A research of sponge city’s experiment results in Jinan

YuHao Xu1,2, HanFang Liu*
1School of Civil Engineering, Beijing Jiaotong University, Beijing, China
216723035@bjtu.edu.cn
*Corresponding author’s addresses: School of Civil Engineering and Architecture, University of Jinan, Jinan, China
*Corresponding author’s email:cea_liuhf@ujn.edu.cn

Abstract. Sponge city is one of the most important projects in China. It is similar with Australia’s Water Sensitive Urban Design (WSUD). Sponge city plan (SCP) has wrought for three years. Some pilot city has already given some results, like Jinan. This article gives two answers by analyse the current circumstances of this city. One is that the condition of China is different to and other country, which means China cannot just replicate WSUD even they have a similar environment. The other one is that financing is still a problem and Public-private partnerships do not give an enough positive effect as a solution.

1. Introduction
China, the most populous country and the second-largest country by land in the word, has a big problem on water resources because of both water shortages and water pollution. In order to control urban flood and ease the water shortages, one project which is called ‘Sponge City Plan’ has be proposed by China government and make some experimental city in 2015. The experiment includes some famous city such as Beijing and Shanghai. For now, three years later, what is the different between these cities and the path? Does Sponge City Plan work well? Why Sponge City Plan is different with other country’s rainwater harvesting system like America and Australia. This article is divided into four parts. At the first is the explaining of ‘Sponge City Plan’. Then there is an introduce of those experimental cities in this time and whether it is better than before or not. After that it has a compare between Chinese Sponge City Plan and Australian Water Sensitive Urban Design. At the end this essay has an analysis of what can Chinese Sponge City Plan improve in the future.

2. What is Sponge City Plan (SCP)
‘Sponge City Plan’ is a new urban storm-water management from China, which’s name is translating from Chinese. The most different between Sponge City Plan and the past storm-water management is that Sponge City Plan deviate from the traditional ‘rapid-draining’ approach. In the past, the most important of storm-water management in a metropolis is how to drain away the rain water from the city as fast as possible. Many large sewer system and asphalt road is designed because that. At present, Sponge City Plan abandon the approach and calls for the use of nature processes, including but not limited to soil and vegetation, as part of the urban storm-water management. The guidelines of this urban storm-water management are summarized by six word, which includes infiltrate, detain, store, cleanse, use and drain, which is very similar to the Low Impact Development (LID) (Yu S L, Jia H.
2016) [1]. The theoretical basis of Sponge City Plan also includes Best Management Practices (BMPs) and Green Infrastructure (GI).

Low Impact Development (LID) have been proposed in America at the first, which is a storm-water management use the ecological system as the foundation and control the flood from the source (Che S Q, St. 2015) [2]. At present, the principles of Low Impact Development are preserving and recreating natural landscape features and treating storm water as a resource rather than a waste product (U.S. Environmental Protection Agency. Green Infrastructure, 2017) [3]. But American Low Impact Development (LID) is not completely in line with Chinese national conditions. The biggest problem is water shortages in North China and urban water logging in south, so the core of Sponge City Plan is different between the north and south, which are respectively store and infiltrate.

3. The difference between SCP and WSUD

Australian Water Sensitive Urban Design (WSUD), which was start in 1960, has a complete system after 60 years’ development. Australia lies between the south Pacific and the Indian Ocean, and its land is flat and dry. Most cities are water shortage except coastal cities. Arid or semi-arid zones account for 70 percent of the land area, and over a third of the area is covered by desert (Che F S, 2009) [4]. To solve the water shortage problem, Australia put forward the concept called ‘Cities as Water Supply Catchments’, which encourage the use of rainwater resources through purification, collection and recycling to get rid of the way of using desalinated seawater to get fresh water. Because of the high Biofiltration technology, Australia has been widely used green rainwater infrastructure such as detention pool and detention basin. The most useful one of them is rain garden, which combines ecological technology with landscape design (Liu S, Li C H, 2016) [5]. Edinburgh Gardens, the most representative of them, has become a model of global rainwater garden construction. Not only the technology, Australian government also formulated policies conducive to WSUD’s development. Best practice guidelines had been compiled by the country and state government and become a technical guideline of WSUD. To reduce the financial burden of land developer, government gave a compensation policy called Storm-water Quality Offsets Strategy, which compensate them by building model and calculating the money they need (Melbourne Water, 2006) [6].

The natural environment of Australia is similar to north China. Both of them have the similar problem, less rainwater and water shortage. But Chinese Sponge City Plan is more like the Low Impact Development. It emphasizes infiltrate and drain rather than store and use. On the one hand, Chinese Sponge City Plan is just start. Infiltrate and drain system is easier to build than store and use system. On the other hand, China stile do not have enough technology to support the using system.

