

Study on the Connotation and Development Status of Sponge City Construction

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Abstract

Under the new situation, sponge city has gradually developed into an innovative technological means to solve urban problems and break through the limitations of urbanization development in China, which has been recognized, supported and vigorously promoted at the national strategic level. However, China's sponge city research and practice are still in the stage of exploration and development. This research starts with the background of city sponge, sponge the connotation of urban construction in China, a systematic carding of different region sponge city to create a key trend and prospect and future development key, respectively, from planning, publicity, technology, supervision, evaluation and put forward the corresponding suggestion, in order to our country city sponge can provide a scientific reference theory and construction practice.

Keywords

Sponge city; Low impact development; Construction of ecological civilization.

1. Background of Sponge City

1.1. China's Geographical Location and Monsoon Climate Determine the Coexistence of Floods, Rainstorms, Floods, Droughts and Other Disasters in China

Precipitation in China by the southwest and southeast monsoon season risk control system, the interannual change is big, the year season distribution, mainly concentrated in 6 ~ 9 month, accounted for 60% ~ 80% in the year and accounted for more than 90%, even in the north at the same time, the uncertainty of climate change in China has brought heavy rain floods, such as the increase of the actual peak flood risk, lead to each summer waterlogging multiple times [1]. Due to the high flood peak in the flood season, most of them are not used and infiltrated, resulting in the alternating occurrence of river cut-off and flood, and the risk is getting higher and higher. The data show that the ratio of the maximum peak discharge to the average annual maximum peak discharge is 5 ~ 10 times in the north and 2 ~ 5 times in the south, which is highly unbalanced within and between years and regions, leading to excessive flood risk. In addition to regional flood disasters, urban waterlogging is also becoming more and more serious.

1.2. Rapid Urbanization Is Accompanied by Excessive Development of Water Resources and Serious Pollution of Water Quality

The exploitation of water resources in China has been unprecedentedly excessive, especially in northern China, where the lower reaches of the Yellow River, Tarim River and Heihe River have been cut off, and large areas of wetlands and lakes have disappeared. The problem of groundwater overexploitation is becoming more and more serious [2]. The area of groundwater overexploitation in China has reached 190,000 km², and many groundwater falling funnel areas in the north are facing the serious crisis of groundwater resource depletion. At the same time, the situation of surface water quality in China is not optimistic.

1.3. Unscientific Engineering Measures Lead to the Overall Degradation of Water System Functions

Urbanization and various gray infrastructure construction lead to the destruction of vegetation, soil and water loss, the increase of impervious surface water, the fragmentation of river and lake water bodies, the interruption of the connection between surface water and groundwater, which greatly changes the hydrological conditions such as runoff confluence, and the overall trend shows accelerated confluence and high flood peak value. In the past 50 years, the runoff of many rivers has changed dramatically, while the construction of DAMS has led to a sharp decline in the runoff of most rivers, and the decline rate of China's rivers has exceeded 30%. Since the 1990s, the Yangtze River, Songhua River, Liaohe River, Pearl River, Huaihe River, Taihu Lake basin and many other places have severe flood and adverse flood combination, the design flood volume has been forced to increase greatly. Shrinking rivers for land and blindly reclamation of lakes, wetlands and floodplains have reduced the area of lakes and land wetlands by 15% and 28% in China, of which reclamation area accounts for more than 80%, reducing the flood discharge and flood storage capacity of river courses.

2. Connotation of Sponge City

Sponge city refers to a city that is able to adapt to environmental changes and cope with natural disasters like a sponge with good "elasticity". When it rains, it absorbs water, stores water, seepages water and purifies water. When needed, the stored water is "released" and utilized. In fact, sponge city construction is the construction of multi-objective rainwater system. By adopting modern rainwater management methods, the total amount of runoff discharged from the city and runoff pollution are controlled, and the standards of urban drainage and waterlogging prevention are improved, so as to realize a virtuous cycle of urban hydrology and maintain a good urban ecosystem [3].

