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Streetscape Regeneration Based on the Walking-friendly Research ——An Example of Lijiao Urban Village Design

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Abstract

The revitalisation of urban villages as an important urban design issue is a diverse and complex topic with high research value. "Both 'pedestrian friendliness' and 'streetscape' emphasise the experience of the human visual dimension, with comfort and aesthetics of the street among the important design objectives. Streetscape quality is also an important factor in the pedestrian friendliness index. Since urban villages are usually small and the streetscape quality is not very high, this article aims to explore the streetscape renewal strategy in urban villages and uses pedestrian friendliness as the starting point for the research.

In the first chapter, through on-site research and analysis of the current situation, a number of problems related to pedestrian-friendly streetscape design in Lijiao village are identified (e.g. inadequate traffic planning resulting in large numbers of motor vehicles parking and taking up landscape resources, lack of consistent management of roads and lanes resulting in narrow or blocked lanes), while the characteristics of individual roads in the urban village (in particular, the height-to-width ratio of roads, the proportion of sky and green visibility to roads, the evenness of the road surface and other quantifiable indicators) are also identified. The study also found that the characteristics of each street in the urban village (in terms of quantifiable indicators such as the height-to-width ratio of the streets, the proportion of sky and greenery on the streets, and the evenness of the street surface) also form a unique and attractive streetscape of the urban village that has the potential to create a multi-level pedestrian experience, which forms the basis for the research and design objectives.

The study is design-led and focuses on design strategies. Based on the theoretical research findings and the factors influencing streetscape renewal, the indicators and contents of the streetscape renewal strategy from a pedestrian-friendly perspective are derived from the concept of pedestrian-friendliness and the evaluation indicators. Chapter 4 examines the indicators and design contents and proposes specific streetscape renewal strategies for Lijiao Village. Chapter 4 examines the indicators and design contents and proposes specific regeneration strategies for the streetscape of Lijiao Village. Finally, the macro planning strategies and the design strategies for intersections focusing on streetscape regeneration are presented in the context of the design outcomes.

The main focus of the paper is on the problem of the existing pedestrian friendliness rating system, which is too mechanical and general. Using a sample of 12 streets in

Lijiao Village, a correlation analysis between subjective evaluation of walking experience and various quantifiable indicators in streetscape is conducted to analyse the streetscape characteristics of streets with high pedestrian satisfaction and to establish regeneration strategies for different types of streets.

The study with a pedestrian-friendly perspective shows that streetscape is not just a discussion about aesthetics, but emphasises the design of a more human city from the human visual dimension. Just as "architecture is frozen music", music is judged by the sense of hearing and harmonic melodies must conform to music theory, which leads the author to consider whether certain "laws" in the design of streets are hidden in the image that emerges from the juxtaposition of street scenes from a pedestrian-friendly perspective, and thus the study is initiated.

Keywords：Streetscape;Wolking-friendly;Urban Village

摘要

城中村的更新作为城市设计的一个重要课题，其问题多样、复杂，具有很高的研究价值。“步行友好”与“街景”都强调在人视觉维度的体验，都以街道舒适度和美观度作为重要的设计目标之一，是回归以人为本设计尺度的两个重要概念，同时街景的质量也是影响步行友好指数的重要因素之一。由于城中村尺度普遍偏小、街景质量不高的特征较为突出，本文以探讨城中村街景更新策略为目标，将步行友好作为切入点进行研究。

第一章通过现场调研和现状分析，发现沥滘村街景存在的一系列与步行友好设计相关的问题（如不合理的交通规划造成大量机动车停放占用景观资源、街巷缺乏统一管理造成巷道狭窄或堵塞），同时发现城中村各个街道的特征（具体体现为街道高宽比、街道天空率与绿视率、街道界面平整度等可量化指标）也形成了独具魅力的城中村街景，具有打造多层次步行体验街景的潜力，为研究目标和设计目标奠定基础。

研究以设计为导向，以设计策略为重点，通过梳理步行友好概念和评价指标中有关街景更新的理论研究成果和影响因子，得出步行友好视角下街景更新策略需要聚焦的各项指标及内容，在第四章分别就指标和设计内容进行研究并提出针对沥滘村街景的具体更新策略，最后结合设计成果阐述步行友好下的宏观规划策略和以街景重塑为重点的节点空间设计策略，展示步行友好视角下街景更新的设计成果。

文章主要的研究重点在于解决行业现行步行友好评价体系过于机械笼统所伴随的针对性不强的问题。以沥滘村中 12 条街道为研究样本，进行步行体验的主观判断与街景中的各项可量化指标的相关性分析，分析步行满意度较高街道的街景数据特征，针对不同类型的街道指定更新策略。

以步行友好视角切入研究，说明街景不是简单地讨论美学，而是强调从人的视觉维度来设计更为人性化的城市。正如 "建筑是凝固的音乐"，音乐由听觉判断，和谐的旋律必定符合乐理，这也促使作者思考在街道的设计中是否有某些 "规律 "隐藏于步行视角下一幕幕街景所串连形成的画面中，由此展开研究。

关键词：街景更新；步行友好；城中村

Chapter1 Research Background

1.1. Urban Village in China

1.1.1. Development of Urban Villages

Urban villages or villages in urban areas are traditional villages that remain in urban areas, and are a unique phenomenon that has emerged in the process of urbanisation in China. In the narrow sense, they are rural villages that have become residential areas as a result of the expropriation of all or most of their farmland during urbanisation, with peasants becoming residents and continuing to live in their original villages(Figure1.1); in the broader sense, they are residential areas that lag behind the pace of urban development, are outside modern urban management, and have low living standards as a result of rapid urban development.

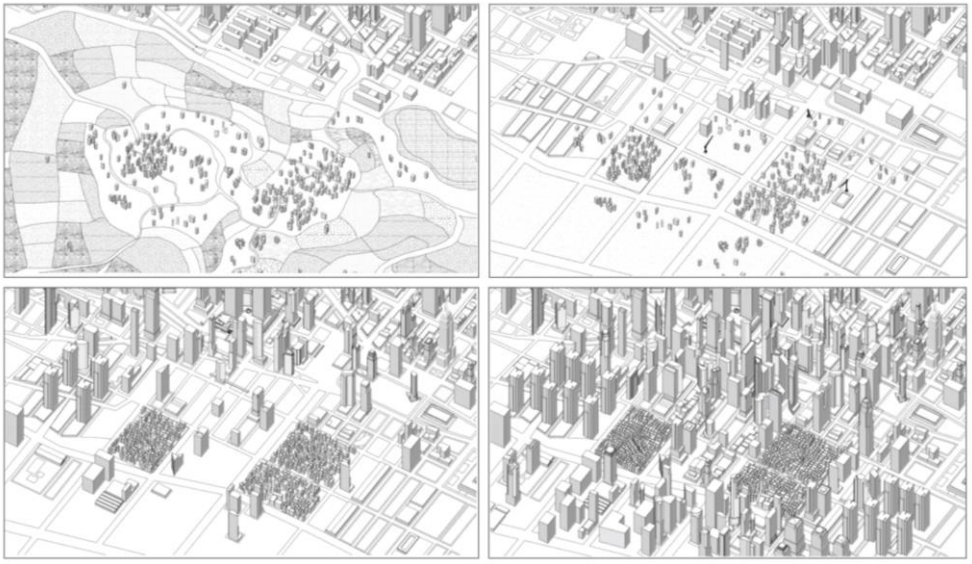


Figure1.1 Analysis of the Current Housing Situation in Lijiao Village
Source: Lecture of the Invisible City,He Jianxiang

1.1.2. The Situation of Urban Village Regeneration

Modernist architects believed that urban spaces, such as urban villages, were too densely built, causing a number of social problems. At the time, when sanitary conditions in cities were so poor, building high-rise buildings and leaving more land for parks and traffic was considered a blueprint for the future of cities. Fortunately, the planning in Paris at that time did not follow such a blueprint, but in fact, we are building such cities and such communities everywhere in China today. (He, 2018) Especially in areas near city centres, the homogenised neighbourhood approach is being replicated in cities across China, where buildings often exist only as financial

instruments, resulting in a lack of human design and often ignoring the hidden historical heritage, landscape patterns, and other valuable elements behind the city[1].

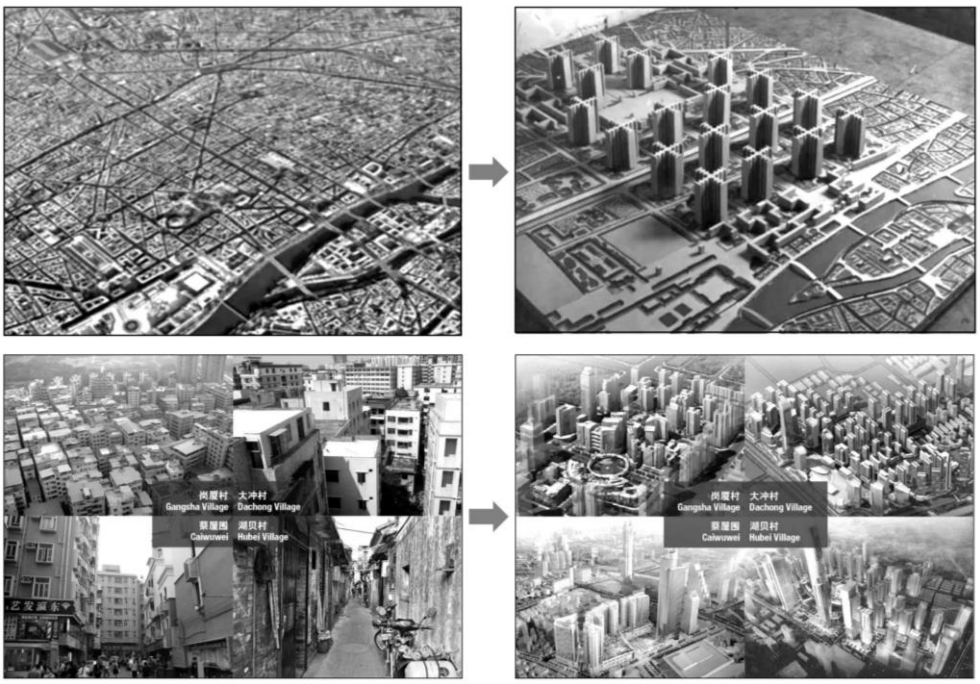


Figure1.2 Urban Village Regeneration in Shenzhen
Source: Baishizhou Exper Workshop,2013;Lecture of the invisible city,He Jianxiang

In 1940-1941, Cullen submitted his criticisms and findings about London in a book of notes for publication. He first opposed the metropolization of Britain before World War II II and argued for the preservation of its 17th-century urban character. He focused on the "pyramidal" architecture of the University of London Senate Library, Broadcast ing House, and the Langham Hotel, which were built of white ashlar. He argues that the materials used in these buildings are similar to those used in the University of London buildings. He argues that the materials and forms of these buildings undermine London's identity and create confusion between horizontal and vertical London, which "needs vertical elements such as towers, columns and domes inserted into it." Second, he sharply criticised the demolition of Bloomsbury, the construction of the University of London with its Senate Building, and the RBA's destruction of the harmony of Portland Palace, rejecting the utopian vision of the "City of Light." He called for a "new spirit to be breathed into the architecture of London," suggesting: 'I like London as it is, and the last thing I want is for it to become a 'shining city.' ... I do not like walking down the boulevards of the High Street. ... All I want is to give London a new spirit. "3 Finally, he turns his criticism from the Shining City to the group MARS. He scoffs, "The group MARS, the 'avant-

garde of British architecture,' has produced the most complete and profound design for London. But strangely, it seems to represent only the personal views of the Swiss-born Corbusier. It may seem perfect, but it is basically a cure for diseases by killing the sick[2].

Using the car as a criterion for new urban construction or redevelopment inevitably leads to the destruction of the urban fabric.

1.1.3. The Value of Urban Villages

Urban planners always desire to reinvent the world, but revitalising urban villages is not the only alternative. The demolition and construction of urban villages destroys much of the intangible cultural heritage, and this destruction is irreversible. The value of urban villages is reflected in the following points:

a. Intangible Cultural Heritage. In Ho Chi-sum's book The Chaos of Planning, it is mentioned that the value of urban villages is not limited to their material aspects, but also to their unique wisdom of life. Moreover, urban villages often have a certain history, and each village has a certain historical origin, which is a cultural heritage that is difficult to reproduce in urban planning.
b. An open community model. Compared to the modern large-scale housing estates, the urban villages preserve the original form of settlement structure, integrated into the city, with a mixture of diverse and dynamic functions. Their structure also conforms to the human scale of traditional streets and has greater potential for walkability.
c. Physical elements. Urban villages with a long history are often rich in valuable preserved buildings, natural elements, and unique regional features.
d. Diversity: urban villages have a high level of integration, a diversity of businesses, and a highly mobile population. This diversity makes urban villages extremely viable in large cities.

1.1.4. Streetscape in Urban Villages

Streetscapes in urban villages are often of low quality, but they are also often unique, and the cluttered spaces give people a sense of belonging, which is the charm of streetscapes in urban villages. The original streetscape in urban villages is often accompanied by notable problems, such as untidy street furniture, old and dilapidated facades, and inadequate greenery. Remodelled streets and alleys are

often unique, and this "wild growth" has resulted in a streetscape that is difficult for architects to design because it is diverse, complex, and uncertain(as shown in Figure1.3).In the context of urbanisation, there are a number of significant problems with the streetscape of urban villages. With the fundamental changes in traffic and transportation structures, the vehicle-driven development model has greatly neglected human scale and human perception, which has led to many urban problems. The widening and lengthening of urban streets has led to more and more pedestrian areas being replaced by roads and motor vehicles, the conflict between vehicular and pedestrian traffic on streets has intensified, and traditional neighbourhoods with a strong sense of life are facing enormous challenges. Streets are now used only as vehicular access routes, and the sense of human scale is diminishing, resulting in a lack of pedestrian spaces and traditional street life. In the context of new energy developments, the concept of environmental protection is no longer an obstacle that restricts the development of the car, and the design of pedestrian zones to promote healthy traffic behaviour is imperative.

Figure1.3 Streetscape Regeneration in Urban Village
Source: Old Hubei Village Regeneration,Urbanus Research Bureau

1.2. Purpose and significance of research

1.2.1. Purpose of Study

(1) Research the value of the village, restore the historic landscape and create a new village streetscape in the context of the times.

A look at Venice and many of China's historic districts shows that pedestrian areas are often blessed with unique conditions, such as the limits of the original size of the district, its strong historical atmosphere, and its labyrinthine and fascinating structure, which are difficult to create in the new urban planning.

In the face of the strong influence of globalisation on regional identity, the problem of

"one city among a thousand, cultural imbalance and similarity of appearance" has become an important problem in Chinese cities. For this reason, urban identity has become an important issue in the field of urban planning since the 21st century. However, under the influence of capital, power and profit, individualised architectural forms, strange styles that contradict regional culture, and grand narrative architectural scales have become means to eliminate the abuse of "zero identity" in cities. These are non-ordinary spectacles and urban anomalies that are difficult to interpret from the cognitive perspective of residents and do not represent identifiable features by which the city can communicate with its residents. The creation of urban features is a design proposal that creates a recognisable system of human-centred cities, a conception of urban design that has some value in the context of the return of "humanism."

(2) The influence of quantifiable indicators in the streetscape on walkability.

British Prime Minister Winston Churchill said that "people shape the environment and the environment in turn shapes people."[3]

The physical environment, consisting of specific spaces and elements distributed according to specific rules, has specific ecological characteristics, supports specific behavioural patterns, and provides the people who need it with a specific place to perform specific behavioural activities. As the small-scale systems closest to life in the human environment, places emerge as specific fixed behavioural patterns in environments that exhibit certain stable characteristics of the physical environment over time. While it is true that the built environment cannot determine all behaviours, it can be designed to facilitate the emergence of certain behaviours and inhibit certain behaviours.

Wang Jianguo, an academician with the Chinese Academy of Engineering, points out that China is now gradually moving to the fourth-generation paradigm of urban design - digital urban design based on human-computer interaction. The use of digital technologies in urban planning is both a result of the continuous development of Big Data and new technologies, and an effective way to push urban planning toward microscopic scale, detailed content, everyday spaces, and humanistic concepts. Big Data in the form of cell phone signal data, social network data, street map data, GPS tracking data, business data POI (point of interest), public transportation map data, and internet data LBS (location based service) can provide a deeper and more realistic picture of people and their lives in the city. It is possible

to quantify the behaviour of residents in the city and to capture the contextual patterns behind the various physical and spatial features and patterns of places with greater precision and granularity. The maturation and mobility of new technologies such as machine learning, virtual reality, physiological sensors, and eye-tracking are also opening new avenues for human-centred analysis of urban spaces and places.

While previous studies of landscape or walkability were often based on subjective assessments, this study combines subjective assessments with a set of objective facts to explore the correlation between quantitative factors and the walking experience to draw different conclusions that can be useful for design and thus guide the final design.

1.2.2. Significance of Research

(1) Discussion on the conservation value of Lijiao village.

In the process of urban planning, the village of Lijiao will also inevitably be razed to the ground. The value of preserving the village in an area of high density development is the starting point for this design study. The city is made up of a sequence of sections, from community to privacy, and the larger and more cluttered the city becomes, the more important the need for small, quiet spaces becomes. Lijiao village is such a quiet space, hidden from the metropolis, poetic and human, in contrast to the disorder, noise and dehumanisation of the big city. The streets of the village have not been created according to urban planning or building regulations, but have evolved spontaneously from the unwritten rules that have been in place for many years and are not seen in the planned city. Yoshiharu Ashihara points out that when streets that are spontaneously created for internal reasons are called "internal order" streets and streets that are built from the outside according to a plan are called "external order" streets, there is a deep sense that there is no "internal order" in such "internal order" streets. The "inner order" of the street is a place where the human touch and the tenderness of nature can be rediscovered in a way that is invisible to the inhabitants of the big city.

The 2011 UNESCO Historic Urban Landscape Recommendation initiative included "urban heritage" in its conservation charter, a document that defines the meaning of "urban heritage" and the need for "This document defines the meaning of 'urban heritage,' provides guidance on the criteria for measuring 'authenticity,' and advocates for the conservation of urban architecture and historic landscapes as

integral heritage in their diversity." Current research on 'urban heritage' and 'urban authenticity' has been brought into the conversation as a counter to homogeneous urban renewal models, which is a common strategic dilemma in the field of urban design under the influence of globalisation. Authentic urban heritage refers to a local, original culture created collectively by urban residents, which is reflected in communal spatial forms, lifestyles, and vibrant neighbourhoods and social networks.

The above list of characteristics, historic values, and significance of Lijiao Village, including its structure and water system, historic buildings and ancient banyan trees, and distinctive streets and alleys, is intended to provide a sufficient planning basis for the preservation of Lijiao Village and to advocate that the City avoid blanket planning and begin detailed planning and design from the bottom up.

(2) Targeted design strategies for pedestrian-friendly optimization of streets.

In the era of rapid development of the Internet, the "fast food" lifestyle represented by Taobao and the take-away industry has gradually changed people's daily travel needs, especially under the influence of the new corona epidemic, "working at home" and "online lectures" have become the norm. While the convenience of living in China is extremely high compared to abroad, the need to travel is also decreasing. Vito Acconci's book Public Space in a Private Time points out that in the electronic age, the concept of public space has been extended to cyberspace, meaning that cyberspace is also a public space. Does the development of the Internet interfere with real life? Is the design of the built environment also being swallowed up by the "meta-universe"? The play between real life and cyberspace in the movie "Top Gun" is thought-provoking.

In this context, this paper addresses the question of how to improve the attractiveness of street space, using the streets of urban villages as a representative example. Business development in a small neighbourhood is like the survival of the fittest, gradually improved by supply and demand. The result of natural survival of the fittest is often more realistic than a formulaic conclusion.

The current evaluation criteria for pedestrian friendliness are mostly based on the accessibility of various functions, which is clearly not the biggest contradiction in Lijiao Village. This study focuses on the most important aspects of pedestrian friendliness based on the project characteristics to maximise the value of Lijiao Village.

(3) Value Orientation

A good pedestrian environment has many benefits such as promoting the health of citizens and contributing to social and economic development. At the same time, the urban environment should have the obligation to shape the aesthetic sensibility of the citizens. And as a public space, the street has the right to share its value regardless of all walks of life. Improving the quality of a street's appearance also helps attract more pedestrians and gives city residents a visual pleasure when walking, and is a responsibility that urban planners should take on. Pedestrian neighbourhoods bring many values, such as economic, social, human, health, and environmental.

Table 1.1 The Value of Wolking-Friendly Street

Benefits	Research evidence
moting economic prosperity	The convenience of walking increases the number of people who shop there, and for ever facilities, there is a return of $11.80.
Good for local business	Retail sales in Brooklyn, New York, have increased 172% since the parking lot was conv less people drive, the more money they spend locally.
Improving efficiency	Walking increases creative performance by an average of 60%, and people are more likely
couraging more investment	The city's investment in walkable public space could then spur further investment in the sar Park has sparked $2 billion in private investment in the surrounding area.
ttracting the creative class	The communities that are most walkable have much higher GDP per capita and more unive
dding value to the property	A pedestrian mall can increase the price of a home by $82 per square foot. Being a landl per month.
tivating the street frontage	In New York City, the expansion of the Union Square pedestrian mall has reduced commer
educing the cost of traffic congestion	In the San Francisco Bay Area, businesses lose $2 billion a year because employees get stu
avings in construction and maintenance costs	A sedentary lifestyle imposes enormous medical costs. The United States spends $190 bi obesity-related diseases alone.
cing the cost of public health care	A sedentary lifestyle imposes enormous medical costs. The United States spends $190 bi obesity-related diseases alone.
king cities more competitive	When Melbourne redesigned its pedestrian zone, its population increased by 830% and it livable city" by economists for the fifth year in a row.
tool for urban regeneration	Improving the walkability of communities can spur urban renewal. In Madrid, pedestrianis investment in new sports facilities, plazas, cafes, and historic landmarks.
Making travel safer	Good street design and speed buffer policies can significantly reduce the risk of acciden reduce the risk of fatal pedestrian accidents by 6%.

Reducing crime	In Kansas City, USA, the crime rate dropped by 74% when some streets were closed to car
courage people to drive less	When Copenhagen turned its main streets into pedestrian zones, pedestrian traffic increa year.
romoting public transport	Better sidewalks will make people more likely to use public transportation than to drive.
Can stimulate creativity	Walkable neighbourhoods more likely to attract public street art and outdoor events.
Generating Social	Walkable streets bring people together who might not otherwise meet.
gthening community identity	In Ireland, a study found that people who live in pedestrian-friendly communities have c than those who live in car-friendly areas.
upporting cultural heritage	The pedestrian zone of Beijing's Sanlitun alone attracts droves of tourists, which in tu surrounding alleys might otherwise disappear.
Longevity	For people over 60, a 15-minute walk per day can reduce the risk of death by 22%.
Weight loss	A normal-weight adult burns 100 calories during a 30-minute walk; those who walk 6,00 obesity by 4.8%.
ce the risk of chronic diseases	Regular walking reduces the risk of diseases such as type 2 diabetes, heart disease, and colo is a major cause of most chronic diseases.
vill make it more enjoyable	It costs 40% more money to commute an hour by car to feel as happy as someone who wa walking a day can improve mental health.
ing reliance on non-renewable resources	Cars consume most of the fuel stored on earth today. In contrast, energy can be gained whe pavements.
Maximising land savings	Sidewalks and bike lanes are more compact than roads and make life easier in densely opposed to traditional car-dependent suburbs.
reduce environmental noise	On the first car-free day in Paris, the noise level on the main roads dropped by 3 decib streets easier to walk on and reduced the noise around them.
elps to improve the urban microclimate	Paved streets can cause a heat island effect in cities, and shaded, planted sidewalks can he as 9 degrees Celsius on a hot summer day.
proving water management	Pavements with permeable surfaces help absorb water and reduce flooding during heavy ra
aking cities more resilient	Walkability makes cities more resilient to disasters.

Source: Self-drawn by the author based on content from the internet[4]

1.3. Project Conditions

1.3.1. Overview of Lijiao Village

With a history of 900 years, Lijiao Village is known as "the largest ancient reform in the centre of Guangzhou" and is an important part of Haizhu Innovation Bay. About the origin of the name Lijiao, Qu Dajun, a famous scholar from Lingnan in the late

Ming and early Qing Dynasties, wrote in the Guangdong New Language, "All water is called sea, ... those who ride boats and rafts are called river, those who do not ride oars are called water. The place where the two waters meet is called Jiao." In the Guangzhou dialect, Li(沥) means "branch of the river downstream of the Pearl River"; Jiao（滘） means "branch of the river", and the combination of the two words makes Lijiao（沥滘）. After the reform and opening up of the rural area, the rural economy began to change, and Lijiao village was filled up and turned into a tenement house, which is no longer on the waterfront[5].

Figure1.4 Analysis of the current housing situation in Lijiao Village
Source: Self-drawn by the author

1.3.2. Location Background and Policy

Lijiao Village is located in the south of Guangzhou, on the northern bank of the Lijiao Waterway of the Pearl River. In accordance with the overall plan of Guangzhou City for the development and construction of the Pearl River Scenic Belt, Haizhu County has proposed the development concept to upgrade the two riverbanks and the three belts forming the economic belt, the innovation belt and the landscape belt of the front and back channels of the Pearl River, which are integrated into the development of the Guangdong-Hong Kong-Macao metropolitan area, and has carried out the overall development planning of the Haizhu Innovation Bay area. Bordered by Haizhu Lake to the north, the Pearl River back channel to the south and the South China Expressway to the east, Lijiao is located at the southern end of Guangzhou's new central city axis. As the "last kilometre" of the southern end of the new urban axis, the Lijiao area of Haizhu Innovation Bay has the planning role of continuing and deepening the new urban axis and helping Guangzhou realise its grand vision of a 12 km urban axis. The Lijiao area of Haizhu Innovation Bay will be developed into the central gateway to the south of Haizhu, a waterfront ecological and technological

innovation cluster in the southern section of Guangzhou's new central city axis. Haizhu District has fewer economic and commercial areas overall compared to Guangzhou. The ancient village of Lixuma has a profound humanistic history, and these unique cultural customs and exquisite traditional buildings can become a trademark for cultural tourism in Guangzhou and promote the development of cultural and commercial activities in Lixuma. The area will become a cluster for high-end business and creative industries, a "multi-charm cultural showcase" on the city's science and technology innovation axis, an area for cultural tourism and a transportation hub connecting Guangzhou and Foshan, a high-end living and residential area along the Pearl River back channel, and an "international waterfront cultural centre" with international influence. ". At the level of Guangzhou city, the area is at the centre of three strategic nodes: the international shipping node, the international air transportation node and the international science and technology innovation node, and becomes an important base for the pattern of "multi-point support". At the level of Haizhu District, the area is located at the intersection of the urban science and technology innovation axis and the waterfront of the Pearl River back channel of "one river, two banks and three belts", and together with Pazhou Internet Innovation Cluster and CUHK International Innovation Valley, forms the three key development areas of Haizhu District, namely "one district, one valley and one bay"[错误!未找到引用源。].