4. The current of pilot cities

At present, there are 30 pilot cities of Sponge City Plan in China. In October 2014, China Ministry of Housing and Urban-Rural Construction (MHURC) issued a draft technical manual on Sponge City construction. In October 2015, a major expansion of the Sponge City Initiative has been announced by the State Council of China, which is being implemented nationwide. In the same year, first 16 pilot cities have been chosen, including Yanan, Baicheng, Zhenjiang, Jiaxing, Chizhou, Xiamen, Pingxiang, Jinan, Hebi, Wuhan, Changde, Nanning, Chongqing, Suining, the new area between Guiyang and Anshun and Xixian new area. In April 2016, the last 14 pilot cities are released by the Ministry of Water Resources, including Beijing, Tianjing, Daliang, Shanghai, Ningbo, Fuzhou, Qingdao, Zhuhai, Shenzhen, Sanya, Yuxi, Qingyang, Xining and Guyuan (The Ministry of Water Resources of the People’s Republic of China, 2016) [7]. Each of these cities is to receive 400 to 600 million Yuan (RMB) (60 to 90 million US$) annually from the central government for three years, with the total investment estimated to be about 42.3 billion Yuan (RMB) or 6.35 billion US$. According to preliminary estimates, the total investment on the Sponge City Plan is roughly 100 to 150 million Yuan (RMB) ($15 to $22.5 million) in all of China, which means the average investment is about 10 trillion Yuan per square kilometer (RMB) ($1.5 Trillion) (The CPC Central Committee, The State Council. The National New Urbanization Plan (2014–2020), 2014) [8].
The construction of Sponge City Plan needs a long time. “Sponge city is a new concept and new way of urban construction and development.” Said by a responsible person of Ministry of Housing and Urban-Rural Development of the People’s Republic of China (MOHURD) “According to About Promoting the Sponge City Construction Guidance, more than 20% of the city proper area should achieve goals and objectives by 2020, more than 80% city proper area should achieve goals and objectives by 2030(Wang H R, 2016) [9].” For now, all of the 30 pilot cities have finished the technology demonstration and start the first phase of the pilot project, and some of them already made some achievements. “The pilot work of sponge city is progressing steadily and has achieved initial results.” Said by a responsible person from Nanjing government “There are 67 pilot projects will be finish in 3 years. At present, nineteen of them have been completed, 43 are in progress and five are in the early stages of development (Ding H Y, 2017) [10].”

As the top of Sponge City Plan building, Jinan’s experience is really useful for other cities. After 2017, 85% of the pilot projects of Sponge City Plan in Jinan have been finished, it will get in to a hard time for this city (Lu Q, 2017) [11]. Xing Long community, which is near the Da Ming lake, is one of the pilot projects. It includes 320 project points and covers 12.87 square kilometers, which is one three of the pilot areas. “The building community project is based on the principle of maximization to retain water purifying water and the landscape improvement as auxiliary.” Introducing by Zhang Qidong, the project leader. “According to the calculation, the annual rainfall achieved 133,900 cubic meters, which is 65.2% higher than the target of 81,000 cubic meters (Lu Q, 2017) [12].” Jinan is a city in north China, and its core of Sponge City Plan is store clearly.

5. The future of Chinese SCP
The natural environment of Australia is similar to north China. Both of them have the similar problem, less rainwater and water shortage. But Chinese Sponge City Plan is more like the Low Impact Development. It emphasizes infiltrate and drain rather than store and use. On the one hand, Chinese Sponge City Plan is just start. Infiltrate and drain system are easier to build than store and use system. On the other hand, China stile do not have enough technology to support the using system.

The scope of current Sponge City Plan expands to include not only dealing with the urban water runoff problem, but also the management of water. For one thing, the flood control, water quality improvement and ecological protection and restoration could apply green and grey infrastructures. For another, to satisfy Sponge City requirements, local governments could adjust their land using plan and storm water infrastructure construction strategies. The Total Maximum Daily Load (TMDL) programs which used successfully in the United States could be one way to effectively improve water quality (Boyd J, 2000) [13].

Some of the control practices are manufactured by private companies, and before such products are used for public projects an evaluation and certification process would be highly desirable. A sustainable development of Sponge City requires a robust industrial base, which is why it is important for the central government to assist related industries and establish a viable Sponge City industry chain.

The Sponge City construction represents an urbanization process of an enormous scale that requires a major financial commitment from the government, including Innovative financial options and simplify the administrative approval process. Decentralization of administrative authority properly to local governments can help them build a tailored and flexible policy approach appropriate for local social, environmental, economic and cultural situations (Jia H F, Wang Z, Zhen X Y, Clar M, Shaw L. Yu, 2017) [14].

How to finance all the Sponge City projects is a real challenge in the era of budgetary constraints and competing needs. The government has listed some innovative strategies for fund-raising, which includes government grants and subsidies, local matching and public-private partnerships. Public-private partnerships is the main policy that Chinese government promote in the Sponge City Plan building. But these partnerships do not work well and give a positive feedback for the Sponge
City Plan. The major current issue for China is how to develop a reliable, and tangible, estimate of returns on investments in the Sponge City projects.

6. Conclusion

4 years’ development of Sponge City gave some suggestion. On the one hand, the methods from other country can only use for reference, such as WSUD and TMDL. On the other hand, finding a new way to instead or improve public-private partnerships to finance Sponge City projects is important for china.

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