Renovation of the old city under low impact development technology--Taking Qingshan District as an Example

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Abstract: The phenomenon of “seeing the sea” in cities is becoming more and more common in the development of various cities. Solving the problem of “every rain” has become a problem that every city needs to face, and the old city as the city has the most concentrated urban characteristics and problems. The place is the most indispensable place in the rainwater management process. This paper first analyzes the shortcomings of urban development and existing rainwater treatment design, and causes the infighting of the city. Then, it lists the excellent cases abroad to compare the domestic reality and find the theoretical system that is most suitable for the transformation of the old city in the country. Take the Qingshan District of the pilot city as an example to analyze the places that should be paid attention to and perfect in the reconstruction of the old city.

1. Introduction

As a representative area in modern society, the city is the main carrier of human reproduction and social and economic development, and it is also the most prominent contradiction between resource and environment carrying capacity. Since the reform and opening up, China has entered the stage of rapid development of urbanization. The rate of urbanization has increased at an annual rate of nearly 1% per year, driving economic and social modernization [1].However, with the gradual construction of modern urbanization, there are more and more contradictions in the process of urban development. On the one hand, urbanization has brought about the impact on the river system and micro-topography of urban rivers and lakes, and destroyed the city’s Central Plains. The natural water circulation mechanism not only affects the storage capacity of rivers and lakes, but also makes the city vulnerable to floods and floods. At the same time, the urban impervious floor area increases, the rainwater seepage decreases, the surface runoff increases, and it is easy to form urban boreholes [2], Secondly, the rapid development of the city also brings a large amount of emissions. When the pollutants discharge exceeds the carrying capacity of the natural environment, the urban water ecology is polluted, which aggravates the shortage of urban water resources; On the other hand, the rapid development of urbanization requires a large amount of water resources, and the pressure on urban supply and demand is increasing. Water shortage has become a common problem in modern cities.

Most of the construction and renewal of towns are based on the old city. The problems in the old city are mainly the lack of functions of the facilities in the city. The management of rainwater in the traditional cities is mainly based on the combination of rain and sewage and fast discharge. The use of rainwater resources, once encountered large-scale precipitation weather, will cause serious sewage overflow problems, unable to cope with sudden extreme precipitation events [3].

In order to solve the water system problems faced by the current city, in December 2013, the Central Urbanization Work Conference put forward the concept of “building a sponge city with natural accumulation, natural penetration and natural purification” and in November 2014, housing and urban and rural construction The Ministry of Housing and Urban-Rural Development issued the “Sponge City Construction Guide - Low Impact Development System”; Subsequently, 30 cities were established as pilots for the construction of sponge cities [4]. The planning and construction of the sponge city emphasizes the initial planning of the city. However, most of the domestic cities are more serious in the old city. How to improve the rainwater management is the future urban development. The problem that should be solved first.

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2. Foreign Rainwater Management Theory and Case:

Foreign countries have started early in urban storm water management, and have formed unique governance theories according to the specific conditions of each country, such as: US best management measures (BMPs) and low-impact development technologies (LID), respectively Proposed solutions with microscopic scales; European and American green infrastructure (GI), effective use of green space, wetlands and rainwater storage and infiltration facilities; Australia's water-sensitive urban design (WSUD), from the perspective of urban planning and facility design, the urban water cycle as a whole for comprehensive consideration And management; The UK's Sustainable Urban Drainage System (SUDS) improves the city's overall water cycle through comprehensive measures [5].The above theories have all been implemented in foreign countries and have achieved results. They can provide a lot of learning experience for urban storm water management in China, but we must pay attention to local geographical characteristics and conditions while studying theory. Through the analysis of these theoretical systems, it can be found that the rainwater flood control in foreign countries starts from the macro-planning of the city and is summarized by the micro-scale technology. This is inconsistent with the current status of the old-fashioned urban renewal in our country. In the urban area, the existing old city in the city has a wide range and complex factors, and it is impossible to imitate the system transformation method from “macro to micro”.

3. Taking Qingshan District as an example to analyze the existing problems in the old city

3.1 Overview of Qingshan District

Location and scope: Qingshan Demonstration Zone is located in the northeast of Wuhan City, facing the Yangtze River in the north, East Lake in the south, and Wuhan Iron and Steel Industrial Zone in the east. The district includes two administrative districts: Qingshan District and Hongshan District. The demonstration area covers a total of 23 administrative districts. The range of square kilometers. The built-up area in the demonstration area accounts for more than 80%, and the old factory accounts for more than 50%. The district integrates various forms such as old industrial areas, shanty towns, old residential areas, water sensitive areas and circular economy pilot areas.

The analysis of Qingshan District will start from the following aspects to summarize the parts of the old city that need to be concerned in the transformation and to find the part of the low-impact development technology that can be adapted to the transformation of the old city, and from the perspective of low-impact development concept to the old city Rainwater management summarizes strategies and principles.

