

“Sponge” Concept -Discussion on the Theory of Stormwater Management Construction in Urban Area

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Abstract: In recent years, many cities and rural areas are facing frequent waterlogging, run-off pollution, huge loss of rainwater resources, damaged ecosystem and many more rain water problems. In regional perspective, how to construct a sustainable stormwater management measure have been presented as an important issue in many cities and urban agglomeration in China. This paper attempts to explain the “big sponge” conceptual point of view through the proposed concept, main construction method and elements, ecological diversity and other perspectives of sponge cities, to provide a basis for the theoretical research of integrated stormwater management construction in regional city group.

Keywords: Urban agglomeration; Stormwater management; “Big sponge” system

Introduction

Proposal for the construction of sponge city is worthy to be heard. Just as its name implies, sponge city, is a city that has the ability to absorb water just like a sponge. This kind of city can retain rainwater to the greatest extent. Specifically, several plots are arranged in city district, with the use of absorbent construction material as sponge body. This area will be public recreation park usually but as a water retention place during heavy rain. From the source to the end, the whole process of stormwater control system of the sponge city construction, if compared to traditional use of rainwater, sponge city pays more attention to the natural accumulation of rainwater, natural infiltration and natural purification; it is a green sustainable drainage pattern.

The basic unit of an urban agglomeration sponge is a single city. It is an integrated construction for regional stormwater management and use that combines rural facilities between cities, mountain and river corridors, transportation corridors, and other natural and artificial infrastructures that form regional urban agglomeration. Construction of urban agglomeration sponge can promote urban-rural integration more effectively, and optimize urban infrastructure and ecosystem. The “big sponge” concept that formed with sponge city as basic unit, thereby allow the further development of sponge effect, serving the human ecosystem in both urban and rural areas.

1. The importance of constructing joint action urban agglomeration sponge

1.1. Improve the present situation of flooding in urban and rural areas

In recent years, flooding has gradually become a chronic illness of about all 360 big and medium cities in China, and it

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is also an important cause of the severely hindered in growth of living in countless rural areas. While there are 1100 urban and rural areas facing serious water shortage problem. The low drainage standard and lacking in rainwater utilization system in these urban and rural areas cause these scarce resources become a course of disasters. The biggest distinguishing feature of the urban agglomeration sponge is that it can be like a sponge, which absorb, store, infiltrate, purify rainwater, recharge groundwater, and regulate water cycle, on the spot or nearby during raining; water is released to be utilized when needed, so rainwater has turned into wealth from a burden, which improve the present flooding problem, while the rainwater resource is used rationally.

1.2 Beneficial to improve the regional ecosystem in urban and rural areas

With the acceleration in the pace of urbanization, impervious area has been increasing, which reduce the amount groundwater recharge. The usage of groundwater is much larger than the amount of recharge, causing surface subsidence and soil desertification and salinization, and ultimately resulting in the weakened in natural regulate ability of water recycling system, and thus causing deterioration in the whole ecosystem. The joint action of sponge city construction is an important measure to achieve the coordinated development of urban and natural ecosystem, with methods like source reduction, ecological restoration and natural regulation, while exploring integration of urban and rural area, with the self-repair approach “ecological breathing”, improve the urban and rural ecosystem fundamentally.

2. Problems in the process of urban agglomeration sponge construction

2.1. The lack of “big sponge” system construction specification and standard

The research on the construction of regional green rainwater infrastructure is a new topic in urban and rural area construction. Currently there is no design specification and system architecture of low impact development and joint action of sponge city construction. Design and implementation units rely solely on experience, corresponding planning design is unfounded, which may cause the problems like the low impact development does not meet the design requirements or irregularities in maintenance management. For example, the sponge city construction projects in different cities have different specifications; some cities just optimize the drainage system of older town, which substantially has less sponge construction. The construction in rural areas is even more irregular, basically there are just temporary drainage projects, design and construction standards are relatively low, stormwater management is less effective.

