The Research on the Rain Environment Strategy of Guizhou in the Low Impact Development View

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Abstract. In face of the problems of climate change and contradictions in the urbanization process, humans begin to realize they will need the new strategy on the rain management. The climate change enlarges the influence of the urbanization, hence to develop new management technology on the rain will be a necessary factor to reduce those influences. The low impact development is a fully new rain management concept which goes in the time front. The original goal of this concept is to make sure the hydrologic regime of the city to be closer to that before the development. In order to achieve this goal, this technology makes use of the separate rains control and the character of natural hydrologic regime, etc. To study on the rain resources in the view of low impact development theory will be good for deepening our acknowledge of collaboratively promoting new style industrialization, informationization, urbanization, agriculture modernization and greenization, deepening the understanding of the urbanization in Marxism, the urbanization law and the rain philosophy. On the other hand, it will be also helpful for promoting the acknowledge of structure, methods and theories related to the healthy development of sponge cities.

1. Introduction
To speed up in developing natural cultures to make a new more beautiful China has already become a most important goal of the new times social development as well as the modernization. The chairman Xi Jinping clearly pointed in the 19th meeting of the Party that the modernization of China should be a modernization with a harmonious relationship between the humans and nature, during which process we need speed up in the rain resources management works, and make comprehensive managements on the river side as well as the sea side environment. In that process, we need enhance the acknowledge of the importance of effectively carrying out the low impact development. Under the instructions of sponge city concept, we need make effective investigates and constructions, to get effective improvement on the current rain resources situation, and also to bring the beauty of our cities to a new higher level.[1]

2. The general introduction on the contents of low impact development
2.1. The concept of low impact development
The low impact development contains the broad sense and the narrow sense. The low impact development in the broad sense means using various kinds of methods to release or even eliminate the attacks of city developments to the original natural cultures during the process of urbanization, to achieve the goal of protecting or even repairing the natural environment. The low-influence in the narrow sense means a series of natural technology system which is useful for collecting the city rains and make recycled use of them, for which the key points are natural purify, original collection, supplying the groundwater and using in-hand resources, and the main measures include rains park, natural grass waterway, green roof, and underground water storage, etc.[2],[3]

2.2. The significance of low impact development

Comparing to the gray infrastructure development of the traditional cities, the low impact development has positive meaning in promoting the consistent and stable development of the cities.[4] Firstly, the low impact development makes effective absorbing and storage of the city rains with its fully new drainage ways, which assures of a sufficient using of the city rain resources besides of improving the urban waterlogging problems. Secondly, on the certain sense, the low impact development makes positive influences in the urban natural environment protection and repairing the natural environment pollution problems as it follows the rules of the nature first, comprehensive strength, harmonious relationship between humans and the nature and the consistent development, all of these points bring new thoughts and new motivations into the urban infrastructure development. Moreover, along with the consistent development of the sponge cities scale and the use of new technology such as the grass waterway, rains park, seepage bricks and green roof, it creates more comfortable living environment for the urban citizens and effectively improves the life quality, which also saves the cost for urban constructions as well as assures of a mutual development of quality, safety and economy.

2.3. The significance of low impact development in Guizhou area

In recent years, with the rapid development of urbanization, the urban construction and development with traditional extensive mode has caused the original river, wetland, lake and other hydro-ecological environment to suffer from varying degrees of damage in the cities. For example, the use of impermeable material on the ground makes the impermeable area on the ground increasingly expand, destroying the hydrological characteristics and natural ecosystems of the cities. The rapid development and construction of cities have allowed a large amount of rainfall that could have infiltrated underground to form a runoff within a short time and to be discharged through gray infrastructure such as conduit, etc. Because the existing drainage system has no enough functions to withstand such huge urban drainage pressure, urban waterlogging eventually occurs, leading to a large amount of rainfall that can not be stored and effectively recycled. In the traditional treatment mode of rapid rainfall, except for evaporation and a small amount of infiltration, the drainage pressure of conduit reaches nearly 80%, resulting in the massive loss of rainfall resources and the emergence of urban waterlogging. The application of LID technology can be conductive to the effectively infiltration of rainfall through the use of ecological grass planting ditch, permeable pavement and concave green space, etc, reducing the discharge of runoff to less than 40%, thereby achieving the purpose of saving and utilizing precipitation resources.