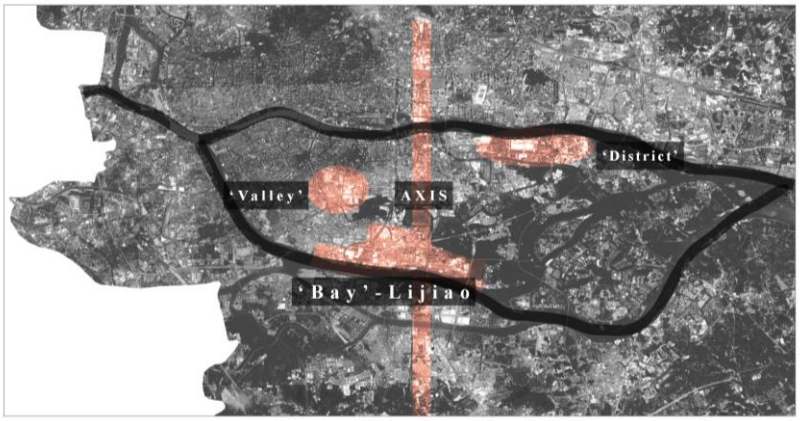


Figure1.5 Location Analysis
Source: Self-drawn by the author

1.3.3. Scope of the Research

(1) Lijiao Area Planning Area and Urban Design Area

The Lijiao area planning area is the Haizhu Innovation Bay area (as shown in Figure1.6), which extends from Haizhu Lake Park in the north to Daganwei in the

west and Erwei Chung in Xiaozhou Village in the east to the administrative boundary of Haizhu District in the south, and has a total area of about 9.82 square kilometres (8.06 square kilometres after deducting the water area of the Pearl River back channel). The core area of urban planning covers a total area of 600 km^2 错误!未找到引用源。.

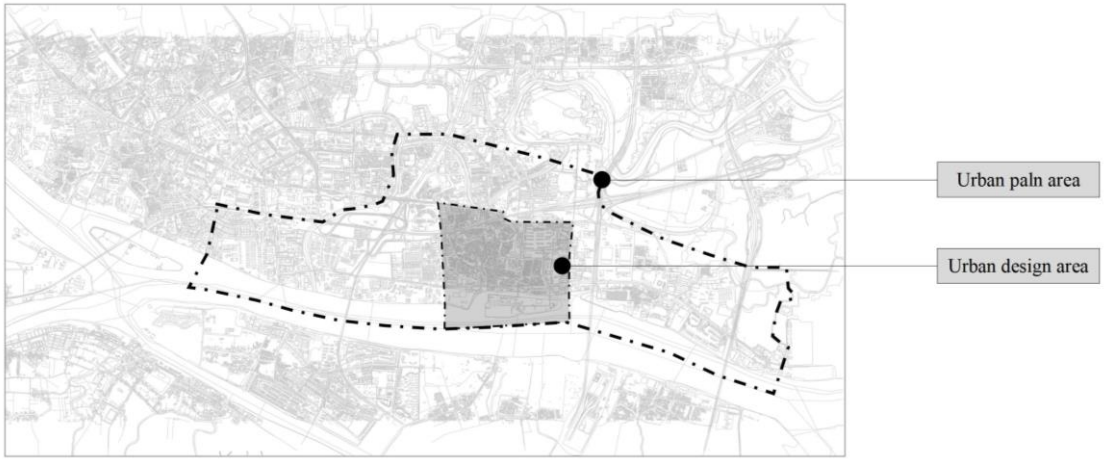


Figure1.6 Urban Design Area
Source: Self-drawn by the author

(2) Research Objects

Victor Dover, in Street Design, says, "The design of a city begins with the design of its streets. A good city needs good streets, places where people enjoy spending time. Streets should be safe and comfortable, they should be interesting and beautiful." In urban design, on the one hand, the boundaries of the buildings determine the external spatial form of the street, and on the other hand, the buildings form the urban landscape as works of art. Even in the Acropolis, much thought was given to the visual dimension, from the movement of the decorative landscape sequences to the proportions and perspective of the building facades, which testify to the cleverness of the visual dimension. A pedestrian-friendly orientation also implies a more nuanced approach to design rather than a one-size-fits-all planning approach; Gaston Pachelard has said that "poets often see the great in the small," and Cullen's reference in Cityscape to a "continuous landscape" is perhaps one such perspective. At the same time, the subtle view has the disadvantage that there is no guarantee that a slum of low-rise row houses will not result if the very subtle plan is ignored [错误!未找到引用源。].

Based on a preliminary understanding of the current situation of Lijiao village, the streets in Lijiao village were selected as the main artery for the design study to deal with the most conspicuous street spaces in the urban village, with the design goal of not being friendly and proposing a local regeneration strategy. In order to ensure the smooth implementation of the study, 12 streets with sufficient information about the current streetscape were selected as the main objects of the study(as shown in Figure1.7). They are Fusiyue Street, Nanan Street, East Street, Wuyuehou Street and Lijiao Street, Shuiji Street, Dashi Street and Wuyue Street, which are located on both sides of Lijiao River.

The refined design objects are the various nodes along the 12 streets, including major entrance areas, traffic intersections, key streets, etc.

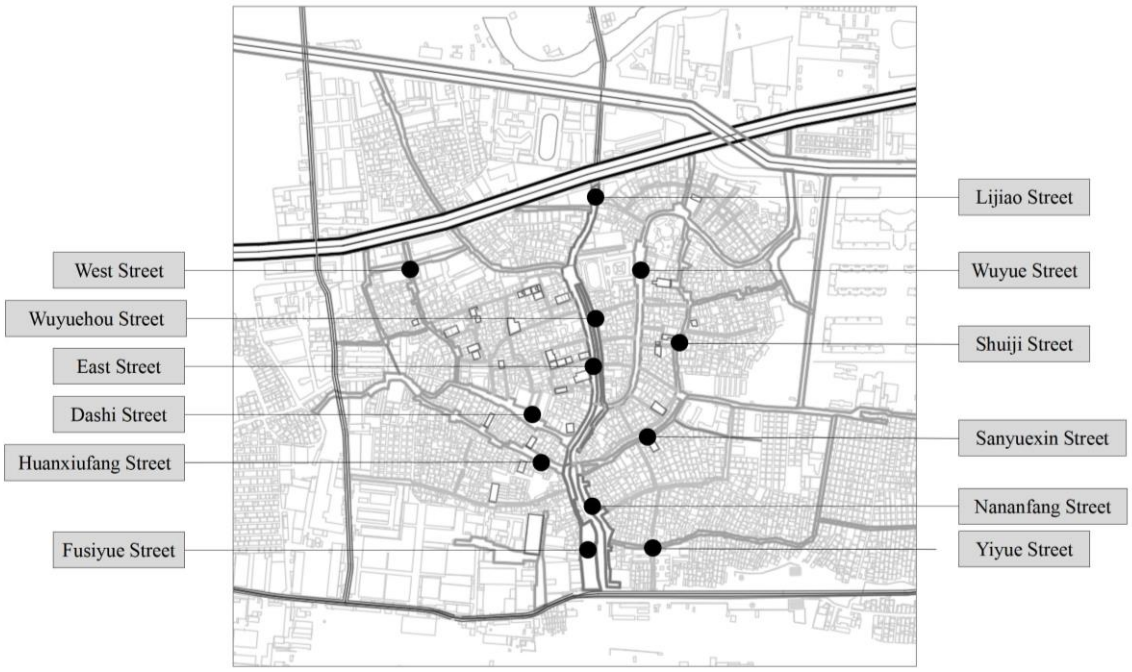


Figure1.7 Map of the Twelve Streets in Focus
Source: Self-drawn by the author

Table 1.2 List of 12 streets in focus

Main street
Fusiyue Street(沥滘副四约大街)
Nanan Street(南安坊大街)
East Street(沥滘东街)
Wuyuehou Street(五约后街)
Lijiao Street(沥滘大街)
Wuyue Street(五约大街)
West Huanxiufang Street(沥滘环秀坊大街)
Sanyuexin Street(三约新街)
Shuiji Street(沥滘水基大街)
Dashi Street(沥滘大市街)
West Street(沥滘西街)

Source: Self-drawn by the author

1.3.4. The Value of Lijiao Village

(1) Streetscape of Lijiao Village

From the perspective of urban road level, it can be divided into urban highway, urban main road, secondary road and secondary road, etc(as shown in Figure1.8); from the perspective of road construction function, it can be divided into commercial road,

residential road and mixed road, etc(as shown in Figure1.9); from the perspective of the characteristics of the road in urban life, it can be divided into monumental road, recreational road and historical and cultural road, etc. Some scholars consider the type of street use, traffic characteristics and landscape characteristics to divide streets into residential streets (including pedestrian shopping streets), traffic streets and other pedestrian areas. According to the research content of this paper, streets are also classified according to this classification, where urban arterial streets are used as a network to connect different areas of the city, with traffic functions and high traffic flow and speed, and the main users are mainly motor vehicles, while non-motorised vehicles and pedestrians are less used. It has a social function with low traffic flow and slow traffic speed, and is mainly used by the residents of the street, residents and pedestrians.

Figure1.8 Road grade map of Lijiao Village
Source: Self-drawn by the author

Road classification table

	Life (h)	Commercial (h)	Transportation (h)	Landscape (h)	Industrial (h)	General (h)	Specific (h)
Expressway (A)	-	-	 At (Guangzhou Ring Road)	-	-	-	Bx Pedestrian Street
Main roads (B)	Bh Life Street	Bs Commercial Street	 Bt (Nanzhou Road)	Bj Landscape Avenue	Bg Industrial Avenue	Bz Comprehensive Avenue	Qx Riding Street
Secondary roads (C)	 Ch (Lijiao Shuji Street)	Cs Commercial arterial roads	 Ct (Lijiao Road)	Cj Landscape arterials	Cg Industrial Trunk Road	 Cz (Lijiao East Street)	GX Shared Streets Sx Community Roads
Branch Road (D)	 Dh General Street	 Ds West Street Market	-	DJ Leisure Street	Dg Park Branch Road	Dz Integrated streets	Mx Green Space Slow Walk

Source: Self-drawn by the author based on the Complete Elements of Guangzhou Roads

Figure1.9 Analysis of street types in Lijiao Village
Source: Self-drawn by the author

The streets and alleys within Lijiao village are different from the surrounding streets. For example, Huandao and Lijiao Road in the far south are near the Pearl River and the commercial port, giving a very open view and relaxed atmosphere; Lijiao Shuiji Road in the east is near the housing estate and has many stores in the streets, which are clean and tidy and full of life; Guangzhou Ring Road in the north forms the space under the bridge(as shown in Figure1.10);The various streets in the village are either shaded by trees and quiet or crowded and chaotic with traffic. Therefore, it is necessary to carry out targeted studies and designs that take into account the different characteristics of each street in Lijiao.

Figure1.10 Streetscape of Lijiao Village
Source: Self-drawn by the author

(2) The Historic Fabric and Water System of Lijiao Village

The name of the village accurately describes the terrain in which it is located, and the branching water system consisting of more than 10 thin springs makes Lijiao unique among the many water villages along the Pearl River. During the Ming and Qing dynasties, two clans developed in Lijiao, the Luo and the Wei. People settled here for generations, and the village was divided into several settlements along the water. The topography of the city and its cultural character have a great influence on the spatial form of the streets, and the different types of streets have different characteristics. The social activities that take place in the streets, such as stopping to talk, walking, and playing sports, promote residents' understanding of society and themselves.

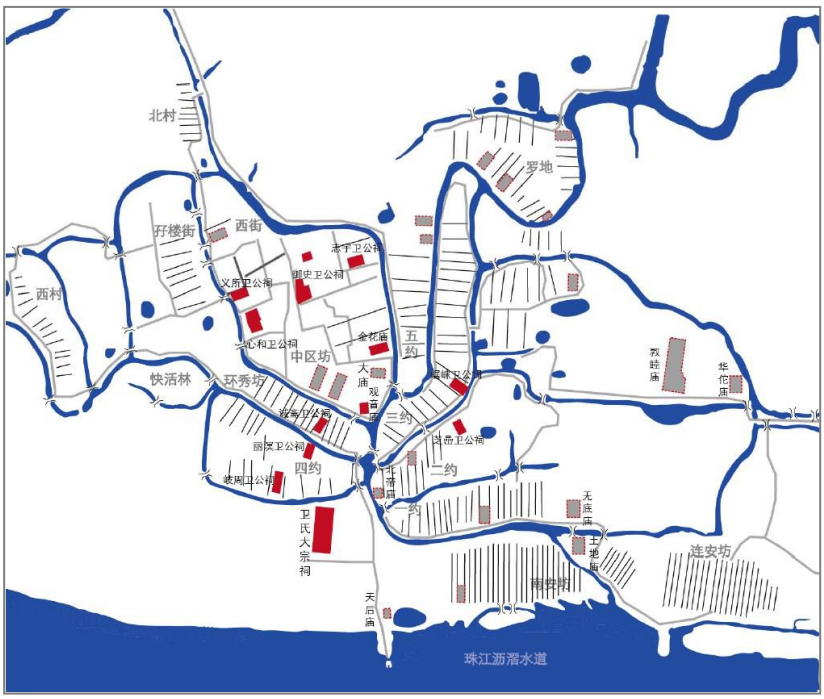


Figure1.11 The Historic Waterways of Lijiao Village
Source: Heritage and Development-Case Sharing of the Chapter on the Protection of Historical and Cultural Heritage of Lijiao Village

(3) Historic Buildings and Ancient Banyan Trees

The natural environment of Lijiao Village was originally typical of Lingnan Water Village, with more than 30 ancestral halls regularly distributed along the river, making it one of the most complete ancestral hall complexes in the Guangfu region over the centuries. The 12 preserved ancestral halls are remains of wooden structures from the Song, Ming, Qing and Republican dynasties. The Wei clan ancestral hall was built in 1615 after fundraising began in 1594. The size and fine workmanship of the building have aroused great admiration among people of all generations. In 1993 it was declared a municipal heritage site.

Scattered around the village are a number of residences of historical and humanistic value, or the former residences of famous people from the late Qing and Republican periods, which bear witness to the historical development of humanities and commerce in Guangzhou. Although some of the buildings themselves are not made of particularly valuable materials, their handicraft decorations such as mountain flower walls, Shiwan pottery roof ridges, oyster shell walls and fine wooden lattice windows are of exquisite craftsmanship and very valuable to study and appreciate.

Only 13 of the 30 ancestral halls have been demolished, and most of the remaining ones are not effectively protected. The Shiya Weigong Ancestral Hall has been

turned into a leaching book, the Zhiyu Weigong Ancestral Hall into a summer school, and the Horai Weigong Ancestral Hall into a paper cup making workshop. The old brick and green-tiled buildings of the Wei Gong Imperial Palace, tucked away in an alley in the central district, have been converted into dormitories for civilian workers; the "red shrine" of Xinhe Wei Gong on West Street is in a dilapidated state, and the Zhiyu Wei Gong Ancestral Hall has been alternatively demolished. Numerous traditional dwellings have been demolished or remodelled, and old houses of historical value have been demolished, leaving less than 30 of the hundreds of Ming and Qing houses remaining. The only remaining temples of any size are the slightly larger Pak Tai Temple, which is still venerated by villagers from time to time, and a few small country temples along the roadside. Many of the historic sites have long since been moved and fallen into disrepair, presenting a picture of broken ruins and overgrown weeds.

There are 38 immovable cultural heritage sites and references in and around Lijiao Village(as shown in Figure1.12 and Table1.3). The information is listed below in order of importance by number:

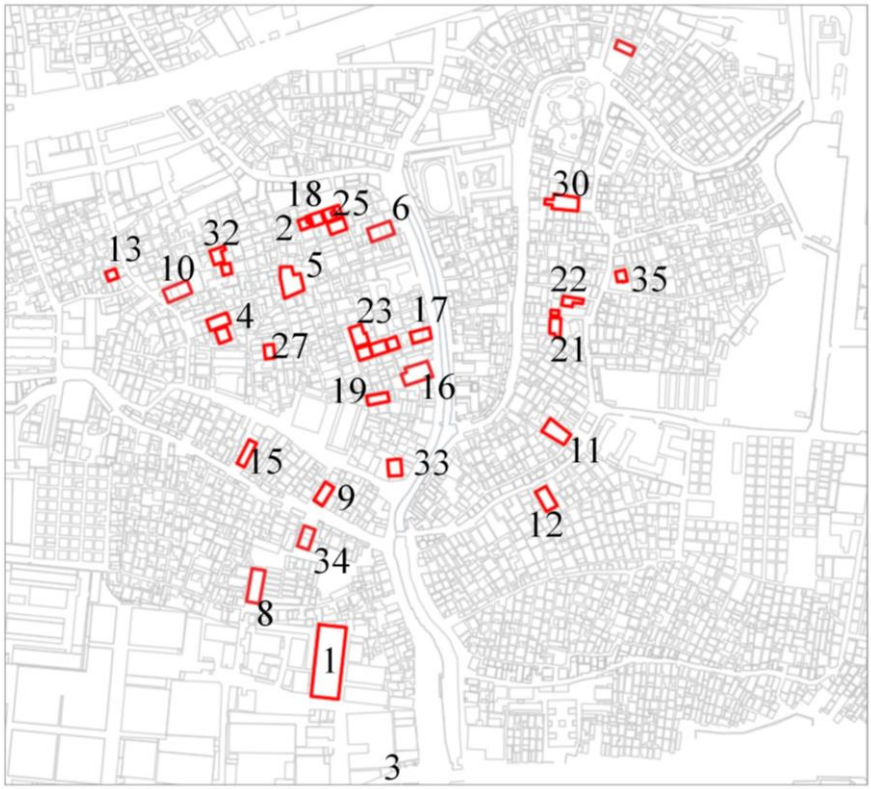


Figure1.12 Map of Protected Buildings in Lijiao Village
Sorce:Self-drawn by the author

Table 1.3 Immovable Cultural Heritage and Cultural Heritage Protection Units in Haizhu Bay (Lijiao Area)

Number	Name	Level of protection
1	Leelu Wei Clan Ancestral Hall (沥落卫氏大宗祠)	Guangdong Cultural Relics Protection Unit
2	Wei Guoyao's former residence (卫国尧故居)	Guangdong Cultural Relics Protection Unit
3	Boundary markers in Leyland Canton (沥溶广州市界碑)	Guangdong Cultural Relics Protection Unit
4	Xinhewei Ancestral Hall (心和卫公祠)	Registered and protected cultural heritage units in Haizhu District, Guangzhou
5	Yushiwei Ancestral Hall (御史卫公祠)	Registered and protected cultural heritage units in Haizhu District, Guangzhou
6	Zhiyuwei Ancestral Hall (志宇卫公祠)	Registered and protected cultural heritage units in Haizhu District, Guangzhou
7	Shiyawei Ancestral Hall (石崖卫公祠)	Registered and protected cultural heritage units in Haizhu District, Guangzhou
8	Qizhouwei Ancestral Hall (岐周卫公祠)	Immovable Cultural Relics in Haizhu District, Guangzhou City, Guangdong Province
9	Limingwei Ancestral Hall (丽溟卫公祠)	Immovable Cultural Relics in Haizhu District, Guangzhou City, Guangdong Province
10	Yisuowei Ancestral Hall (义所卫公祠)	Immovable Cultural Relics in Haizhu District, Guangzhou City, Guangdong Province
11	Juelai Ancestral Hall (崛崃卫公祠)	Immovable Cultural Relics in Haizhu District, Guangzhou City, Guangdong Province
12	Zhiyanwei Ancestral Hall (芝岩卫公祠)	Immovable Cultural Relics in Haizhu District, Guangzhou City, Guangdong Province
13	Zhaochang House (肇昌堂)	Historic buildings
14	Former site of the repair workshop (修造厂旧址)	Historic buildings
15	House No. 4,Huanxiufang street (环秀坊大街 6 号民居)	Historic building trail
16	House No. 4,East street (沥滘东街 2 号民居)	Historic building trail
17	House No. 2,Ally 2,East street (沥溶东街二巷 2 号民居)	Historic building trail

18	House No. 3,Ally 7,East street (沥滘东街七巷 3 号民居)	Historic building trail
19	House No. 3,5,Ally 1,East street (沥溶东街一巷 3、5 号民居)	Historic building trail
20	House No.1,Shuiji street (沥溶水基大街 1 号民居)	Historic building trail
21	House No.11,Wuyue street (沥滘五约大街 11 号民居)	Historic building trail
22	House No. 12,Wuyue street (沥溶五约大街 12 号民居)	Historic building trail
23	House No. 4,6,Ally 10,East street (沥溶东街二巷 4、6 号民居)	Traditional style architectural clues
24	House No. 4,Ally 10,East street (沥溶东街十巷 4 号民居)	Traditional style architectural clues
25	House No. 15,Ally 10,East street (沥溶东街十巷 15 号民居)	Traditional style architectural clues
26	House No. 7,Ally 5,East street (沥溶东街五巷 7 号民居)	Traditional style architectural clues
27	House No. 5,Ally 2,Central Leach (沥溶中区二巷 5 号民居)	Traditional style architectural clues
28	House No. 6,Ally 2,Central Leach (沥溶中区坊 6 号民居)	Traditional style architectural clues
29	Ancestral Hall (诚斋卫公祠)	Traditional style architectural clues
30	Ancestral Hall (大夫卫公祠)	Traditional style architectural clues
31	Lijiaonan Temple (沥溶南庙)	Traditional style architectural clues
32	House No. 5,Ally 10,East street (沥滘东街十巷 5 号民居)	Traditional style architectural clues
33	Beidi Temple (沥滘村北帝庙)	Traditional style architectural clues
34	House No. 3,Ally 2,Fusiyue street (沥澹副四约北二巷 3 号民居)	Traditional style architectural clues
35	House No. 9,Ally 2,Samyue street (沥溶三约北街九巷 2 号民居)	Traditional style architectural clues
36	House No. 17,Ally 1,Central Leach (沥溶中区一巷 17 号民居)	Traditional style architectural clues
37	House No. 4,Ally 10,East street (沥溶东街 5 号民居)	Traditional style architectural clues
38	Former site of the repair workshop (交通部四航局船舶修造厂旧址)	Traditional style architectural clues

Source: collated and drawn by the author

The landscape of ancient banyan trees gives each ancient village settlement a unique atmosphere. The ancient village of Lijiao in Guangzhou, founded 900 years ago, is in danger of total destruction, and there are more than 20 ancient trees left(as shown in Figure1.13), most of which are different kinds of banyan trees and urgently need to be preserved. Ficus microcarpa is a tree of the genus Ficus in the mulberry family, native to tropical Asia. Ficus microcarpa is known for its unusual shape, lush foliage and huge canopy. The aerial roots that grow from the branches extend into the ground to form new trunks, also known as "columnar roots". Ficus trees can grow up to 30 feet tall and stretch freely in all directions, with the buttress roots and branches intertwining to form a dense jungle [错误!未找到引用源。].

Some designers do not like the arching effect that the mighty roots of the banyan tree have on flooring and walls - "banyan trees do not tolerate people," as they say. In fact, it is possible to turn a negative into a positive. With the physiological characteristics of the banyan tree such as soil roots, aerial roots, branches and thick beards, the tree can be maintained, guided and pruned to create many interesting plant landscapes. For example, banyan bridges spanning the banks of rivers, banyan gates with branches on both sides of the road at the entrance of the village, banyan caves that can be protected from wind and rain like pavilions and galleries, and banyan branches for people to sit and lie on near the ground. Since the banyan tree can form a large public shade area under the ceremony space, it can define an "umbrella-like" place. In short, they are places of remembrance, places of ecological and humanistic interest worthy of appreciation.

The poem "Banyan Yin Asking for the Moon", one of the eight ancient scenes of Lignuma, is about the combined scenic effect of the elements of "river, water, clouds, banyan and moon". The cultural landscape of "Banyan Yin" gives people an immediate feeling of closeness to the heart, a strong piece of "nostalgia" that cannot be stopped and cut off. Although there is no way to identify these specific landscapes, when you come to the old Lixol ferry terminal, the modern Lixol dock and the contemporary remains of Banyan Tree Boundary Park, it seems that you can still vaguely experience the residual charm of one of the eight picturesque places in the waterfront city.

According to the preservation survey, there is an old mulberry tree and egg plant near the Wei Gong Ancestral Hall in Lixol, which have historical ornamental value, and a large red cotton tree near the Chung River, which is four to five people tall and

bears bright red flowers in spring. On the grounds of Zhaochangtang Garden, there is a longan tree that has been growing for over 100 years, and at No. 14 Sanyuebei Street, there is a sweet and sour "mandarin duck peach tree" that is Wei Qi Xi's "ancestral property" and has been carefully guarded for over 100 years. The large banyan in front of the village's health centre is comparable to the one on the pier, and below it is the "Tai Gong Bu Tou", a magnificent tree whose branches cover the river. Nowadays, wherever there is a banyan tree in the shade, apart from old shrines and houses, is the courtyard of the oldest of them. The courtyard of the house is the same place through which the Chung River flowed at that time. In the street squares of the old village, there are also a number of large banyan trees that must be held together by many people and are said to be several hundred years old. They are said to be several hundred years old and are often used by different groups of people at different times.

The environment in which the trees originated cannot be separated. According to Lynch's research, it stands to reason that trees were an important opportunity for Americans during their formative years. However, there are far too few large trees in urban habitats that are necessary for people's important formative years. A large tree that has braved the elements for many years looks majestic or elegant, and because it has stood in the same place for many years, it has developed a calm, patient, and unruly character, as if it were a quiet and stern father watching over people. In children, he imprints himself as a strong impression from early childhood, from which many lessons can be retrieved. Therefore, it is important to design the public space around the village banyan tree, in connection with the street.

Figure1.13 Banyan trees in Lijiao Village
Source: Self-drawn by the author based on Baidu Street View

(4) Analysis of Village Vitality in Lijiao

The functional map shows that the eastern side of Lijiao Village has a high number of schools and residential areas and is an area of high amenity and quality in its current state. There is great potential for commercial development within the village and to the south and east.