The main idea of LID is to “save flood storage and water storage” and restore the natural hydrological characteristics of the site. The domestic sponge city concept also restores the water system of the city from six aspects: “seepage, stagnation, storage, net, use and drainage”. 6]. through the classification and pertinence of the measures technology, we can grasp the key factors in the old city:

1) Rainfall status: The analysis of rainfall values shows the runoff values and seasonal differences within the site. The city of Wuhan, where the Qingshan District is located, is in the mid-latitude zone. In recent years, the annual precipitation fluctuated between 700-2100mm. The precipitation is mainly concentrated in the early summer without season. The rainfall in April-August of the year accounted for 65.8% of the year and the rainfall continued. The rainfall is characterized by abundant rainfall, frequent plum rains, frequent rainstorms during the flood season and heavy rainfall.

2) Drainage system: Grab the situation of rainwater treatment in the site by combing the drainage system. There are four rainwater systems in the Qingshan District: the Hong Kong West System, the Qingshan Town System, the Industrial Port System, and the Dongsha Lake System. The drainage system is a rainwater and sewage diversion system, but there are local rain and sewage marriages, and depending on the season and the Yangtze River flood season. In the dry season, the rainwater in the park can be automatically discharged through the system. Because the water level is higher than

the ground elevation during the rainy season, the rainwater needs to be pumped out of the river.

3)Type of land: Understand the type of land used in the site, surface elements, etc., and find corresponding improvement measures according to different conditions. The terrain in the Qingshan District is mainly hills and plains, and the terrain is relatively flat. The current situation of land use in the region is also relatively complicated, with urban land area as the main area, totaling 1700.05 hectares, accounting for 73.5% of the total land use. Locally existed villages, potholes and other land.

4) Soil type: determines the infiltration rate and infiltration of rainwater, affecting urban rainwater infiltration and recovery. The topsoil in the Qingshan District is basically mixed with soil. The second layer of soil is filled with plain, silty clay and silty silty clay. The soil permeability coefficient is 2.25mm/day 32.2mm/day. Which permeability is the overall soil?

5) Groundwater level: affects the depth of infiltration and is associated with the depth of improvement measures. The groundwater depth in the Qingshan District is shallow.

6) Underlying surface: Determines the size of the control runoff coefficient. The site in the district is mainly residential, and the hard pavement with poor water permeability has a large area.

Table 1 Current situation

Current underlying surface category	Area
road surface	342.88
roof	340.30
Square and transportation facilities	52.63
railway	60.80
Green space	279.19
Waters	58.49
embankment	14.89
Unbuilt area	285.06
Others	802.69
Non-construction land	103.67

3.2 Main contradiction points in the reconstruction of the old city

Through the analysis of various aspects of the area in the Qingshan District, it is possible to draw the main problems that need to be solved in the reconstruction of the old city:

The old city lacks the “carrier” for building a rainwater management system. The infrastructure in the urban area is imperfect, and the green infrastructure network has not been added in the early urban construction. The green land rate is low, and the urban surface water impermeability rate is high. Limited to the old city area, it is impossible to adjust the urban land and categories in a large area. For the old city, only the infrastructure can be used to increase the number of carriers in the city that can build a “sponge city”.

There is no systematic planning in the urban area, and there is a lack of rainwater planning and pipeline network construction that can cope with unexpected situations. In the process of urban development, the drainage of the old city is getting more and heavier, and because the management is not in place or the equipment is outdated, the city is prone to guilt; and the urban rainwater is mainly discharged by pipelines, and there are no other regulation or flood control measures. It cannot respond to the situation in time.

The existing drainage system in the old city is backward, and the drainage and flood control capacity is insufficient. The traffic flow in the old urban area is large, the water impermeability is high, the pollutants are complex, and the rain cannot be completely separated.

Insufficient management level. At present, the management and planning of the old city are quite chaotic. There is no systematic management plan like the successful cases in foreign countries. Most of the means of transformation are still in the improvement and transformation of the middle and the onlookers.

3.3 Old Town Reconstruction Principles

Restricted by the reality of the old city, the transformation of the old city needs to take into

account the existing resident population, the cultural heritage and appearance of the city, the renewal of the old facilities, etc., so the transformation of the old city cannot follow the foreign To the microscopic grasp of the transformation model. Based on the analysis of the old town and the concept of rainwater management for low-impact development, the principles that should be followed are:

1) Protect the city's original urban appearance. While carrying the place of residence, the old city also retains the unique urban style of a city. On the basis of upgrading the urban rainwater management system, the city's cultural heritage is preserved, and the city's functionality and development core are developed together.

2) Develop adaptive low-impact development techniques in conjunction with sites with different functions in the area. The venues and conditions applicable to different management technologies are also very different. Before carrying out the transformation for specific sites, a series of analysis and evaluation, conditional objectives, etc. should be fully understood to select appropriate control measures to achieve low impact development. The best effect of technical control.

