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Strategies for Adaptive Planning of Municipal Water Supply and Drainage Pipes in Sponge Cities

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Abstract: SPONGE CITY can absorb and store rainwater like a sponge, is a means to solve urban flooding, is a kind of urban planning and concept, is the secondary use of water resources, the implementation of sustainable development of the city, reduce the load of the drainage system. Based on the background of the sponge city proposed, China's climate conditions in general deviation, droughts and floods are obvious, the benefits of sponge city in Jiaxing and the problems that exist are analyzed, the improvement method is proposed, and the difficulties and points that exist in the process of pipeline laying are pointed out, and the precautions are proposed, so as to provide a basis for the vigorous development of sponge city in our country and to learn from it, and to help the city to adapt to the impact of disasters and to cope with the various challenges.

Keywords: Sponge City; Pipeline Planning

1. Background of the construction of sponge city in Jiaxing City

Jiaxing City is the first batch of sponge city construction pilot cities, starting from April 2015, after three years of construction, completed the construction of 18.44 square kilometers, with a total investment of 4.023 billion yuan, in April 2019 passed the acceptance of the Ministry of Housing and Construction sponge city pilot construction. It is understood that Jiaxing City pre-treats collected rainwater for irrigation, watering roads and landscaping, realizing the recycling of water resources and reducing the pressure on the city's drainage system. The government claims to have achieved "no waterlogging in light rain, no flooding in heavy rain, and no black odor of water bodies."

2. Problems of building sponge city in Jiaxing

2.1 Insufficient cost

Jiaxing total area of 4526.8 square kilometers, 3 years to complete the construction of 18.44 square kilometers, spent 4.023 billion yuan, if you want to build the whole of Jiaxing into a sponge city is about to spend 987,599,000,000 yuan, Jiaxing City, the annual financial revenue to be used in the field of public services, such as education, health care, social security and so on. Infrastructure construction, such as roads, bridges, water conservancy facilities. Government investment projects, such as urban renewal and public transportation. Social program areas, such as culture, sports, tourism, etc. Public safety areas, other administrative expenditures, and other areas that can't be used exclusively to spend fiscal revenues on building sponge cities. If too much is invested in building sponge cities, it will affect the quality of life and welfare level of citizens.

2.2 Defective pipeline laying

The general life of the pipeline is 50 years, but the pipeline used for a long time will be corroded and scaled. Pipeline corrosion will lead to a reduction in the wall thickness of the pipeline, which makes the pipeline fragile and prone to leakage and rupture. Scaling will make the pipeline inner diameter reduction, reduce the flow of transported water, head loss increases, flow rate reduction, the pollutants attached to the pipe wall will make the water quality lower, scaling will lead to serious blockage of the pipeline, affecting the normal operation of water supply and drainage. Pipe corrosion and scaling easily increase the chance of urban flooding. Therefore, timely maintenance and replacement of pipelines is also a critical part of stopping urban flooding.

When laying pipes, the specification specifies the thickness of overburden for each pipe under different paths, which refers to the vertical distance between the top of the outer wall of the pipe and the ground. If the pipe is buried shallow will make the pipe is subject to

increased pressure, easy to be crushed by cars and so on, in the north of our country, the shallow depth of burial will also make the pipeline is frozen cracks, all of these will lead to pipeline leakage, but if the depth of burial is too large will increase the difficulty and cost of the project. So the specification gives specific figures, water supply pipe metal pipe under the carriageway ≥ 0.9m, sidewalk ≥ 0.7m; plastic pipe (including steel wire mesh skeleton plastic composite pipe) under the carriageway ≥ 1.0m, sidewalk ≥ 0.8m, and need to be located in the freezing line under the 0.15m. Sewage pipe under the carriageway ≥ 0.7m, sidewalk ≥ 0.6m, sewage water temperature ≥ 4 ℃, do not have to be laid all the time! Under the freezing line. Pipe laying depth order are water supply pipe, sewage pipe, rainwater pipe. In the pipeline design should pay close attention to the depth of burial.

2.3 Urban flooding

Building a sponge city does not completely solve the problem of urban flooding. Sponge cities require that the total annual runoff control rate in urban areas is ≥75%, which means that about 75% of the rainwater from each site shall not be directly discharged into municipal storm drains or rivers. The construction of sponge cities can improve the city's flood prevention and disaster resistance, conserve water, and improve the city's ecological environment. China's northern precipitation is less than the south but there is also a need to build sponge cities. Because the northern region also has the problem of increasing urbanization. Sponge city is also a necessary means to achieve sustainable urban development, not only to solve urban flooding.

3. The solution strategy to the problem of building sponge city in Jiaxing City to

Some of the current technical innovation means of sponge city are: rainwater collection and utilization technology, green roof and wall technology, cistern technology, natural floodplain technology, intelligent monitoring technology.