Table 1.4 Functional statistics within a 700m radius of Lij iao village centre

Regional support functions	Number
Residential area	13
Commercial area	6
Office space	4
School	13
Hospital	3
Transportation	13

Source: collated and drawn by the author

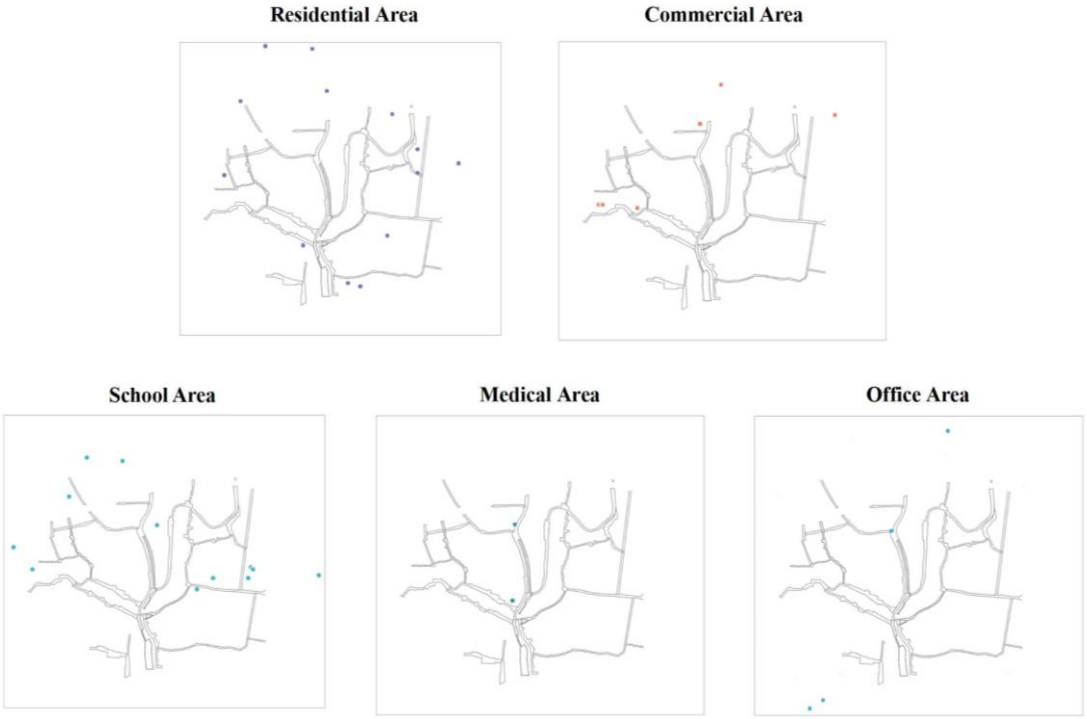


Figure1.14 Main functions of Lijiao Village
Source: Self-drawn by the author

The distribution of POI shows that the northern part of Lijiao Village is rich and has a high number of stores; retail is the main business in this area and there is a high probability that residents will be able to operate retail stores after renovation; restaurants are mostly concentrated at the entrances and exits of the street. A bigger problem is the lack of vitality of Lijiao East Street, which is the main street.

Table 1.5 Statistics of business types within 700m radius of Liji ao Village center

Regional formats	quantity
Restaurants	373
Retail	798
Recreation	72
Education and Training	69
Sports & Fitness	17
Life Services	336

Financial Insurance	17
Beauty and Wellness	114
Vehicle Services	61

Source: collated and drawn by the author

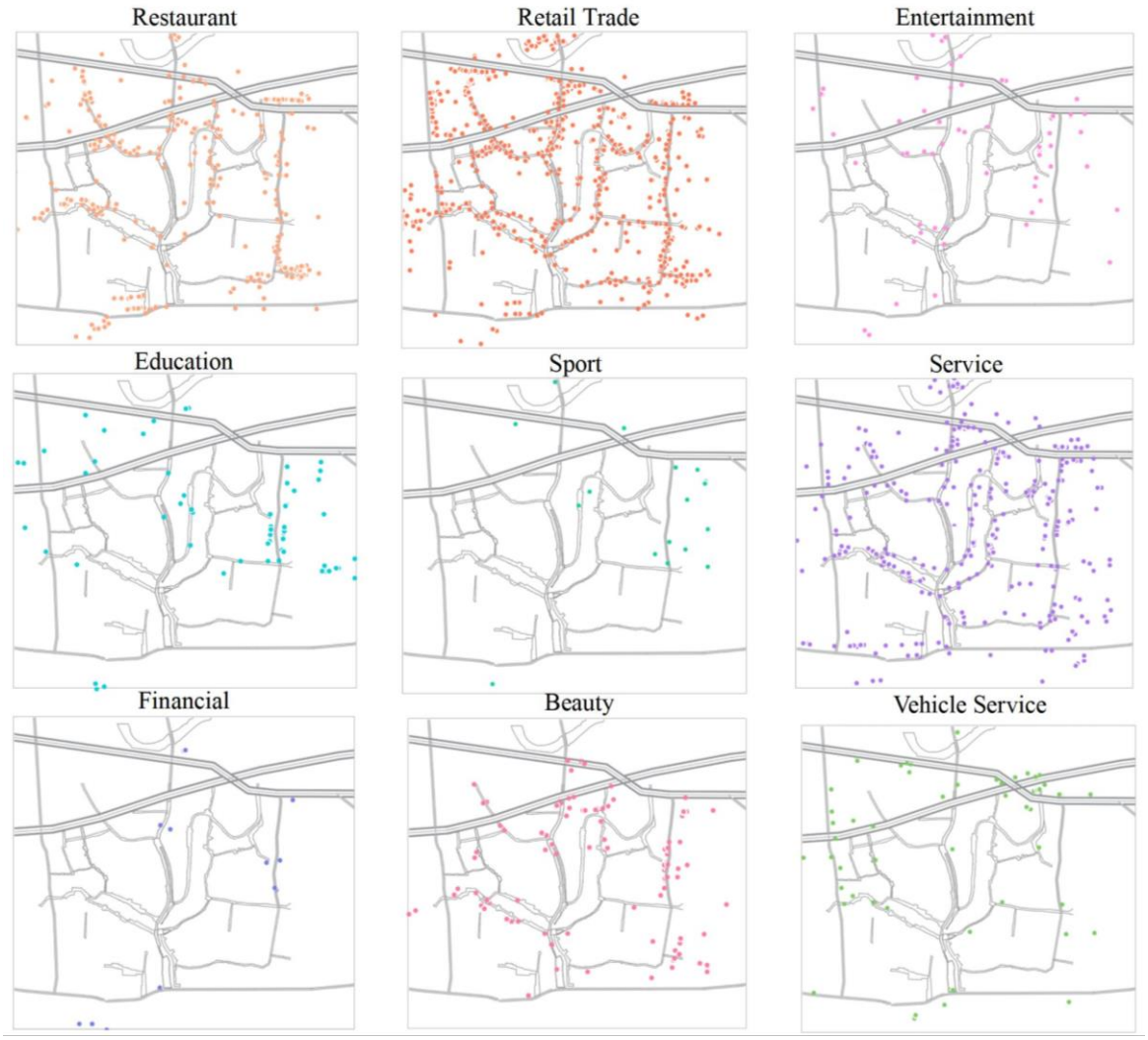


Figure1.15 Distribution of points of interest in Lijiao Village
Source: Self-drawn by the author

A higher proportion of residents and visitors to urban villages are young people aged 25-34, and a lower proportion are aged 19-24. There is little difference in the proportion of children and older people. The proportion of working-age people is predominantly young, and the proportion of young people in the post-development composition of the population is expected to continue to increase.

Figure1.16 Analysis of population of Lijiao Village
Source: Self-drawn by the author

Due to the winding and narrow roads within Lijiao Village, public transportation is spread around the periphery of the village, with heavy use of buses on Nanzhou Road to the north and the subway to the south. Travel within the village is mainly on foot and by car, and there is a lack of a low-speed transport system to connect to the public transport system. Non-motorised transportation has the advantage of good accessibility and low travel costs, but the author's research on the current situation shows that there are very few slow modes of transportation, such as shared bikes, in the village, and there is no bicycle parking; residents' bicycles are even placed against the wall in the narrow alleys. The few bicycle sharing bikes that are in the alleys of the village have become "private bikes" due to their hidden location.

Table 1.6 Top 10 bus Stops Around Lijiao

Rank	Station	lines
1	Sanjiao Village Station	22
2	Lijiao Station	22
3	Houjiao Station	21
4	Zhenxing Street Station	4
5	Lijiao Metro Main Station	3
6	Lijiao Dabutou Station	3
7	Zhenhai Road Station	1
8	Lijiao Dabutou Main Station	1
9	Lijiao Street Station	1
10	Lijiao Zhenxing Street Main Station	1

Source: collated and drawn by the author

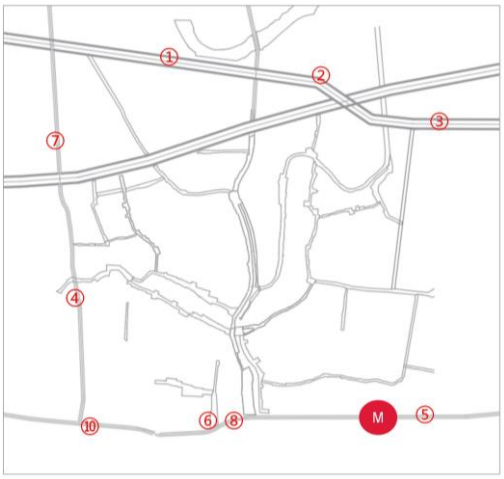


Figure1.17 Current bus Vitality Analysis
Source: Self-drawn by the author

1.3.5. Curret Streetscape Problems in Lijiao

(1) Street Satisfaction Survey in Lijiao

The road satisfaction survey is one of the main measures of quantitative assessment of roads in this study. The data charts of satisfaction for each road were constructed by evaluating the 12 roads in Lijiao village by 20 villagers according to the criteria of safety, convenience, comfort, and aesthetics. Then, hierarchical AHP analysis was used to determine the weights of each indicator and comprehensively evaluate the streets. Finally, the author selected representative street photos to correspond with each other according to the characteristics of the data. The results of the survey are shown in the following table.

A survey of main street satisfaction in Lejiao Village

Street	Safety (0.25)		Convenience (0.33)		Comfort (0.23)		Aesthetic (0.19)		verall Satisfacti	introductions
Siyue Street	1.8		4.6		1		1.4		2.464	
Nanan Street	3.8		5.4		3.4		3		4.084	
East Street	3.2		6.2		4.6		5.3		4.911	
Wuyuehou Street	5.8		4.6		6.6		4.6		5.36	
Lijiao Street	2.2		4.6		2.2		1.8		2.916	
Wuyue Street	5		3		4.6		3.4		3.944	The overall satisfaction was weighted
Huanxiufang Street	2.6		1.4		2.2		1.4		1.884	1 - very poor 3 - poor 5 - general 7 - good 9 - very good
Sanyuexin Street	1.4		5		1.8		1		2.604	
Shuiji Street	1.8		1.8		2.2		1.4		1.816	
Dashi Street	3.4		2.2		3.4		2.6		2.852	
West Street	2.6		1.8		1.4		2.2		1.984	
Yiyue Street	1.4		6.6		1		1		2.948	
Average	2.92		3.93		2.87		2.43		3.05	

Source: collated and drawn by the author

Figure1.18 Street satisfaction survey

Sorce：Self-drawn by the author

A line chart was created based on the survey data to provide a clearer picture of the characteristics of the data (Figure 1.19).

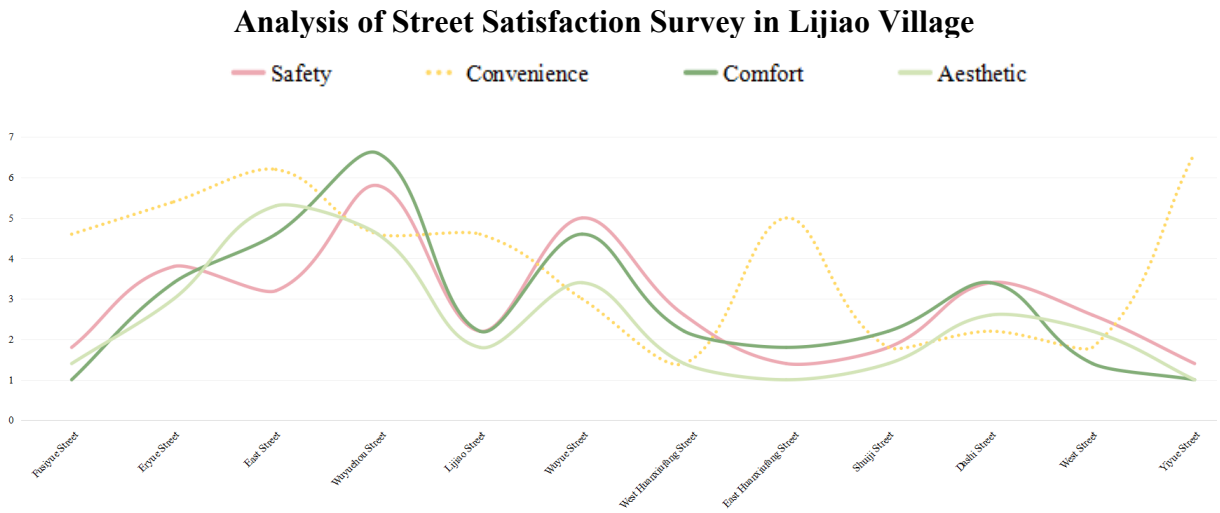


Figure1.19 Street satisfaction line graph
Sorce：Self-drawn by the author

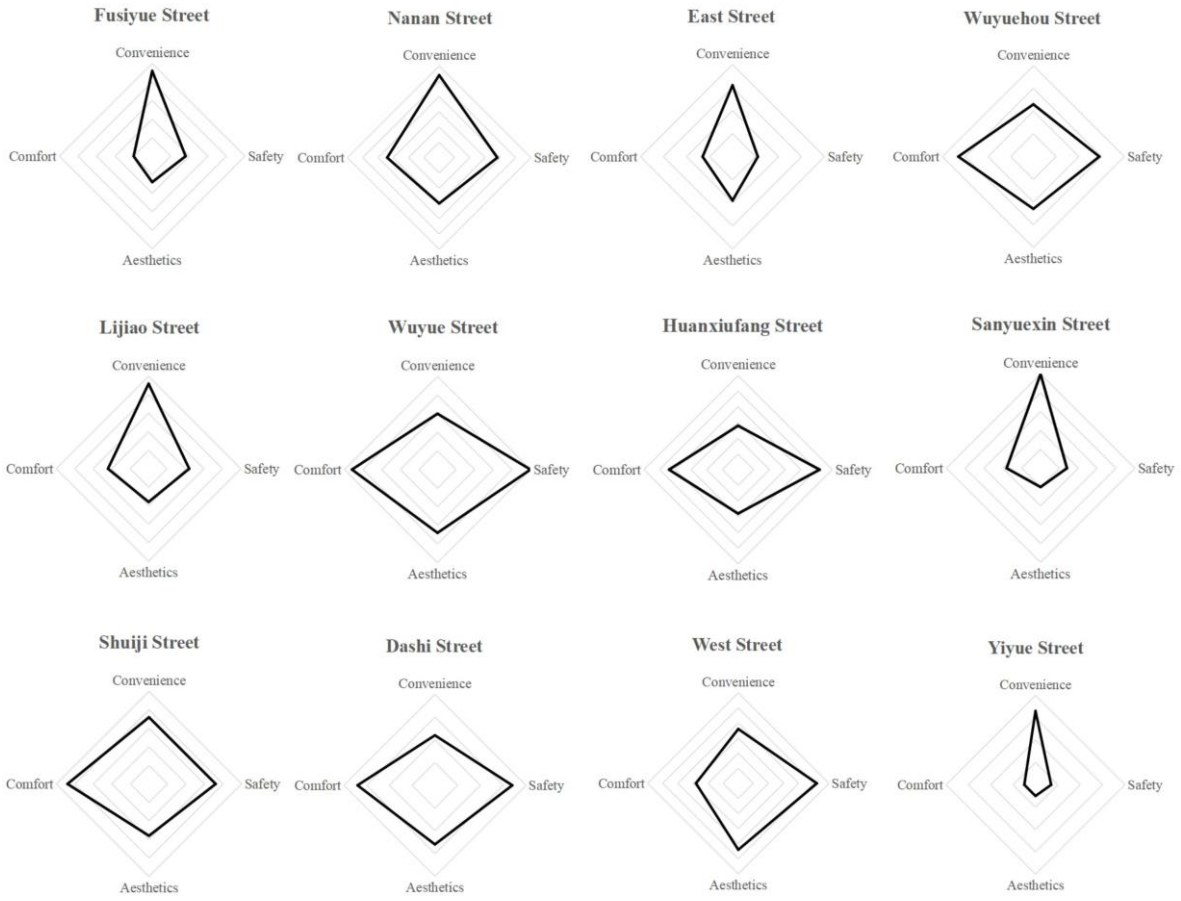


Figure1.20 Comparative Radar Map of Important Indicators for Twelve Streets in Lijiao
Source: Self-drawn by the author

Evaluation weight analysis of pedestrian friendly oriented urban village streets

	Safety	Convenience	Comfort	Aesthetic
Safety	1.000	0.833	1.111	1.250
Convenience	1.200	1.000	1.429	2.000
Comfort	0.900	0.700	1.000	1.250
Aesthetic	0.800	0.500	0.800	1.000

Source: collated and drawn by the author

AHP analysis results

	Eigenvector	Weight	Max-Eige	CI
Data 1	1.014	25.36%	4.007	0.002
Data 2	1.330	33.26%		
Data 3	0.919	22.98%		
Data 4	0.736	18.40%		

Source: collated and drawn by the author

Summary of consistency test results

	CI	RI	CR	Consistency test results
4.007	0.002	89.00%	0.003	pass

Source: collated and drawn by the author

Random consistent RI table

	3	4	5	6	7	8	9	10	11		13	14	15	16
RI值	0.520	89.00%	1.120	1.260	1.36	1.410	146.00%	1.490	1.520	1.54	1.560	158.00%	1.590	1.594
n 阶	17.000	1800.00%	19.000	20.000	21	22.000	2300.00%	24.000	25.000	26	27.000	2800.00%	29.000	30.000
RI值	1.606	161.33%	1.621	1.629	1.6358	1.640	164.62%	1.650	1.656	1.6587	1.663	166.70%	1.669	1.672

Source: collated and drawn by the author

Figure1.21 AHP analysis of street satisfaction
Sorce：Self-drawn by the author

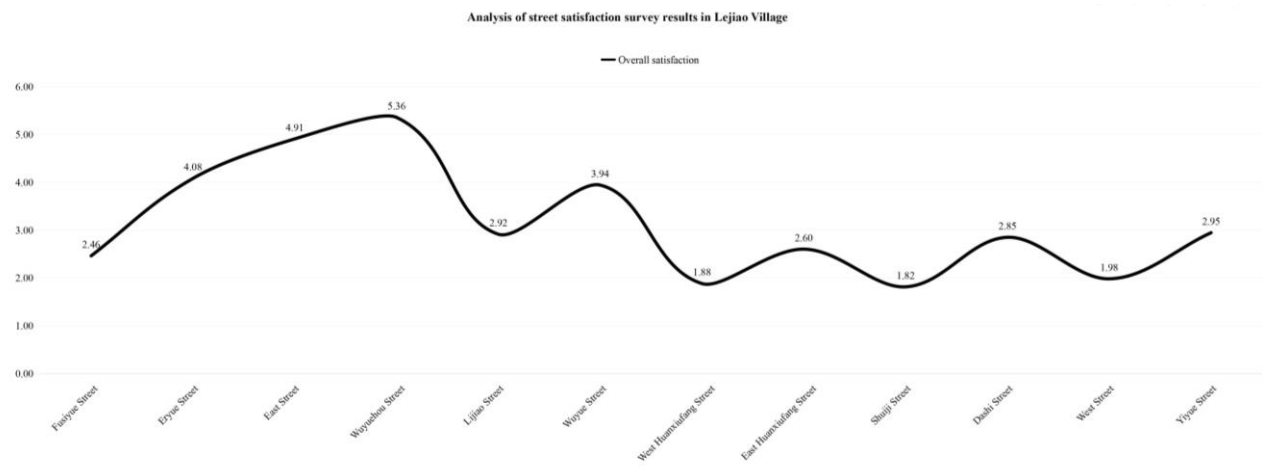


Figure1.22 Comprehensive satisfaction of street in Lijiao
Sorce：Self-drawn by the author

The statistical results have the following implications for design:

a. Convenience is evaluated mainly on the basis of accessibility to public transportation and is determined mainly by the location of the road and its traffic conditions. The safety, comfort and aesthetics of the streets with higher convenience should be fully improved. That is to say, East Street, Lijiao Street, Sanyuexin Street and Yiyue Street should be upgraded as a priority.

b. Safety, comfort and aesthetics are somewhat related and need to be improved at the same time.

c. Streets with high overall satisfaction include East Street and Wuyuehou Street, whose spatial characteristics can be fully utilised and considered.(as shown in Figure1.23)


Figure1.23 Streetscape of East Street and Wuyuehou Street in Lijiao
Sorce：Baidu street view, photo by the author

d. Streets with low overall satisfaction are Sanyuexin Street, Huanxiufang Street and Yiyue Street, which are in greater need of renewal.(as shown in Figure1.24)



Figure1.24 Streetscape of Sanyuexin Street，Huanxiufang Street and Yiyue Street in Lijiao
Sorce：Baidu street view, photo by the author

e. Since there was no systematic planning when the villages were built, the roads were mostly natural, and the level of motorization was low at that time, there was insufficient foresight for future development, which led to an unreasonable structure of the road network in the villages. The roads within the urban villages do not form loops, and there are many branching roads, which makes the accessibility of the roads difficult.

f. Most major roads in urban villages have the dual function of a main road and a major thoroughfare, and because of the mixture of the dual function of road and street, there is a lot of mixed traffic between pedestrians and vehicles, and mixed traffic between machines and vehicles. This phenomenon not only affects the safety of pedestrians, but also reduces the speed of vehicles and increases the noise pollution from traffic.

g. The low level of motorization at the time of the construction of the villages has resulted in very narrow roads in the villages, with some of the main roads having

only two lanes for mixed traffic in both directions and not being able to fulfil the traffic functions of the main roads(as shown in Figure1.25).

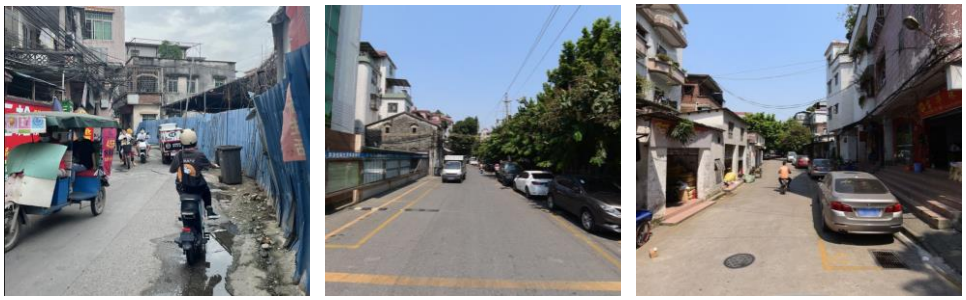


Figure1.25 Streetscape of Sanyuexin Street,East Street and Wuyue Street in Lijiao
Sorce：Baidu street view, photo by the author

Based on the statistical results, the author has again made a detailed evaluation and analysis of the main roads on both sides of the Lijiao River, using diagrams in conjunction with textual evaluations to document the most important aspects of the current appearance of the road.

(2) Motor Vehicles Occupy Street Space

Most urban villages were built with a low standard of motor vehicle parking. As people's living standards have improved in recent years, motor vehicles have gradually become more popular, and their parking conflicts have increased. Meanwhile, the lack of parking facilities has greatly affected the daily life of residents in urban villages and limited the development of urban villages.

The author draws and analyses the parking situation in the 12 streets with reference to the local conditions and street photos, including the location of parking spaces, the number of parking spaces, the parking area, the ratio of parking area to street length, and the ratio of parking area to street area for each street. The specific data are as follows.