2.2. The lack of “big sponge” system construction joint action mechanism

Some pilot cities are still lacking of knowledge in the difficulties in sponge city construction joint action mechanism. Pilot city areas that have successfully declared to be city generally includes old town which is extremely difficult to be transformed, and also parts of them are new cities and regions to be built. To complete the construction of joint action mechanism and transformation in more than 15km² pilot areas, generally involving hundreds of reconstruction and planning and design of new projects, construction joint action mechanism and running assessment. Not only the number of project is large, period of time available is short, but also to cover various selection and rational grouping of grey infrastructures and green infrastructure inevitably, and may even involve the comprehensive improvement of rivers, lakes and watersheds. How to complete the overall implementation plan quickly and orderly, and carry out comprehensive joint action of design and construction work of each project scientifically and orderly, is an unusually urgent and very difficult work. Moreover, construction joint action risks and implementation difficulties will be varied according to regions.

2.3. Insufficient correlation between department, the “Sponge system” feeder system between urban and rural areas is not perfect

Currently, it is still the period of rapid urbanization. Urbanization involving multiple departments, construction of urban agglomeration sponge not only involving regional system of both urban and rural regions. In the process of construction horizontal implementation will involve various departments such as land, planning, agriculture, and transport department to work together. Management and cooperation between departments in urban and rural regions is an important measure to promote the construction of “big sponge system”. How to coordinate multiple departments to cooperate effectively, effective comprehensive are important issues in the construction of urban agglomeration sponge.

3. Specific measures in the construction of joint action urban agglomeration sponge

3.1. The concept of the construction of joint action in transformed city

To construct urban agglomeration sponge, we must first change our concept. With sustainable ecological civilization as the basic idea to guide the construction of urban agglomeration sponge. To be specific, with green ecological facilities as basic construction main point, and the use of modern technological resources to effectively regulate rainwater resources, to form optimized layout between cities and between urban and rural areas, to form harmony between nature and human beings. The second thing is to improve the research theory of urban agglomeration sponge, so to practice the theoretical guidance. Urban agglomeration sponge is the integrated system engineering project that target to construct a “big sponge” system covering the urban and rural areas, and manage the rainwater resources regionally. The engineering system is large, it is obvious that theory has to be practiced first, and therefore, to strengthen the research and construction theories of urban agglomeration sponge is a must.

3.2. Expanding the scale of “Sponge system” of urban agglomeration

The joint action construction also must have a certain scale of urban “sponge system” on the basis of improving the original “sponge system” quality. First, expand the greening scale of urban constructions, roads, greens, plaza and etc. construction joint action, setting up a variety forms of greening including vertical greening, for example, the implementation roof greening. While green roofs retained rainwater it can also save energy, and east the “Urban heat island effect”; Secondly, by constructing ecological corridor to protect the biodiversity or urban and rural area, to improve the ecosystem of urban and rural areas, and provide the necessary channel for migration of living creatures and water resources regulation; Again, through the joint action mechanism of important water conservation engineering projects, and regional greening in urban agglomeration to form integrated fundamental rainwater engineering construction in urban agglomeration. For example, the construction of important wetlands area based on local conditions, has important significance in the protection of water ecosystem in urban and rural areas.

3.3. Improve the evaluation system, quantization practice

Quantifiable benefit evaluation shall be practiced, to evaluate the practical application of “big sponge” system development technology facilities, so as to promote the application and improvement of development technologies. In the evaluation system, qualitative and quantitative variables are combined, while strategies and indicators are combined. For the assessment and quantization of development technologies, the sustainable performance of the whole life cycle shall be paid attention, with the use of continuous monitoring and measuring data to carry out analysis and correction, to make adjustment for the next stage design or management.

3.4. Develop policies and regulations that support the urban agglomeration sponge construction

Research and develop policies and regulations that support the urban agglomeration sponge construction based on the welfare features that used by urban and rural areas rainwater integration, by referring to the experiences of developed countries, to promote the construction of urban agglomeration construction. Research and development shall be done to enforce and encourage policies and regulations that used in urban and rural areas rainwater integration, and limit the excessive use of impervious pavement and roof in urban and rural constructions, enforce the use of rainwater utilization measure in municipal construction and development projects, employ fiscal subsidies, and set up special funds to encourage engineering technology research and development of rainwater utilization, to promote the development of derivatives industry from urban agglomeration sponge.

Conclusion

Theory exploration and study of urban agglomeration sponge is currently an important stage in regional development and urban agglomeration construction. For the requirement of urban and rural areas planning or the growth requirement characterized by rising urban agglomeration, the construction of urban agglomeration sponge is the basis and strategic leading engineering construction. Therefore, this paper proposes the “big sponge” concept aiming to carry out prospective study in the regional stormwater management research.

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