In general, sponge city construction can be summarized as "one core, three components, multiple goals, multiple approaches, multiple technologies and the whole process". "One core" refers to the core guiding ideology of Low Impact Development (LID). The runoff and pollution are controlled through decentralized and small-scale source emission reduction measures, so that the hydrological characteristics after development are as close as possible to the natural hydrological cycle, and the sustainable development of the city is guaranteed. At the same time, we should pay attention to the combination of green infrastructure and gray infrastructure. The "three components" include the narrow sense of low impact development rainwater system, the traditional rainwater pipe drainage system and the exceeding standard rainwater drainage system. Through the scientific application and reasonable connection of the three systems, a flexible rainwater infrastructure system is jointly constructed. "Target" is actually the true content of the urban construction sponge, change its traditional rainwater system in our country fast mode, puts forward total control, peak runoff control urban runoff, runoff pollution control, and multiple targets for rainwater utilization and drains in the sponge to accurately

grasp the root of the problem in the construction of the city, have the key to determine the control objectives, To determine the design scheme according to local conditions, so as to effectively solve the increasingly prominent problems of water security, water resources, water environment and water ecology in urban development. "Way, technology, the whole process of" refers to the sponge in the process of urban development and construction through the protection, restoration and development of a variety of ways, such as system construction of city "sponge", and USES the "hysteresis, net, permeability, storage, use," and other technology, by midway through the source reduction, in the process of the transfer and storage at the end of the control of runoff, To minimize the damage to the original natural hydrological characteristics and water ecological environment caused by urban development and construction.

The construction of ecological civilization [4] is a systematic project, whose ultimate goal is to establish the ecological security pattern of the whole territory, restore the ecological environment, repair and maintain the integrity and health of the ecosystem, so as to achieve the harmony between man and nature, make the ecosystem provide sustainable services for people, and realize the sustainable development of the city. Sponge city, the starting point of which is the natural control of rainwater, is implemented at the level of the entire urban ecosystem, emphasizing the systematic role of the construction area, natural green space, water system, etc. Sponge city takes water control as the starting point, and its essence lies in the management of the entire ecosystem that affects water ecology, which is the basis of ecological civilization construction.

3. Sponge Cities in Different Regions of China

3.1. Sponge City Construction in Warm Temperate Climate Zone

Warm temperate climate zone typical cities such as Beijing, Tianjin, Xuzhou, Taiyuan, the summer precipitation characteristic is affected by the temperate maritime air or degeneration tropical Marine air, annual rainfall between 400-600 - mm and uneven distribution of rainfall mainly concentrated in six to eight months can be accounted for about 80%, but the region overall urban for DuanQueXing city water resources. The balance between "storage" and "discharge" should be considered in the construction of sponge cities.

In terms of natural system, the landfill rivers, lakes and other water systems should be restored to increase the water storage space inside and outside the city to facilitate rainfall and drainage of the wrong front; In road construction, rainwater collection and storage ponds should be set up in the rainwater main pipes downstream of the catchment water surface. Rainwater collection and water-saving of infrastructure should be coordinated in urban poor functional areas, especially in residential areas. At the source of rainwater, the excess rainwater should be drawn away from rivers and lakes in the city, and the density of drainage ditches and ditches in the city should be increased. The rainwater should be channeled and discharged in a timely and organized manner by using the river network, drainage ditches or culverts within the city. A variety of comprehensive measures to promote rainwater infiltration and natural purification, forming an effective supplement to groundwater.

3.2. Sponge Cities in the North and Middle Subtropical Climate Zones

Typical cities in northern and subtropical climate regions, such as Shanghai, Hangzhou, Nanjing, Wuhan, Chengdu, etc., have an average annual precipitation of 1100-1600mm. There is a plum rain season from May to June every year, and rainstorms brought by typhoons from July to October. The cities in this climate region have abundant rainfall, and most of them are plain areas with densely covered lake and river networks, and the catchment area is large. Therefore,

the construction of sponge cities should pay more attention to "infiltration", "stagnation" and "drainage".