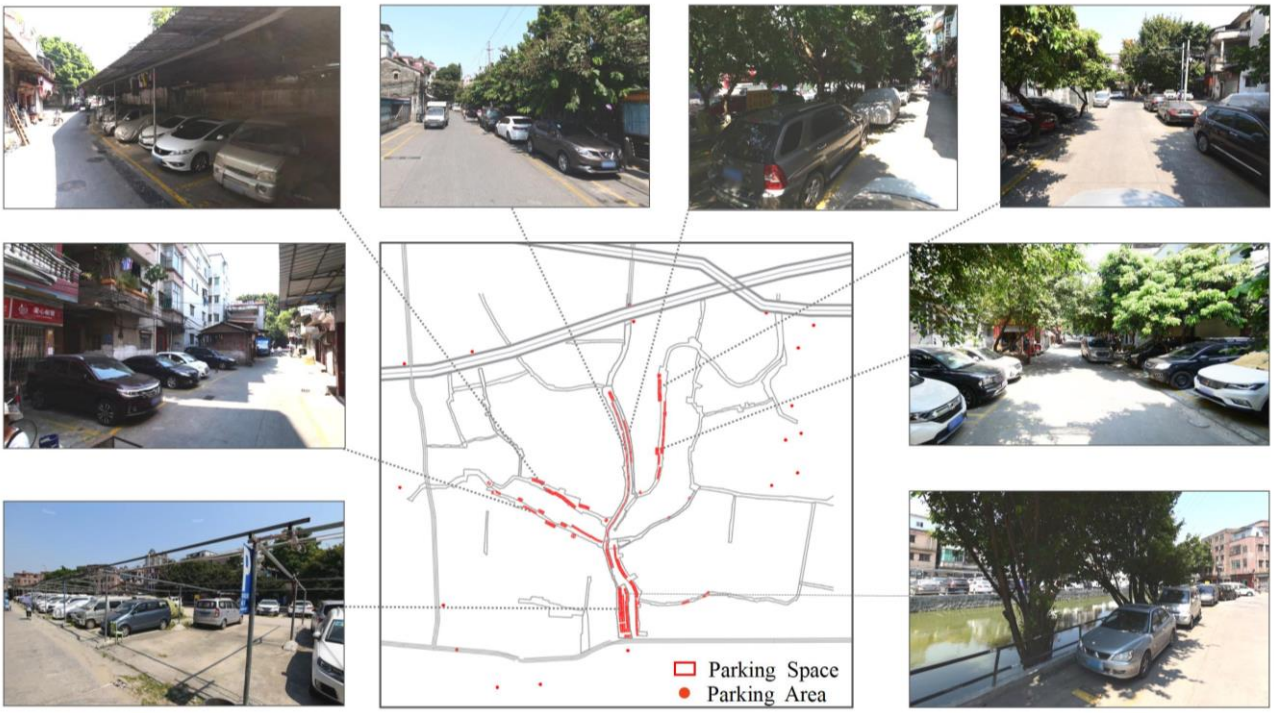


Figure1.26 Distribution of existing parking spaces in Lijiao Village
Source: Self-drawn by the author

Table 1.7 Statistics of Parking Status In Lijiao Village

Street	Number	Parking Area（㎡）	Street Area（㎡）	The length of street（m）	Ratio of parking area to street area	Ratio of parking area to street length
Fusiyue Street	119	1576.75	3909	219	0.40	7.20
Eryue Street	55	728.75	2236	205	0.33	3.55
East Street	66	874.5	3856	359	0.23	2.44
Wuyuehou Street	18	238.5	1318	226	0.18	1.06
Lijiao Street	0	0	1643	146	0.00	0.00
Wuyue Street	62	821.5	7882	760	0.10	1.08
West Huanxiufang Street	43	569.75	2941	286	0.19	1.99
East Huanxiufang Street	2	26.5	1357	243	0.02	0.11
Shuiji Street	0	0	2572	321	0.00	0.00
Dashi Street	52	689	3535	292	0.19	2.36
West Street	0	0	1855	271	0.00	0.00
Yiyue Street	5	66.25	2198	395	0.03	0.17
			5591.5			

Source: collated and drawn by the author

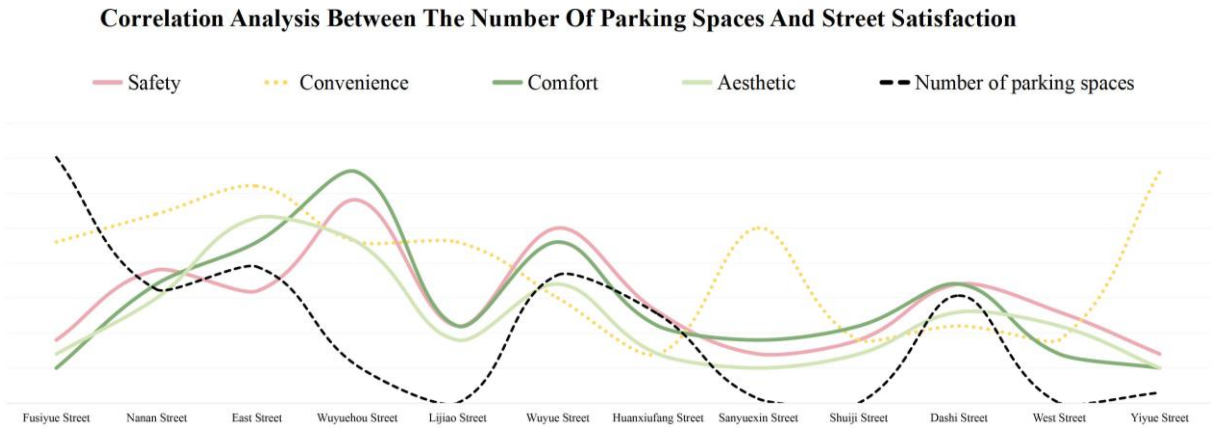


Figure1.27 Correlation analysis between the number of parking spaces and street satisfaction
Source: Self-drawn by the author

Figure1.28 Correlation analysis between parking area and street satisfation
Source: Self-drawn by the author

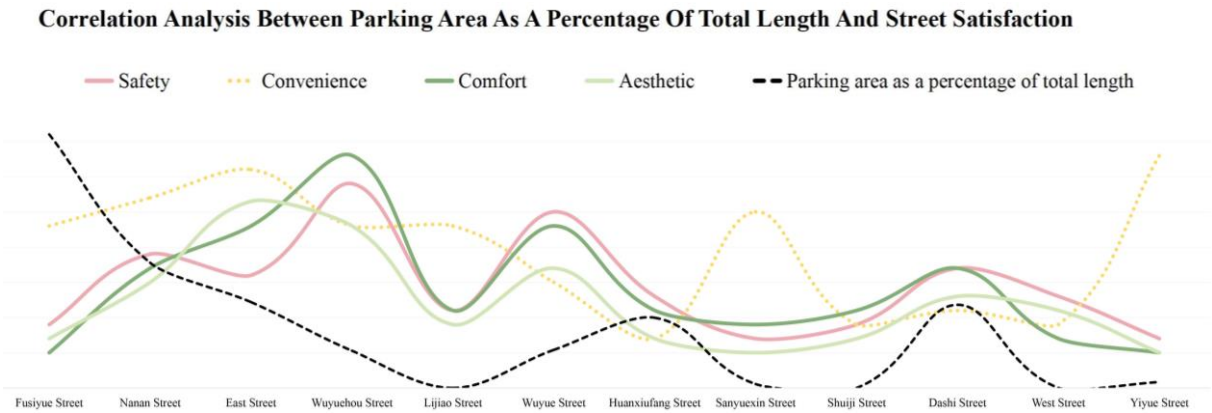


Figure1.29 Correlation analysis between parking area as a percentage of total length and street satisfaction
Source: Self-drawn by the author

Implications of the statistical results for design:

a. The extent to which the number of on-street parking spaces is positively correlated with satisfaction, suggesting both that streets with high satisfaction levels have adequate space for vehicles and that on-street parking could be considered as a design option for on-street parking in redevelopment planning.
b. Streets with high overall satisfaction have a ratio of parking area to street area of no more than 0.25
c. Streets with high overall satisfaction, where the ratio of parking area to total length of the street does not exceed 1.1.
d. Lijiao Street, Sanyuexin Street, and Yiyue Street have higher convenience and lower parking supply, suggesting that the degree of accessibility by public transportation affects the demand for motor vehicles to some extent.

(3) Large Number of Boundary Walls Blocking the Alleyway

The lack of uniform design and planning in urban villages, and the fact that they are mostly residential, has led to each family enclosing and fencing their property, increasing the private area, but hindering traffic within the village and swallowing up public space. The sheer number of enclosures has greatly affected the appearance and experience of visiting urban villages. The occurrence of such problems is a sign of a lack of concern for the streets in front of the houses and a lack of a concept for beautifying the streets.

In his book Aesthetics of the Street, Yoshinobu Ashihara points out on the subject of walls that the streets of Japanese residential areas, even in the so-called posh neighbourhoods, do not have the wonderful atmosphere of the wall-free residential areas of Western Europe. It is impossible to beautify a street by surrounding it with an expressionless wall. It is important to have a few metres of land along the street. Setting the wall back from the road and greening it or turning it into a hedge or a living fence can be used as a method of redevelopment.

The author has drawn three diagrams to illustrate these issues(as shown in Figure 1.30), as shown below from left to right, showing the distribution of existing fences, the current walkable path of the alley, and the walkable path of the alley after removing some fences and buildings.

Current bounding wall | Current alleyway | The alleyway after the removal of the wall and part of the building

Figure1.30 Alleyways and bounding wall in Lijiao village
Source: Self-drawn by the author

Analysis of the problem of the wall in Lijiao Village Central

Example	Degree of blockage	Conversion proposals
	Direct cut-off of the alleyway enclosure	All compulsory demolition
	Fencing that seriously encroaches on the alleyway area	All compulsory demolition
	Extra long fence that also cuts off and encroaches on the alleyway	All compulsory demolition
	A wall used to enclose the front yard of a building	Retain as appropriate depending on overall design requirements
	Fences conducive to maintaining street scale	Appropriate beautification

Source: collated and drawn by the author

Figure1.31 Analysis of the problem of the courtyard wall in Lijiao
Source: Self-drawn by the author

(4) Analysis of the Current Problems of the River

Field and literature research revealed the following problems with the river in Lijiao Village:

a. The bank height of the river bank is insufficient. The banks on both sides of the Li Kau Chung have not been fully straightened, and the bank heights are generally low, with most bank heights between 6.5 and 7.0 m, which is lower than the average maximum tidal height of 7.12 m in the outer river for many years.

b. The water quality of the river is poor. The current situation is that the banks of the Lijiao Chung have not been fully intercepted and the sewage discharged into the river pollutes the river badly, the local residents are not aware of the protection of the river and dump garbage from time to time, so the water quality of the river is mostly poor V.The water is black and smells bad, and the aquatic communities have disappeared, and the fish and shrimp are practically extinct.

c.The river channel of Lijiao Chung is gentle and belongs to the lowland area of the river, with a slow water flow, which easily leads to the siltation of the riverbed and the odour of the substrate, posing a serious health hazard to local residents and requiring regular desilting.

d. At present, the northern end of the Lijiao Chung is a breaking point, and the water in the Chung cannot flow for a long time and is difficult to replace.(as shown in Figure1.32)

Figure1.32 Analysis of the problem of the courtyard wall in Lijiao
Photo source：Taken by the author

(5) Linguistic landscape

Building facades are largely invisible on Japanese streets, but they have a not insignificant impact on the boundary of the street space. However, it is not so much what protrudes from the façade that defines the street. Here, the shape that defines the original appearance of the building is called the "first contour line" of the building, and the shape formed by the projections and temporary additions to the building

facade is called the "second contour line" of the building. The streets of Western European cities are determined by the original "first contour" of the building, while the streets of Hong Kong, South Korea and Asian countries and regions, in contrast, are usually determined by the "second contour". In contrast, the streets of Hong Kong, South Korea and Asian countries and regions are mainly determined by the "second contour line".

For the purpose of this section, the second contour is divided into three types: the brand contour, the ornamental contour, and the vegetative contour, as follows.

In the streets of Japan, especially in Akihabara, the contour of the logo is the main element of the streetscape. In Loyang's Lijingmen, the use of flags as the basic uniform element of signage has also become an important style feature. However, the narrower the street, the more difficult it is to see the facade from a pedestrian perspective.

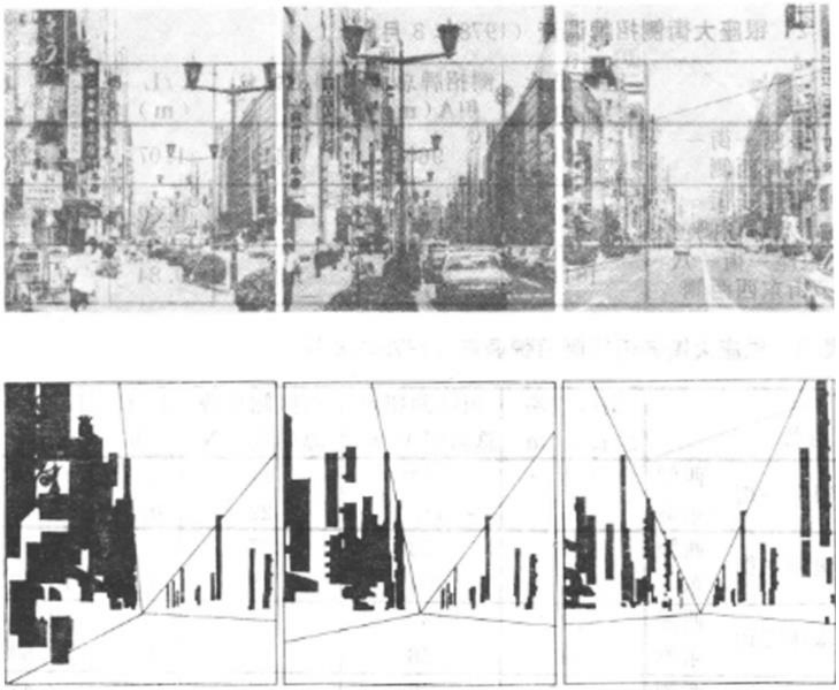


Figure1.33 Second contour line - logo outline in Ginza, Tokyo
Source: Street Aesthetics

The linguistic landscape is a field of research in sociolinguistics that deals with the symbolic meaning of different kinds of linguistic signs in public space. In terms of the forms of linguistic landscapes, Chinese is clearly dominant in all linguistic landscapes. Private linguistic landscapes convey a sense of history in the historical and cultural neighbourhoods of Suzhou by using handwritten scripts with calligraphic features, traditional Chinese characters, right-to-left writing order, and golden characters on a

black background; the linguistic landscapes in the neighbourhoods contain a deep historical culture.

As the following figure shows, the confusion of the current linguistic landscape of Lijiao village is an important reason for its poor appearance.(as shown in Figure1.34)

Figure1.34 Linguistic landscape in Lijiao
Source: Photo by the author

1.3.6. Urban Plan on Lijiao

(1) Function Plan

According to the land use map of Guangzhou Haizhu Zoning Plan(as shown in Figure1.35), the spatial structure of Haizhu Zoning District is "one district, two areas, green heart and blue veins, four axes and four centres". Haizhu District will develop into a centre of information industry and education research, a trade centre and an ecological island with a rational spatial layout, perfect support facilities, convenient transportation, beautiful environment, developed trade and a prosperous economy.

The development of Haizhu District is an important part of Guangzhou Central Group, a bridgehead for the southern expansion of Guangzhou urban area, an ecological island, an island of wisdom and an information island in the south of Guangzhou central city, and a modern ecological urban area suitable for business, housing and entrepreneurship, based on the ecological pattern of "river, chung, enclosure and garden". It is an important part of the urban green space in the southeastern part of Guangzhou city centre with an ecological reserve of fruit trees and an urban landscape characterised by natural landscapes, Lingnan style and a waterfront city.

The development strategy of Haizhu District includes the construction of Guangzhou Information Port. The core area of the information port IT is the area east of Guangzhou Avenue, including the ecological fruit tree reserve, Pazhou Island and Bio Island. Taking advantage of the scientific research advantages of the University City, CUHK and other research institutions, Pazhou Convention and Exhibition Centre as the leading centre, Fruit Tree Ecological Reserve as the green heart, the new urban axis as the support, the development momentum of Bio Island and the full integration of Guangzhou's high-tech industrial parks, Guangzhou Information Port will be built as the information, talent, research and innovation base for Guangzhou's high-tech industry.

Figure1.35 Haizhu Innovation Bay (Lik Qian Area) Urban Design and Detailed Control Plan
Source: www. gzlpc. gov.cn

As can be seen from the plan, the unique village structure of Lijiao no longer exists, and the entire village has been filled with a grid of squares to meet the demands of intensive development. Only some of the important ancestral halls have been preserved, but the traditional village atmosphere could not be preserved. The planning of the road network also shows that the preserved parts are mainly used as pedestrian streets, and a north-south road has been constructed on the east side of the Lijiao River for automobile traffic. Road traffic: a network of six horizontal and thirteen vertical major roads is formed; the density is increased and the neighbourhoods are refined, and the road density in the core area is optimised to at least 19.0 km/km^2. The newly planned Lijiao area has a large number of new

commercial and business areas, and the traditional village life will be completely replaced by a modern city.

(2) Water System Plan

As part of the development and construction of the Lijiao Chung area, the eastern tributary of the Lijiao Chung was covered and developed as a road, and the current length of the Lijiao Chung is 0.629 km. The current length of the river is 0.629 km, making it an unconnected section. According to the latest results of Haizhu County's "Three Plans in One" and the "Detailed Control Plan of Haizhu Eco-City (2013.6)", the Lijiao Chung is to be directly connected to the Xilu Chung in the north. The width between the planned shoreline of Lijiao Chung is 10-20 m, Lijiao Chung belongs to the third category of rivers and springs, and the width between the river bank and the planned red control line is set at 6 m, so the total width of the red control line within the river management area is 22-32 m. The Lijiao Chung River basin is planned as a self-drainage area, with a sluice gate at the mouth of the river to regulate the water level in the landscape [错误!未找到引用源。].

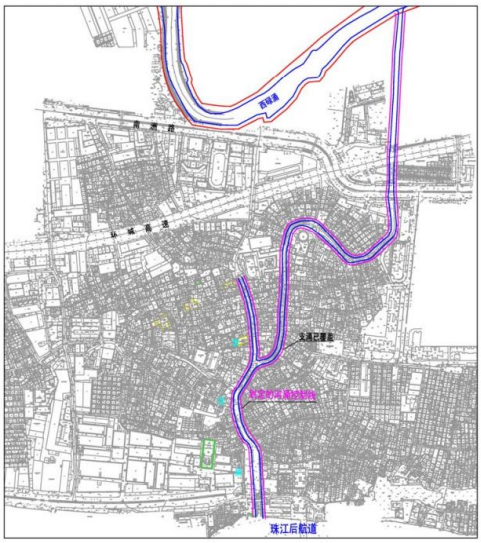


Figure1.36 Lijiao River Water System Plan
Source:Control diagram of Lek kau surge of river drainage system planning in downtown Guangzhou

1.3.7. Analysis of Existing Design Achievements in Lijiao

(1) "Eight Views of Lijiao" Design Scheme

The traditional "eight scenes" of landscape culture have played an important role in preserving the structural form, ecological environment, humanistic features and folklore of the city and countryside created by the optimal choice of ancestors through their universality in Chinese urban planning, consistency in the history of urban development, sociological common good and profound experience in literary

aesthetics. They play an important role in preserving the structural form, ecological environment, humanistic features and folklore created by our ancestors. With the increasing loss of urban and rural landscape features, there is a need for conservation and research.

The term "landscape" is derived from Shen Kuo's "Mengxibitan - Painting and Calligraphy", which reflects the natural and human elements of the area. The organic combination of the "eight scenes" of the landscape - a kind of general reference point - is the result of the interaction between people and the diversity of the natural environment in which it is located:

a. The landscape designed by human beings;
b. Landscapes of natural organic evolution;
c. associated cultural landscapes, i.e., landscapes in which natural elements or phenomena are strongly associated with religion, art, and culture.

The selection and naming of the eight landscapes has become a cultural phenomenon with a thousand-year history of planning science. It is necessary to consider and promote the "eight scenes" scattered over cities, villages and towns as regional cultural maps of famous villages, cities and towns and as an important structure of urban ecology.

The significance of the "Eight Views" in the history of urban and rural aesthetics.

The scene of "Banyan Danger Asking for the Moon" in Lijiao is still a rich heritage and can be found everywhere in Guangfu city and countryside. The poem is about the combined scenic effect of "river, water, clouds, banyan and moon", which is comparable to the "night of spring river flowers and moon". The dynamic scene of the shimmering "banyan shade" gives people a very apt and joyful feeling of a piece of rich, ceaseless and unceasing "nostalgia". It is necessary for the garden community of Guangdong to call again for including the eight scenes of culture and art in the strategy of protecting China's cultural heritage, identifying and preserving the security patterns of the cultural landscape, integrating the cultural heritage and ecological green space systems in urban and rural areas, establishing a civilian protection and supervision organisation for the landscape planning system of the "eight scenes", and resisting the "great 错误!未找到引用源。.

Figure1.37 A proposal based on the "Eight Views of Lijiao"
Source:The Cultural Importance of the Eight Views of Lijiao, an Ancient Village in Guangzhou

(2) Urban Design and Conceptual Scheme Analysis of the Core Area of Lijiao, Haizhu Innovation Bay, Guangzhou

According to the development plan of Haizhu Innovation Bay, the core area of Lijiao will be developed into a multi-faceted industrial hub including urban landmarks such as super grade A offices and ecological cloud grade A offices, as well as a heavyweight cultural, commercial and tourism destination with more than 300,000 square metres of tourism and entertainment elements and a wide range of service spaces such as benchmark residences, quality apartments, ultra-luxury hotels and open and flexible ecological public open spaces.On January 22, 2021, the international competition for the design of the Lijiao core area of Haizhu Innovation Bay with the theme "Beyond Space: Dialogue with the World", opened at the Haizhu Innovation Bay City Exhibition Hall.

For example, Gensler's competition proposal(Figure1.38) combines the organic development of the urban village with the related cultural and economic development, preserving and honouring the causes of their growth to reflect the wisdom of human history and the cultural core of Guangzhou's urban spirit. The design of this building complex also tries to take into account the harmonious relationship between people, the city and nature, so that they can form an orderly and progressive development space. It expresses the spirit of the place and the future values we expect from the

Innovation Bay area in Lijiao. The aim is to give the residents of this area a sense of the idea that "the best is what can grow on this land".

The design also shows the intensity of development and future vision required for the Lijiao area, and the author will meet the higher planning and design requirements as much as possible while preserving the integrity of Lijiao Village and fulfilling the harmonious design of conservation and development.

Figure1.38 Urban design for the core area of Lijiao, Haizhu Innovation Bay, Gensler Associates

Source:International Competition for the Urban Design of the Lijiao Core Area of Haizhu Innovation Bay and Conceptual Design of the Building Complex

Chapter2 Theoretical Studies

2.1. Research Background

2.1.1. Walking-friendly Concept related to Streetscape

(1) Origins of the Walking-friendly Concept

The concept of pedestrian friendliness was first introduced by the Centre for Transportation Studies in the United States in the late 1990s and encompasses the dimensions of the built environment associated with pedestrian travel. In this context, pedestrian traffic refers to walking between places such as schools, workplaces, or other everyday needs such as shopping. Characteristics of the built environment associated with pedestrian travel include elements such as the pervasiveness of streets, number of intersections, residential density (population density), mixed land uses (i.e., a mix of residential, commercial, retail, and recreational uses, and multiple destinations within walking distance)[12].

(2) Development of the Concept of Walking-friendly

Historically, the development of pedestrian-friendly cities has gone through four main phases, namely the period of traditional pedestrian traffic, the period of decline of pedestrian traffic due to the prevalence of motor vehicles, the period of revival of pedestrian traffic due to the increase of environmental disciplines, and the period of return of pedestrian traffic.

In the early years, pedestrian research focused on the needs of people, the quality of structures, the comfort and safety of the built environment, and the pedestrian experience.

From the standpoint of aesthetic structure, Poselman's study of the urban built environment found that the façade, spatial variation, and visual interest of the streetscape affect walking time to some extent, with a continuous street façade slowing the pedestrian's perception of time, while a confined space with an interesting and attractive façade and an effective transition of the street into the local space speeds up the pedestrian's perception of time.

In 2000, Isaacs found in his study that the smaller scale of two paths of equal length for a given length of block affects pedestrians' psychological perception of feeling shorter 错误!未找到引用源。.

In Life between the houses, Jan Gehl analyses the importance of the first floor as an interface between buildings and the street in increasing urban vitality. Pedestrian activity on the street is constrained by the conditions of the pedestrians themselves,

such as sightline width and height, and the first floor interface along the street plays an important role in attracting pedestrian stops [14].Pedestrian friendliness is understood in different ways: According to Neibers, pedestrian friendliness reflects the overall support for pedestrian travel in an area, i.e., the overall pedestrian conditions of the area. Pedestrian friendliness takes into account the quality of pedestrian facilities, street conditions, land use patterns, community support, and safety and comfort while walking. Walkability can be assessed in a variety of ways and scales. At the site level, walkability is influenced by the quality of trails, accessibility of buildings, and related amenities. At the street and neighbourhood level, it is influenced by the provision of sidewalks and crosswalks and by street conditions (street width, traffic flow, and speed). At the community level, it is influenced by the accessibility of land uses, such as the relative location of daily destinations and the quality of connections between them.

Because of the objective and subjective factors and the different evaluation perspectives, there is no precise academic definition of "pedestrian friendliness." Ewing et al. define pedestrian friendliness as "the perception and experience of walking on the street by the people who use it."

According to Manaf and Rittman, pedestrian friendliness is "an attractive pedestrian environment near recreational, commercial, office, and other destinations."

Li, Huai-Min considers pedestrian friendliness as "the attractiveness of the urban environment to pedestrians and the evaluation of the pedestrian experience"; Some scholars have attempted to define "pedestrian friendliness" by incorporating the needs of various sectors such as transportation, planning, and landscape and providing a definition of "how pedestrian friendly the built environment is." Others have defined pedestrian friendliness as "the extent to which the built environment and land use of an area are conducive to walking for exercise, recreation, commuting, public services, and access to commerce."

In his book, Designing the Walkable City, American scholar Michel Southworth defines "walkability" as the extent to which the built environment is safe and comfortable for pedestrians. The extent to which it encourages the use of pedestrian travel by guiding pedestrians to their destinations, accommodating their physical reach, walking distance and time, and providing visual interest through streetscape and amenities as they move." Emphasising the primacy of pedestrian travel in the age of the motor vehicle, the study provides a more comprehensive account of the

factors of pedestrian friendliness, including the characteristics of pedestrian travel and the pedestrian's experience of walking, and proposes six indicators for measuring the pedestrian friendliness of cities,

a. Connectivity and accessibility of the road system;
b. Other transport and pedestrian connections;
c. The degree of mixed land use;
d. Safety (crime rate and traffic safety);
e. Street quality (paving materials, signage guidance, lighting, etc.);
f. Aesthetic interest (architectural colours, landscaping, architectural transparency, etc.);

The main theories on Wolking-friendliness are New Urbanism,Smart Growth Theory,Redbourn System,Traffic Peace Concept,Street Sharing Theory,Complete Streets,etc.These theories focus more on aspects such as the organisation of functions, street furniture and some focus on the quality of the street (e.g. street interfaces, street colours, ground materials, etc.).

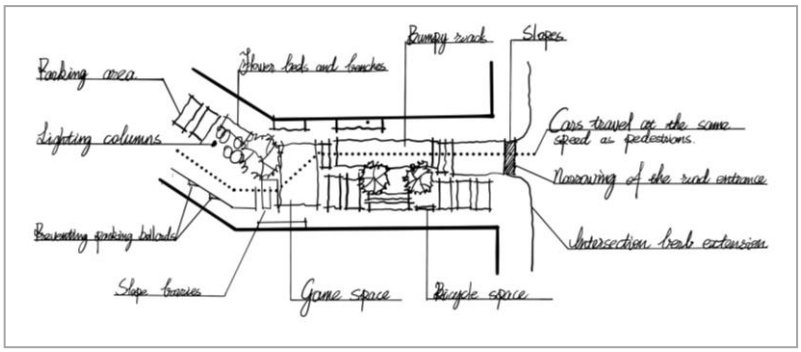


Figure2.1 Traffic claming schematic
Source: Self-drawn by the author based on Hasclaw's "Civilized Streets - A Guide to Stabilizing Traffic 错误!未找到引用源。

(3) Comments on Streetscapet Design related to Woling-friendly concept

Table 2.1 Theories on street design

Year	Author	Publications	Opinion
1889	Camillo Sitte	Building a city according to artistic principles	Today's urban design should take into account the wholeness, the scale of people and the environment, and the effect of the physical environment on people in terms of art, so that the urban street or square gives a sense of security, humanity, continuity and recognizability.

