

Exploration on Landscape Reconstruction Design of Old Residential Communities Embedded with Green Technology Based on Smoke-Free Environment: Regarding Shangdatianwan Central District in Yuzhong District of Chongqing a Case

Liu Fanyi, Master

Dong Lili, Professor

Chen Yuan, High Level Engineer

Liu Yuanyuan, High Level Engineer

Liu Fanyi, Master in landscape architecture, spongecity, and ecological environment, School of Architecture and Urban Planning, Chongqing Jiaotong University, China. Dong Lili, Professor in landscape architecture planning and design, School of Architecture and Urban Planning, Chongqing Jiaotong University, China. Chen Yuan, High Level Engineer in sponge city planning and design, urban rain and flood management, Chongqing Municipal Research Institution of Design, China. Liu Yuanyuan, High Level Engineer in municipal drainage and control of water environment, Chongqing Municipal Research Institution of Design, Municipal Drainage and water environment treatment, China. Correspondence author: Fanyi Liu; 470926161@qq.com

Abstract: A smoke-free environment is crucial to the health of low-income, marginalized and vulnerable groups in the wake of COVID-19 and extreme weather. Low-income vulnerable groups mostly live in old residential areas, where the quality of living environment is poor. Ground buildings lack fire protection and smokeless facilities, and ground, rain and sewage pipes are mixed, posing serious safety and health risks. However, urban reconstruction and restoration often pay attention to the smoke-free environment, underground pipe network facilities and green and intelligent application of new residential areas, while ignoring the implantation of smoke-free environment, environmental protection and energy saving sustainable technology measures in the reconstruction of old residential areas. The old residential areas are the last link in the implementation of smoke-free policy and the most vulnerable areas of urban governance. Urban renewal design implanting smoke-free environment and green technology into urban fabric can improve its resilience and quality of living environment. Based on this, taking Shangdayanwan Central District, Yuzhong District of Chongqing, a typical mountain city, as an example, the reconstruction and design of the old residential area with green technology embedded in smoke-free environment was carried out, and the technical mechanism was explored, providing reference for urban renewal design to reduce pollution, prevent disasters and improve the ecological conservation of human settlements.

The spread of COVID-19 combined with resource depletion and frequent extreme weather conditions makes people pay more attention to environmental safety and health. Smoke-free environment, environmental protection and energy saving are the focus of safety and health in recent years. However, the construction of smoke-free environment and the application of green technology in urban governance often emphasizes the construction of new residential areas, while ignoring the reconstruction of old residential areas where marginalized vulnerable groups live together, there is a lack of fire-fighting and smoke-free facilities on the ground, and the mixing of ground rain and sewage is very serious. Old village in response to environmental pollution, heat island effect, floods and other cities in the very fragile, to increase its toughness against risks, need comprehensive, providing in architectural design, construction, renovation and integrated health architectural practice during the operation and maintenance, fit a smoke-free policy implementation, organic implanted green new materials, new products, new technology, new design sustainable green technology measures. For instance, we will help reduce the impact of ecological imbalance and balance environmental protection and economic development. Implanted a smoke-free environment, green science and technology of old village renovation in the shortage of resources, environmental pollution and save multiple horizon, such as environmental protection, sustainable development has extensive significance, but after all need according to the various countries the comprehensive environmental considerations of adjust measures to local conditions, to improve the residents' health consciousness self-discipline, defense against the climate change risks, enhance the elasticity and toughness of city community. Therefore, this study takes Shangdayanwan Central District of Yuzhong District, chongqing's mother city with large population density, complex geographical environm

ent and frequent flood disasters, as an example to conduct landscape design research on the reconstruction of old residential areas with smoke-free environment and green technology, so as to provide reference for urban reconstruction.

LITERATURE REVIEW

Smoke-Free Environment

Smoke-free environments are an essential element of comprehensive tobacco contro¹. Strengthening smoke-free environments in public places and workplaces has significant public health benefits. There are a lot of studies on the value, recognition and implementation of smoke-free policies, but there are gaps in policy environment (public and private), community environment and social environment (tobacco use norms/acceptability).² Smoking bans are essential to the health of tenants and the community.³ The vast majority of residents prefer smoke-free buildings, but smoking bans are more common in workplaces and public outdoor Spaces than in private places such as apartment buildings and homes. Increased awareness and enforcement will improve the long-term outcomes of smoke-free environments.⁴ We should pay attention to the implementation of tobacco control in low-income areas, marginal areas and all kinds of vulnerable groups. Extend the implementation of new smoke-free policies for private and outdoor Spaces,⁵ focus on the development of e-cigarette use in smoke-free environments in the new situation, and establish social and spatial boundaries for e-cigarette use.⁶ Community as the last kilometer of smoke-free policies, community participation in smoke-free homes project can improve the impact of family members on secondhand smoke understandings smoke-free homes and common management environment,⁷ as well as the awareness of the implementation of a smoke-free environment and regulations for community and support.^{8,9} Perform community alliance's effect in changing social norms and community ready to

implement tobacco control policy.¹⁰Smoking ban will need to adapt to and modernization, especially for minors frequented a smoke-free environment of outdoor places and residential environment, design and environment development related to tobacco control policies and the local community prevention plan is critical to,^{11,12} such as community participatory methods and incentive programs, improve the community on the smoke-free environment (including electronic cigarettes a smoke-free environment) expectations. Ensuring the effectiveness of existing smoke-free areas and increasing them will be new challenges for tobacco control in the coming years.^{1,35}

Green Technology

The concept of green technology originated from the environmental protection trend of thought in the 1960s and the green movement in the 1970s, which has been highlighted in the increasingly deteriorating ecological environment.¹³At present, due to the lack of unified understanding in the academic circles, the relevant theoretical research is mostly focused on the concept, connotation, significance, policy platform and system construction. It is believed that green technology is a general designation of various green products, techniques, materials, etc. that combine the green concept.Under the increasingly severe situation of negative ecology and extreme climate in urban human settlements, green technology is an important support for the sustainable development of ecological environment and economic development, and is the development direction and trend of a new mechanism, new measures and new methods to promote the harmonious development of man and nature, which is of great significance for reducing resource shortage, preventing pollution and realizing ecological sustainable development.¹⁴It is necessary to improve the policies and platforms of the green technology to promote the comprehensive application of the system.However, the relevant application research is mostly focused on the application presentation and effect promotion of an energy-saving technology and product in industry, agriculture, construction industry, etc., such as photovoltaic roofs in

green buildings, energy-saving optimization application, but lack of penetration of various systems and details, which need to be further strengthened in the future.