2.3.1 LID is conductive to reduce the load of the grey infrastructure in urban. The municipal rainwater pipe network of the underground is the main way for achieving urban drainage. Roof gutters and pavement along 3% slopes help the rainwater to enter the municipal rainwater pipe network and eventually discharge away city. Before the drastic reform, the situation of urban drainage was as follows: 40% of rainfall was evaporated, and 50% of it infiltrated underground soil to supplement groundwater resources. 10% enter the river. However, the rapid development of urbanization has resulted in changes in soil cover patterns, reducing the amount of rainfall infiltrated into the underground soil to 5%, and more than 55% of the precipitation was fed into municipal rainwater networks and discharged away the cities. As a matter of fact, it's the impermeability of soil in the
process of urbanization that caused the loss of rainwater absorption and storage function of underground soil, which eventually brought about urban waterlogging. Another main reason is that urbanization has neglected and buried the original urban waterways and gully in the process of its development.

2.3.2 LID is conductive to supplement groundwater resources to cities. The important sources of groundwater replenishment include atmospheric rainfall and infiltration of surface water and atmospheric rainfall is the most important replenishment of groundwater resources. It's showed based on the results that the infiltration of rainfall is caused by the common effects of molecular force, capillary force and gravity and other factors, and the infiltration rate of atmospheric rainfall is also affected by soil conditions. As mentioned earlier, the change of current urban land cover has destroyed the original hydrological cycle model, eventually leading to the loss of rainwater resources and the shortage of groundwater resources. Experts pointed out that groundwater infiltration decreases by 250,000 cubic metres per square kilometre of impermeable area in recharge area of groundwater, at the same time, surface runoff increased by 457,300 cubic metres.

2.3.3 LID is beneficial to the sustainable utilization of rainwater resources. The change of surface cover forms of urban leads to the rapid loss of rainwater resources. The main contradiction in water resource has become the contradiction between the water resources utilization that urban inhabitant has a great number of demand increasingly and the loss of water resources in cities. The suggestion of sustainable utilization of rainwater resources will inevitably become an important measure to solve the contradiction of water resources, and will also become the development trend of ecological civilization construction planning in China.

LID constructs ecosystem used by urban rainwater by means of planting grass ditches and artificial wetland, etc. Effective rainwater recycling can be used for non-potable water in residential life, public places or factories, such as toilet flushing, green planting irrigation and water for landscape, to maximize the utilization of rainwater resources. LID comprehensively takes into account the rainwater runoff path, effectively controlling rainwater discharge starting from the sources, and realizing rainwater's recycling through a series of measures such as filtration, precipitation, purification and storage, etc, and then used for living, production and landscape, thus realizing the rainwater recycling. It can be seen that LID is an important way to realize the sustainable utilization and management of rainwater resources.

3. The analysis on the current problems with Guizhou rains environment

3.1. The urban rains environment of Guizhou is not positive

Along with the urbanization and industrialization of Guizhou, the urban sickness happened with various cities. And regarding the natural rains, it mainly reflects in the 2 aspects as below:

The urban rains environment gets worse. Currently, most of cities in Guizhou still use the drainage system which deals with the rains and sewage together. In case of heavy rains, the sewage of urban will come up to the rains water. Besides, low collection rate of the sewage of certain cities makes this situation much worse. Lastly, due to the construction lands shortage of Guizhou, the greening rate of certain cities is not good, which causes the problem that most of urban sewage will directly flows into the rivers without any effective purify process in case of the heave rains. All the above factors causes the problems that the rivers and lakes environment of most cities become worse and worse, even with black water and big smells.

The urban waterlogging happens frequently. Along with the fast development of the urbanization, rapid increase of the urban citizens and enlargement of the urban lands, the foundation situation changes a lot comparing to what before the constructions.[5] And it brings much heavier burden to the original urban drainage system, no speaking of some drainage systems with not good enough quality from the beginning, which caused big loss of economy. For example, on 18th of Jul, 2014, it rained
201.7mm in main district of Guiyang within 24 hours, and it affected nearly 190 thousand people, which also caused an economy loss as high as 73 million yuan.

3.2. The karst landform forms in Guizhou, and the urban rains environment is weak

Most cities of Guizhou are located in karst landforms, where the lands are too separated, the earth is thin, the water leaks easily, the rains storage situation is terrible and the stability of rains environment is bad, which makes it difficult to repair it once the environment broken.