1960	Kevin Lynch	Urban Imagery	There are five main categories of perceived urban intentions: Way, Edge, District, Node, and Landmark. The element of way is also discussed and analysed, focusing on continuity and directionality in the specific design of the street to make it more recognisable and provide a sense of rhythm [错误!未找到引用源。].
1961 年	Jacobs Jane	The Death and Life of America's Big Cities	In the use of urban space and streets, the concept of the "street eye" is further developed from the perspective of the pedestrian, with a detailed study and analysis of the various details of life on the street and a search for the inner meaning of urban space and streets [错误!未找到引用源。].
1963	Colin Buchanan	Buchanan Report	“Pedestrians walking through the streets are the main part of the city and enjoy absolute freedom to use the urban space, such as strolling through the streets, resting and observing, stopping to talk, moving and walking, resting and resting, etc. The feeling of the user should be paramount." The report suggests that the design of the street environment should be integrated with the design of the traffic flow, taking into account factors such as traffic safety, accessibility and noise.
1974	American Urban Land Institute	Street of residence	Local roads should have lower standards, and other roads should adapt their functions to the local environment and the nature of the terrain, so that the roads can not only be used for car traffic, but also integrate the feelings of the people who are the main users in the city. Since then, the idea of sharing people and vehicles in the development of roads has become popular, advocating the diversity of road functions and advocating the sustainable development of roads, reflecting the humanistic spirit and idealism.
1977	Christopher Alexander	Architectural Pattern Language	High-quality streets have a variety of elements, such as easily identifiable entryways, interior spaces such as windows and terraces along the street, balconies, and porches that open onto the street, that are relevant to the study of pedestrian-friendly

			streets and wolking-friendly cities [错误!未找到引用源。].
1979	Yoshinobu Ashihara	Aesthetics of the street	In the design of the building, especially the layout, the visual order of the street formed by the shape of the building is fully taken into account, and the aesthetic design principles can be explored step by step from the environmental characteristics, artistic characteristics and regional characteristics of the street as a prerequisite for the design, while the classification, composition, proportion and scale of the street are further clarified, the relationship between the street and the city, the behavioural activities carried by the street are explored. The design of the street space is based on a new concept and creative approach, which proposes that the interface of the street should have continuity and rhythmic beauty, integrating the building and the street as a whole, as well as form and space, and designing the entire street space from the perspective of the street user [错误!未找到引用源。].
1979	Norberg Schulz	Spirit of Place: Towards a Phenomenology of Architecture	The importance of creatively preserving and nurturing the spirit of place shows the close relationship between the way people live and the environment in which they live, indicating at the same time that the street is a specific way of composing the spatial structure of the city, and that its form, sense of order, and rhythm together constitute the entire spatial environment of the city [错误!未找到引用源。].
1980	William White	Social life in a small urban space	Using observation, field research, time-lapse photography, interviews, and group discussions to observe people's preferences in urban spaces, the design guidelines for public spaces that function well and attract visitors are summarised. It is argued that the humane design of small, ubiquitous spaces in cities can help promote the occurrence of crowds and the construction of friendly streets [错误!未找到引用源。].
1986	Roger Transik	Finding lost space	A good space should integrate theories of the relationships between map base, connectivity, and place into the macro

			planning of the city, and strengthen people's sense of identity in the city by creating enclosed places, changing landscape environments, and public interaction spaces with a sense of humanity and belonging 错误!未找到引用源。.
1992	Carmen Hasclaw	Civic Street: A guide to traffic stabilisation	Based on the introduction of effective traffic calming measures in the Netherlands, Sweden, Germany, and Denmark, such as speed reduction in curves and street bends, the experience with traffic calming is summarised and the five objectives of Woonerf are presented: Improving traffic safety, reducing travel speeds, reducing through traffic, creating more The five goals of Woonerf are: Improving traffic safety, reducing travel speeds, reducing through traffic, creating more open space, and providing more space for streetscapes such as flower beds, shrubs, and trees 错误!未找到引用源。.
1995	Alan B. Jacobs	Great Streets	By analysing, comparing and summarising the characteristics of more than one hundred streets from around the world, the street plan and street profile are drawn at the same scale to analyse the urban street and building structure, which differs from street to street and neighbourhood to neighbourhood, reflecting the differences in topography, scale, complexity, natural environmental features, spatial attributes and route choices of the city. The importance of the street to sustainable and healthy development of the city or region is emphasised. In addition to the basic attributes of safety, convenience, and comfort, the creation of a great street must also have social attributes, i.e., social impacts that result from pedestrian activity at its core 错误!未找到引用源。.
1997	Michael Southworth	The formation of streets and towns	The book summarises a number of characteristics of shared streets and argues that street design standards should be flexible and dynamic, in the context of the city's historic conditions, natural environment, and cultural connotations 错误!未找到引用源。.
1999	Clive	Streets and	Based on early and contemporary principles of urban design

Mountfortin squares	and composition, which are highly aesthetic in art, the book analyses the spatial organisation, design conception, and detailed expression of squares, streets, and buildings in urban planning. Numerous good examples are used to highlight the importance of structure, function, and symbolism of squares and streets in urban design. The book also provides a detailed and systematic account of the length, form, and function of the street, not only as a linear space for urban traffic, but also as a place for residential activities [错误!未找到引用源。].

Source: Self-drawn by the author based on relevant papers

Chinese urban planning started late and was rather influenced by European and American countries in terms of urban and road construction, and has localised and absorbed their theories and experiences. A number of scholars have carried out relevant studies and researches, analysed and discussed the development of road space, and put forward constructive suggestions, which are of great significance to the current urban road construction. The following is a compilation.

Table 2.2 Theories on street design

Author	Publications	Opinion
刘东洋 (Dongyang Liu)	街道的挽歌 (Elegy for the Streets)	An overview of Shanghai's streets in different eras by three well-known writers who emphasise the important role of streets in the city and express a criticism of the city's current construction and a longing for traditional streets [错误!未找到引用源。].
陈丹燕 (Danyan Chen)	永不拓宽的街道 (The street that will never be widened)	The book points out that the architectural style of urban streets is integral and that street trees, pedestrian passages and street widths are important components of the city's historical memory and the sense of identity of its inhabitants and should not be changed at will, so that the inhabitants of urban street spaces can feel and come into contact with the historical and humanistic precipitation of urban spaces in their daily lives [错误!未找到引用源。].

陈鸿针 (Hongzhen Chen)	传统街巷空间的意象延续 (The imaginative continuation of traditional street spaces)	A rational analysis and summary of the characteristics of Suzhou traditional streets and alleys, and the application of urban design methods to further improve the street interface, scale, spatial structure and nodes of streets and alleys 错误!未找到引用源。.

Source: Self-drawn by the author based on relevant papers

2.1.2. Walking-friendly Evaluation Indicators related to Streetscape

(1) Current Practice Abroad Regarding Wolking-friendly Streets

Along with the development of pedestrian systems theory, pedestrian-friendly practices are beginning to be developed in various countries. These are described below at macro, meso and micro levels.

Table 2.3 Current Practice Abroad Regarding Wolking-friendly Streets

Dimension	Year	Region	Specific methods
Macro	-	Germany	Promote non-motorised transport and a range of measures to encourage walking, such as priority for walking, public transport and integration of walking.
	-	Korea	Introducing a transport text with the needs of street users at its core.
	-	Old Town, Cerda, Spain	Design and adapt the City's pedestrian network and environment to provide a high quality pedestrian environment that aligns with the Master Plan and relevant policies.
Central View	-	Singapore	Green corridors are created by connecting urban parks and green spaces through the construction of pedestrian and bicycle path networks.
	-	Copenhagen, Denmark	Construction of a humanized slow walking system
	-	Hong Kong	Combining planning and management for pedestrian political transformation in the Causeway Bay Area.

Micros copic	2004	London	The London Street Design Guidelines were published to guide the construction and development of streets through specific design guidelines, to pay more attention to the streetscape itself, and to create a positive experience for pedestrians in terms of comfort and safety on the street. The guidelines state that the key principles of street design are: Design Sustainability; Project Integrity; Clarity and Homogeneity; Multi-party Coordination; Pedestrian Demand Orientation; Humanity; Maintenance of Street Order; Safety and Efficient Use; Character and Legibility; Equity and Inclusion; Material Maintenance; and Durability.
	2009	New York	The New York City Street Design Manual, completed in 2009 by the New York City Department of Transportation over a two-year period, advocates a win-win approach to street design that takes into account community context, traffic conditions, and human history. The primary goal of the guidelines is to promote more attractive streets in New York City, improve the quality of life for citizens, and facilitate economic development of transportation projects. The Design Toolkit is the centrepiece of the manual and provides a public platform for numerous participants to provide input on street design. In addition to focusing on the design of street layout, street furniture, amenities, and landscaping, the manual proposes key prescriptions for street design in relation to the historic environment and relationship to the neighbourhood as appendices to ensure that all elements are standardised and easily accessible.
	2011	Los Angeles	The Los Angeles Department of Public Health has released a new version of the Los Angeles Street Design Guidelines, which aim to create livable and vibrant streets based on the needs of residents. The guidelines advocate for the renovation of existing streets and suburbs to create a human-scale street surface, elevate the importance of public transportation in the

		streetscape to a higher level, design streets ecologically based on economic principles, plan for stormwater management and propose appropriate measures, and encourage multiple parties to actively voice their opinions and participate in street design.
2010	Abu Dhabi City	The Abu Dhabi Urban Planning Commission has issued the Abu Dhabi Urban Street Design Guidelines, whose main objective is to improve the safety, interest and comfort of the pedestrian environment to enhance the pedestrian friendliness of streets, communities and the city. The guidelines revolutionise the traditional urban street hierarchy, standardise the street design process and modularize the design of different cross-sectional subdivisions of streets according to their type, and finally establish new requirements for the operation and maintenance of streets by the relevant authorities.

Source: Self-drawn by the author based on relevant papers

Looking at the micro level, wolf-friendliness is also assessed using a number of criteria.Empirically based walkability assessment indicators include the UK Pedestrian Environmental Assessment System （ PERS ） ， American Neighbourhood Environmental Walkability Scale（NEWS-.CFA）， New Zealand Community Street Review（CSR））；Network walkability assessment tools include Walk Score， Walkonomics' mobile app for walkability assessment（Walkability APP），Walkability Score by Mapology Campany.The categories are listed in the table below:

Table 2.4 Urban design development in the visual dimension

Type	Year	Name	Region	Scope of application
Empirical evaluation	2001	PERS	United Kingdom	Pedestrian environment
	2002	NEWS	United States	Neighbourhood Settlements
	2004	ALPHA	Europe	Neighbourhood Settlements
	2004	CSR	New Zealand	Street
	2008	PEQI	San Francisco,	Street

			USA	
Web reviews	2007	Walk Score	United States	Neighbourhood Settlements
	2011	Walkability APP	Europe	Pedestrian environment
	2013	Walkability Score	United States	Neighbourhood Settlements

Source: Self-drawn by the author based on international experience with behavioural evaluation methods and tools

In 2007, Walk Score, a company founded by Jesse Kocher and Matt Lerner, developed a website and mobile device to provide walkability-based housing services and tools. The company's flagship product is a comprehensive, publicly available walkability index that can be used to rate and rank the walkability of any location in the U.S., Canada and Australia when searching for walkable communities. The company's mission is to "promote walkable communities" and believes that walkable communities are one of the simplest and best solutions to environmental, health and economic problems.[错误!未找到引用源。] .

In 2011, Walkonomics developed Walkability APP, a mobile walkability rating app that combines open data with public ratings to assess the walkability of streets. The system has since been fully evaluated for 600,000 streets in England and New York City. The app provides a more detailed walkability assessment and is a new platform for communities and governments to discuss issues and develop solutions. More streets and cities are being added, and users can access and add their own ratings to their own streets[35].In 2013, Maponics, founded in 2001, developed the Walkability Score, a web-based walkability assessment tool. The company explains, "Walkability data is an important resource in urban and suburban areas. Many homebuyers are looking for detailed information about community amenities and services and whether they are within walking distance. This type of information helps buyers answer those questions, especially when looking for homes with multiple blocks." The Walkability Index was developed primarily for homebuyers, [36] and the company offers three types of indices for this purpose: the Overall Walk Score, the Amenities Score for amenities and services (e.g., shopping centres, dry cleaners, etc.), and the Leisure Score for recreational and cultural facilities. To account for the convenience of walking, the company uses the street network to simulate how pedestrians get to the places they want to go [37]: Location Details on the Property Information page and

Quality of Life on the Community Details page. A selection of the three walkability-related metrics typical of the first type of empirical, research-based assessment systems2 - PERS in the UK, NEWS in the US, and CSR in New Zealand - and the three web-based walkability assessment tools, Walk Score, Walkability APP, and Walkability Score, are presented below. They are analysed and compared in detail [错误! 未找到引用源。].

① UK Pedestrian Environmental Assessment System（PERS）

PERS is both a pedestrian evaluation tool and part of a multimodal street evaluation tool. It evaluates quality and level of service through a continuous pedestrian environment. The system consists of two parts: 1. evaluation of the local environment with annotations; 2. storage of results and output of images [38]. The parameters and criteria used by PERS to evaluate the six types of pedestrian environments are listed in Table 2.5.

Table 2.5 UK Pedestrian Environmental Assessment System（PERS）

Category	Parameters	Criteria
Travel routes	Orientation, permeability, road safety, personal safety, legibility, rest areas, environmental quality, footpath connections, intersection connections.	
Footpaths	Effective width, lowered curbs, slopes, obstructions, permeability, legibility, lighting, tactile information, colour contrast, personal safety, surface quality. User conflicts, environmental quality, maintenance.	-3 : Bad -2 : Major problem -1 : Minor problem 0 : average +1 : Better than the evaluation criteria +2 : Good +3: Very good
Intersections	Intersection supply, demand line deviation, performance, capacity, delay, legibility, handicap accessibility, ramps, grades, barriers, surface quality, maintenance, waiting area information, waiting area infrastructure, bus stops, waiting area information, perception of safety, personal safety measures, lighting, environmental quality, maintenance and cleaning, comfort of waiting areas.	
Bus stops	Information about access to waiting areas, infrastructure of waiting areas, bus stops, information about waiting areas, perception of safety, personal safety measures, lighting, quality of environment, maintenance and cleaning, comfort	

	of waiting areas.
Interchange space	Movement between different modes, identification of destination, personal safety, sense of comfort, quality of environment, maintaining movement in space, interpretation of space, personal safety, sense of comfort, sense of place, opportunities for movement.
Public spaces	Movement in space, interpretation of space, personal safety, sense of comfort, sense of place, possibilities of movement.

Source: Self-drawn by the author with reference to the evaluation criteria

② American Neighborhood Environmental Walkability Scale（NEWS-CFA）

For example, the most recent revised version of NEWS-CFA evaluates 13 aspects, including: Housing Type, Pedestrian Accessibility to Services, Accessibility to Services, Neighbourhood Streets, Quality of Pedestrian Facilities, Neighbourhood Environment, Traffic Crisis, and Neighbourhood Safety, with a total of 67 specific questions. Four scoring levels are established for all aspects, except for housing and neighbourhood service accessibility, which have separate scoring criteria (Table 3). In the youth version of the NEWS (NEWS -Y), the questionnaire is better adapted to the needs and understanding of young people, e.g., by adding "walking distance to neighbourhood recreational facilities," simplifying the classification of neighbourhood types, and making the questions more concise and clear. The questions are more concise and clear[39].

Table 2.6 American Neighborhood Environmental Walkability Scale（NEWS-CFA）

Category	Parameters	Criteria
Neighbourhood housing type	Single-family homes, 1- to 3-story townhomes or multi-family dwellings, 1- to 3-story apartments, 4- to 6-story apartments, 7- to 12-story apartments, 13-story apartments and above.	1: None; 2: Few ; 3: some; 4: more; 5: all
Walking distance to neighbourho	Hypermarkets, supermarkets, hardware stores, fruitand vegetable markets, laundromats, clothing stores, post offices, libraries, elementary schools, other schools, bookstores, fast food places, cafes, banks, restaurants, video stores,	1:1-5min;2:6-10min;3:11-20min

od services	pharmacies, hair salons, places of employment and training. Bus or train stations, parks, recreation centres, fitness facilities.	4:20-30min;5:>30min;6:don't know
Convenience of service facilities	Shopping. Stores within walking distance, destinations within walking distance, train stations within walking distance.	
Neighbourhood Streets	Spacing between intersections, many road crossings and a good connection between roads.	
Quality of pedestrian facilities	Sidewalks, pedestrian obstacles, pedestrian safety, street lighting, pedestrian obstacles, intersection safety, shade, walking in the city. Slippery sidewalks, recreational facilities..	
Neighbourhood Surroundings	Street trees, landmarks, natural landscapes, attractive buildings, litter.	1: Strongly agree
Transport crisis	Heavy traffic, slow speeds (< 30mph, approx. 48km/h), speeding, parking onthe street, traffic flow.	2: Partially disagree
Neighbourhood safety	Pedestrian visibility, safety, pedestrian safety by day, pedestrian safety by night, pedestrian volume, child safety by foot.	3: Partially agree
Lack of parking	Parking difficulties at shopping venues	4: Strongly agree
Lack of proximal roads	Number of end-of-road streets in the neighbourhood	
Slope	Walking slope	
Physical barriers	Obstacles to walking continuity (highways, railways or rivers, etc.)	
Social interaction	Human interaction on foot	

Source:Self-drawn by the author with reference to the evaluation criteria

③ New Zealand Community Street Review（CSR）

The Community Street Audit System is a new survey method that combines Community Street Audits (CSA) with a quantitative rating system that provides quantitative assessment of pedestrian conditions in identified problem areas. CSA is a method for assessing the quality of streets and spaces and was developed by Living Streets UK in 2002. It is a qualitative assessment of the quality of public places such as streets, lots, parks, and squares from the perspective of users rather than managers[40].

Table 2.7 New Zealand Community Street Review（CSR）

Category	Parameters	Criteria
Security variables	Overall: Walkability Characteristics: Traffic safety, accessibility, personal safety, efficiency, pleasure.	Very bad (1) ~ Very good (7)
Traffic variables	Prioritise non-motorised traffic (e.g., reduce the likelihood of motor vehicles arriving). More separation of roadways and sidewalks. Fewer bicyclists and motor scooters. Better visibility of roadways (building setbacks or parking restrictions). Less motorised traffic (less loaded traffic or noisy traffic).	Has it improved No Some Significant
Engineering variables	More direct routes; smoother street crossings; no steps or gentle inclines along paths. More and better tactile, visual aids; better street lighting; smooth and smoother surface quality; wider path widths.	Very bad (1) ~ Very good (7)
Environment variables	Better public art in the streetscape; better landscaping or greening; cleaner; fewer sidewalk barriers; more seating and water fountains, etc.; more street activity and nature monitoring.	Has it improved No Some Significant
Intersections	General:Walkability Characteristics:Traffic safety, safety from falling objects, waiting to cross, directness, accessibility.	
Traffic variables	Priority for non-motorised traffic (e.g., signalised or crosswalks at street intersections) Slower traffic speeds; less motorised traffic; better visibility of roadways (building setbacks or parking restrictions).	

Engineering variables	More direct routes; narrower streets (fewer lanes or elimination of parking spaces); gently sloping curbs; more and better tactile, visual aids; better street lighting; smooth and smoother surface quality; wider sidewalks and crosswalks; pedestrian signal warnings before cars start; longer walk signal times; audible walk signals; more safety islands; less waiting when crossing streets.

Source: Self-drawn by the author with reference to the evaluation criteria

④ Walk Score

The Walkability Index measures the walkability of any location using a patented system. For each address, the Walkability Index analyses hundreds of walking routes to neighbouring services. Facilities that can be reached in less than 5 minutes receive the highest score. A downward function is used for facilities that are farther away, and no score is given for facilities that are more than a 30-minute walk away. The Pedestrian Index also measures pedestrian friendliness by analysing population density, block length, and intersection density. These data sources include Google, education.com, Open Street Map, U.S. Census, Localeze, and 12% more.[41].Walk Score now has a corresponding mobile app that lets you view Walk Score for any location to find pedestrian-friendly neighbourhoods and homes 错误!未找到引用源。.

Table 2.8 Walk Score

Evaluation parameters	Walk Score	Level	Description
Distance to services, population density, block length, intersection density	90-100	Walking Paradise	Daily activities do not require a car
	70-89	Suitable for walking	Most activities can be done on foot
	50-69	Walkabl	Some activities can be done on

	e	foot
25-49	Car dependency	Most activities require a car
0-24	Car dependency	Almost all activities require a car

Source: Self-drawn by the author with reference to the evaluation criteria

⑤ Walkonomics' walkability assessment mobile app（Walkability APP）

Find a Walkable Route is the acoustics company's tagline. The company's Walkability APP focuses on spatial analysis based on open data provided by countries and uses it to evaluate the walkability of any road. The tool provides a powerful and objective basis for walkability maps. However, it cannot yet fully replicate human review and may contain some errors. The best way to understand the walkability of an area is to interview people who have actually walked through the place. To this end, Mimetic Acoustics uses crowdsourcing, which allows local citizens to give their ratings for each street. More and more streets are being rated and the mistakes are gradually becoming fewer. The founders hope it will eventually become a self-organising crowdsourcing system like Wikipedia or the Open Neighbourhood Map[35].

Table 2.9 Walkonomics' walkability assessment mobile app（Walkability APP）

Category	Introduction
Road safety Easy to cross High quality of pavement/footpaths Gentle road gradient Has an orientation Stay away from crime	The Walkonomics motto is "Find a walkable route." Walkability APP is a spatial analysis based on open data provided by jurisdictions to assess the walkability of individual streets. Data such as street width, crime rate, traffic volume, and even the number of trees on a street (in New York) can be used to calculate the score.

	Wisdom and Beauty
	Fun & Leisure

Source: Self-drawn by the author with reference to the evaluation criteria

⑥ Walkability Score by Mapology Campany

The Walkability Score is a system of three walkability ratings that takes into account factors such as street density, intersection complexity, presence of landmarks (such as retail stores, restaurants, or parks), population density, highways, and bodies of water. The scores range from 0 to 5. The three ratings are as follows.

a. Overall rating: reflects the time and distance to walk to daily attractions, as well as the availability of attractions in the area;

b. Amenities score: reflects the pedestrian accessibility of everyday attractions such as retail stores or salons;

c. Recreational value: reflects the walking distance to e.g. restaurants and parks.

Other factors may increase or decrease the score, such as road type, speed limits, road intersections, weather, public transportation, and population density. An index of zero simply means that there is not enough data to calculate it. Also, the overall index is not an average of the facility accessibility index and the recreational accessibility index[36].

Table 2.10 Walkability Score by Mapology Campany

Category	Contents
overall score	Reflects the time and distance to walk to daily attractions and the availability of attractions within the area.
amenities score	Reflects walking distance to places of daily need (e.g., retail stores or salons).
leisure score	This is reflected in the pedestrian accessibility of restaurants and parks, for example.

Source: Self-drawn by the author with reference

to the evaluation criteria

(2) Current Practice in China Regarding Wolking-friendly Streets

On September 9, 2013, a State Council document (Guo Fa [2013] No. 36) first formulated requirements for the design of urban pedestrian systems, stating that urban transportation should introduce the concept of pedestrian priority, improve residents' travel environment, ensure travel safety, and promote environmentally friendly transportation. Cities should build urban pedestrian and bicycle paths, expand crosswalks, bicycle parking facilities, street greening, lighting and other facilities, and effectively change traffic development that relies too much on cars [错误!未找到引用源。].

A number of studies on pedestrian-friendly practices have been conducted in China, and the content of each city's guidelines and special pedestrian-friendly plans will not be repeated here. In the following, the criteria for pedestrian-friendly street design are discussed with reference to the evaluation indicators for pedestrian-friendly cities in China and the Guangzhou Road Design Manual.

Table 2.11 Guangdong Province's Documents on Unfriendly Aspects

Policy documents	Year of publication	Effectiveness
Guangzhou Total Element Street Design	2017	Guiding norms
2017 Guangzhou Environmental Enhancement Programme Work Programme	2017	Guiding norms
The 13th Five-Year Plan for Urban Infrastructure Construction in Guangdong Province (20I6-2020)	2017	Guiding norms
Walking and Cycling Transport Blue Book	2017	Guiding norms
Planning Study on Slow Mobility System in Long Lake District	2017	Guiding norms
Luohu District Complete Streets Design Guidelines	2018	Guiding norms

Source: Self-drawn by the author with reference to the evaluation criteria

Table 2.12 Walkability assessment in Chinese cities - A study of walkability in vital city centres 错误!未找到引用源。

Category	Street Environment Index	Evaluation Methods
Evaluation indicators	Instructions	
Street crossing facilities	e.g. signal signs, overpasses, underpasses, crosswalk markings, pedestrian refuge islands, etc.	
Street greening/street trees	The streets are lined with shady street trees	The walkability rating system for the street environment (Figure 1) shows a 360-degree street panorama with magnified observation points on the left and nine indicators on the right. A checkmark on an indicator means that it meets the evaluation criteria and is rated 1, while a noncheckmark means that it does not meet the indicator content and is rated 0.
Comfortable building height to width ratio on both sides	The appropriate height to width ratio is 0.5 - 1	
Street furniture	Furniture such as chairs and stools placed along the street to allow pedestrians to rest when tired from walking (including chairs and stools in bus shelters).	
Machine and non-machine separation facilities	Includes barriers, roadside parking lanes, barrier flower beds, car stop bollards	
Walkways of appropriate width	The width should not be too narrow, walking on the sidewalk feels moderately wide, too narrow usually manifests itself in too much vegetation (such as tree pits, bushes, etc.), amenities (such as trash receptacles, streetlights, seating, electrical distribution boxes, etc.) taking up too much of the sidewalk and making it difficult for	

	pedestrians to walk (pay particular attention to whether the width is wide enough for handicapped people or strollers or for two people walking side by side). Do not consider the path too wide for the time being.
No long term occupation of footpaths	No prolonged occupation, e.g., no peddlers on the sidewalk, no parking of motor vehicles, etc.
Dedicated cycle paths	Clearly marked, paved or separated bike lanes.

