Landscape Design Research of Old Community under the Concept of Low Impact Development

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Abstract: The expansion of urban construction has led to a continuous reduction of the surface permeable area of the community, and the ability of the surface to penetrate rainwater has been weakened, resulting in various rainwater problems. After a brief description of the characteristics of the old community, this paper combines the status quo of the old community, introduces the low-impact development concept in the landscape design of the old community, studies the available measures, and then uses the appropriate low-impact development measures after screening. In the landscape design of the old community, the landscape design of the artistic rainwater management and the diversion design of the rainwater management provide reference for the sustainable development of the old community in China.

1. Introduction

With the urban population growth and urban development accelerating, there are mass old communities in China's cities. Most of the buildings in the community have good streets, but the infrastructure is relatively old and incomplete. The community rainwater problem is getting worse. Space is gradually decreasing. In order to create sustainable development of urban communities, low-impact development concepts are introduced to create sustainable landscape spaces in old communities to improve the environmental quality of community outdoor spaces and promote the old community’s development.

2. Research Background

The application of low-impact LID development is to integrate ecological green rainwater management measures into the landscape design of the site. Low-impact development was first applied in the Somerset residential area in Prince George’s County, USA [1]. In 2002, the United States publicly pointed out that the low-impact development concept can be used in the transformation of the old city, and also formed the green road [2], green community and other theories and methods; then low-impact development has been applied to urban construction by major cities in the United States. Spread to Europe [3]. In addition, the US Low Impact Development Research Center compared traditional storm water management with low impact development in 2007 and summarized the advantages of low impact development [4].

The concept of low-impact development (LID) has been introduced into China for a short period of time. China's research on low-impact development theory is still in the exploration stage, and it takes time to establish a sound theoretical system [5]. Because low-impact development technology can save the cost of construction projects and has a very low impact on the environment, it is a way to complete site development with as little infrastructure as possible and a small amount of economic expenditure [6].

3. Characteristics of the Old Community

3.1 Old Community Status

The landscape design of the old community in the city does not include the update of the open space of the old community street. Most of the old community planning was arranged in a row

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because of the economic needs at that time. As a result, the outdoor space inside the community was single, the area was limited, and the venue was lacking, which greatly restricted communication and activities.

Firstly, activity space type is monotonous. The residential buildings in the old community are arranged in a determinant layout. The area between the front and rear buildings is the common public activity space of the community. The middle is the roadway with simple greening on both sides. Meet the use of people at the peak stage, restricting the daily outdoor activities and communication of community residents.

Second, Outdoor space is disorder. Due to the limited area of the old community and the lack of parking lots in many old communities, the parking spaces in the community are tight. The public spaces that should have been provided to residents are occupied by bicycles, cars, sundries and sundries. The first floor of the building directly occupied the fence and occupied the public space.

And the green space is damaged. The greening rate of most public spaces in the old community is very low, and the practicality is not strong, and the landscape green space is seriously missing. The old community has a large number of elderly people, but there is very little activity space that can be used by the elderly. The small outdoor activity green area can no longer meet the diversified activities of the elderly, and it is difficult for the active people to share space.

In addition, the space culture is disappeared. Many old communities were originally corporate residences, and these areas were given corporate culture or entrepreneurship. With the improvement of economic development and management system, these areas are reasonably divided into independent communities, but the residents do not change much. Most of them still have similar working backgrounds and memories of working together, but because of the old community space. Outdoor spaces and public spaces cannot give people a sense of belonging without memories of places and things.

3.2 Old community development trend

As the city has experienced large-scale urbanization, the urban community has a situation of less people and more people, directly affecting the old community with mixed population as the main development direction. Although the renewal of the old community is one of the urban development processes, based on years of theoretical research and practical experience at home and abroad, the old community renewal can realize the concept of sustainable development, and the updated design of the community not only includes the renewal of the interior space of the structure. The restoration of the structure itself pays more attention to the renewal of the outdoor environment. Because the outdoor environment of the community directly affects the daily activities and quality of life of residents, it is a very important part of the old community renewal. The renewal of the old community is based on the scientific concept, taking reasonable measures to effectively improve the environmental quality, create space vitality and continue the venue culture, and create a sustainable outdoor space environment is the development trend of the old community.