Reconstruction Design of Old Residence Communities

Because the impervious environment threatens health and safety, the old communities are the most vulnerable in urban governance.As a result, it is necessary to redesign water and landscape, solid management, waste treatment, etc., and innovate technology to build a fortress in a natural way.¹⁵In the long run, it will increase the demand for green products and services.Extreme weather events will become more serious and frequent.¹⁶People, as the ecological subject of urban renewal, should pay attention to not only materials and quality, street layout and traffic, activity selection and other components of the building environment, but also air and water quality, accessibility of green space, climate and climate-related disaster potential at specific locations, which are harmful to health.¹⁷In view of the fact that a major difference between developing and developed economies is that the former often finds a balance between development and nature, green technologies should be inserted into the urban fabric through urban renewal design to promote the reconstruction of green space and improve the quality of life of the human settlement environment.¹⁸Proper urban landscape design, planning and management will enhance global sustainability and play an important role in project design that respects people's needs and protects the environment. Therefore, designers should create sustainable landscape design with the principles of function, maintenance, environmental protection, cost-effectiveness, and visual effects, so that people can enjoy new technologies with simple operation and low cost for moderate exercise, work and recreation in the landscape with ecological and ornamental plants and hard landscape.¹⁹There are many ways to realize the sustainable development of landscape design, such as site health, including protecting trees and preventing soil erosion, using correct practical equipment and tools, flexible materials capable of ecological restoration, sustainable renewable materials, respecting the

water of life, collecting and saving water, using permeative paving materials, and using new technologies with low cost, low maintenance, low voltage and LED revolution.²⁰ In the concrete practice, reference should be made to the green community planning guidelines and current needs and technological changes.²¹ Sustainable stormwater purification systems must be integrated into buildings and blue-green infrastructure must be adopted to enable people to obtain healthy public service life and opportunities. The blue-green infrastructure is designed to adapt to the multi-dimensional space of climate and social needs, through the design of street community rainstorm toolkit, the use of green technology into the public domain.¹⁶

RESEARCH METHODOLOGY

Project Overview

Yuzhong District is the mother town of Chongqing, with the per capita construction land area of 35.82m² based on conservative calculations, the smallest in the whole city of Chongqing. Shangdatianwan Central District, which is located in the ShangdatianwanCommunity in Yuzhong District of Chongqing, has the per capita construction land area of 20.15m², even smaller, and 179 physically disabled persons with subsistence allowances. Shangdatianwan Central District is located in the center of the jurisdiction, adjacent to Xinlongda Building and Huimei Building in the north, residential area of Hongye Nursing Home in the south to southwest, Huzhuli Residential Area in the west and Meizheng Garden Residential Area in the east. It consists of a central circular square, Miluo Garden Building and courtyard terraces facing the circular square. The square semi-enclosed courtyard is the highest place

in the whole plot, and the ground around the circular square is the lowest, constituting the maximum ground elevation difference (excluding the depressed plot of garage) of about 1m. There are revetments and walls in the south and east, with the highest ground clearance of about 11.22m and the lowest ground clearance of about 2.1m, which leads to frequent waterlogging every year.

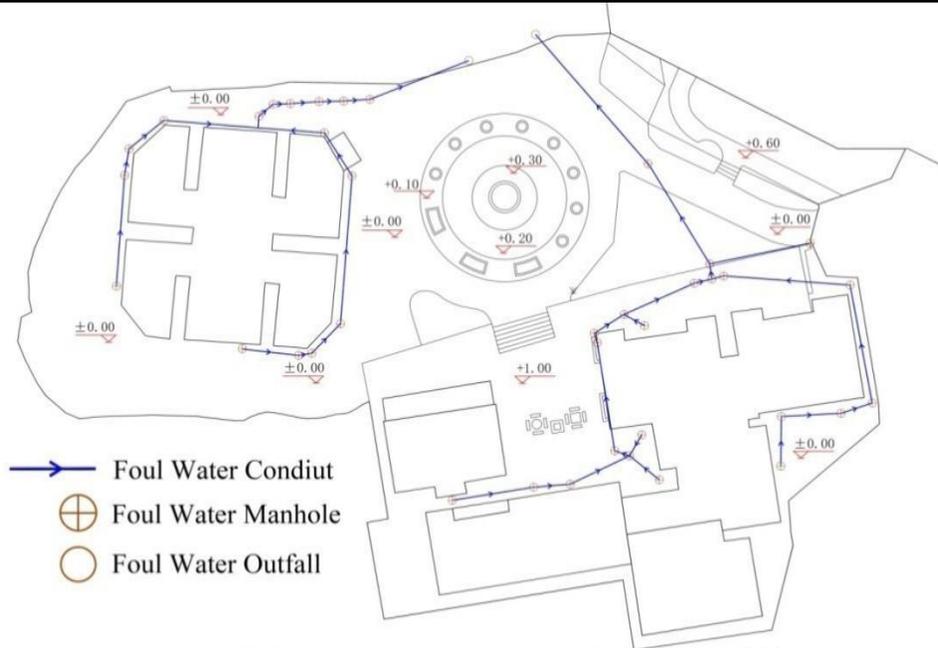
The Problem of Original Landscape in the Community

First of all, there is a lack of landscape with green technologies. The community has a total area of 5,384.32m², which is composed of impermeable hard paving, green space and building roof (hardened), among which the hardened underlying surface (including hard roof and paving) accounts for the majority, and the green space rate is low. Moreover, the ecological and environmental protection of hard surface pavement is poor, all of which are impermeable, with serious water accumulation on the ground in rainy days and insufficient water storage function of green space. The corresponding indicators are shown in Table 1. Judging from the vertical layout, elevation and current pipeline network, stormwater collected in two semi-enclosed terrace courtyard spaces, terrace-type rising circular squares, residential buildings, revetments and walls, which are formed by buildings, greening or fences with high terrain, flows to the lower road surface and the surface near the floor of Miluo Garden Building. In addition, the design of only sewage pipe network but not stormwater pipe network inside the land parcel, as shown in Figure 1, results in the absence of ecological water management system, as well as the lack of old material regeneration and energy sustainability system.

**Table 1
Different Underlying Surface Area and Area Proportion of Shangdatianwan Central District**

Types of underlying surface	Hard pavement (impermeable)	Green space	Building roof (hardened)
Area (m ²)	3120.81	461.5	1796.28
Area ratio(%)	58	8.6	33.4
Rainfall runoff coefficient	0.85	0.15	0.9

Comprehensive rainfall runoff coefficient	0.81
---	------



Present Condition Arrangement of Level Difference and Conduits of Shangdatianwan Central District

Figure1: Present Condition Arrangement of Level Difference and Conduits of Shangdatianwan Central District

Secondly, the landscape has weak humanity and amenity. As the residential area has been built for a long time, the ground and small parergons are aging and damaged to varying degrees without available and ornamental structures. According to the residents, the former portico at the circular central square has been demolished, with large hard paving area, more damage, less green area, poor quality, many bare land surfaces, weak biodiversity, and strong sense of old-fashioned green at the revetment. In addition, the slope of barrier-free access is not properly set, which results in poor visual appreciation and weak organic correlation.

Thirdly, the functions and traffic flow lines are not properly arranged. There are only desks, chairs for rest and planting beds in the whole community, and a small number of sketches and facilities for leisure and recreation, which cannot meet the normal diversified activities of residents.²² The vehicles are parked in disorder, with obvious mix of people and vehicles and great potential safety hazard.

