

# Study on the Construction of Sponge City in Bengbu City

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## Abstract

Since 2013, China has gradually promoted the development of sponge city. Building sponge city is an important development direction for cities to resist rain and flood attacks. The proposal of sponge city is the innovation and development of rain and flood utilization theory, which is of great significance for solving urban water problems. Bengbu City, Anhui Province is a water-deficient city, which has been affected by rain and flood for several years. Since 2017, Bengbu City has gradually promoted the construction of sponge city. By analyzing the construction of sponge city in Bengbu City in recent years, this paper summarizes the existing problems in the development of sponge city, and finally puts forward some suggestions for promoting the construction of sponge city in Bengbu City from several aspects, such as dealing with the relationship between urban water and introducing technical support.

## Keywords

Sponge city; Rain and flood; Sponge city construction.

## 1. Introduction

Bengbu City, Anhui Province is located in the north of Anhui Province. Affected by the geographical climate and the rapid economic and social development of the basin, the annual rainfall distribution in Bengbu City is uneven, and the water resources storage capacity is weak. The per capita water resources in Bengbu City is about 550 cubic meters, which is less than a quarter of the national average and less than half of the provincial average. The per capita water resources are relatively small, and it is listed as a water-deficient city by the Anhui Provincial Government. However, continuous heavy rainfall will cause a lot of water accumulation in Bengbu city, which will test the city's drainage ability. Bengbu city is facing a more severe situation of urban waterlogging, and cities will be trapped in heavy rain over the years. Rain and flood management has become an important issue in urban development, and the construction of sponge city is particularly important. Bengbu City is one of the nine provincial-level sponge city construction pilot cities in Anhui Province. In September 2017, Bengbu City issued a special plan for Bengbu Sponge City (2016-2030). In 2021, Xueyuan Road project designed by Bengbu Planning and Design Institute passed the acceptance test, which is the first sponge road built by systematically applying the concept of sponge city in Bengbu City, and it is an exploration and attempt to apply the concept of sponge city to municipal road projects. In recent years, Bengbu City has vigorously promoted the construction of a "sponge city" while unblocking the drainage channels of urban accumulated water and managing the "smart pipe gallery" in real time.

In view of this, this paper firstly summarizes the concept of sponge city, then through literature study and sorting and induction, understands the current problems in the construction of sponge city and the views and strategies put forward by various universities on the construction of sponge city, and summarizes the current problems in the promotion and construction of sponge city. Finally, combined with the pilot situation of sponge city construction in Bengbu in recent years, according to the geographical location and its

development status of Bengbu, some suggestions are put forward for promoting the construction of sponge city in Bengbu from several aspects.

## 2. Literature review

"Sponge city" means that the city can be like a sponge and has good "elasticity" in adapting to environmental changes and responding to natural disasters. The concept of "sponge city" is a kind of image expression, which comes from the industry and academic circles' habit of using the physical characteristics of "sponge" to compare a certain adsorption function of the city and the ability of the city to absorb rainwater. Its academic term is "low impact development of rainwater system construction" [1]. In 2018, the Ministry of Housing and Urban-Rural Development issued the Evaluation Criteria for Sponge City Construction, which clearly pointed out that sponge city construction "is conducive to achieving multiple goals of restoring urban water ecology, conserving urban water resources, improving urban water environment, ensuring urban water safety and reviving urban water culture". To sum up, the goals of sponge city construction at the national level mainly include repairing water ecology, improving water environment, conserving water resources and ensuring water safety [2].

The research on urban storm water management in China started late, and began in 1980s. The earliest proposal of sponge city in China can be traced back to 2003, which was put forward by scholars such as Yu Kongjian. In October 2015, the National the State Council issued "Guiding Opinions on Promoting the Construction of Sponge City". Since then, there have been more and more researches and explorations on the concept and technology of sponge city, and the research contents and directions of scholars have gradually shown a diversified trend. Regarding the construction of sponge city, Ma Shanshan et al. (2023) proposed that we should proceed from the essential meaning of life community, interest community and development community between man and nature, man and city, nature and city, and form a joint effort to promote the construction of sponge city in terms of concept cognition, institutional mechanism construction, technological innovation and personnel training [3]. Kong Luting et al. (2022) conducted a follow-up survey on the construction of sponge city in Shenzhen, a pilot city. The results show that Shenzhen's experience has good reference significance in terms of reward coverage, institutional system and foresight. The author puts forward that the incentive policy of sponge city construction in foreign countries is based on the private ownership economic system, mainly based on the charging system, and carries out fee reduction, subsidy and reward, etc. Domestic provincial and municipal governments mainly use the method of giving social investment incentives and subsidies to encourage sponge city construction [4]. Zhu Zhengwei (2021) put forward that it is necessary to upgrade the direct goal of disaster prevention and reduction in sponge city to the resilient governance system of modern city in the face of the practical difficulties of sponge city, and put forward four aspects to optimize it: modernizing the urban governance system and governance capacity, improving the urban emergency management system, promoting the practice of engineering projects and non-engineering measures, and paying attention to local conditions and making policies according to the city [2]. In recent years, scholars have put forward more and more ideas and views on the study of sponge city. Different scholars have shown different views. The main overview is that the construction of sponge city needs to be adapted to local conditions, combined with new national ideas, new internet technologies, new materials and new designs, and improved urban resilience management. The research on the construction of sponge city is still in full swing, but from the overall literature of scholars, the research on the construction of sponge city is not detailed enough. In 2022, Zhengzhou, Henan Province, experienced a torrential rain and flood attack, which attracted people's attention all over the country. Strengthening the resistance of

