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Waterfront Spatial Design from the Perspective of Sponge City

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Abstract Due to environmental awareness, demand for watercourse landscape eco-function is growing domestically. However, flood control and drainage are the only focuses, and the rest functions of water course are slighted. Besides, cross-section biodiversity is falling and wetland self-cleaning capacity is impairing, resulting from river limitation on riverbed, making a straight river bend and revetment. So, water course has to be managed from ecology, economy, culture and social effect, to restore natural river function and meet human demands. And to return to nature and people first would be the general principles.

Key words Sponge city; Waterfront area; Planning and designing

The waterfront area is the earliest settlement in which people live, and currently faces increasing concerns of living function decline. Coordinated development between waterfront area and modern civilization has been its top priority in modern urban waterfront design by reinforcing waterfront eco-construction and resurrecting old waterfront area. Anyway, an urban waterfront is both a natural landscape and a human landscape. The focus is on urban waterfront designing and constructing based on its location and resources. And we observe the concept of sponge city from urban waterfront construction in early design, application and follow-up maintenance. The research analyzed urban waterfront design approaches based on sponge city concept, and it is meaningful for improving urban environment quality, enriching local culture and bolstering economic growth.

Status quo and Existing Problems of Urban Waterfront Landscape

Status quo of urban waterfront landscape

Recent years have witnessed increasing growth of urban landscape and waterfront area is a top issue. However, domestic relevant researches are hardly supportive. That is because a body of water is the only emphasis, while its relation with a city is always slighted in urban waterfront construction. Economic benefits seem overweight ecological benefits[1]. With people first theory rising, many cities shift the focus to environment-friendliness and refocus attention to waterfront landscape design, renovation and protection to improve waterfront environment oriented by ecological theory.

Existing problems of urban waterfront landscape

With slow start, China lags behind developed countries on urban landscape planning and designing. Pursuing fast development, there are a lot of problems emerging domestically, such as a lack of systematic thinking, the conflict between landscape design and eco-conservation, and a lack of local culture. Consequently, urban waterfront landscaping factors can be not coordinated, or eco-functions can decline or urban waterfront can be contaminated. We must learn the problems and deal with them in order to

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基于海绵城市视角下的滨水空间设计探讨

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摘 要 随着人们环保意识的增强,河道景观的生态功能已经成为普遍需求。但大多数城市河道由于曾经比较片面地强调防洪、排水,忽略了河道的其他功能,对河床进行约束、截弯取直、陡坡护岸等工程处理,使河道过流断面具生物多样性的湿地消失,湿地净化河水的能力被削弱,减低了河道的自净能力。为此,河道整治要从生态、经济、人文、社会效应等多方面来考虑,既要恢复自然河道的功能,又要满足人类依赖生存的要求,以"回归自然"与"以人为本"相结合为河道治理思路。

关键词 海绵城市;滨水空间;规划设计

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better planning of waterfront.

A lack of systematic thinking

Waterfront designs available lacks systematic thinking. At first, every design stresses design and construction, while early-stage investigation and appraisal and later-stage conclusion are always slighted. Secondly, urban structure and waterfront functions are not included. Thirdly, land use tends to be in chaos and resources be unscientifically used.

The conflict between landscape design and eco-conservation

Present waterfront design and renovation only puts highlight on landscaping effects, and eco-conservation is where the design is pretty empty. For example, either riverbed hardening or making a straight river bend has destroyed original eco-structure; construction of landscape roads along river ways has ruined local soils; industrial and domestic wastes are beyond water self-cleaning capacity.

The Concept and Design Conception of A Sponge City

The concept

According to Technical Guideline of Sponge City Regulatory Planning, a sponge city can be defined as one like sponges that can hold, clean, and drain water in a natural way using an ecological approach[2]. Firstly, it will be an effective way for arid cities to tackle water problems. Secondly, a sponge city is based on low-impact development (LID) without changing hydrological characteristics. Thirdly, a sponge city allows rainwater store and reuse, in consistent with sustainable use. It means a sponge city has a wide range of adaptation rainfall conditions in recurrence interval, answering to flood problems and maintaining local environment.

Design conception

The ecological idea is meant to stress the importance of ecology and eco-environment conservation, and balance human and nature relationship, by creating landscaping effect and using human mentality.

We must firstly refocus attention to the wholeness of the sponge city. We can fully analyze the waterfront and prepare design from its geographical location and natural resources.

Furthermore, both of artistic quality and landscaping can be observed from waterfront design to allow tourists to better enjoy and experience the landscape.