Rainwater collection and utilization technology is the core means of sponge city, the main content for the construction of rain gardens, recessed green space, wetlands, etc., and then this part of the collected water for storage and secondary use, watering roads, green space, to provide a certain amount of water resources for the city. It is summarized as rainwater collection, rainwater storage, rainwater treatment, rainwater utilization, rainwater management and rainwater governance. Rainwater is water that falls from the atmosphere, which is a clean water resource in itself, but it is susceptible to atmospheric pollution and environmental pollution in the process of collection, which makes it carry pollutants such as heavy metals, bacteria, etc., and it can not be used as a source of drinking water. As an ordinary city dweller, we don't have the conditions for softening and disinfecting treatment of rainwater, but we can provide a little bit of tiny help in the construction of sponge cities by collecting rainwater to be used for flushing the Toilets and so on.

Green roof and wall technology is closely related to us ordinary citizens. By planting plants on the roofs and walls of buildings and utilizing bioretention to collect rainwater, this technology not only reduces the heat island effect of the city and improves air quality, but also saves energy. However, in the process of implementation, attention needs to be paid to: the limitations of the load-bearing capacity of the roof, the management of pests and diseases, and the maintenance of plants.

Cistern technology, as the name suggests, is to build a cistern to collect rainwater, this technology is the easiest, but it is by no means simple, it needs to solve the problem of land, cistern maintenance problems. Cisterns require regular desilting and drainage, and maintenance requires a lot of manpower and material resources.

Natural floodplain technology can slow down the impact of flooding on the city, is the construction of sponge city an important technology. Floodplain is a plain river and lake depressions, beach or low dike, with the river water level rises to a certain level of water naturally or artificially stagnant flood water place. Jiaxing City is in the Taihu Lake and Hangzhou, Huzhou, downstream, located in the basin of the depression, known as the Taihu Lake Basin "flood corridor". Historical and traditional drainage outlets have two directions, namely, east drainage Shanghai, Huangpu River, north drainage Yangcheng Mao area, Jiangsu Province in the 1950s after the excavation of the Taipu River, blocking the north drainage road, in the rainfall in the early Taipu River has not yet flooding, the water level is relatively low, can be a small amount of rush to drain some of the floodwaters into the Taipu River, the east drainage into the drainage of the main outlets. 2021, the "People's Government of Jiaxing Municipality on the agreement to adjust the first batch of important water list. The Approval of Jiaxing Mu-

nicipal People's Government on Agreeing to Adjust the First Batch of Important Waters List" in 2021 planned 21 municipal rivers in Jiaxing City as important waters, and planned to become municipal rivers and other backbone rivers for flooding and drainage.

Intelligent monitoring technology is to monitor the water level and water quality of the city in real time through sensors, monitoring systems and other technical means to improve the city's ability to cope. Currently Jiaxing has realized the intelligent management of sewage in the joint sewage plant.

4. Outlook for Sponge Cities in China

Urban flooding can lead to traffic congestion, cause serious local economic losses, pose a threat to personal safety and life and property, and affect social stability. Flooding in cities can lead to serious consequences. The implementation of sponge cities, by solving the problem of rainfall in the city and collecting rainwater, not only improves the city's ability to cope with disasters and protects the safety of the people, but also solves the problem of the river's dry period, so that the city can develop sustainably. There are two major benefits of building sponge cities, from the spatial level, changing the way rainwater flows, using green space as a channel for infiltration, and from the temporal level, delaying the time when heavy rainfall reaches the flood peak.

The sponge city of the future will definitely be more intelligent, green and humanized. Combined with artificial intelligence, it will use big data analysis to retrofit pipelines in areas prone to heavy rainstorms, better plan greening systems, and put every penny to good use. Cities will also be more habitable, with a large number of green facilities built to improve comfort and air quality.

Currently, 30 cities such as Jinan, Beijing and Tianjin have carried out pilot work on sponge cities. The implementation of sponge city is incumbent upon us, I believe that by 2030, the area of sponge city must be able to reach more than 80% of the cities, more than 50% of the counties, can be on-site absorption and utilization of more than 70% of the precipitation, the city flooding problem will not occur.

The government of each region should be based on their own situation, economic conditions to develop appropriate sponge city strategy guide, at the same time in carrying out sponge city work must pay attention to low-impact development, before and after the development of hydrological characteristics can not be changed. Construction of sponge city not only rely on the efforts of the government, but also need to be guarded by each citizen, the government should have to strengthen the public's knowledge of sponge city, sponge city promotion and publicity, so that the public realize that the destruction of green facilities not only does not have any benefit, but also damage their own interests.

References

[1] Xiang C. Analysis of municipal drainage pipe renovation and repair technology--Fuqing City drainage pipe renovation project as an example[J]. Jiangxi building materials,2022(03):218-220.

[2] Zeng QH. Municipal gravity flow sewerage pipeline renovation of engineering construction management research[J]. Residence,2022(10):46-48.

[3] Zhang C, Li SK. Analysis of rainwater utilization planning and design under ecological sponge city[J]. Engineering Construction and Design,2022(24):59-61.

[4] Duan C, Wang Q, Zhao WJ. Importance and application of municipal rainwater and sewage pipe diversion renovation project[J]. Yunnan Hydropower, 2021,37(12): 263-265.

[5] Song J. Research on the development of sponge city and low impact development measures with Chinese characteristics[J]. Intelligent Building and Smart City, 2023(01):154-156.