urban rain and flood attracted more attention from scholars and the general public, and the construction of sponge city became particularly important.

### **3. Existing problems of sponge city construction**

#### **3.1. The cognition of the overall construction process of sponge city in the early stage of construction is low**

Sponge city is understood by many people as a separate project. In fact, the construction of sponge city is a systematic project, which is built by various low-impact facilities such as permeable mulch, roof garden and constructed wetland. The treatment of rainwater in sponge city can be seen as three links: source control, intermediate control and final control, among which source control is the most important [5]. The selection of facilities for source control needs to consider whether they are suitable for local urban green space, local climate, material tolerance, and whether auxiliary structures are needed. Therefore, before the construction of sponge city, only by adapting measures to local conditions, taking measures according to the city, and considering from multiple levels and angles can we build a high-quality sponge city.

#### **3.2. The relevant system is not perfect and the technological innovation ability is not outstanding**

There are also some problems in the construction process of sponge city, including the imperfect government-related laws and regulations, strong construction demand but not outstanding scientific and technological innovation ability, the overall planning level needs to be improved, and the operation and maintenance needs to be strengthened. It is of great guiding significance for the country to issue specific laws and regulations to guide the construction of sponge city. As a pilot city, Bengbu City also needs to learn and communicate with the outside world, and constantly improve the system related to the construction of sponge city. The technological innovation ability related to the construction of sponge city needs technical support, and Bengbu City needs to introduce technical support and talent team from outside during the construction of sponge city.

#### **3.3. Lack of experience, low public awareness and low cooperation**

In terms of sponge city construction, Bengbu City has not had much experience, few relevant policies and insufficient scientific and technological innovation ability. In the process of promoting sponge city construction, it is necessary to introduce technical support and talents from outside. The public's understanding and cognition of sponge city plays an important role in the construction and popularization of sponge city. Only by solving various obstacles can the effect of sponge city construction be achieved. Therefore, at the same time, in order to improve the awareness of sponge city and vigorously promote the concept of sponge city construction, it is also necessary to popularize and publicize it in all aspects among the public in Bengbu. The recognition and support of the people will play an important role in promoting the construction of sponge city in Bengbu.

### **4. Measures to promote the construction of sponge city in Bengbu**

#### **4.1. handle the relationship between city and water and adjust measures to local conditions**

The construction of sponge city is an important part of urban flood control. The key is to consider the relationship between city and water, and it is necessary to consider and shape the urban water circulation system according to local conditions. Picture Urban construction needs to emphasize the concept of symbiosis between people and water, and deal with water-related problems in cities with holistic thinking and systematic methods. Bengbu City is a water-

deficient city in terms of structure, ecology and resources, but it is a city along the Huaihe River, with abundant transit water resources, and most of the floodgates of the Huaihe River are discharged by floods. Therefore, Bengbu City needs to make scientific use of water resources, prevent water pollution and handle the relationship between city and water, which is very important for Bengbu City to build a sponge city.

#### **4.2. Introduce technical support from outside to improve the technological innovation ability of local teams**

In order to promote the construction of sponge city, firstly, Bengbu, as a pilot city, needs more exchanges than other cities. It is necessary to study and learn from cities that have done well in sponge city construction. In the early stage of construction, it is necessary to introduce technical support and talent teams from outside. At the same time, it is also necessary to improve local technical strength and talent teams, learn and deepen technological innovation, and promote the development of sponge city construction technology. The ability of technological innovation is soft power and the key to building a good sponge city as a whole. It is necessary to make rational use of the relationship between various low-impact facilities and use them reasonably.

#### **4.3. Popularize the concept of sponge city and build a diversified investment model**

Because of the city's policy to promote the construction of sponge city, the construction concept of sponge city will be gradually popularized in urban renewal and old residential renovation, which will continuously stimulate the enthusiasm of the people and the market, lead the people to participate constantly, and integrate the concept into all aspects of construction management practice during the construction process. The construction of sponge city needs financial support. Therefore, it is also necessary to promote urban economic consumption, improve economic strength, attract foreign investment, expand investment space, build a new mode of capital participation, diversify development, and promote the diversified development of financing methods. The government also needs to gradually introduce and formulate relevant standards to continuously enrich and develop sponge city in concept and practice.

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