Besides, eco-environment conservation and resource saving would top waterfront design in the context of sponge city construction. So, we must protect riverbank, wetlands, animals and plants depending on low-carbon methods.

Finally, urban culture and history can be incorporated by reserving and modifying local characteristic buildings. It will be environment friendly and full of regional features.

Waterfront Design Methods

Local natural environment and its location within a city can be the highest priority in waterfront design, supplemented by eco-environment and historical and cultural features. Water-related facilities and specific schemes can be appraised as a whole in accordance with laws and regulations. In the meantime, general urban planning and successful cases can be references. In general, we can prepare waterfront design from the following aspects.

Ecodesign for waterfront

Waterfront development necessitates landscape ecodesign. For instance, water landscape helps water resource protection and landscape ecology helps protection on waterfront environment and biodiversity. Anyway, we should take measures adapted to local conditions and ecological way will be the best in waterfront structure protection.

To protect water quality and improve water self-cleaning capacity

Water quality protection should top waterfront design so as to improve water self-cleaning capacity. We must protect water cycling system and control sewage emission to protect water quality from the source. We can plant *Eichhornia crassipes* and *Scirpus validus* for water cleaning.

To protect biodiversity and regulate urban microclimate

We can ecological approaches to conserve and recover living beings and original wetlands in waterfronts, providing habitats and increasing biodiversity. Microclimate regulation depends on temperature reduction and air humidity improving. And massive wetlands do help in improving urban environment and air quality. Bailian Jing during World Expo 2010 has been a real success story in ecological rehabilitation and landscaping. The watercourse has a total of over 2 000 m and the project stretches from Yilin Road inside to Liuliqiao outside. Besides, aquatic plants cultivation and wetland restoration target habitats for birds, aquatic plants, and microorganisms, completing aquatic eco-environment, and conserving biodiversity. And the project has benefited natural environment of the river and riverbanks, conserved eco-system, and exerted influences on eco-environment and urban competitiveness[3].

To protect waterfront structure by ecological revetment

We must protect riverbank, alluvial island and wetlands, and avoid massive development. Ecological embankment, natural or imitated, can be used based on stones, woods and plants to increase permeability and control flood, protect levee and regulate water level.

Continuity in waterfront design

Waterfront plays a major role in urban development and historical inheritance. Its continuity ranges from urban structure to urban historical culture inheritance.

Continuity from the perspective of urban structure

The waterfront area is of linear characteristics, covering all scenic spots. In 1880, Frederick Law Olmsted, the father of American landscape architecture, was famous for conceiving of entire systems of parks to connect certain cities to green spaces concerning Boston, Charles River, and branches, and beaches, making breakthrough on coordinated system of public parks. Similarly, waterfront and urban structure could be interconnected by landscape corridors[4]. So, waterfront can be well coordinated with other public spaces, while microclimate regulation will relieve heat island effect.

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Continuity from urban culture

The waterfront area is full of urban culture. It is a major part of urban cultural inheritance and characteristics. We must further local areas in terms of nature, cultural resources, and design and construct eco-oriented buildings and landscapes as per ecology theory and materials to embody urban characteristics and preserve historical values.

Function compounding design

The waterfront area is so complicated and valuable, and function compounding would be a solution to full exploitation of the public space and meeting users' demands. We must first make full use of waterfront location and declined industries have to move out. Meanwhile, leisure industries or businesses can be introduced if eco-environment permits to boost coordinated development.

Function compounding is involved in recreation and entertainment, commercial value, and living. Specifically, the function of recreation and entertainment refers to building cultural square and resting space based on stones and woods, with natural revetment. The function of commercial design refers to creating multi-functional compound waterfront business development mode as per waterfront linear characters. The living function refers to developing nearby areas and playing the role of neighboring lands, to bolster urban development, provided by waterfront protected.

The Darling Harbor in Australia is a good example. It consists of a number of major public facilities and attractions, including shopping center, bay wharf, movie theatre and aquarium. It is for the public, embodying multi-levels, continuity, compounding and three-dimensional. With local waterfront environment restored and urban characteristics displayed, The Darling Harbor turns the page in urban waterfront development and boost urban growth[5].

Conclusion

Different aspects have to be included in the design of urban waterfront and urban aquatic environment can never be slighted. The research explores design approaches to urban waterfront and concluded fitted sustainable ways based on eco -theory and sponge city concept, so as to advance waterfront development.

People in cities are always longing for the nature. So, we must emphasize eco-conservation and eco-design in urban waterfront design and relieve the conflict between urban development and eco-conservation. We can diversify waterfront functions while maintaining local environment. These would contribute to urban growth and living environment improvement.

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