RESULTS AND DISCUSSIONS

Design Ideas

Design principles

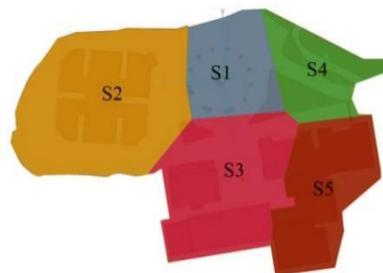
The design principles focus on sustainability from three aspects: coupling, dividing and connecting. Firstly, coupling. In the reconstruction design of the existing urban areas where green technology is integrated, green and gray infrastructure, ground and underground, landscape and function should be coupled, so as to create a landscape with ecological sustainable function, humanization and visual comfort. Secondly, dividing. In the reconstruction design of green technology, different functions, nodes and watersheds are divided, so as to form a landscape system with multiple styles and features, and play the roles of ecology, energy saving and low carbon, recreation, leisure and appreciation. Thirdly, connecting. In landscape reconstruction design, the soft and hard scenes, functional areas and nodes are connected with each other through green technology, so as to better connect different landscape spaces and form the correlation change of visual sense.

System construction

A green technology landscape system dominated by the ecological water management system and supplemented by old material regeneration system and energy sustainable system will be formed through re-engineering design.²³

Firstly, the ecological water management system. The principles of water seepage, water stagnation and water purification of the sponge community are applied through the construction of

ecological water management system. According to the terrain elevation and stormwater runoff flow direction in the plot, the whole site is divided into five sub-catchment areas in Infoworks ICM, and stormwater conduit nets are added according to the sub-catchment areas, as shown in Figure 2-3. At the same time, the rain and sewage diversion mechanism is established to separate the sewage and stormwater in the plot to for landscaping.



Sub-catchment Area Division of Shangdatianwan Central District

Figure 2: Sub-Catchment Area Division of Shangdatianwan Central District



Stormwater Conduit Net Placement of Shangdatianwan Central District

Figure 3: Stormwater Conduit Net Placement of Shangdatianwan Central District

Second, it comes to the regeneration system of waste and old materials. Because waste materials are constantly produced in the daily life of residential areas, which not only causes environmental pollution but also is not conducive to health, the waste recycling system can respond well to the principle of “every object has its own value”, turn waste materials into valuable, and form landscaping elements for ornamental and leisure purposes. Therefore, the native and local recyclable waste materials such as waste wood, stone and brick are used for creating landscape, which can maximize energy saving.

Third, it is the energy sustainable system. Sustainable energy is an indispensable part of green

science and technology. In this case, solar photovoltaic panels are installed on the top of the building for LED lighting, and LED photovoltaic street lamps are added to effectively reduce energy consumption, reduce environmental pollution and enrich landscape details.

Design Contents

Measures selection and combinations

The area corresponding to No.1 sub-catchment area (S1) is a circular central square rising in a platform style and surrounding roads, which is located in the area where sponge landscape can be designed. There are several circular tree pools and short arc flower pools in the square that are not organically related to each other, sluggish and rigid.

It is advisable to properly open up the greening, and take advantage of waste bricks, stones, wood and other materials for landscaping, in the form of concave green space with steeping stone and permeate pavement with gravel, dry rain garden, infiltration trench, ecological tree pool and steps, so that the elevation of planting pool around the central tree pool is lower than that of hard ground. The rain garden is partially equipped with retaining stones, and the central tree pool is made into an ecological infiltration tree pool²⁴. The square is paved with permeable brick, grass-embedded

paving (including permeative shale) which is a combination of permeable material and impermeable material. At the same time, the removed gallery frame is restored and its structure is implanted with ecological base material, photovoltaic panels and LED lighting lamps, which are composed of green plants and gabions with the quality of strong water absorption, water retention and water permeability. The roads around the square are paved with permeative asphalt, as shown in Figure 4-6:

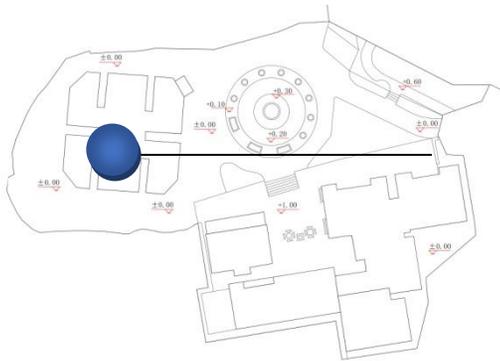


Figure4: The Effect of Adding Wood Gabion Gallery Frame, Platform Rain Garden, Permeative Shale, Permeative Brick Pavement and Permeative Asphalt Road in CAD Drawing



Figure5: Comparison of Effects after the Installation of Photovoltaic LED Gallery Frame, Permeative Shale and Permeative Brick Pavement, and Rain Garden and Infiltration Trench



Figure6:Comparison of the Effects of Adding Permeative Brick, Pavement with Implanted Grass, Eco-Infiltration Tree Pool, Photovoltaic LED Lighting Gallery Frame and Wooden Gabion Gallery Frame

The area corresponding to No. 2 sub-catchment area (S2) consists of the Miluo Garden Building and its surrounding environment, with enclosed walls and revetments, and only the revetments have landscaping. When using waste wood and stone for landscaping during reconstruction, step greening and plant container walls with different heights are selected for retaining and storing rainwater, which will be organically combined with gravel trench at the edge of wooden stake, and solar photovoltaic panels and LED lamp posts are added at the top and inside of some walls. The combined landscape of rainwater flower terrace and infiltration trench and the supporting photovoltaic power generation

structure are appropriately added around the building. The rainwater flower terrace is connected with the building stand pipe, equipped with gravel overfall gaps, dividing strips and opening curbs inside and at the edge to facilitate the partition storage and consumption of rainwater and let rainwater naturally flow into the infiltration trench. The infiltration trench takes permeable and water-retaining gravel as the base material and wooden stakes with staggered height as the edge. The pavement is made of permeative implanted grass bricks and impermeable plain concrete. The comparison effect is shown in Figure 7-9.



Figure7:Comparison of Effects of Adding Step Greening Revetment, Rainwater Flower Terrace, Infiltration Trench and Shale with Implanted Grass



Figure8:Effect of Adding the Photovoltaic Power Generation Structure, Photovoltaic LED Wall and Shale with Implanted Grass Attached to the Building at the Corresponding Position in the CAD Drawing



Figure9:Comparison of Effects of Adding Photovoltaic LED Wall, Rain Flower Terrace, Infiltration Trench and Permeative Shale Pavement

The block corresponding to No.3 sub-catchment area (S3) is a square semi-enclosed courtyard-style space with 7 steps above the ground, which contains a planting bed with more obvious characteristics of sunken green space. Therefore, it is suitable to design the planting bed as a combination of sunken green space and rainplanting bed (that is, biological detention pool, embodied in flower pool and tree pool), and the planting bed near the building is connected with rainwater conduit (partially disconnected) to add a sunken biological detention pool-style green landscape. At the same time, two rain gardens in the form of wet pool are set up to meet the needs of sewage treatment in the ecological disposal site and collection and purification of rainwater falling to the ground. One is located beside the tree pool, table and stool combination as the main landscape, with a large area and the edge mainly composed of hygrophytes, the hygrophyte gabion floating island in the middle is connected with the disconnected sewage pipe of the building with the sewage

treatment tank,²⁵ and the other is located in the narrow and long space between the wall and the building as the secondary landscape, with a small area and the edge of the combination of gravel and hygrophytes, the central floating plants are organically connected with the underground sewage pipe, and the sewage pipe and the treatment tank are matched.²⁶ And the ascending ecological infiltration planting pool are organically combined to form a miniature wetland landscape.²⁷ In addition, the slope greening is transformed into a multi-layer gentle slope platform with wooden stakes and water-blocking curbs. The barrier-free access is designed as a streamline with twists and turns and straight curves, and is matched with an ecological low wall implanted with green plants and dry masonry. The pavement in the block is designed as a combination of permeable pavement (including permeative concrete, gravel pavement, implanted grass bricks, implanted grass stones and implanted grass wooden pavement) and impermeable pavement, and the slope is designed as an implanted grass grills side slope. In addition, waste local

Liu Fanyi et al.