4. Application of low impact development concept in the landscape space of old communities

4.1 Sinking Green Space

The lawn is an important part of the green space of the old community. The lawn area is also a popular space for community residents. At the same time, grassland is also a carrier for low-impact development facilities. Based on the concept of low-impact development, the rainwater collection area is designed in the old community, and the blind pipe is added to help the rainwater transportation to be updated into an ornamental and entertaining green space. In addition, the green space itself has the functions of rainwater purification and rainwater saving, which can indirectly improve the outdoor environment quality of the old community.

During daily rainfall, the rainwater accumulated in the impervious areas of the pavement in the old community cannot flow into the green areas above the road on both sides of the road, and more is designed to be discharged into the municipal drainage system through rainwater wells near the

ground through small slope design. However, this will lead to a sharp increase in the runoff of rainwater pipes near the main road, which in turn will increase the load on the municipal rainwater system. The sunken green space allows the unpermitted water or accumulated rainwater to naturally flow into the sunken green space through the height difference, and then purify and slow down the rainwater through the natural effects of plants, bacteria absorption and soil penetration in the green space.

4.2 Floor Covering

In the outdoor space of the newly-built residential area, the pavement is mostly made of water-permeable concrete and water-permeable asphalt, but the corresponding cost is slightly higher than that of non-permeable paving materials such as cement. Because the old community was built earlier, the paving materials were mostly impervious pavement materials such as cement. The landscape design under the low-impact development concept uses permeable materials to update the pavement, which not only can quickly improve the rainwater penetration rate of the community pavement, but also reduce the impervious area in the old community.

There are many types of permeable pavement materials on the market, but the various materials are suitable for paving. The permeable pavements commonly used in newly built residential areas are equipped with perforated permeable bricks, mesh bricks, plastic, permeable asphalt, and permeable concrete. The rainwater penetrates down through the permeable pavement, gradually penetrates into the ground through the interception of the permeable layer, and then flows into the municipal drainage system through the drain pipe

Common pavement permeable pavement materials in urban communities are water seepage through the pores of their pore-like structures. Regular maintenance is still required after being put into use, because road traffic and people flow in the community are extremely high, and dust particles in the air, motor vehicle emissions and artificial wastes may fall into the gaps of permeable paving materials. , plugging the pores of the material seepage, which will greatly reduce the penetration of rainwater through the pavement. The water seepage rate of the community pavement decreases, directly affecting the discharge effect of rainwater. However, the blockage of the pores of common permeable bricks basically appears on the near surface of the material. Although there are hidden dangers of pore clogging in the permeable pavement materials, it is still higher than the permeability of the soil.

4.3 The Rain Garden

The urban old community has a relatively simple space type. Due to the low space utilization rate among residential buildings, it is suitable to increase the rain garden landscape according to the environmental conditions of the old community. The rain garden not only effectively manages the flow of rain and flood in the community, but also enriches the landscape space of the community. The common rain garden landscape in urban residential areas is a small-scale low-lying area, covering an area ranging from 500 m^2 to 1000 m^2, which has good aesthetic effects and can save the rain. The rainwater accumulated on the surface of the traffic road without infiltration can be collected into the rainwater garden area through drainage, and then the rainwater garden can effectively block the concentrated rainwater; the green plants and soil planted in the rainwater garden can also filter the pollutants in the rainwater with the purification effect.

4.4 Green Roofs

Common green roofs are divided into three types: dense, semi-intensive, and expanded. The three design features and maintenance needs vary. The most prominent ecological function of the green roof is to effectively store rainwater, especially the runoff of storm water, and effectively realize the source control of storm water. The interception effect of the green roof on the rainwater is mainly to absorb and filter the rainwater through the soil such as the surface layer of the roof, and the photosynthesis of the green roof plant itself also promotes the circulation of water. The construction of a green roof in the landscape design of the old community not only increases the three-dimensional green area, but also purifies the pollutants in the air at high places, thereby

improving the air quality of the old community. In addition, due to the transpiration of plants, the temperature around the roof space can be reduced, thereby alleviating the urban heat island effect. Green roof space can also alleviate the limitations of the ground space in the old community, because it does not occupy the floor space, but also meet the needs of most of the community residents.

