental quality but also generates economic and social value, moving beyond traditional environmental remediation methods that are often costly and yield limited results. By employing ecological technologies such as phytoremediation, soil improvement, and stormwater management, the ecological functions of the site can be gradually restored, and a stable ecosystem can be constructed. Achieving a remarkable transition from a "brownfield" to a "greenfield" represents an imperative for ecological environment restoration.

3.3 The Historical Responsibility of Cultural Value Inheritance

As products of a specific historical period, industrial sites carry rich industrial cultural memories and socio-historical information, possessing irreplaceable cultural value. Their industrial buildings, equipment, and spatial layouts bear witness to the course of urban development and reflect the technological levels and aesthetic conceptions of different eras, constituting an important component of urban cultural heritage. Allowing them to fall into disrepair or being demolished indiscriminately would cause an irreversible cultural loss. Integrating industrial elements with modern functions through landscape design techniques not only preserves the historical value of the industrial cultural heritage but also meets the usage needs of contemporary society, achieving the living inheritance of history and culture. This is the historical responsibility of cultural value inheritance.

4. The Practice of "Ecological Restoration + Cultural Inheritance" in Landscape Design for Industrial Site Redevelopment

Through a systematic review and case analysis of the "ecological restoration + cultural inheritance" landscape design practice in industrial site redevelopment, it is evident that this design philosophy not only provides an effective solution for urban regeneration but, more importantly, explores a sustainable development path that balances historical preservation with modern development, and ecological restoration with cultural inheritance.

4.1 Inheriting Memory: The Symbolic Representation of Industrial Elements through

Landscape

Cultural inheritance in the redevelopment of industrial sites is primarily reflected in the preservation and representation of industrial elements. Based on designers' thorough understanding of the site's historical and cultural significance, these elements are transformed into landscape features with aesthetic and educational value through landscape design techniques ^[2]. The design adheres to the "minimum intervention principle," maximizing the retention of original industrial structures and spatial textures while ingeniously endowing them with new functions and meanings. The symbolic representation of industrial elements through landscape is not merely about simple preservation and display; it involves reinterpreting and re-presenting them with a modern design language under the premise of respecting historical authenticity. In this process, designers delve into the technical characteristics, aesthetic value, and cultural connotations of industrial facilities, translating abstract industrial memories into tangible spatial experiences. Furthermore, through signage systems, cultural walls, interactive installations, etc., historical industrial information is conveyed to the public, enhancing the space's cultural and educational function. This approach not only continues the urban industrial context but also provides citizens with a window to understand the city's development history, allowing the industrial heritage to regain vitality in a contemporary context.

The Changchun Water Culture Ecological Park masterfully integrates various industrial elements of the former water filtration plant into its landscape design, fully embodying the design philosophy of symbolically representing industrial heritage through landscape. The all-ages activity playground is replete with vibrantly interpreted industrial elements from the plant. Its basic play facilities and rest areas incorporate industrial memories, allowing citizens to experience the weight of history during leisure and recreation. The central lawn atop the former clear water reservoir has been transformed into a plaza for large-scale cultural events and artistic activities, endowing the original industrial structure with new cultural functions and establishing it as a crucial of urban memory. The plaza, with pathways leading to functional areas such as the sedimentation tank, clear water tank, forest corridor, and the Water Culture Museum cluster, offers distinct and beautiful vistas in every direction, forming a richly layered spatial sequence. By converting the original water purification process into a landscape feature, the project enables visitors to learn about the history of the city's water supply during their tour. This achieves an organic integration of industrial relics and natural scenery, creating a cultural landscape that is both educational and aesthetically valuable.

4.2 Reshaping Space: The Three-Dimensional Corridor Touring Experience

Spatial remodeling is a critical factor for the successful redevelopment of industrial sites. Its core lies in transforming formerly enclosed industrial spaces into open public touring areas through innovative design approaches ^[3]. The construction of a three-dimensional corridor system is an effective design strategy. It not only effectively connects industrial structures at different elevations but also provides visitors with a multi-dimensional spatial experience. This design technique ensures both the safety and convenience of the visit while enhancing its interest and interactivity.

The design of these corridors must fully consider the structural characteristics and spatial relationships of the industrial buildings. Through scientific structural calculations and rational path planning, the safety and practicality of the corridor system are ensured. Simultaneously, the material selection and form design of the corridors should harmonize with the overall of the industrial site, reflecting the clean aesthetics of modern design while establishing a dialogue with the historic structures. Through rational path organization and node design, visitors can appreciate the charm of the industrial site from various perspectives, achieving a progressive experience from distant viewing to close contact, thereby enhancing the spatial hierarchy and dramatic effect.