Exploration on Landscape Reconstruction Design of Old Residential Communities Embedded with Green Technology Based on Smoke-Free Environment: Regarding Shangdatianwan Central District in Yuzhong District of Chongqing a Case substrates are used as landscaping materials, and solar LED photovoltaic lighting lamps are also considered to improve the lighting conditions of residential areas. The practices are as shown in Figure 10-14.



Figure10:Reconstruction Effect of Barrier-Free Access in Corresponding Area on Original CAD Drawing



Figure11:Comparison of Reconstruction Effects of Adding the Concave Greenbelt Pool with Purification buildings and Sewage Suction and Storage



Figure12:Comparison before and after Adding Infiltration Flower Bed and Sinking Planting Bed for Absorbing Roof Runoff and Ground Runoff



Figure13:Comparison of Sunken Ecological Tree Pool before and after Reconstruction

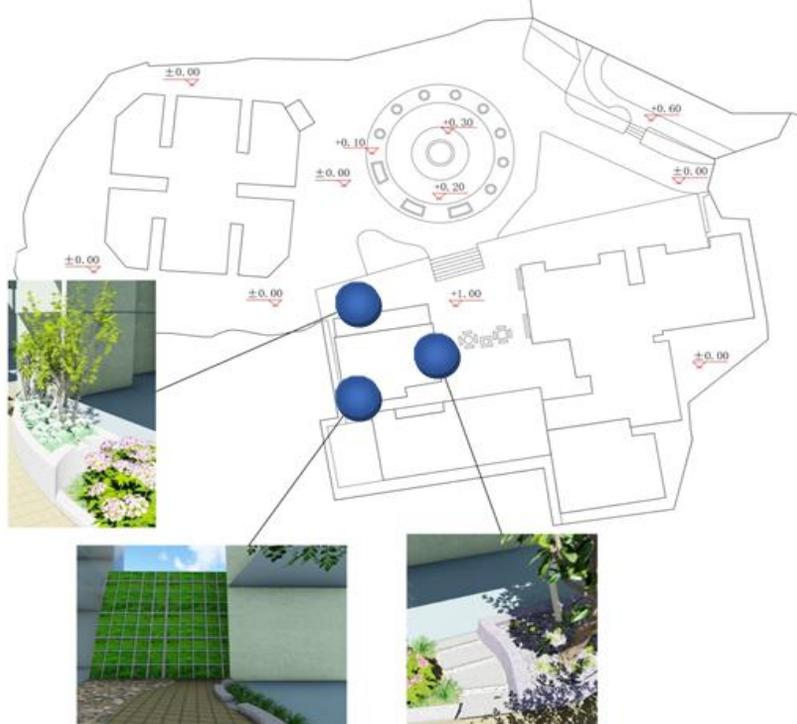


Figure14:Effect of Infiltration Tree Pool, Flower Bed and Sinking Flower Bed, Infiltration Stepping Stone and Implanted Grass Grills Side Slope

The block corresponding to No.4 sub-catchment area (S4) consists of an enclosed courtyard space and parking lot exit which are 4 steps above the ground. In terms of sponge landscaping, the flower terrace at the parking lot exit is designed as an ecological infiltration flower terrace,²⁶ and the landscaping at the enclosed courtyard space is a low-level flower terrace, so it is suitable to be designed in the form of an ecological greening rain gate (infiltration surface made of ceramsite, gravel and sawdust),²⁷ which is combined with a stormwater conduit disconnected from the building, and a step greening is formed at the stair, and an

opening is arranged at the bottom of the terrace to facilitate natural inflow of rainwater. Besides, different types of permeable pavement are moderately laid, including porous concrete and implanted grass boards. An ecological enclosure wall matched with dry masonry blocks and green plants is set locally at the rainwater outlet of ecological greening to organically blend with permeative materials and fully absorb rainwater. In addition, it is also considered to appropriately use waste materials as the base material for creating a sponge landscape, and to reflect the sponge landscape with the solar LED photovoltaic lighting lamps. The practices are as shown in Figs.^{28,29}



Figure15:Comparison of the Effects after Transforming into Infiltration Flower Bed and Adding Solar Photovoltaic Street Lamps

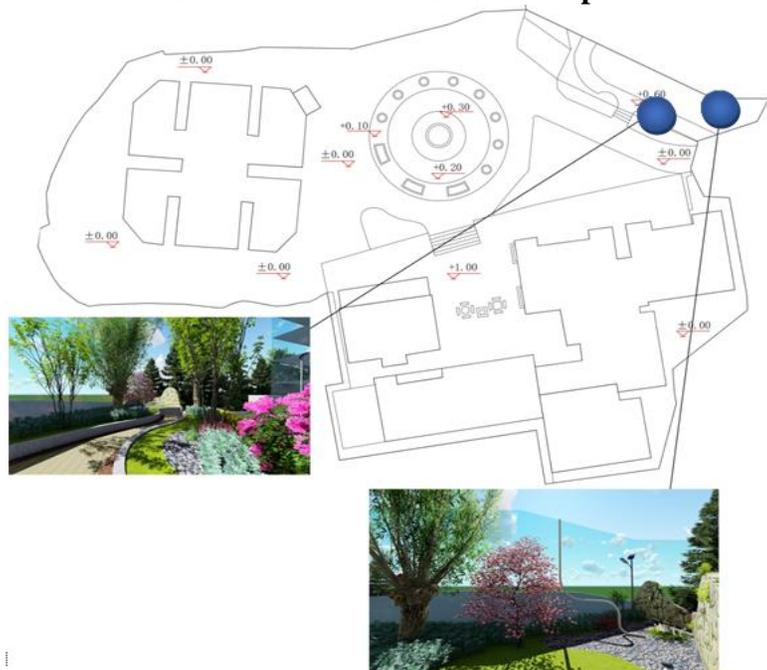


Figure16:Reconstruction of Ecological Gutter Inlet Green Space and Locations for Adding Solar Photovoltaic Street Lamps

The area corresponding to No.5 sub-catchment area (S5) is a flat and narrow space behind the semi-enclosed courtyard space 7 steps above the ground.Originally, there was only one green space on the terrace, so green space can be appropriately added during reconstruction. The added green land is blended with ceramsite and bark derived from waste wood as a permeable base material,²⁷ and the waste wood is bordered, matched with a gully pot

and organically connected with a disconnected rainwater down pipe.The greening of the terrace is designed as an infiltration flower bed with waste stone as the matrix, and the bottom is additionally provided with a rainwater inlet so as to facilitate rainwater absorption.The rest of the surface is paved with implanted grass gravel locally, and the walls are designed as photovoltaic LED walls. The practice is as shown in Figure 17.