4.5 Plant Configuration

One is planting ditch. The common grass-growing ditch in the newly-built residential area refers to the surface ditch drainage system with landscape vegetation on the surface of the ground. Street roads and public buildings along urban communities are the transmission channels for storm water runoff. Through the difference of rainwater runoff transmission methods, the planting ditch can be divided into three types: standard grass ditch, dry grass ditch and wet grass ditch. The common standard planting ditch is at the bottom of the drainage ditch, and there is a soil with good water permeability for rain and water seepage. In order to connect with the rainwater storage and purification facilities, the green plant adopts shallow planting. Dry grass ditch can significantly improve the penetration of rainwater. Wet grass ditch can make full use of the natural absorption capacity of grass for rainwater and the ability to intercept rainwater and reduce flood peak flow.

The other one is wall greening. Three-dimensional greening that is common in urban communities includes roof greening and wall greening. The outer walls of the buildings in the old community are in the form of cement-covered ordinary brick walls. The landscape walls of urban public spaces are not suitable for design in old communities, because the external walls of structures in old communities are damaged. If you want to achieve three-dimensional greening in the existing wall, you need to repair the wall first, which will seriously affect the lives of residents. Therefore, the use of planting for climbing and hanging growth characteristics to achieve wall greening in old communities is also the most cost-effective and easy-to-implement method for updating the landscape of old communities.

5. Landscape design of old community under the concept of low impact development

The road planning in the old community is relatively complete. The road system in the community can meet the daily travel needs of the residents in the community. Although there will be congestion in the morning and evening peak hours, there is no major negative impact. However, due to the community's population density has not declined in recent years, outdoor space has been put into use, the existing road surface is damaged, the outdoor environment is less ornamental, and the public space is also difficult to meet the changing needs of residents, so the community landscape design is updated.

5.1 Road paving

The biggest difference between the roads of old communities and the roads of newly built residential areas is that the use area of cement is large. Due to material constraints and economic considerations in the construction of old communities, only the cement pavement is considered to meet the requirements for wear resistance of motor vehicles. The impermeability of the cement itself and the irreversible damage to the base environment are neglected.

The low-impact development concept advocates the use of permeable materials to pave the pavement, allowing rainwater to penetrate into the permeable layer through the pores of the permeable paving material, and then directly into the municipal drainage system through blind pipes and other facilities. Since the motor vehicle road is the most frequently used area in the old community, the daily traffic flow and traffic volume are the largest. The paving of the main road pavement adopts permeable asphalt. The water permeable asphalt has strong water absorption and is dark because of its own material. It is easy to absorb heat under sunlight, and it absorbs moisture faster than other water-permeable materials. The pavement of the pavement is made of permeable bricks, the color is lighter, the evaporation of rainwater is slower, the surface temperature is not too high after the summer rain, the grassy ditch is provided on both sides of the pavement, the blind

pipe is buried underneath, and the rainwater seeps through the permeable brick. The seepage layer is then drained through the blind pipes on both sides to the municipal drainage system for discharge. The post-maintenance methods of these permeable bricks are also relatively simple, and the specific permeability of the materials can be maintained by periodically spraying special glue.

In addition, the type of activity space is single, and the public space is limited, and there is no space for exercise in the old community. But the jogging plastic road could be added. The design is an irregular circular fitness runway running through the community. The route follows the original traffic road design in the community. Some routes can coincide with the sidewalk, but cannot be adjacent to the motor vehicle road. The runway is paved with colored permeable plastic to increase the rainwater penetration rate of the community's road surface. And the runway has no deliberate design starting point, residents can start from any position as a starting point, or they can end in any position.