Source: Self-drawn by the author with reference to the evaluation criteria

Table 2.13 Design Manual for All Elements of Urban Roads in Guangzhou (Guangzhou Municipal Commission of Housing and Urban-Rural Development, Guangzhou Urban Planning, Survey and Design Institute)

Category	Sub-item	Key elements	General elements
Slow moving system	Space	Pavement width, non-motorized lane width	Pavement widening
	Road surface and structure	Sidewalk panels and structures, non-motorised sidewalk panels, non-motorised emergency signage on sidewalks, decorative manhole covers.	-
	Ancillary Facilities	Steps, stairways and ramps, kerb ramps, slow-moving guidance facilities, blind alleys	Car stops, bicycle parking racks, public bicycle rental points, lifts, escalators, wheelchair lifts, pedestrian and non-motorized signal lights

	Street crossing facilities	Crossing safety islands, crosswalks (raised crossing aids).	Underpasses (crossing tunnels), pedestrian walkways, bicycle crossing lanes.
Motorway	Space	Highway widths, on-street parking, small turning radii, lane features, highway spreads, stepped sections.	Bus lanes, bus stops, cab stands, traffic islands, turn lanes.
	Road surface and structure	Motorway pavement and structures, side (flat) stones	Motorway markings
	Ancillary Facilities	-	Traffic signals, traffic monitoring and detection devices, electronic police, traffic signs, guardrails, accident protection devices (buoys, bollards, etc.).
Urban furniture	Public facilities	-	Street lighting (street lights), landscape lighting (garden and lawn lighting, major intersections of the plaza, landscape decorative lighting, etc.), guardrails, trash receptacles, fire suppression equipment, security monitoring.
	Public service facilities	-	Public seating, newsstands, portable toilets, handwashing stations (direct drinking water), mailboxes, public telephone booths, smart service facilities, sanitary rooms, power distribution and substations, vulnerability facilities, street name signs, sun (rain) shelters, information boards, light boxes for police station signage, security kiosks

	Transportation Services	-	Bus stop signs, bus shelters (corridors), electronic bus stop signs, electronic bus maps.
	Artistic landscape facilities	-	Vignettes, sculptures
Plant greening	-	Street trees, tree ponds	Street greening (sidewalk greening, roadside greening, greening of traffic islands), greening under viaducts, greening of bridges, greening of pedestrian bridges, greening of parking lots, hanging flowers on guardrails, flower ponds, flower beds, mobile flower pots.
Building façade	-	Exterior wall advertising, shop signs, building names.	-
Room to retreat	Ground	-	Surface paving, surface parking
	Ancillary Facilities	-	Shade structures, information boards, steps, fences, vignettes

Source: Drawn by the author from the Guangzhou Urban Road Design Manual for All Elements

e 2.14 Evaluation index of pedestrian friendly evaluation method based on multi-source data research - A typical str Changchun city as an example

ification of ators	Evaluation indicators	Indicator Meaning and Calculation Methodology
urity	Pavement continuity/%	Continuous length of passage as a percentage of total section length

	Availability of non-motorised lanes	A separate non-motorised driveway with continuous access on the roadway w 50 m before and after the observation point takes the value; otherwise, it is
	Is there a separation between the pavement and the motor vehicle parking space	If there are no adjacent motor vehicle parking spaces on the road segment wi 50 m of the observation point on either side of the roadway, the value is 1; if are adjacent motor vehicle parking spaces but they are separated from each o the value is 0.5; if there are adjacent motor vehicle parking spaces but they ar separated from each other, the value is 0
	Road network accessibility/(km·km²)	Density of the road network within a radius of 500 m
venie	Bus stop density/(seat-km)	Number of bus stops within a radius of 400 m Radius
ce	Density of street crossing facilities (block-km)	Number of street crossing facilities within 150 m
	Relative width of pavement/%	Effective width of pavement as a proportion of total road width
	Interface enclosure/%	Length of buildings along the street / length of section
	Street interface permeability	Transparent, translucent, opaque, fences, enclosures
	Availability of sitting facilities	Includes street benches, flower beds and street side sitting facilities provided businesses
nfort	Availability of pedestrian lighting	If there is pedestrian lighting on the road within 50 m of the observation point value is l; otherwise it is 0
	Availability of street trees	If there are street trees on the road within 50 m of the observation point, the v is 1; otherwise it is 0
	Green Looking Ratio/%	Percentage of area of green vegetation in streetscape images

Note: In this study, observation sample points were taken along the street at a distance of 100m.

ource: Author's drawing based on "Research on pedestrian friendliness evaluation method based on multi-source data - taking typical street in Changchun City as an example

Table 2.15 Drawing of the author based on "Research on pedestrian friendliness evaluation method based on multi-source data - taking a typical street in Changchun City as an example

Classification of indicators	Evaluation indicators	Classification of indicators	Evaluation indicators
Connectivity	Pedestrian network accessibility	Coherence	Architectural harmony
	Pedestrian body accessibility		Coordination of street furniture
Convenience	Accessibility of services	Comfort	Physical space suitability
	Service Amenity		Perceived walkability
Security	Safety in the pedestrian environment	Diversity	Diversity of street functions
	Safety of the main body of the walk		Diversity of pedestrian space

Source: Self-drawn by the author based on "A study of street walkability in Beijing's historic and cultural districts based on multi-source data

able 2.16 Multi-source data analysis of indicators for environmental research assessment of neighbourhood walkabili

Evaluation indicators	Description	Contents	Analysis n
Road encroachment	Refers to the temporary occupation of roadways by cars, bicycles, vendors, etc.	Road network selectivity, road network integration, road network density	CAD analysis, s GIS
Satisfaction with service facilities	Refers to the evaluation of the service facilities within the street	15-minute facility accessibility, 15-minute facility diversity, classified facility accessibility, service facility satisfaction	Open Data, GI
Missing service facilities	Indicates which services are missing within walking		On-site research

	distance		
Traffic	Refers to the total volume of traffic on the road		
Traffic Accidents	Refers to whether there are frequent traffic accidents on the street		
Speed	Refers to the speed of vehicles on the street	Urban road markings Installation of facilities	
Law and order	Refers to daytime and nighttime policing in the street	Road access Street Policing	
Traffic Safety Facilities	means facilities such as road crossing rails		
Lighting	Refers to the lighting of the road at night		
Road cleaning	street surface clean		
Leisure facilities	Seating facilities in roads and public spaces	Street Green Visibility Sky openness Street environment	Baidu Street Analytics, St Seman
Street trees for shade	Shade effect of street trees		
Greenery configuration landscape	Greening of roads other than roadside trees		
Natural and open spaces	Satisfaction with natural landscape, parkland, etc.	Satisfaction with landscape amenities, satisfaction with architectural design, satisfaction with natural open space.	On-site research
Architectural design	Satisfaction with architectural landscape design		

drawn by the author based on "Indicators for the evaluation of research on the walkability of neighbourhoods based on the ar from various sources.

Overall, it appears that pedestrian-friendly streets have a solid theoretical and practical basis in research, and pedestrian engineering has demonstrated the need for refined development, while pedestrian-friendly research on the spatial

environment of streets from the perspective of pedestrian behaviour is lacking, as are renewal strategies for problematic streets such as urban villages.

Based on the above evaluation criteria, the following principles can guide the study of streetscape renewal strategies in Lijiao Village.

a. Feasibility: indicators are relatively easy to identify, easy to understand, easy to calculate, results-oriented, and have some generality for planning studies such as landscape renewal;
b. Specificity: the selected indicators should reflect the salient features of the research object, resolve the main contradictions in the renewal design and avoid the "formula" of generality;
c. Combining quantitative and subjective assessment, identifying correlations between quantitative data results and subjective assessment, ensuring practical guidance for design implementation;
d. A human perspective: understand the place and express the design from a visual dimension, using the cityscape sequence landscape approach, so that the design is closely related to the research and the design results can be easily understood.

2.1.3. Walking-friendly In the Visual Dimension

The visual dimension of urban design is also known as Visual Urbanism, The Artistic Tradition in Urban Eesign, or Picturesque Areas of Concentration. It is based on the urban researcher's personal perception of the elements of the physical spatial environment, the qualitative description of the "good" environment through language or iconography, the expression of design strategies in aesthetic and abstract terms, and the study of the physical spatial environment as an object of study. The field of urban design research[44].

Until the late 1960s, it formed the basis and core of Western urban planning theoretical research and dominated institutional education and urban planning practice.[错误!未找到引用源。] .

At the beginning of the study, the author conducted an AHP needs assessment based on the five aspects of Maslow's hierarchy of needs to discuss different aspects of pedestrian friendliness with three groups of respondents: children, adults, and elderly, professionals and non-professionals. The pedestrian environment (including physical environment, traffic environment, social environment, visual environment,

and cultural environment) in an urban village was each rated according to its weighting.

As can be seen from the final statistical results, people's needs in relation to the street environment do not fully conform to Maslow's hierarchy of needs, but rather have a centre of gravity. Since people themselves have some adaptability to climate and, with the exception of extreme climates, generally have some ability to regulate their physiological experience, the study found that despite the medium weighting of the visual environment in the final results of the sample, when comparing individual data, visual needs outweigh physiological needs in the majority of cases. In connection with the author's feelings during her stay in Italy, she tends to travel even in severe winter cold precisely because the visual environment provides greater emotional value.In the analysis of the statistical sample classification, the lower demand for social environments among young people is partly due to the influence of virtual social spaces on the Internet. Thus, creating social places that meet young people's needs can help encourage a return to the real world and a focus on real-life communication, which may also contribute to mental health.

Table 2.17 A Walking-friendly Oriented Evaluation Weighting Analysis of Streets in Urban Villages

	Physiological environment	Transport environment	Social environment	Visual environment	Cultural environment
Physiological environment	1.000	0.864	1.133	1.008	1.238
Transport environment	1.158	1.000	1.133	1.143	1.034
Social environment	0.883	0.883	1.000	0.903	0.857
Visual environment	0.992	0.875	1.108	1.000	1.188
Cultural environment	0.808	0.967	1.167	0.842	1.000

Source: Self-drawn by the author

Table 2.18 Results of AHP Hierarchical Analysis

	Eigenvectors	Weighting values	Maximum Eigenvalue	CI value
Physiological environment	1.038	0.208	5.013	0.003

Transport environment	1.090	0.218
Social environment	0.901	0.180
Visual environment	1.023	0.205
Cultural environment	0.948	0.190

Source: Self-drawn by the author

In 1948, Cullen developed the pedestrian theory in Legs and Wheels. He argued that places such as cathedrals, schools, and squares should give unrestricted priority to pedestrians, with only emergency traffic such as ambulances and fire engines. Cullen exemplifies his pedestrian zone with a mix of cobblestones and slates, with bollards to ensure pedestrian priority, without the use of hedges. In some ways, this article is groundbreaking and influential, as it was adopted in pedestrian zones throughout Europe beginning in the late 1950s. Pedestrianisation theory goes back to Cullen's habit of looking at the city from the pedestrian's point of view, and has its roots in his "sequential landscape" and his theory of places.

The simplest approach to pedestrian-friendly design strategies in this study is the visual dimension, which harkens back to the 18th century British "Picturesque" theory of urban design that draws on empirical tradition, emphasises direct sensory contact and response, rejects linear geometry, and encourages natural irregularities. "Picturesque" theory, the original British theory of garden aesthetics, was not only the origin of urban planning theory in its visual dimension, but also the basis for the emergence of many architectural and urban planning theories in Britain. In a way, it contributed to the conservative tendencies and nostalgia in Britain and also had an influence on Cullen's urban planning thinking. Following the "picturesque" theory, the visual dimension of streetscape design theory developed as shown in the following table.

Table 2.19 Urban design development in the visual dimension

Time	Author	Publications	Opinion
1889	Camillo Sitte	City PlanningAccording to Artistic Principles	Through a careful analysis of the organisation of urban space in historic cities, the principles of the arrangement of streets, squares, monuments, and buildings in the city are elaborated to recover a theory of urban design that emphasises the visual experience of the city and uses artistic principles as the supreme

			order.
1909	Raymond Unwin	Town Planning in Practice:An Introduction to the Art of Designing Cities and Suburbs	He developed the concept of garden-like suburban design, which was implemented in design guidelines for social housing, which grew rapidly between 1920 and 1957.
1953	Thomas Sharp、Frederick Gibberd、W Holford	Design in Town and Village	Gibbard emphasises the importance of creating a "streetscape" in the design of settlements, referring to the principles of building and paving, the form and character of the site, the pattern of facades and the line of buildings, and the need to improve the design of spaces that are parallel, at an angle, or perpendicular to the street.

Source: Self-drawn by the author based on relevant papers

As for the development of the theory of urbanism in the visual dimension until the middle of the 20th century, its theoretical roots and subsequent development were mainly concentrated in the United Kingdom. As a result, an anti-urban aesthetic in urban planning and design principles prevailed in the United Kingdom for a long time. The Townscape movement is clearly a continuation of the British tradition of visually oriented urban design. Although the visual dimension of urban design theory was criticised as "rudimentary knowledge, lacking theoretical rigour, and unworthy of deeper investigation," it was adopted and developed and to focus on the spirit of place, the history and spatial meaning of place behind the visual. In the context of the multidimensionalization of urban design, the study of the visual characteristics of architecture and urban space remains an important component of urban design.

2.2. Research Methodology and Framework

2.2.1. Research Methodology

The study of the regeneration concept for Lijiao village begins with site reconnaissance and document analysis. After a comprehensive understanding of the characteristics and historical and cultural background of Lijiao village, questionnaire research and quantitative statistical analysis are used to determine the design conditions of Lijiao village. At the same time, analogous analysis and relationship analysis between the case and the map base are conducted to derive specific design reference strategies related to the design objectives.

2.2.2. Research Framework

Through on-site research and analysis of the current situation, Chapter 1 identified a number of problems related to pedestrian-friendly streetscape design in Lijiao village (e.g. inappropriate traffic planning resulting in large numbers of motor vehicles parking and taking up landscape resources, a lack of consistent management of roads and lanes resulting in narrow or blocked lanes), while at the same time noting that the characteristics of each street in the urban village (in particular the ratio of street height to street width, the proportion of street sky and the proportion of green vista, The study also found that the characteristics of each street in the urban village (in the form of quantifiable indicators such as the street height to width ratio, the proportion of street sky and greenery, and the evenness of the street surface) also form a unique and attractive urban village streetscape that has the potential to create a multi-level pedestrian experience, which forms the basis for the research and design objectives.

The study is design-led and focuses on design strategies. By drawing out the theoretical research findings and influencing factors of streetscape redevelopment from the concept of pedestrian friendliness and evaluation indicators, the indicators and contents of streetscape redevelopment strategies need to be focused from the perspective of pedestrian friendliness. Chapter 4 examines the indicators and design elements and proposes specific streetscape regeneration strategies for Lijiao village. Finally, the macro planning strategies and intersection design strategies that focus on streetscape regeneration from a pedestrian friendliness perspective are presented in the context of the design outcomes.

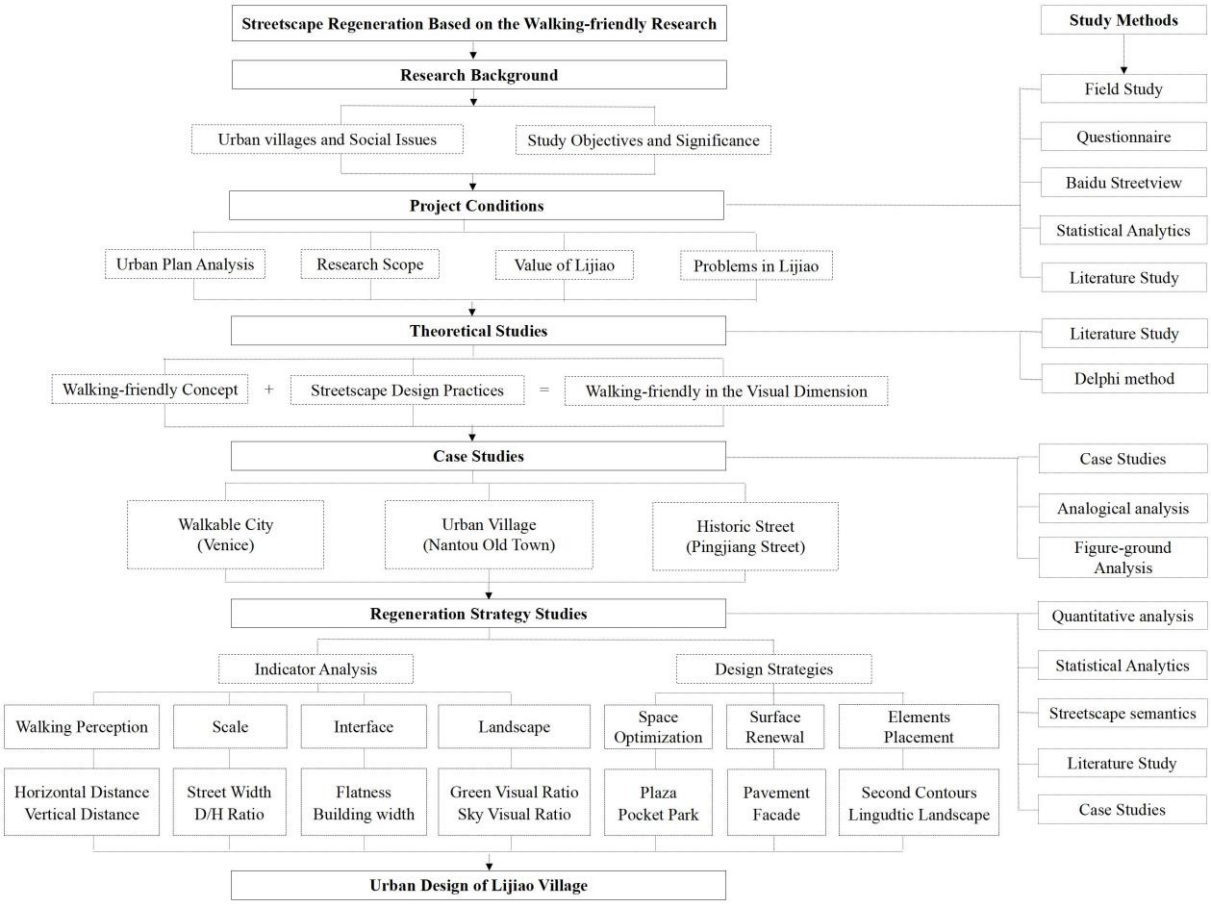


Figure2.2 Research Framework
Source: Self-drawn by the author

Chapter3 Case Studies

3.1. Introduction of Cases

In the case study section, three case studies with different levels of walkability were selected: Venice for pedestrian city, Nantou Old Town in Shenzhen for urban village and Pingjiang Road in Suzhou for pedestrian street. In addition to the high degree of walkability, the three cases also match Lijiao Village in terms of the characteristics of the street profile and planimetric texture.

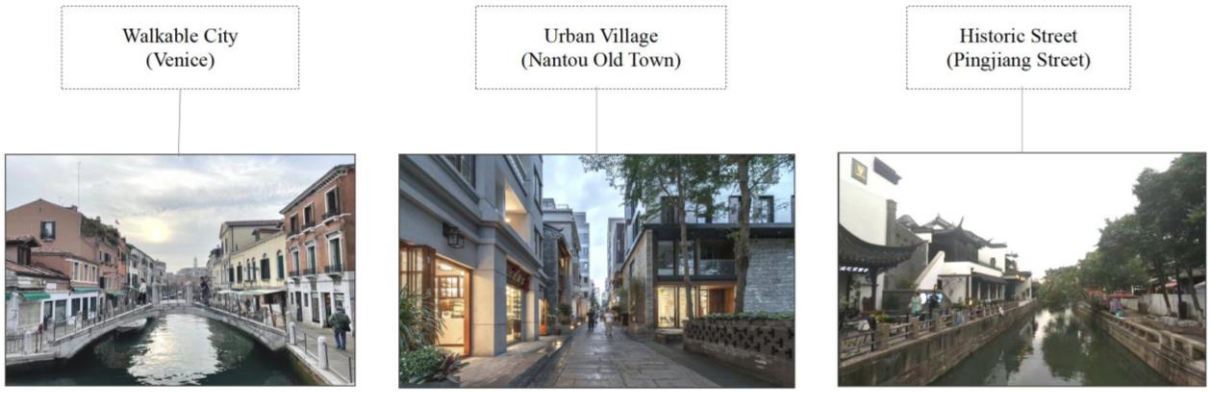


Figure3.1 Case studies of walking at different scales
Source: Photo by the author,From the internet

3.1.1. Venice, Italy

Venice has the reputation of being the most famous "city on water" in the world, with a well-developed waterway system. These waterways and canals carry traffic through Venice and replace city streets, but they function like a system of well-designed highways and greenbelts in a modern city, and it is thanks to this well-developed water transportation system that Venice is the largest car-free area in Europe and a prime example of a walkability study.

The Grand Canal, Venice's longest street, connects the city's political centre, San Marco, to its commercial centre, Rialto, and the "S" shape of the Grand Canal, an avenue of traffic with small waterways extending into the city, is naturally organic and complementary to the city's development.

Lewis Mumford also noted that "no city is more typical of mediaeval urban structure than Venice. Nor is there any city that can better represent a new urban structure in its own development than Venice. "The Venetian plan is also a continuous dynamic design that does not change arbitrarily or adapt to the needs of a particular time, but allows itself to grow. The Venice of today is a unified entity of change and growth that stands out among European cities.[错误!未找到引用源。] .

Over the centuries, Venice has preserved a rich tangible and intangible cultural heritage, including shipbuilding techniques that have been registered as intangible cultural heritage, ancient buildings, churches, squares and paintings that are constantly being improved and restored, and the gondolas that are famous for local transport. The gondolas are famous all over the world.

These characteristics of Venice, together with its tight urban fabric, short walking distances, wonderfully continuous spaces, high degree of mixed functions, active first floors, excellent architecture and well-designed details, make it a typical case for this design study.

3.1.2. Pingjiang Street, Suzhou

Pingjiang Road is an old historic street along the Pingjiang River in Suzhou and is by far the best preserved area of the old city. The spatial arrangement of Pingjiang Road follows the pattern of city squares that has existed since the Tang and Song Dynasties, and preserves the water city pattern of "parallel waterways and adjacent river streets". Today, Pingjiang Road is a road section from Baita East Road in the north to Ganzhong Road in the south, with a total length of 1,090 metres. With Pingjiang Road and Pingjiang River as the main axis, it is bounded by Dacang Street and Linden Road on the east and west respectively, leaving several water alleys and dense narrow lanes. The area also contains a number of residential buildings, more than ten cultural relics and over 40 control buildings.

In 2005, Suzhou's Pingjiang Historic District was awarded the UNESCO Asia-Pacific Heritage Conservation Excellence Award, making it the only historic district project to receive the award that year. The project specified from the outset that the district should be planned as an integrated area for residential, commercial and leisure tourism with the unique cultural and historical features of Suzhou." A prerequisite for renovating stores in the landscape is that they harmonise with the overall historical image of the district, otherwise they would be detrimental to the preservation of cultural heritage and require regulatory intervention. The protection and renovation will respect the four principles of "authenticity, integrity, legibility and sustainability", and the original historic environment will be respected as much as possible, with protective restoration without falling off the shelves, so that the real traces of history are preserved. The buildings on both sides of Pingjiang Road are of moderate size and uniform architectural style [错误!未找到引用源。] .

3.1.3. Nantou Old Town, Shenzhen

The ancient city of Nantou in the Nanshan District of Shenzhen was built in the Jin Dynasty and has a history of over 1700 years. The village is surrounded by the village, and the village is surrounded by the city.

Due to its location in the centre of Shenzhen, land prices are high, and villagers have built houses on the site to profit from renting. The result is "handshake houses" throughout the village, with very close spacing between buildings, poor ventilation and lighting, and no guarantee of privacy. Since almost all the land in the village has been used to build houses, there is a lack of public space and green areas, and the streets in the village are not well connected, with inadequate road networks and narrow street widths.

After the renovation of the old town of Nantou, many new places for residents' activities have been created in the village, such as "Cross Street Square", "Newspaper Deity Square" and "Oasis in the City", which enliven community life and increase community openness. The successful renovation of some buildings is also a possible reference for future renovations by residents. The restoration and renovation of some historic buildings in the Old Town also restored the historic appearance of the Old Town. The renovated Nantou Old Town successfully hosted the Shenzhen-Hong Kong Biennale of Urbanism in 2017 and has changed the stereotypical image of the urban village as a "dirty and disorganised" environment without vitality in the community, but the problem of high building density and high land ratio has not improved much due to the preservation of too many original buildings and the condition of the land. Buildings continue to have poor ventilation and lighting. The narrow width of the streets in the village also makes it impossible for vehicles such as fire trucks and ambulances to pass through.[错误!未找到引用源。] .

3.2. Comparative Analysis of Case Studies

3.2.1. Analysis of Figure-ground

The theory of figure-ground relationships comes from Gestalt psychology and is used in cognitive theory to study the relationship between context and graphics. For example, if the street space is interesting, the street space can be considered as the background and the building becomes the subject; if the street space is negative, the street space cannot be considered as the background and the building can only be

considered as the background and the street space becomes the subject. Therefore, the "figure" and the "background" can merge according to their respective degrees of positivity or negativity.

The theory of figure-ground relationships has been used to evaluate the positivity of space in cities and architecture. In Search of Lost Space, Roger Transik proposed the theory of figure-ground relationship, the theory of connection, and the theory of place as the three most important theories of urban design, of which the theory of figure-ground relationship is a direct indication of what is wrong with the modern city; Colin Rowe and Fred Kotter, in Collage City, also proposed the importance of texture in the city, emphasising that texture is the spatial body of the city and the basis for creating a diverse city [错误!未找到引用源。].

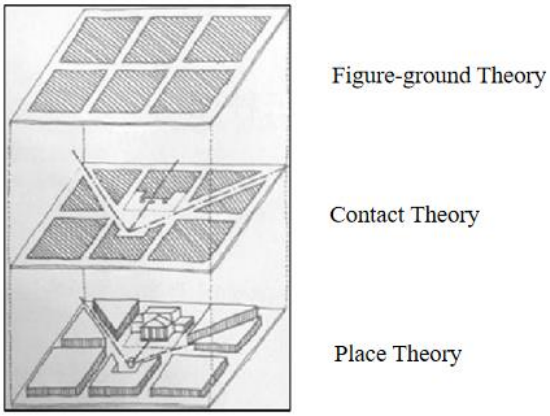


Figure3.2 The three main theories of urban design by Roger Transik
Source:Illustration of In Search of the Lost Empty Question

In Ashihara Yoshinobu's book The Aesthetics of the Street, he uses a "relationship diagram" to analyse an ancient European city represented by an Italian city, and concludes that the reason for the excellent public space is that Italian streets and squares are places of life for Italians, and therefore the interior and exterior of a house are treated equally. This means that streets and squares play an important role in Italian life and form part of it; at the same time, they are treated as walls of external public spaces (streets and squares) that form "shadow spaces", taking into account the interrelation between the surrounding buildings and the effect of the external public space they enclose [错误!未找到引用源。].