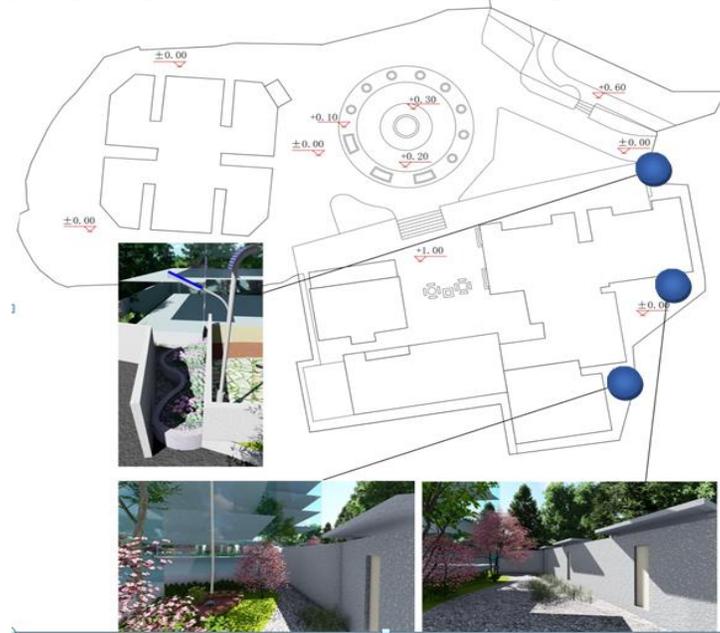


Figure17:Locations for the Reconstruction and Addition of Photovoltaic Street Lamps, Percolating Flower Beds, Photovoltaic Walls and Ecological Rain Water Inlets

Technology Roadmap

In terms of ecological water management, roof runoff flows into the green space through disconnected stormwater conduits and is received by rainwater flower beds, infiltration trenches, biological retention pools (rainwater planting pools) and green spaces with ecological rainwater inlets and overflow wells. Runoff from the hardened surface penetrates into the permeable pavement to be absorbed, or reaches the spongy green space through the open curb and sinking overflow, enters the sunken green space, grass trench, dry and wet rain gardens, ecological planting pool (including

flower pool and tree pool), and finally flows into the hole at the bottom of terrace greening. The rainwater in the revetment and wall can be absorbed and intercepted by three-dimensional greening and infiltration trenches, such as porous green side slope, step greening and green container with different heights. Greening runoff flows into platform gentle slope greening, rainwater flower terrace, infiltration flower terrace, grass planting ditch type concave green space, rainwater garden type concave green space, ecological planting pond type sinking green space and green space with ecological rain inlet, and can also be absorbed by different types of three-dimensional greening and ecological landscape walls, as shown in Figure 18.

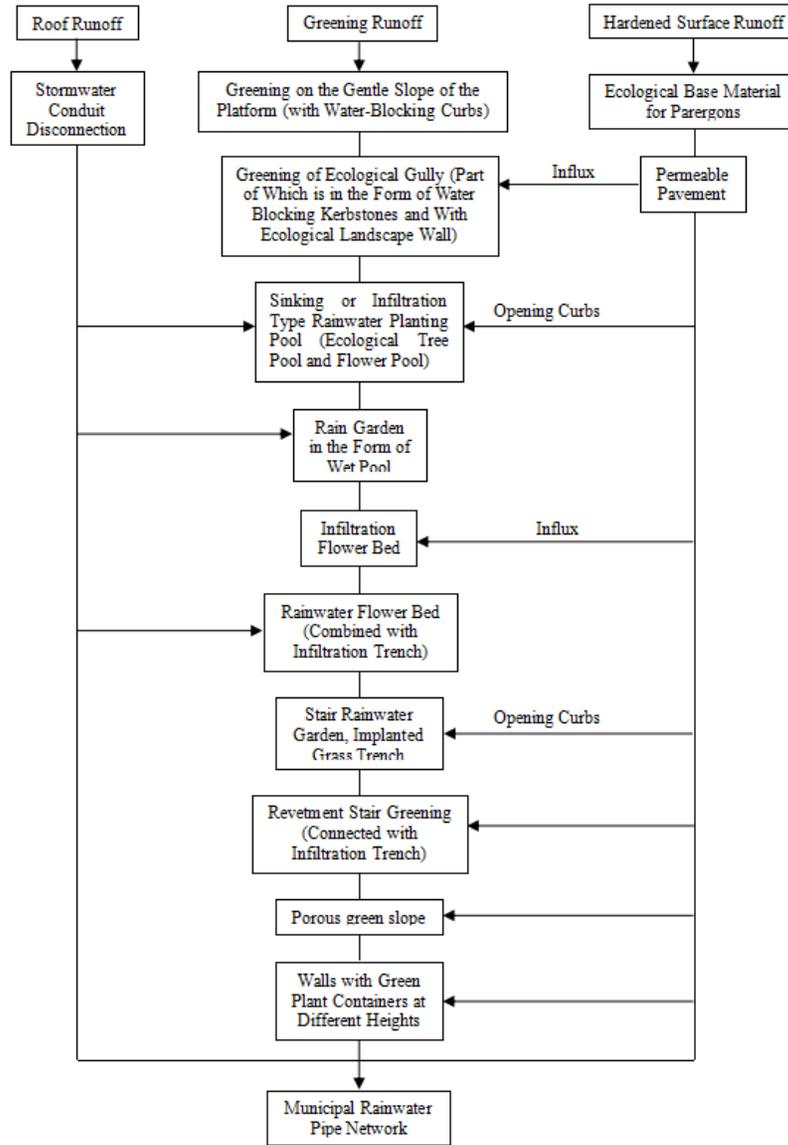


Figure18:Technical Roadmap of Ecological Water Management

In terms of reuse of old materials, waste woods are used for the edge of sponge landscape, infiltration of the ground surface, water-blocking curbs and paving, gallery frame structure, waste stones are used for the infiltration surface of sponge landscape, floating island, matrix, retaining strip stone, ecological base material structure of gallery frame and other places, waste bricks are used for permeable brick pavement, waste concrete is used for ground pavement, and waste metal is used for rainwater wells.

In terms of energy sustainability, solar photovoltaic power generation is integrated into the construction of parergons. In terms of reuse of old materials,

waste woods are used for the edge of sponge landscape, infiltration of the ground surface, water-blocking curbs and paving, gallery frame structure, waste stones are used for the infiltration surface of sponge landscape, floating island, matrix, retaining strip stone, ecological base material structure of gallery frame and other places, waste bricks are used for permeable brick pavement, waste concrete is used for ground pavement, and waste metal is used for rainwater wells.

In terms of energy sustainability, solar photovoltaic power generation is integrated into the construction of parergons, which are used for lighting and power supply of gallery frames, walls,

lamps and LED lamp posts of building structures to form photovoltaic gallery frames, photovoltaic lamps, photovoltaic walls and photovoltaic houses, which are uniquely constructed.

In terms of smoke-free environment, fire protection facilities, fire passageways and smoke-free alarm facilities will be integrated into each building, and anti-smoking propaganda and measures will be implanted into the public space for the elderly and children to have a rest, to warn and persuade smokers.