The uniqueness of the Jining Zoucheng Ferroalloy 1971 Industrial Site Park lies in the multi-disciplinary collaboration between architecture, landscape architecture, structural engineering, and industrial heritage restoration teams. This collaboration enabled a "secondary traffic weaving" intervention on the preserved industrial buildings, exemplifying innovative practice in three-dimensional corridor design. The project ensured the creation of an elevated walkway that

allows access into the core industrial structures. This corridor not only solves the problem of circulation between buildings at different levels but, more importantly, creates unique viewing perspectives for visitors. The corridor system, combined with released nodal spaces and the incorporation of functional facilities such as platforms, rest areas, and viewing decks, significantly enhances the tour's interest and comfort.

Citizens can not only enjoy panoramic views of the park's core heritage area from a distance, experiencing the grandeur of the industrial site, but also use the corridor system to enter the interior of the ruins, observing the details and structures of the industrial facilities up close. This three-dimensional touring experience provides visitors with rich spatial sensations, allowing people to deeply engage with the industrial culture and the site's history from multiple dimensions, achieving a perfect combination of and educational value.

4.3 Integrating Nature: The Reconstruction and Cultivation of Ecosystems

Ecological restoration in industrial sites is not merely about greening and beautification; it is a complex systematic project that involves reconstructing and cultivating the entire site's ecosystem by applying ecological principles, scientific plant configuration, and ecological technologies. The goal is to establish stable ecological communities and restore/enhance ecological functions. This process requires comprehensive consideration of multiple factors, including soil conditions, hydrological environment, climatic characteristics, and biodiversity.

In specific designs, the site's topographic features should be utilized to create diverse ecological habitats through multi-layered vegetation configuration. Native plants with strong adaptability and prominent ecological functions should be selected to build composite community structures combining trees, shrubs, and herbaceous plants, thereby forming stable ecological chains. Concurrently, the application of ecological technologies such as stormwater management, soil remediation, and microclimate regulation should be considered to construct sustainable ecological cycles. This ecological reconstruction not only improves the site's environmental quality, mitigates the urban heat island effect, and purifies air and water bodies but also provides vital ecological services for the city, such as carbon sequestration, biological habitats, and stormwater retention, making it an important component of urban green infrastructure.

The Changchun Water Culture Ecological Park uses ecological green space as a carrier to organically integrate industrial relics with natural landscapes. By creating 300,000 square meters of ecological green space in the urban core, it provides significant ecological services for the city and effectively alleviates the shortage of green space in the central urban area, fully embodying the design philosophy of ecosystem reconstruction. Among its features, the open sedimentation tanks were cleverly transformed into ecological water features, preserving industrial memory while serving functions of rainwater collection and ecological purification. The forest ecological corridor links the park's green spaces into a complete ecological pathway, providing habitats and migration routes for small animals. The project also emphasizes plant seasonal variation and ecological function, building a stable ecosystem through multi-layered vegetation configuration.

4.4 Serving the People: Functional Implantation in Quality Spaces

The fundamental purpose of industrial site redevelopment is to benefit citizens' daily lives by creating high-quality public spaces that offer diverse functional services. This requires designers to appropriately integrate functional facilities that meet the needs of contemporary life—such as leisure and entertainment facilities, cultural and educational venues, and sports and fitness areas—on the basis of properly preserving the industrial heritage.

Implanting functions into quality spaces must adhere to human-centered design principles, fully considering the needs and behaviors of different user groups. Regarding spatial scale, humanized design should be emphasized to create a comfortable and pleasant activity environment, avoiding inconvenience caused by excessively large scales. In terms of functional layout, the needs of different age groups and user types should be considered, providing a rich variety of service facilities to achieve all-age-friendly spatial design. Functional implantation should also focus on spatial flexibility and adaptability to meet usage demands at different times and seasons. Meanwhile,

attention must be paid to universal accessibility design and safety measures to ensure that all groups can equally enjoy the services provided by the public space, reflecting social equity.

The Jining Zoucheng Ferroalloy 1971 Industrial Site Park has achieved remarkable results in serving people's lives. The newly created nodal spaces within the project provide considerate cultural and functional areas for visitors. Node designs themed around the factory's history and industrial culture are distributed throughout the park, providing spaces for cultural commemoration. With their comfortable scale, refined details, and natural landscaping, these designs create high-quality public spaces. These include a non-powered playground in the children's activity area, seating areas in rest zones, and activity and leisure areas in small plazas, comprehensively meeting the daily life needs of the public.

5. Conclusion

In the process of redeveloping industrial sites, landscape architectural practices centered on the "integration of ecological restoration and cultural inheritance" have provided crucial theoretical support and practical pathways for urban regeneration. Through measures such as the symbolic representation of industrial elements via landscape, the creation of three-dimensional corridor touring experiences, the reconstruction of ecosystems, and the implantation of functions into quality spaces, not only has the effective protection of industrial cultural heritage been achieved, but high-quality public spaces have also been provided for cities.

Looking forward, the application of this philosophy should be further promoted, interdisciplinary collaboration strengthened, and relevant policies and regulations improved. This will facilitate the successful redevelopment of more industrial sites, contributing actively to the creation of beautiful cities with a pleasant ecological environment and high livability.

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