5.2 Parking area

Since the old community was built earlier, there was no great demand for parking spaces in the early communities, so there were very few parking spaces in the original community. However, residents are increasingly demanding parking spaces, due to limited space in the old community, unconditional construction of underground parking lots or rooftop parking lots. However, the proportion of elderly people and children in the old community is relatively large. Compared with the community with the same density of residence, residents have relatively small demand for parking spaces. Therefore, parking spaces can be designed in community roads and building gaps to help ease parking pressure.

In addition, parking areas can be selected to be built on the central square and on the main motorway roads in the community. If the old community uses outdoor public space to increase the parking area, the current situation of parking tension can be alleviated rather than resolved. Since the accumulated area occupied by the parking area after construction is not too small, in order to ensure the high water permeability of the road surface, the pavement of the parking area is designed as a grid brick, and the rainwater penetrates into the grass through the space gap.

5.3 Green Space

The center of the community rainwater runoff network of the lawn in the community side by side building design the lawn between the houses as a sinking green space, and the rain garden is set under the water level, and the horizontal surface serves as both a rest space and an entertainment space. The steps around the sinking green space become a natural isolation area through greening, and the ornamental plants form a harmonious garden landscape within the community. The surrounding rainwater flows down into the sinking green space through the height difference of the surrounding steps, through the rain garden below. Savings are purified. At the same time, there are blind pipes in the lower ground around the sinking green to help drainage when the rainwater is concentrated. The grassland vegetation on the surface layer has a preliminary absorption and filtration effect before the rainwater seeps into the surface environment, so as to protect the community's ecological environment system. Sinking green space not only increases the permeable area of the old community, but also provides people with richer outdoor activities, while enriching the type of community landscape activity space, thereby improving the outdoor space quality of the community.

5.4 Roof Garden

Roof space is a place that is ignored by residents in the old community. The main reason is that there are no elevators in the community buildings, low-level residents rarely go to the top floor, and high-rise residents stay on the top floor because of weather and environmental reasons. However, the roof space is conducive to the expansion of the space of the old community, and is also a large potential interaction space for the community residents. Because the buildings in the old community are not high, the design is a roof garden, which not only satisfies the concept of low-impact development, but also attracts people to come to the event and gives residents a space garden

atmosphere.

In order to make full use of the roof space of the old community, design the roof to dry the small platform, provide ample sunshine space for the elderly community in the old community, and avoid the occupation of the public space on the road. The roof path is paved with pebbles and enhances the landscape of the roof garden. The rest platform is built in the form of a wooden plank road. Its natural texture is easy to give the residents a natural feeling. The anti-corrosion wood is also durable, making the landscape more natural.

6. Conclusion

To sum up, due to the influence of urban diseases, there are widespread problems in the outdoor space of various cities, such as the shortage of available land and the seriousness of the rainwater. The landscape environment of the old urban communities has gradually declined with the development of the city, in order to create sustainable urban old communities. The development introduces the concept of low-impact development, combining more technologies in landscape design to provide more options for updating the technology in the outdoor space environment of the community. The article takes the old community as the object, integrates the low-impact development concept into the landscape design, realizes the landscape design of the artistic rainwater management and the rainwater management diversion design in the old urban community.

References

[1] Zhou Xiaobing. Research on rainwater control utilization in urban landscape planning and design [D]. Beijing Institute of Civil Engineering and Architecture, 2009.

[2] Metropolitan Service District (or). Green streets: innovative solutions for stormwater and stream crossings [M]. Portland, Ormetro, 2002.

[3] Berndtsson J C. Green roof performance towards management of runoff water quantity and quality: a review[J]. Ecological Engineering, 2010, 36(4):351-360.

[4] Tan Qi, Ding Qin.Review and Research Progress of Low Impact Development Technology Theory [J]. Chinese Horticultural Digest, 2014(3): 54-56.

[5] Han Jia.Application of Low Impact Development in Landscape Design[J]. Architectural Engineering Technology and Design, 2016(23): 656-657.

[6] U.S. Environmental Protection Agency. Guidance for Developing Best Management Practices (BMP)[R]. 1993:1-3.