Traffic Streamline and Functional Division

People and cars shall be separated in the reconstruction design. According to the planned

parking building, an underground garage will be set up, and the planning and organization of vehicle streamlines, parking spaces and pedestrian spaces will be carried out in combination with the existing underground garage, as shown in Figure 19. According to the current spatial structure of the plot, the sub-catchment area is divided into five functional areas, so as to create an ecological rainwater landscape with vivid, interesting, winding, pleasant and close-to-people, beautiful and rich community center garden square, leisure space beside the building, building half-enclosed courtyard, green enclosed courtyard and landscaping and viewing space, as shown in Figure 20.

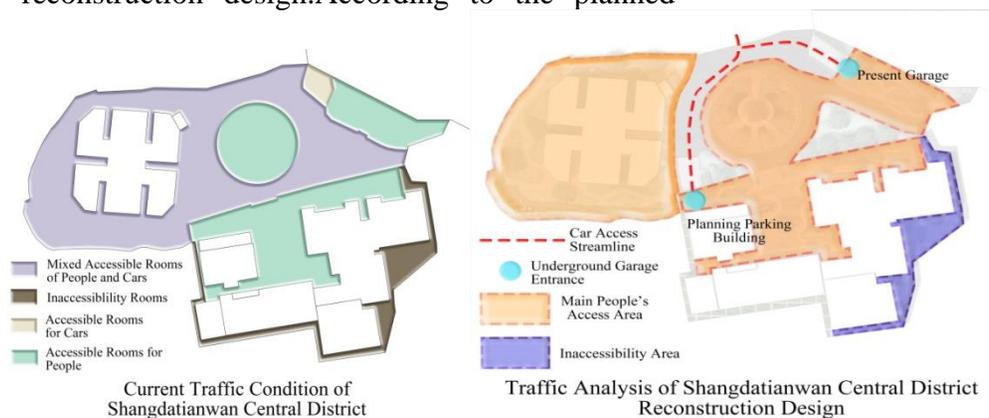


Figure19:Comparison of Traffic before and after the Reconstruction Design of Shangdatianwan Central District

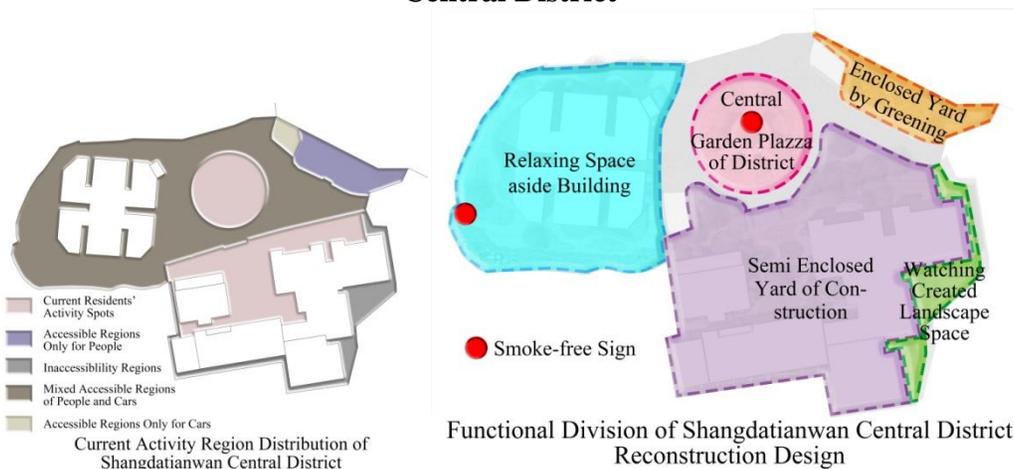


Figure20:Comparison of Functional Division before and after the Reconstruction Design of Shangdatianwan Central District

Design Highlights

Inspired by “Butterfly Dance”, the overall landscape is shaped with a dancing butterfly. The

design language with twists and turns is used to create rich and varied landscape forms, and recyclable local materials and plants with strong adaptability, drought resistance and water resistance, such as Lespedeza bicolor, water palm

bamboo, Chelidoniummajus, barracuda, Polygonumhydropiper, astilbe, hemerocallis, iris tectorum, Scirpustabernaemontani, lotus and water lily, are adopted in large quantities, especially in the construction process. Meanwhile, the balance of digging and filling is considered to reduce the cost of management and protection, and the artificial nature is reproduced, thus symbolizing the meaning

of the magnificent transformation of “natural regeneration of butterfly transformation” : representing the magnificent reconstruction of the old community-constructing a complete sponge landscape system and a strongly humanized and distinctive landscape, as shown in Figure 21.

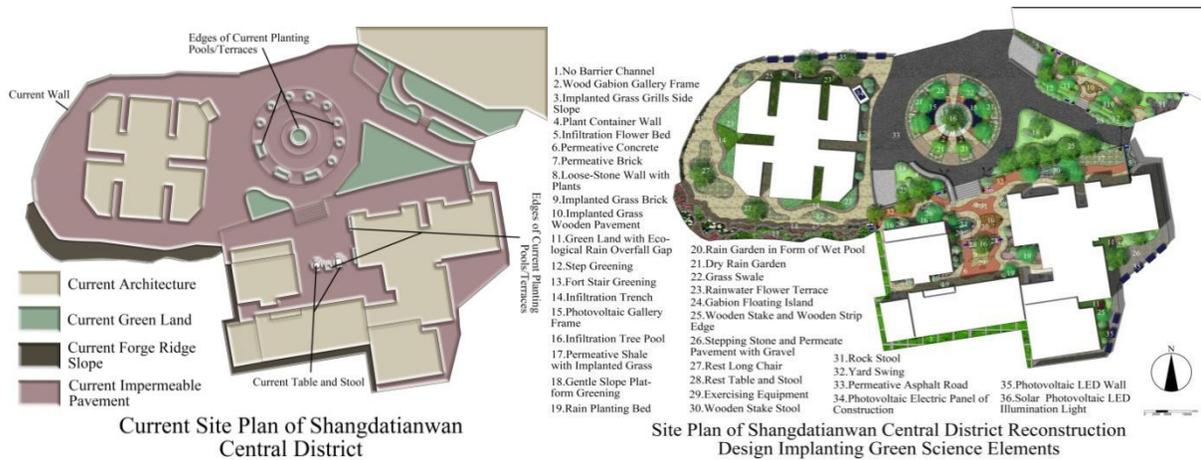


Figure 21: Site Plan of Shangdatianwan Central District Before and after Reconstruction Design

CONCLUSION

The calculated rainfall-runoff coefficient is reduced after the reconstruction design with the concept of green technology, which can effectively avoid waterlogging due to rain, water and rainstorm all year round. As a result, landscape facilities in the community have comprehensive functions, pedestrian and traffic flows are reasonably separated, barrier-free access is improved, and the safety of the vulnerable groups in the community is

improved. In addition, after the implantation of environmental protection and energy-saving elements, the community's native plants and various water-sensitive plants blend with each other, and the landscape is rich and pleasing to the eye, forming a blue-green landscape system,²⁸ which makes the life, entertainment and movement of residents in the community more convenient. The indicators and key area effects after reconstruction are shown in Table 2 and Figure 22-29.