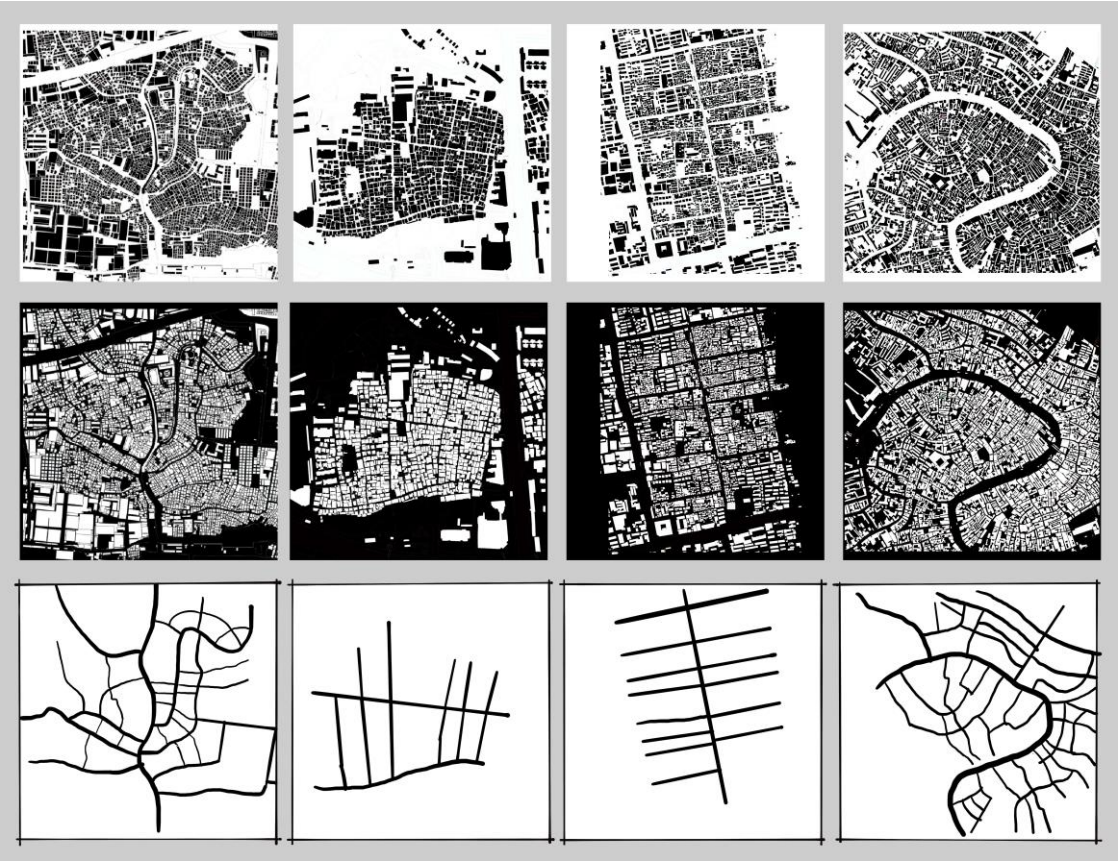


Figure3.3 Comparison of the relationship at the bottom of the case diagram
（From left to right: Lijiao Village, Nantou Old Town, Pingjiang Road, Venice）
Source: Self-drawn by the author

Comparing the structure of Lijiao Village with that of the old town of Nantou in Shenzhen, Pingjiang Road in Suzhou and Venice in Italy(as shown in Figure3.3)it can be seen that unlike most urban villages and historic districts in China, the structure of Lijiao Village has some simiarities with that of Venice and is of great conservation value. At the same time, with the exception of the main street, most of the alleys in Lijiao village are hidden by unauthorised buildings, resulting in a lack of clarity of structure, boundaries and public space.Many European cities have similar graphic features and spatial qualities, as the concept of space is the same. The streets and squares of these old cities are of a pleasant size, rich in public space, with a strong sense of enclosure and connectedness; the building density is high, the street facades are continuous, clear and uniform, the streets meander freely, the rhythm is soothing but full of variety and bounce, and interest is high. A walk through the city is often a stroke of luck and a surprise.[错误!未找到引用源。] .

The first analysis of the spatial form of the present area of the ancient city of Nantou shows that the space within the ancient city of Nantou developed from the village and gradually weakened as a village space, with the city surrounding the village space.

With the change of spatial form, the way of life of villagers has also changed. With the development of the economy, three representative types of textures emerged after a long period of disorderly development. The first type of texture is a mixture of new buildings and existing buildings, with large-scale building forms as well as buildings built on the original residential plinths of the old town. The second type of structure is a mixture of factory and residential areas, with large areas around the factory areas. The third type is the most typical of the original village areas in the old town and is also the main form of housing in the village, with a variety of architectural forms and inconsistent styles, some of which are of poor quality. The buildings of this type of area occupy the street space and are too close together, making access difficult [错误!未找到引用源。] .Nantou Old Town has two longitudinal streets as its main street, but the rest of the area is underdeveloped and the building density has the common characteristics of urban villages in first-tier cities, i.e. too high a density, which leads to problems such as lack of light and ventilation in the village buildings. Compared to Pingjiang Road and Venice, a visit to Nantou Old Town often gives a feeling of under-excitement.

Pingjiang Road is a typical fishbone street pattern, with buildings and roads on both sides of the block growing in a direction perpendicular to that of the main street, forming a fishbone block texture, with the fishbone street pattern usually using the main street as a public space for people to interact and live, and the streets extending from the main line to both sides, forming a more private living space, i.e. a courtyard space, forming a landscape pattern of public space in series with courtyard space. The landscape pattern of the courtyard space is formed by the public space. From the visitor's point of view, however, it is difficult to perceive the atmosphere of the alleyways beyond the main street [错误!未找到引用源。] .

The old town of Nantou has two longitudinal roads as the main street, but the rest of the area is underdeveloped, and the building density has the usual characteristics of urban villages in first-tier cities, i.e. too high density, leading to problems such as lack of light and ventilation in village buildings. Compared with Pingjiang Road and Venice, a visit to the old town of Nantou often gives the feeling of being too unexciting.

Pingjiang Road is a typical herringbone street pattern, in which the buildings and streets on both sides of the block extend perpendicular to the main road, forming a herringbone block structure.The herringbone street pattern generally uses the main

road as a public space where people interact and live, and the streets extending from the main line to both sides form a more private living space, i.e. a courtyard space, which is a landscape pattern of public space in series with the courtyard space. The landscape pattern of the courtyard is formed by the public space. However, from the visitor's point of view, it is difficult to perceive the atmosphere of the alleys beyond the main street [错误!未找到引用源。].

The following suggestions were made for the planning and design of Lijiao Village:

a. retain the character of the fabric of Lijiao Village as far as possible
b. to unclog the lanes to make the road system clearer and more complete
c. create a neat but rich street interface
d. increase public activity space

3.2.2. Planning Analysis

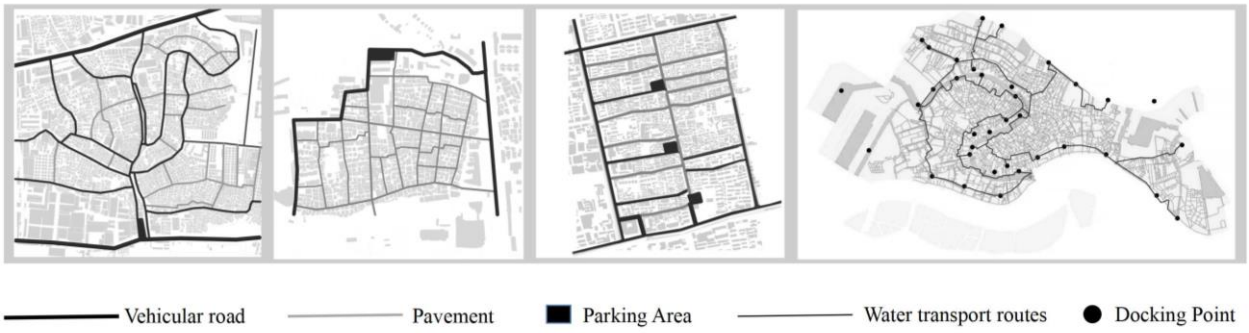


Figure3.4 Transport planning analysis comparison
（From left to right: Lijiao Village, Nantou Old Town, Pingjiang Road, Venice）
Source: Self-drawn by the author

The highways in the old town of Nantou and Pingjiang Road are on the periphery of the village and are not allowed to be driven on; the village has two main roads running lengthwise, while the other roads are not very open.

The overall spatial arrangement of Pingjiang Road Historic District is mixed and organic, maintaining the traditional spatial structure of "dwelling - alley - neighbourhood", with a gradual transition from private to open interaction, creating a typical spatial pattern of interaction in the streets of Jiangnan.[错误!未找到引用源。].

The water transportation system in the historic city of Venice is very closely related to the pedestrian transportation system. Many of the city's pedestrian walkways run directly along the waterways, allowing water cabs to stop at any time along the waterways where they can, while the waterways where they cannot are provided with stops for boats at a certain distance. Water bus stops are located on both sides of the Grand Canal and throughout the city, and are directly connected to pedestrian

walkways, thus linking water transportation and pedestrian walkways. Water and pedestrian traffic are not spatially intertwined, but are very closely connected. Venice has a very well developed pedestrian transportation system. The city's pedestrian transportation system includes not only the sidewalks, but also all of the city's bridges and ferry system. The city's main pedestrian network consists of interconnected circular routes and connects almost all of the city's famous landmarks. The old buildings of the city are well preserved and there are no tall skyscrapers or oversized buildings, creating a pleasant and environmentally friendly streetscape.[错误!未找到引用源。] .

Comparison with the old town of Nantou, Pingjiang Road, and Venice shows that Lijiao Village has a high percentage of roadways, lacks a parking plan, and pedestrian walkways do not form a complete system.

The only large parking lot is located on Fusiyue Road. A detailed description of the parking situation in Lijiao Village can be found in Chapter 1 and will not be repeated here. The parking needs of the old town of Nantou are being solved on the periphery of the village; Pingjiang Road has now invested 50 million in the renovation of three new three-dimensional parking garages, located at the end of the three wider side streets of the town, with a total parking capacity of about 1,500 motor vehicles.

Table 3.1 Statistical Table on the Modification of Traffic Problems in Urban Villages

Type	Conversion method	Road network	Public Transport	Private Car	Slow traffic	static traffic
Strictly demand-restricted	Conservation, maintenance and repair	Maintaining the existing structure	Exterior Public Transport	Severe restrictions	Set up a slow-moving zone	Exterior parking
Moderately Demand Restrictive	Remediation, partial reconstruction	Small-scale renovation, partial grooming	External public transport, internal microcirculation	Moderate control	Installation of slow lanes	Exterior parking
Demand-satisfying	Redevelopment	Reprogramming	Introduction of main bus routes and	Properly catered for	Effective separation of	Planning of the correspond

	increased density of feeder routes	pedestrian and vehicular traffic	ing car park

Source: Self-drawn by the author based on a paper[55]

The following inspirations for the planning and design of Lijiao Village.

a. The percentage of walkable streets in Lijiao Village should be increased to limit automobile traffic;
b. Parking should be planned near all entrances;
c. The design should consider the organisation of a complete and smooth pedestrian system.

3.2.3. Street Section

By comparing the street profiles of Venice, Nantou Old Town and Pingjiang Road and their aspect ratios(Figure3.5), the characteristics of the three cases can be better understood and can also serve as a reference for the renewal of street spaces in Lijiao Village.

The distribution of aspect ratios in Lijiao Village is examined and illustrated in detail in Chapter 4 and is not compared in this section because the distribution of street aspect ratios in Lijiao Village covers a wide range and is not uniform for each street.

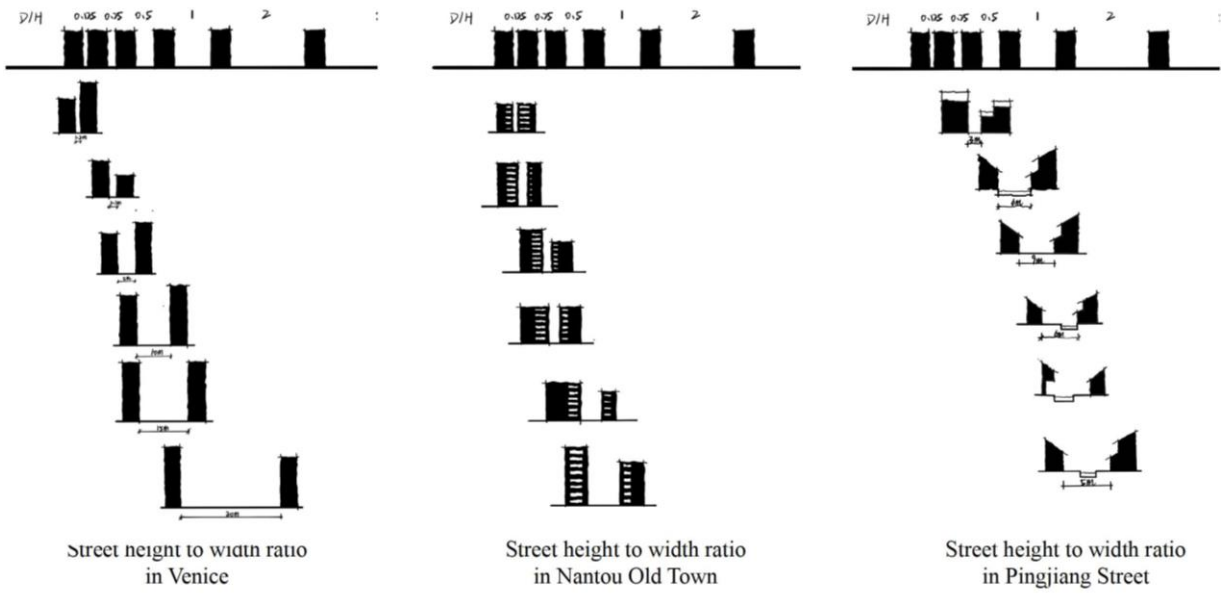


Figure3.5 Comparison of street height and width ratios
（From left to right: Nantou Old Town, Pingjiang Road, Venice）
Source: Self-drawn by the author

The distribution of the height-to-width ratio in Venice decreases from the centre outward, with a height-to-width ratio between 2 and 5, giving the impression of a compact or even narrow space. In the centre, buildings are compact and dense, forming blocks of comparable size separated by narrow streets or waterways. In the outskirts, there are factories or wharves that usually have a height of about 4 metres, and the streets are usually traffic-oriented and wide, giving the impression of openness and emptiness, with a lower ratio of height to width [错误!未找到引用源。].

In the Pingjiang Road historic district, where the height-to-width ratio is appropriately distributed, the streets can be roughly divided into streets (markets), alleys and lanes, with the markets along the river generally 6 to 8 metres wide, the streets and lanes 3 to 6 metres wide, and the small alleys 1 to 1.5 metres wide. The space is varied, with different sizes of streets and alleys that have different functions, and with different profiles related to the water system, and the architecture is very characteristic. The width of the main street space in Suzhou Old Town is usually 15m, the height is usually limited to 8-12m, and the D/H ratio is usually between 1-2, which gives a friendly and pleasant feeling.

The comparison of the profiles has inspired the design for the renovation of the streetscape in Lijiao village as follows.[错误!未找到引用源。].

The height/width H/W ratio of the streets in the old city is calculated as 1 to 6. The longitudinal streets have deep ravines, the building heights around the six streets are

statistically equal, and the buildings around them have a high degree of enclosure, which can be used to compare the effects of street layout on the internal environment of the streets. Due to their long length, the internal physical environment has different distribution characteristics 错误!未找到引用源。.The ratio of width to height D/H of the open spaces in the public areas of the old town of Nantui is similar to that of Venice and is basically within a comfortable range. Unlike the Venetian street spaces, the width to height ratio D/H in Nantui is comfortable only for the level 1 street spaces, while the level 1 street spaces have almost no comfortable width to height ratio. This results in a large number of level 2 and level 3 street spaces repeating the oppressive aspect ratios, leading to an imbalance in the D/H aspect ratio for the entire urban village. People focus on the more comfortable width and height of the grade 1 street space, resulting in the common image of a crowded main street (grade 1 street space) in an urban village, while a large number of side streets (grade 2 and 3 street space) are empty. Even if neighbours or friends are resting and chatting with each other, they would prefer to move to an open space or a level 1 street space, even if it is not too close, than to a street space with an unbalanced width-height ratio in front of their house 错误!未找到引用源。.

The proportions of existing buildings in Lijiao Village are similar to those in the old town of Nantou in Shenzhen, but new buildings should be more in line with the relationship between street height and width of Pingjiang Road, to provide a distinction between "street-street-street" and create a comfortable waterfront street environment.

3.2.4. Texture of the building

We must try to make the world understandable, not more confusing. What looks like wood should be wood, and what looks like iron is iron." -- Guenter Bennis

Since most major street surface materials are determined by the status quo in renewal design, architectural materials (brick, stone, wood, etc.) allow the eye to move while the building becomes flat and visual. The materials express the character and qualities of the building, its construction, its origin and even its wear and tear enrich and deepen the perception of time and experience.

The texture, grain, and pattern of a building's materials can convey a specific meaning, and materials always convey a specific sensory experience; the use of materials plays an important role in the experience of walking.

The buildings that line the street are connected to each other and form the main facade. As an important part of the design, the facade design can be combined in different ways to achieve an organic combination of visual aesthetics and rational function, using different methods and approaches such as addition, subtraction, concavity and convexity, repetition, rotation, displacement and so on.

Different colours can give people different emotional signals, because the visual sensitivity to colour is very high, so colours tend to attract the eye. It plays an important role in architecture, not only to promote the recognition of buildings, but also to beautify them, enhance their perception and trigger emotional resonance. It is an element that is often visually considered in experiential architecture. Each city has its own colour positioning, for example, in the old city of Paris, beige building facades with cyan or red roofs form a very harmonious neighbourhood colour; in the old city of Rome, Italy, the buildings are coloured orange and orange-red, while maintaining the original colour of the historic buildings.

There are several options for the colour of the building facade, determined by the design intent of the project in terms of planning and in terms of material and colour in terms of expression. The colour of the façade is also an important factor in the pedestrian experience, as different colours often evoke different psychological perceptions and thus affect the pedestrian experience index. Below is a list of possible colour design options based on street scenes I captured while studying in Europe, as well as a comparison of the current colour scheme of Lijiao Village with that of Nantou Old Town to analyse the key points of colour design in urban villages and provide ideas for design.

Figure3.6 Building texture in Venice, Italy
Source: Photographed and analysed by the author

Figure3.7 Building texture in Burano Island, Italy
Source: Photographed and analysed by the author

The colours of the city of Venice are predominantly warm, rich and overall harmonious. The roofs of the buildings are either vaulted or sloped, with the sloped roofs more often used for residential buildings and made of ceramic tiles, usually in earthy red or brick red, while the vaulted roofs are generally for public buildings such as churches and have light grey or cream roofs. The walls of the buildings are warm colours, mostly light yellow, pink-orange and brick red, interspersed with a few cream and off-white facades, so that the overall colours are not too dull. The advertising signs and awnings in the commercial area are blue-green and purple-red, contrasting

and relating to the building. The detailed window columns and bases of the building are designed in white and off-white to contrast with the warm colours of the facade, which are very striking. In Europe, the narrow louvred windows on building facades are very characteristic, and the windows in Venice, coloured in shades of wood or blue-green, create a rich yet unified urban colour palette.

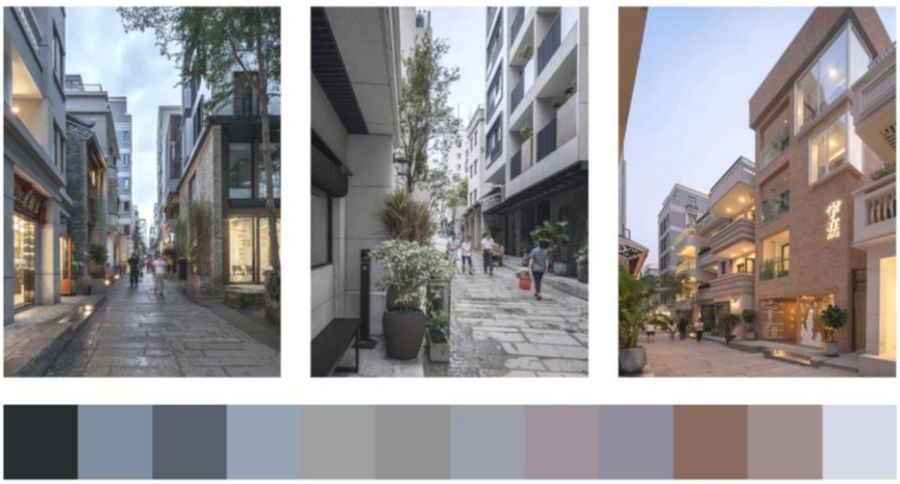


Figure3.8 Building texture in Nantou Old Town,Shenzhen
Source: https://www.gooood.cn

The architecture of the old town of Nantou is varied, and although it retains the characteristics of an urban village, the renovation of the buildings mainly uses modern architectural practises, with a strong sense of mass and an overall low colour saturation, contrasting cool and warm colours. The materials of each building are more uniform, usually a combination of solid brick and concrete walls with large glass windows.

Figure3.9 Building texture in Pingjiang Street,Suzhou
Source: From the internet

The material of Pingjiang Road is mainly white painted walls with wooden doors and windows, a unique feature of Jiangnan. The cooler walls contrast with the warmer wooden elements, and the signs, decorations and lighting accent the simple colour scheme.

Figure3.10 Building texture in Lijiao Village,Guangzhou
Source: Photographed and analysed by the author

The buildings in Lijiao Village are mainly made of brick as the exterior cladding material, including older brick buildings and newer buildings with brick cladding, which have an overall warm colour tone and poor quality of house facades, and have an overall poor appearance.

It is an irrefutable fact, as stated in Art and Visual Perception, that colours can express feelings. Indeed, different hues can convey different emotions, and inappropriate use of colour can detract from the original character of a place, affecting to some extent the emotions of its users and further compromising the experience of being on the street. Therefore, it is important to play a reasonable role in the coordination and unity of the street by controlling the exciting colours of the street, balancing and softening the tones, so that the street architecture provides a better background for the protagonists of the human street and highlights the pretty faces and beautiful dress colours of the protagonists. First, it is useful to keep the local colour palette. It helps to better preserve the memory of the place and regional identity, and makes it more accessible. Second, the colours of the materials themselves should be used as much as possible, with the dominant colour of the street being the centre colour. This will help stabilise the colour of the place and not overly visually stimulate people. Secondly, the use of the material's own colour is more natural and soft, and more compatible with the environment. In addition, it is important to use colours with high intensity and discard colours when necessary. The use of large areas or too much variety of high intensity colours is visually stimulating, messy and restless, with high visual tension, so that people are easily visually tired, but if used correctly, they can easily become a highlight, increasing the corresponding tension and creating a certain visual stimulation, guidance and impression marking. Some of the buildings can also be used without colour, which makes their shapes stand out better and brings out the beauty of the changes in light and shade, making them fit more naturally into the environment. Finally, there is the harmonisation of colours. Too much uniformity of colours can lead to a monotonous and uninteresting street. Therefore, there must be some commonality between the three attributes of hue, brightness and colour, maintaining an appropriate balance between dominance and subordination to give the whole a unified and coordinated visual aesthetic [错误!未找到引用源。] .

The following conclusions can be drawn from the colour analysis

a. The current colour scheme of Lijiao Village is dominated by warm colours, so a predominantly warm colour scheme should be maintained in the design of the renewal;
b. Compared with European streets, the photographs of the street scene in Lijiao village are based on the principle of colour matching, that is, when considering a

street scene as an image, a colour-matched image should contain primary and secondary colours, and the two should be contrasting, weaker in this respect;

c. As can be seen from the contrast, streets with lighter colours tend to convey a more relaxed feeling, so consideration should be given to using lighter colours for the renewal of Lijiao Village;

d. The law of "strong colours for small areas and weak colours for large areas" is an important guide for urban and architectural colour planning and design, and is the key to colour coordination in a given space [错误!未找到引用源。].

Chapter4 Regeneration Strategies of Lijiao

This chapter is divided into an indicator analysis and a design strategy study. The indicator analysis takes the twelve streets listed in the first chapter as the object of study and quantifies the important factors that influence pedestrian friendliness at the visual level and compares them with the street satisfaction survey curve to better derive local design strategies; the design strategy study collects a wide range of theoretical and practical cases to derive a reference strategy for streetscape renewal. Urban renewal is often incremental, and it is often difficult for urban design to guide specific building renovation programmes. Therefore, the results of the study, while not fully applicable to this redevelopment design, can be used as a guide for urban design, providing a basic reference point for more refined and systematic urban and building planning.

(where in the line graph, the correlation between study participants and street satisfaction is quantified with reference to the threshold of street satisfaction correlation in the data to see the relationship more clearly).

4.1.Factors that Determine the Character of the Landscape in Lijiao

Cullen's idea of the 'cityscape' relies on the 'sequential landscape' as the primary means of urban perception. In Planning in the Wilderness, the idea that "one house is a building, two houses are a cityscape" suggests that the "cityscape" is a "relational art" [63] and that the "urban design" industry operates as a "relational art". Independent streetscapes exhibit various relationships, such as the ratio of building height to street width and the flatness of the street surface. Continuous streetscapes also exhibit a relationship, such as an assembly of streetscape segments that form a "sequential landscape" of walking experiences.