3) The measures should be matched with each other, and the overall plan should form a complete system with the original facilities.

The planning of the rainwater management system is incorporated into the overall planning of the site, and is integrated with various measures such as landscape design and engineering technology, so that the low-impact development technology has economic and social benefits on the basis of ensuring drainage efficiency.

3.4 Analysis of the overall transformation of Qingshan District

The current situation in Qingshan District: There are 16 water-staining points in the Qingshan Demonstration Zone. Most of them are concentrated in the drainage area of the Inner Harbor West Pumping Station in Qingshan District. The rest are mainly due to the fact that the old community cannot afford the pipe network. The displacement of the old city. In general, the reason for the internal sputum in the Qingshan District is mainly due to the fact that during the same period of the rainy season, excessive rainwater cannot be drained in time, and it is under the pressure of external flooding.

Therefore, the part of Qingshan District that should be paid more attention to in the overall planning of rainwater construction is:

1) The old pipe network is updated and improved

2) Update of the drainage pump station

3) Increase the design of other rainwater in the city to relieve drainage pressure

4) Increase the collection and utilization of rainwater

In the Qingshan District, the overall framework of “small sponges to ensure water quality and large sponges to ensure safety” was established in accordance with the technical route of “promoting stagnation, promoting osmosis, promoting storage by net, promoting storage and arranging storage”. In response to the special conditions of the old city, the whole program solves the problem of waterlogging in the area through the ideas of source reduction, process control and end management.

Source emission reduction: covering the public construction of public buildings, municipal roads and park green areas in the demonstration area, improving the runoff control rate through the development of technical means, reducing the efflux, simultaneously carrying out the improvement of the internal network pipe network and the rain and sewage diversion.

Process control: Analyze the internal and internal pipeline network in the demonstration area, collect statistics on the relevant waterlogging points, formulate the drainage system reconstruction plan, upgrade the municipal drainage network, and build a new pumping station to improve the drainage capacity of the demonstration area.

Table 2 Statistics on waterlogging points in Qingshan demonstration area

	Water Stain on Road	Cause of Guilt
1	The Travel street	Insufficient drainage capacity of the road network in the current situation, insufficient pumping capacity of the Hong Kong West Pumping Station
2	Industrial Three Roads Ezhou Street	Low terrain, insufficient drainage capacity of the pipe network, insufficient pumping capacity
3	Culvert along the port road	Low terrain and insufficient pumping capacity
4	Red Steel Third Street	Insufficient drainage capacity of the pipe network and insufficient pumping capacity
5	Building a five-way culvert	Low terrain, pumping station system is old
6	Building four roads	Insufficient drainage capacity of the pipe network and insufficient pumping capacity
7	Honggang Second Street Jianba Road	Insufficient drainage capacity of pipe network
8	Peace Avenue built four junctions	Inadequate rainwater harvesting system and insufficient pumping capacity
9	Second construction junction	Insufficient drainage capacity of the pipe network and insufficient pumping capacity
	waterlogging point in Community	
10	49th Middle School	Insufficient drainage capacity of the pipe network
11	Wuhan Iron and Steel Second Hospital	Insufficient drainage capacity of the pipe network
12	Friendship community	Old community status network is not perfect
13	Eight people community	Old community status network is not perfect
14	Juyou Community	Old community status network is not perfect
15	Jiangnan Spring City	Insufficient drainage capacity of the pipe network
16	Steel City Second Middle School	Low terrain, surrounded by rainwater

End treatment: comprehensively rectify the port system in the demonstration area, improve the drainage capacity of the port and improve the water system.

In source reduction and end-of-pipe treatment, low-impact development technologies provide technical means for governance programs. The renovation in the Qingshan District is mainly based on the renewal of the watermarks in the city. Different types of internal stains cover specific sites in the city that carry different functions: for example, schools, hospitals, roads, etc. As a main technical support in the sponge city concept, low-impact development can directly rely on urban green space and garden landscapes, such as rain gardens, sunken green spaces, ecological revetments, etc. These devices can alleviate urban drainage pressure. It can be inserted into the above functional sites, not only can technically carry out rainwater infiltration and purification, but also add beauty to the landscape and create an ecological environment.

4. Conclusion

The transformation of the old city is one of the links that the city must solve in the development process. Through the management of the rainwater system in the old city, it can not only strengthen the functions of rainwater infiltration, regulation and storage, but also control the rainwater and alleviate the urban problems. Explore better urban rainwater management practices for future urban development through transformation practices. However, there are still many constraints on the transformation of the old city in China. There are many shortcomings in terms of policy and macro-control. Any development of the city must be based on its climate, geographical environment,

social factors, etc. On the top, it is not possible to blindly pursue urban management and blindly move abroad to build cases.

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