Figure 22: Reconstruction Effect of Circular Central Square



Figure23:Effect of Original Hard Walls after Reconstruction



Figure24:Comparison between Old and New Environment on the West Side of Barrier-Free Access in Semi-Enclosed Courtyard



Figure25:Comparison between Old and New Environment in the Middle Part of Semi-Enclosed Courtyard



Figure26:Effect of Reconstruction on the East Side of the Steps of the Original Semi-Enclosed Courtyard



Figure27:Effect of Open Space after Reconstruction of Original Enclosed Courtyard Space



Figure28:Effect of Environmental Reconstruction on Northwest Side of Enclosed Courtyard Space



Figure29:Effect of the Reconstruction of the Stairs of the Original Enclosed Courtyard Space

Table 2		
Runoff indicators after reconstruction design of ShangdatianwanCentral District		
ShangdatianwanCentral District		
Types of underlying surface	Area (m ²)	Runoff coefficient
Gravel and dry bricklaying	181.3	0.4
Permeable pavement (including implanted grass grills side slope)	1266.16	0.3
Green space	944.25	0.1
Waters	18.97	1
Hard roof	1796.28	0.9
Impermeable firm ground	1177.36	0.85
Comprehensive rainfall runoff coefficient	0.59	

Annual total runoff control rate	77%
Total control volume of stormwater runoff(m ³)	71.23
Stormwater runoff pollution control volume(m ³)	77.64

Through the reconstruction design of Shangdantianwan Central Community in Yuzhong District of Chongqing with smoke-free environment and green technology, it is concluded that the reconstruction of old residential communities in mountainous cities with complex geography requires more scientific and technological elements of environmental protection, energy saving, safety and health²⁸⁻³². Healthy architectural practices should be integrated during architectural design, construction, transformation, operation and maintenance. Smoke alarm, e-cigarette warning, smoke-free home, smoke-free community and other facilities and publicity are implanted in community buildings and public recreation zones, which can improve the health self-discipline and heteromorphism effect of residents. To uphold the “pay attention to the landscape and technology at the same time, don't ignore the characteristics of auxiliary into” the reconstruction design concept, systematic and detailed, security and ornamental, scientific and humanistic union, creating a pleasant, livable, ikea, appropriate, appropriate rest residential landscape ecology, improve the quality of old residential living, and for other mountain characteristics of sponge old village transformation design to provide the reference.

Acknowledgements

This paper was financially supported by Chongqing Social Science Planning Project “Research on Sponging Reconstruction of Old Communities in Chongqing”(Grant:2020YBSH103), Chongqing Business and Economy Research Institution “Renewable Resource System of Chongqing and ‘Two Net Integration’ Construction Study”.

Author Declaration

This research is not funded by any organization related to tobacco production

References

1. Alecia Brooks, Tanya Buchanan, Wendy Oakes. Smoke-free environments: current status and remaining challenges in Australia. *Public Health Research & Practice*. 2020; 30(3):e3032022.
[doi:https://doi.org/10.17061/phrp3032022](https://doi.org/10.17061/phrp3032022)
2. Jennifer B Unger, Frank J Chaloupka, Donna Vallone, James F Thrasher, Destiney S Nettles, Tabitha P Hendershot, Gary E Swan. PhenX: environment measures for tobacco regulatory research. *Tobacco Control* 2020;29:s35-s42.
[doi:https://doi.org/10.1136/tobaccocontrol-2018-054469](https://doi.org/10.1136/tobaccocontrol-2018-054469)
3. Indira Debchoudhury and Shannon M Farley. Implementing smoke-free housing policies among multiunit housing owners in New York city between 2012 and 2015. *Tobacco Use Insights* 2019; 12: 1-10.
[doi:https://doi.org/10.1177/1179173X19859355](https://doi.org/10.1177/1179173X19859355)
4. Ngoc Bich Nguyen, Mike Capra, Kelly Johnstone, Hoang Lan Vu, Vu Tran, Minh Tham Nguyen, Kim Ngan Nguyen, Margaret Cook. Change in Compliance of Staff at 4 Vietnam Universities after the Enactment of Smoke-free Environment Decree. *Environmental Health Insights* 2020; 14: 1-8.
[doi:https://doi.org/10.1177/11786302209729](https://doi.org/10.1177/11786302209729)
5. Nienke W Boderie, Famke JM Mölenberg, Aziz Sheikh, Wichor M Bramer, Alex Burdorf, Frank J van Lenthe, Jasper V Been. Assessing public support for extending smoke-free policies beyond enclosed public places and workplaces: protocol for a systematic review and meta-analysis. *BMJ Open* 2021;11:e040167.
[doi:https://doi.org/10.1136/bmjopen-2020-040167](https://doi.org/10.1136/bmjopen-2020-040167)
6. Sabrina L. Smiley, Elexis C. Kierstead, Emily Harvey, Haneen Abudayyeh, Jennifer L. Pearson. An exploratory analysis of adult daily smokers' experiences using e-cigarettes in smoke-free places. *Tobacco Induced Diseases* 2018;16:54.
[doi:https://doi.org/10.18332/tid/98958](https://doi.org/10.18332/tid/98958)
7. Peeraya Suteerangkul, Sunee Lagampan, Surintorn Kalampakorn, Naruemon Auemaneekul. The effects of community participation program on smoke-free homes in a suburban community of Thailand. *Tobacco Induced Diseases* 2021;19:35.
[doi:https://doi.org/10.18332/tid/133876](https://doi.org/10.18332/tid/133876)
8. Meita Veruswati, Al Asyary, Edi Sucipto, Wahyu Sulistiadi, Abdillah Ahsan. Perceived community support about the implementation of a smoke-free environment regional regulations in the Tegal municipality. *Family Medicine & Primary Care Review* 2020; 22(3): 222-227.

Liu Fanyi et al.

Exploration on Landscape Reconstruction Design of Old Residential Communities Embedded with Green Technology Based on Smoke-Free Environment: Regarding Shangdatianwan Central District in Yuzhong District of Chongqing a Case

[doi:https://doi.org/10.5114/fmpcr.2020.98250](https://doi.org/10.5114/fmpcr.2020.98250)

9. Laura Twyman, Carla Cowles, Scott C. Walsberger, Amanda L. Baker, 'They're going to smoke anyway': a qualitative study of community mental health staff and consumer perspectives on the role of social and living environments in tobacco use and cessation. *Front. Psychiatry* 2019; 10:503.

[doi:https://doi.org/10.3389/fpsy.2019.00503](https://doi.org/10.3389/fpsy.2019.00503)

10. Carla J. Berg, Ana Dekanosidze, Arevik Torosyan, Lilit Grigoryan, Zhanna Sargsyan. Examining smoke-free coalitions in Armenia and Georgia: baseline community capacity. *Health Education Research* 2019; 35(5):495-504.

[doi:https://doi.org/10.1093/her/cyz024](https://doi.org/10.1093/her/cyz024)

11. Christina Heris, Katherine A Thurber, Darryl Wright, David Thomas, Catherine Chamberlain, Lina Gubhaju, Simone Sherriff, Bridgette McNamara, Emily Banks, Natalie Smith, Sandra Eades. Staying smoke-free: factors associated with nonsmoking among urban aboriginal adolescents in the study of environment on aboriginal resilience and child health (SEARCH). *Health Promotion Journal of Australia*. 2020;00:1-12.