In terms of natural system, the construction of urban water network should be based on the natural water system, and the original "natural spongy body" such as rivers, lakes, wetlands and ditches should be protected to the greatest extent from the influence of development activities, and the restoration and repair of the hydrological function of urban natural components should be carried out step by step. The retention effect of multi-level greening on rainfall should be considered comprehensively, such as urban three-dimensional greening space and green space canopy space of trees and plants. At the same time, the local greenbelt of subsidence road can improve the hysteresis and water permeability, and enhance the human infiltration capacity of urban soil. The construction level of urban drainage pipe network should be improved to cope with flood season drainage.

3.3. Sponge Cities in the South Subtropical Climate Zone

Typical cities in the south subtropical climate region, such as Guangzhou, Shenzhen, Guilin, etc., have an average annual precipitation between 1500mm and 2000mm. The rainfall increases sharply from April every year, and the annual rainfall is concentrated in May to June, and the tropical cyclone rain brought by typhoons and strong convective rain in summer are more common. In this climate region, the water and heat conditions are excellent and the city is rich in natural resources, but the water quality is poor. Therefore, the construction of sponge cities should pay more attention to "seepage", "stagnation", "purification" and "drainage".

In terms of natural system, urban natural vegetation restoration, such as urban forest and natural wetland, should be carried out by utilizing regional excellent hydrothermal conditions to improve urban microclimate and enhance biorestasis and purification effect. The plot ratio per unit area shall be controlled within the urban planning and construction areas, the red line of ecological land shall be delimited, and the water area shall be appropriately increased. In the aspect of road construction, the impervious structural form of roads in the built-up areas shall be transformed, and the scale and level of the construction of green belts on both sides of the roads shall be improved to act as rain creatures. For belt; To realize the integration and coherence of the ecological corridor network between urban plots and improve the integrity of the urban ecological network.

4. Trend Outlook and Future Development Focus of Sponge City Construction in China

In the long run, the urban rainwater drainage system construction to sponge city - low impact development pattern rainwater system construction mode shift, the shift and the establishment of the new system is not achieved overnight, is a long-term and arduous system engineering, must be in such aspects as management concept, policy mechanism, a major breakthrough and key support, It is necessary to establish a systematic basic theory, engineering technology system, professional personnel team and cultivate new industries, etc., hoping to achieve quick results in a short period of time. We should make sponge city construction truly become a powerful starting point and a long-term mechanism for "Beautiful China" and future "Green Urbanization", give full play to its important historical role in China's urbanization and urban agglomeration construction and development process, and serve for our people to seek grand well-being and create a healthy environment. For the great rejuvenation and prosperity of the Chinese nation to lay a good geographical environment and resource conditions [5].

(1) Cities and towns are the most important source of water pollution. Through the construction of sponge city (LID), cities become the main battlefield to deal with water pollution and the hope to solve water shortage.

(2) The connotation of the concept of sponge city (LID) is still under development, and there is still a long way to go to create the theories, norms and standards of sponge city with Chinese characteristics. The Ministry of Housing and Urban-Rural Development has issued a technical guide for the construction of sponge cities, but it is far from enough and needs to be explored and revised in practice.

(3) Sponge city (low-impact development) planning and smart water are two major systems engineering to coordinate the effective operation of each unit of sponge city. If we say that sponge city planning is "push", sponge wisdom is "pull". "Push and pull" can effectively coordinate the whole sponge system, so that neither waste nor information island will appear. Therefore, "one push and one pull" two systems are very important system design.

(4) Sponge city system should be divided from large to small into four subsystems, namely, region, city, community and building. The four levels of system have different emphases of low-impact development, so it is necessary to promote system innovation by combining the upper and lower levels.

(5) According to the control rate of total annual runoff, it is particularly important to establish a scientific and reasonable evaluation system of urban "sponge degree" and give incentives and guidance. Accelerate the guidance and promotion of the whole sponge city vigorous development, out of a Chinese characteristics of sponge city construction healthy development road.

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