4. The analysis on rains environment repairing measurements under the low impact development concept

4.1. To strengthen the flood control construction

The flood control construction is a most important part of the urban rains environment repairing works, which it is with important meaning in promoting the urban flood control ability. During the flood control construction, according to the concept of low impact development, on one hand, we can allocate the storage lakes on the upside of urban rivers area following the rule of a comprehensive management of the rains environment and the scene environment, to make them as the important parts of the sponge cities; On the other hand, to arrange sludge cleaning and widen the river side on the downside of the urban rivers area, to improve the urban flood control ability, as well as for an effective management on the rains environment of those areas. Besides, to effectively block the urban sewage and to adopt low-influence sewage disposal system, which is mainly for improving the urban sewage pollution and solving the urban water shortage as well as reducing the influence of the sewage to the rains environment.

4.2. Strengthening the water replenishment project construction

The water replenishment project construction is mainly for improving the urban flood control ability, and to assure of a more sufficient use of the rains resources. Therefore, during the process of strengthening the water replenishment project construction, and according to the concept of low impact development, we can improve the upside environment of the rivers area based on the actual situation, to increase the whole volume of the rains environment. Meanwhile, we can transform the higher quality rains to natural living water, to make more sufficient supply to the urban citizens, and also to increase the using rate of the rains resources. For example, the Moon Lake Park of Guian, Guizhou, constructed the storage lake on the upside area during the process of repairing the rains environment there, to successfully transform the rains to the natural scene water of the park.

4.3. Scientific management on the natural environment

To connect the rains environment management with the urban scene constructions, and to improve the contradictions between improving the rains environment and the urban economy development. During this process, according to the conception of low impact development, we need effectively improve the flood control project, the water supply area constructions, and effectively repair the rains environment. Meanwhile, the constructions need be more attractive, which can also better serve the urban scene constructions. All of these is for a harmonious development of rains environment, urban economy development and social development.

5. The principle of low impact development

5.1. The construction principle of sponge city which respects the nature

The goal of low impact development towards the sponge city is strengthening the management and using of the urban rains resources, to improve the urban waterlogging problems and for a full using of the rains resources; The designing principle of low impact development is to keep the natural cultures almost same before and after the constructions. Therefore, the new constructions under the principle of
low impact development should sufficiently obey to the original natural conditions, and high efficiency sponge city construction strategy is necessary for a more sufficient using of the rains resources.

5.2. The construction principle based on division
The construction of sponge city and the urban waterlogging problems cannot be solved only by any separate area development. And it has to follow the rule of up to down, and we need also insist on the construction principle of division, to make sufficient analysis on the general rains situation of the whole years. Besides, during the new constructions process, we need follow the guidance of the division construction principle and make different strategies according to the actual situations of different areas, to make sure each part of the new constructions will play its characteristic role during the whole sponge city constructions.

5.3. To establish the rains system which is suitable to the low impact development.
The division principle determines the low-influence construction principle as well as its strength. Therefore, we need make suitable technology spots for the low-influence developments according to the location situation, the scale situation as well as the economy situation. Moreover, while proceeding with a new construction, we need establish a whole low impact development system on the general view, to make sure that each new construction will play a better role in serving the development of the sponge city of Guizhou besides of sufficiently showing its own characteristics.

6. Conclusion
As a natural, scenic and low-costing urban rains management system, the low impact development is playing important role during the greening development of the future city. Currently, it’s a heavy revolution to bring the low impact development concept into our country, and this concept should be widely used in our current constructions such as the scenes designing, infrastructures constructions, building constructions and environment managements. And it should follow the characters of different areas, to connect relevant constructions with the rains environment managements, which makes the rains as a root of the urban nature as well as a root of the urban scenes. This thesis is mainly based on the current situation of Guizhou, and making some research of the low impact development strategy of the sponge city in Guizhou. However, there will be more and more new constructions during the process of urbanization. Then how to make full use of the rains resources with the new constructions and how to make them to play an important role during the low impact development and sponge city development of Guizhou? You may get some inspirations from this thesis.

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Reference
[1] Du Jiandong. China's sponge city construction currently lacks the necessary technical support [J]. Building Blocks and Block Buildings, 2015 (4): 2-4.
[2] Dong Zengchuan, Hu Wenjie, Liang Zhongmin. Comprehensive effects and regulation of urban artificial water bodies [M]. Beijing: Science Press, 2008.
[3] Yu Kongjian et al. Sponge City--Theory and Practice[M],China building industry press,2016.
[4] YangYang, Lin Guangsi. Concept and Thought of Sponge City[J].Southern architecture,2015(03):59-64.
[5] JuMaosen. Reflections on Sponge City Construction Concept, Technology and Policy [J]. Water conservancy development research,2015,15(03):7-10.