[doi:https://doi.org/10.1002/hpja.430](https://doi.org/10.1002/hpja.430)

12. Martin Mlinarić, Laura Hoffmann, Pirjo Lindfors, Matthias Richter, SILNE-R study group. Enhancing implementation of smoke-free places: a comparative qualitative study across seven European cities enhancing implementation of most study across seven European cities. *Social Science & Medicine* 2020; 247:0277-9536.

[doi:https://doi.org/10.1016/j.socscimed.2020.112805](https://doi.org/10.1016/j.socscimed.2020.112805)

13. Lu Lu, Zhao Weifeng. Research on the green science and technology support system for the construction of ecological civilization. *Journal of Anhui Science and Technology University*. 2021, 35(1):89-93.

[doi:https://doi.org/10.19608/j.cnki.1673-8772.2017.091](https://doi.org/10.19608/j.cnki.1673-8772.2017.091)

14. Wang Yue. Discussion on the application of green technology in the renewal of Hutong. *Technology Wind*, 2020(13).

[doi:https://doi.org/10.19392/j.cnki.1671-7341.20201312](https://doi.org/10.19392/j.cnki.1671-7341.20201312)

15. A. Ferrante, G. Mihalakakou. The Influence of Water, Green and Selected Passive Techniques on The Rehabilitation of Historical Industrial Buildings in Urban Areas. *Solar Energy* 2001; Vol. 70, No.3, pp. 245-253.

[doi:https://www.elsevier.com/locate/solener](https://www.elsevier.com/locate/solener)

16. Ryan Shubin. How Blue-Green Infrastructure Can Create Liveable Cities and Address Climate Change. T. Schröpfer and S. Menz, Dense and Green Building Typologies, Springer Briefs in Architectural Design and Technology.

[doi:https://doi.org/10.1007/978-981-13-0713-3_9](https://doi.org/10.1007/978-981-13-0713-3_9)

17. Lisa Eckenwiler. Displacement and solidarity: An ethic of place-making. *Bioethics*. 2018; 32:562-56.

[doi:https://doi.org/10.1111/bioe.12538](https://doi.org/10.1111/bioe.12538)

18. C. Y. Jim. Sustainable urban greening strategies for compact cities in developing and developed economies. *Urban Ecosyst*.

[doi:https://doi.org/10.1007/s11252-012-0268-x](https://doi.org/10.1007/s11252-012-0268-x)

19. Ministry of Energy, Green Technology and Water, KETTHA, 2011. Guideline On Green Neighbourhood Planning Launched.

20. William Thompson, Kim Sorvig. Sustainable Landscape Construction: A Guide to Green Building Outdoors. *TRB Publication*.

[doi:https://trid.trb.org/view/680366,2001.6](https://trid.trb.org/view/680366,2001.6)

21. Siti Norjihan Jamaludin, Nik Hanita Nik Mohamad, Sharifah Khalizah Syed Othman Thani, Designing Conducive Residential Outdoor Environment for Community: Klang Valley, Malaysia. *Procedia-Social and Behavioral Sciences* 2014; 153: 370-383.

[doi:http://creativecommons.org/licenses/by-nc-nd/3.0/10.1016/j.sbspro.2014.10.070](http://creativecommons.org/licenses/by-nc-nd/3.0/10.1016/j.sbspro.2014.10.070)

22. Chen Peiqing, Lou Qian. Practice and Exploration of "Landscape + Sponge" Micro-update in Old Residential Areas--Nanban Alley Reconstruction Project in Hangzhou Shangcheng District. *Chinese Landscape Architecture* 2020; 36 (S2):77-80.

[doi:https://doi.org/10.19775/j.cla.2020.S2.0077](https://doi.org/10.19775/j.cla.2020.S2.0077)

23. Zhang Yujing. Brief discussion on sponge reconstruction of old residential quarter based on a case study of Huashan Huayuan sponge reconstruction pilot project. *Housing Science* 2020; 40 (08):25-28.

[doi:https://doi.org/10.13626/j.cnki.hs.2020.08.005](https://doi.org/10.13626/j.cnki.hs.2020.08.005)

24. Lu Bo, Lei Xiaoling. Construction Case of Mountainous Sponge City. *Beijing: China Building Industry Press* 2017.

25. Xuan Jinjin. Landscape Rehabilitation Design of Old Community Based on Sponge City Principle based on a Case Study of Guanghua Community of Zhenjiang City. *Housing Science* 2020; 40 (10): 39-42.

[doi:https://doi.org/10.13626/j.cnki.hs.2020.10.008](https://doi.org/10.13626/j.cnki.hs.2020.10.008)

26. Liu Weixun, Kang Zhen, Cai Dianqing, Han Yuan, Li Xinjian. Rehabilitation Method of Old North Residential Quarters under Sponge City Concept based on a Case Study of Tongzhou District Construction Quarter in Beijing. *Construction Technology* 2019; (07): 54-58.

[doi:https://doi.org/10.16116/j.cnki.jskj.2019.07.010](https://doi.org/10.16116/j.cnki.jskj.2019.07.010)

27. Martin Coyle. Low-energy urban landscape. *Guilin: Guangxi Normal University Press* 2017.

28. Shubin, R. How Blue-Green Infrastructure Can Create Liveable Cities and Address Climate Change. *Dense and Green Building Typologies* 2018; 55-63.

[doi:https://doi.org/10.1007/978-981-13-0713-3_9](https://doi.org/10.1007/978-981-13-0713-3_9)

Liu Fanyi et al.

Exploration on Landscape Reconstruction Design of Old Residential Communities Embedded with Green Technology Based on Smoke-Free Environment: Regarding Shangdatianwan Central District in Yuzhong District of Chongqing a Case

29. Lave, Lester B, Hendrickson, Chris, McMichael, Francis C. Recycling decisions and green design. *Environmental Science & Technology* 1994; 28(1): 19A-24A.

[doi:https://doi.org/10.1021/es00050a001](https://doi.org/10.1021/es00050a001)

30. Den, Walter; Chen, Chih-Hao; Luo, Yung-Chien (2018). Revisiting the water-use efficiency performance for microelectronics manufacturing facilities: Using Taiwan's Science Parks as a case study. *Water-Energy Nexus*, 1(2): 116-133.

[doi:https://doi.org/10.1016/j.wen.2018.12.002](https://doi.org/10.1016/j.wen.2018.12.002)

31. Hossain, Md. Faruque. Green science: Advanced building design technology to mitigate energy and environment. *Renewable and Sustainable Energy Reviews* 2017.

[doi:http://dx.doi.org/10.1016/j.rser.2017.08.064](http://dx.doi.org/10.1016/j.rser.2017.08.064)

32. Wang, Xin; Cho, Soo-Haeng; Scheller-Wolf, Alan. Green Technology Development and Adoption: Competition, Regulation, and Uncertainty—A Global Game Approach. *Management Science* 2020.

[doi:https://doi.org/10.1287/mnsc.2019.3538](https://doi.org/10.1287/mnsc.2019.3538)