Primary divisions	H (人文) HUMANITY	A (人造要素) ARTIFACTS	M (心境) MOOD	S (空间) SPACE
Secondary divisions RANGE (范围)	Scales COMMUNITIES (社区) 1 size 2 density 3 mobility 4 age 5 class 6 sect 7 oddity 8 regionality 9 ethnicity	Scales STOCK OF PARTS 1 atmosphere (组件) 2 water (储备) 3 land 4 plants 5 animals 6 objects 7 structures (uninhabited) 8 structures (inhabited) 9 complexes	Scales STIMULI (刺激) 1 position 2 size 3 shape 4 implication 5 symbolism 6 colour 7 texture 8 sound 9 touch/smell	Scales ENCLOSURES (围合) 1 surface distinction 2 staked out 3 screened 4 walled—random 5 walled—opening 6 walled— solid 7 roofed/glass 8 enclosed 9 imprisoned
USE (用途)	EMPLOYMENT (职业) 1 cleansing 2 nourishing: body 3 nourishing: spirit 4 travelling 5 working 6 shopping 7 free-wheeling 8 healing 9 resting	FUNCTION (功能) 1 feasibility 2 tenure 3 climate 4 shelter 5 communication 6 manufacture 7 trade 8 association 9 administration	PROPRIETY (得体) 1 organic landscape 2 hierarchy 3 good manners 4 propriety 5 insensate 6 snob/pop 7 bad manners 8 chaos 9 outrage	OCCUPANCY (占用) 1 moral space 2 contemplation 3 ceremony 4 recreation 5 display 6 trade 7 mingling 8 meeting 9 corporate realisation
BEHAVIOUR (行为)	ZESTS (欲望) 1 exercising 2 limit-testing 3 winning 4 table/bottle/bed 5 collecting 6 serving 7 creating/arts 8 fulfilling 9 sublimating	ATTRIBUTES (属性) 1 stature 2 vitality 3 style 4 proportion 5 grace 6 geometry 7 integrity 8 intricacy 9 comfort/austerity	AMBIENCE (氛围) 1 dread/awe 2 mystery 3 solemnity 4 serenity 5 tranquillity 6 urbanity 7 gaiety 8 excitement 9 elation	FORMALITY (形式) 1 random 2 irregular 3 overlapping 4 sequence 5 continuous perspective 6 logical complex 7 asymmetrical 8 axial/sloping 9 axial
RELATIONSHIP (关系)	ASSOCIATION (关联) 1 rebellion 2 competition 3 climbing/using 4 opting in/out 5 loneliness/crowd 6 mutual benefit 7 interdependence 8 loyalties 9 love	LOCATION (位置) 1 hidden 2 glimpsed 3 recessed 4 merged 5 particular 6 incident/focal point 7 closing 8 blocking 9 axial feature	FOILS (烘托) 1 surprise 2 anticipation 3 illusion 4 scale 5 rhythm 6 manners 7 foils 8 harmony 9 metaphor	INTERPENETRATION 1 threshold/gate (渗透) 2 inside/outside 3 public/private 4 articulation 5 osmosis 6 captured space 7 spatial complex 8 deflection 9 infinity

Figure 4.1 Notation method charts
Source：Visions of urban design-Gordon Cullen

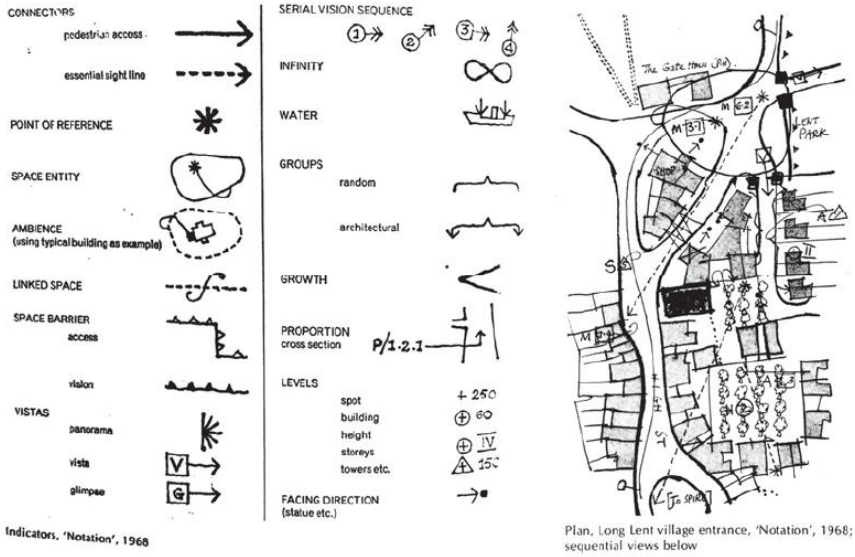


Figure 4.2 Signals of notation(left),the notation practice(right)
Source：Visions of urban design-Gordon Cullen

The definition of 'townscape' as 'the art of relationship' stems from a reflection on the life of human groups and an understanding of the nature of the city: the gathering of buildings is akin to the gathering of people and leads to a visual pleasure that is

difficult to achieve with individual buildings. The root of the problem with the new urban planning is the lack of 'relationships'. He argues that the city is not a 'street model' but a 'series of (interconnected) spaces created by groups of buildings' and that there should be an 'art of relationship' between groups of buildings, similar to the 'art of architecture'. There should be an 'art of relationship' between building groups, similar to the 'art of architecture'. The 'relationship' covers a wide range, including the relationship between different material elements such as buildings, trees, nature, water, traffic and advertising, between different spatial elements such as enclosure, openness and displacement, and between different landscape types such as metropolis, city, paradise, park, industrial area, cultivated land and wilderness. Relationships Furthermore, the 'art of relationships' forms the basis of Cullen's perception of urban 'place' and 'content'.

The author has attempted to document the main streets of Lijiao village using a notational approach by first labelling landscape features according to a road map (as shown in Figure 4.3), focusing on the pedestrian experience from a human perspective and the relationships between the different elements of place. Following the notation, important junctions in the map were re-marked in the form of images to enable an understanding of the character of the main roads in Lijiao village.

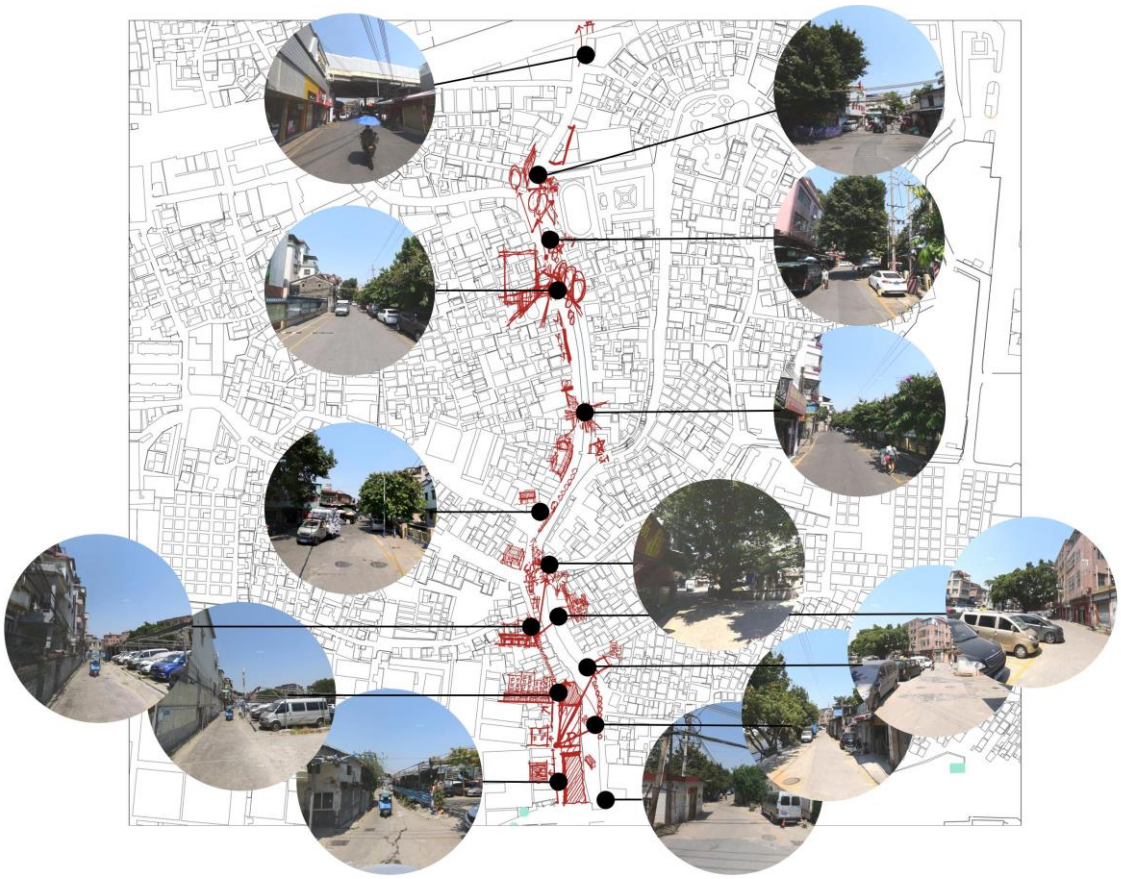


Figure 4.3　Streetscape of main streets in Lijiao
Source：Visions of urban design-Gordon Cullen

As can be seen from the sequence of streets, the sky, greenery, walls, and soil form the main material elements of the streetscape; the position of plants and the shape of buildings form different spatial forms; and the activities of villagers and rich historical resources form another important element of the landscape.

In Chinese urban design practise, designers tend to interpret the existing social, historical, and physical relationships of the city from a professional perspective and respond to urban conflicts with a focus on style, concept, or ideological expression. However, little attention has been paid to the way ordinary residents perceive the city. At the level of perception of urban space, there are major differences between them and ordinary residents. Designers' perceptions of the city are relatively rational and holistic, focusing on both the structural elements of the city, such as urban fabric, street network relationships, and landscape views, and the microscopic qualities of the city, such as scale, colour, and material. In contrast, ordinary residents find it difficult to establish macro concepts of urban form, texture, and structure in their minds, and their perceptions of the city are relatively subjective and local, focusing more on a series of spatial and event-related fragments in their field of vision that

evoke a sense of memory and identity. As Cullen points out, the variability of discourse among different stakeholders is fundamental to the problems of the urban environment. Planners' disregard for this perceptual gap and neglect of urban residents' perceptions has resulted in many urban planning outcomes being complacent and contrary to residents' positions.

In studying the design of the regeneration of Lijiao village from the human point of view, the following elements can be considered.

Tbale 4.1 Elements of the streetscape in Lijiao

Physical elements	People	The most proactive material element of street space
	Buildings along the street	As the most important material element defining the street space, it determines the morphological character of the street space
	Street greening	It has an orienting effect on people and regulates their psychological and spiritual activities
	Environmental facilities (street lighting, seating, litter bins, etc.)	Facilitating pedestrian access and providing material support for venue activities
Spatial elements	Side interface	Vertical elevations of buildings along the street, affecting the proportions and scale of the street
	Bottom screen	The ground level of the street, consisting of pavement, carriageway, road furniture and street greenery
	Top interface	The skyline formed by the contours of the top of the building
Human element	History	The material and immaterial essence of the history of a country and a city in the course of its development.
	Street Culture	The term evolved from American street rap culture and now refers to all forms of art on the street such as mural painting, street vending, dancing, skateboarding, etc.

Source: Self-drawn by the author

4.2.Indicator Analysis

Walking-friendly is usually assessed in two ways: by subjective psychological judgement (including safety, convenience, comfort, aesthetics, etc.) and by objective

quantitative index assessment (mainly including construction of various road facilities, practise of road design standards, etc.). As technology developed, tools such as spatial syntax and streetscape semantics were also applied to the study of pedestrian friendliness. The authors found that there was no correlation between many quantifiable indicators and the pedestrian friendliness index.

In a study on a sample of streets in Lijiao village, subjective psychological judgements (i.e. street satisfaction surveys) were compared with various quantifiable indicators in the streetscape (e.g. green ratio, airspace ratio, street height/width ratio, etc.) to derive correlations between the quantifiable indicators and the subjective psychological perceptions in order to determine the degree of influence of each indicator on the pedestrian friendliness index and to derive design strategies.

In order to create a "humanistic" value standard for urban design that is close to public opinion, designers should constantly pay attention to and research how residents perceive the city, engage with their cognitive and aesthetic tendencies, build bridges between them and professional designers, and avoid imposing "design concepts" on them. "We must avoid imposing 'design ideas' on them. However, this does not mean that designers should please and submit to the residents, but rather actively focus on their cognitive pathways and harmonise and direct their values. This is what Cullen does in Silent Signals: he seeks to use "identity iconography" as a case study for designers to explore how residents perceive the city and use it as a basis for consensus discourse among various stakeholders. However, Assessment of residents' perceptions of the city and how he bridges the perception gap are based on his personal understanding of the specific contextual relationship and are not necessarily relevant to the present. The essence of residents' perception of the city should be thoroughly researched, refined and quantified in the context of China's current reality, drawing on theories from various fields such as environmental psychology and behavioural science, as well as the latest analytical tools and methods.

4.2.1. Walking Perception

The relationship between sensation, communication (behavioural activity), and scale is an important topic in urban planning. The study of a pedestrian-friendly scale means using human criteria and bases. Jan Geiger refers to the human dimension as the dimension of the city that allows people to walk, stand, sit, hear, and speak.[错误!未找到引用源。]

Human scale is a quantifiable quantity that can be determined by studying the human body and human behaviours. The human scale can be divided into a horizontal scale and a vertical scale, depending on the direction of human behaviour. Both the horizontal and vertical scales are picked up by the sensory organs such as the eye, nose, mouth, ears, skin, and muscles of the human body, and then processed by the brain. More than 80% of information about the world is received visually, and vision plays a very important role in all human activities.

In various forms of contact in public spaces, people prefer to be at a certain distance from other people or things. Different forms of communication take place at different distances, and the distances are constantly changing, depending on the subject and the nature of the contact. The spatial distance between people that corresponds to the content of their respective behaviour is kept fixed. There is growing evidence that the regularity of spacing observed by humans is the result of sensory variation, and that interactions between people or things always occur in spaces of appropriate spacing. Of the various forms of contact between people in street space, the simple visual and auditory bases are the most widespread and the most important. By simply seeing and hearing people in street space, we can gain information, get an overview, and generate inspiration.[错误!未找到引用源。] .

(1) The Relationship between Walking Distance and Perception

Walking is highly limited by the physical capacity of the body, so in addition to the visual and auditory sensations of distance, the kinesthetic sensations of the skeletal muscles are closely related to walking.

According to the survey, the most satisfactory continuous walking distance is 200 metres; in general, pedestrians are suitable for continuous walking distances of 300 to 500 metres; when the continuous walking distance exceeds 500 metres, pedestrians feel bored and tired. According to the physiological and psychological characteristics of human beings, the general radius of walking is 400-500 metres; too large a radius is more likely to cause fatigue.

Tbale 4.2 Pedestrian Walking Distance Survey Form

Description	Source	Distance（m）
70% of people actually walk the distance without difficulty	Report on the Pedestrian Awareness Survey	1220
70% of people walk without difficulty for distance	Report on the Pedestrian Awareness Survey	720
Distance over 50% of people get bored walking	International Transport Series	500

The right distance to walk to your destination	Design of External Spaces	500
80% of people walk the distance in one go	The Pleasure Walk	500
Optimal walking time 5 minutes distance	Environmental plan for the new urban area	450
Walking distance without problems	International Transport Series	400
Distance of reduced enthusiasm for walking	The Pleasure Walk	300-400
Walking preferred distance	Theory and Design of the Living Environment	350
Distance walked regularly by 70% of the population	International Transport Series	300
Preferred walking distance in general	The Space for Walkers	300
90% of people are satisfied with the distance	International Transport Series	200

Source: Self-drawn by the author based on Psychology of the Built Environment

According to the survey data in Table 4.2, a streamline length of about 200 metres is the only continuous walking distance that satisfies 90% of people; at a streamline length of 300 to 400 metres, people's enthusiasm for walking begins to decline, and at a streamline length of more than 500 metres, 50% of people develop a sense of disgust. Therefore, we limit the length of the pedestrian streamline to about 200 metres, and beyond that, we need to provide suitable resting qualities or facilities to ensure the quality of the experience 错误!未找到引用源。.

(2) The Relationship between Social Distance and Perception

In The SilentLanguage and The HiddenDimension, American anthropologist Edward T. Hall examined the behavioural habits of white North American middle-class society and proposed four spatial distances for interpersonal interactions: intimate distance (0-0.45 m), individual distance (0.45-1.2 m), social distance (1.2-3.6 m), and public distance (> 3.6 m). 0.45 m), individual distance (0.45-1.2 m), social distance (1.2-3.6 m), and public distance (> 3.6 m), which are further divided into proximity-distance and distance. Different interpersonal distances correspond to different types of interpersonal relationships and corresponding types of behavioural activities[67]. Ichiro Soma also explains the classification of psychological distance in detail in his book Environmental Psychology. Jan Gehl's research has extended personal communicative spatial distances to the visual social domain. In Cities for People, he summarises observations on distance, sensation, and communication: Almost every change in distance is between 100m and 25m and then metre for metre, with a significant increase in detail and communicative richness. In the social realm of vision,

100m and 25m are two boundaries that are significant for the natural physical environment. At 100 metres, we can see people in motion; at 25 metres, we begin to interpret emotions and facial expressions. The importance of the 25-metre module is also highlighted by Yoshinobu Ashihara in his book, Outer Space. Xu Leiqing summarised the relationship between spatial distance and perceptual properties in the range of 0-1000 metres by analysing the properties of the distance-dependent sensory organs that combine vision, hearing, and smell [错误!未找到引用源。].

Tbale 4.3 **The relationship between distance and perception**

Distance	Perception	Source
0-0.45	Intimate distance	
0.45-1.2	Individual distances	The Silent Language
1.2-3.6	Social distance	The Hidden Dimension
＞3.6	Public Distance	
25-100	Observations of distance, sensation, and communication change metre by metre, and the richness of detail and communication is greatly increased	Cities for people
25	Begin to interpret feelings and facial expressions	External space

Source: Self-drawn by the autho

(3) The Relationship between Vertical Height Distance and Perception

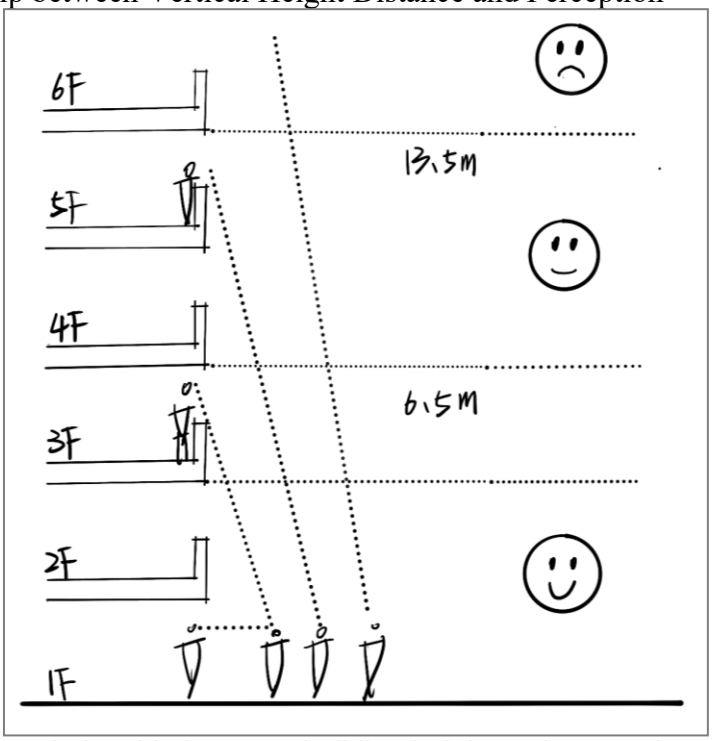


Figure 4.4 The relationship between building height and perception along the street
Source: Self-drawn by the author

As for the communication between the skyscraper and its surroundings, it is excellent up to the 2nd floor and feasible from the 3rd to the 5th floor. From there we can observe and follow the life of the city, conversations, shouts and flailing of arms are all noticed. Above the 5th floor, the situation changes dramatically. There are no more details to be seen. The people on the ground are neither recognisable nor reachable. Logically, above the 5th floor should be offices and apartments, which are airy floors. They no longer belong to the city in any way [错误!未找到引用源。].

(4) The Length of Streets in Lijiao

Tbale 4.4 **Analysis Of The Street Interface In Lijiao Village**

Street	Total length (m)
Fusiyue Street	219
Nanan Street	205
East Street	359
Wuyuehou Street	226
Lijiao Street	146
Wuyue Street	760
West Huanxiufang Street	286
Sanyuexin Street	243
Shuiji Street	321
Dashi Street	292
West Street	271
Yiyue Street	395

Source: collated and drawn by the author

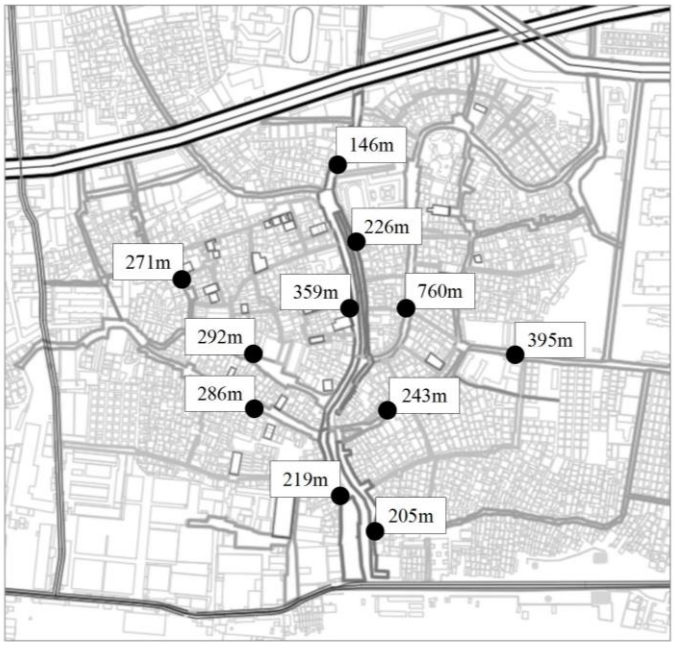


Figure 4.5 Map showing the length of streets in Lijiao Village
Source: Self-drawn by the author

In addition to the establishment of seating for rest, squares and pocket parks, the shape of the neighbourhood can be designed with reference to the streets of Pingjiang Road as outdoor spaces, treating the different landscape units separated by bridges or road crossings differently and designing outdoor spaces with different functions such as rest, communication, recreation and entertainment, making the walking distance shorter in people's psychological perception and more interesting along the road.

4.2.2. Scale

(1) Street Width

In ancient China, the road shape was described in the Zhou Li - Kao Gong Ji: "The craftsman has the state, nine miles square, next to three gates, nine meridians and nine shots in the state, and nine tracks in the Jing Tu .....". The "nine lanes of Jing Tu", which means that the north-south road could accommodate nine chariots in parallel, is the earliest definition of the scale of the road, thus defining the spatial shape of the royal city.

In Lijiao village, the width of the road is defined by the width of the river, the width of the passage, the width of planting, paving and other elements. The width of the road is also an important measure of the relationship between the height and width of the road. The statistics are compiled below:

Tbale 4.5 **Sample statistics of road width in Lijiao village**

Street	Sample 1 width (m)	Sample 2 width (m)	Sample 3 width (m)	Sample 4 width (m)	Sample 5 width (m)	Sample 6 width (m)	Sample 7 width (m)	Sample 8 width (m)	Sample 9 width (m)	Sample 10 width (m)
Fusiyue Street	12	9	10	2	3	4	25	25	26	28
Nanan Street	10	10	12	11	8	13	7	5	7	7
East Street	13	9	11	10	10	8	8	8	8	9
Wuyuehou Street	6	6	7	7	7	7	6	5	4	4
Lijiao Street	12	12	9	12	10	10	10	12	10	11
Wuyue Street	8	8	10	11	17	6	11	6	7	13
Huanxiufang Street	8	5	20	6	13	11	5	14	11	13
East Huanxiufang Street	6	8	8	5	4	5	5	6	5	5
Shuiji Street	6	6	11	5	5	6	12	6	9	8
Dashi Street	20	7	6	14	25	12	17	12	11	7
West Street	5	13	5	5	10	8	4	11	4	4
Yiyue Street	5	6	6	5	4	6	8	7	6	4

Source: collated and drawn by the author

Tbale 4.6 **Analysis Of Street Widths In Lijiao Village**

Street	Minimum width (m)	Maximum width (m)	Average width (m)	Total street length (m)	Ratio of length to width	Sum of errors
Fusiyue Street	2	28	14.4	219	15.2	92.8
Nanan Street	5	13	9	205	22.8	22.0
East Street	7	13	9.4	359	38.2	12.8
Wuyuehou Street	4	7	5.9	226	38.3	9.4

Lijiao Street	9	12	10.8	146	13.5	10.0
Wuyue Street	5	21	9.7	760	78.4	27.0
West Huanxiufang Street	3	22	10.6	286	27.0	36.8
Sanyuexin Street	2	13	5.7	243	42.6	10.4
Shuiji Street	5	17	7.4	321	43.4	20.8
Dashi Street	6	25	13.1	292	22.3	47.2
West Street	4	13	6.9	271	39.3	28.8
Yiyue Street	4	8	5.7	395	69.3	9.6

Source: collated and drawn by the author

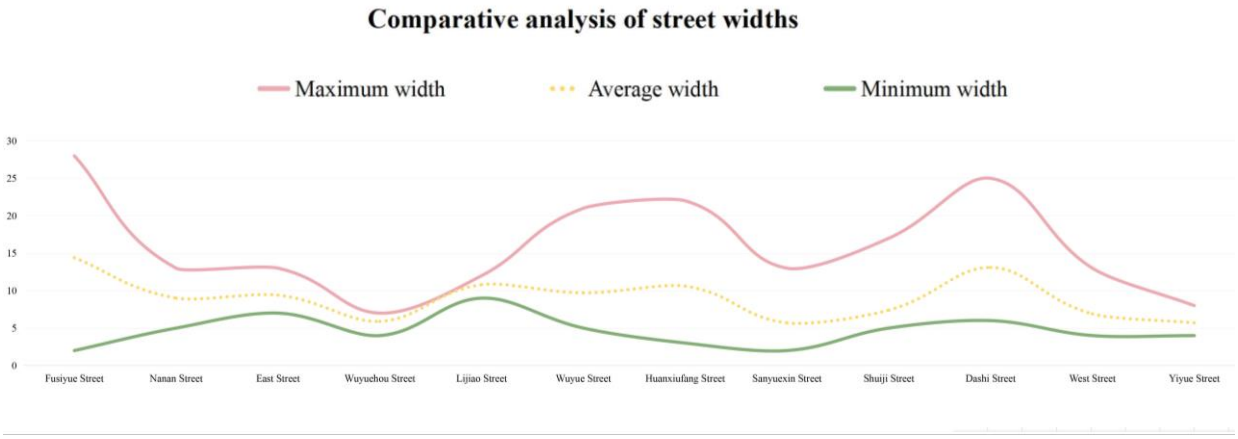


Figure 4.6 Comparative analysis of street widths
Source: Self-drawn by the author

The statistical results have the following implications for design:

a. With a fire access width of, say, 4 metres, more than half of the streets have a minimum width that does not meet fire access requirements.

b. East Street, Yiyue Street, Wuyuehou Street, and Lijiao Street have lower variations in street width, East Street and Wuyuehou Street, which have the lowest variations in width, have higher satisfaction with the streets and should be maintained in their extent in the updated design, while the other streets should be redesigned The average width of the streets can be adjusted to the average width of the streets.

c.cBased on the average width of the streets, the streets of Lijiao Village can be divided into different types and redesigned to avoid uniform street size.

d. In order to avoid indiscriminate parking, the width of the streets in Lijiao village should not be too wide and should be as uniform as possible to avoid excessive useless space.Street Height to Width Ratio

Let the width of the street be D and the height of the building facade be H. D/H is the ratio of height to width of the street. Camino Sette mentions that "the perfect

perceptual experience of a straight street depends largely on the proportions of the length, width, and height of the street itself," suggesting that the spatial scale of the street is an essential property of the street and that the proper spatial scale gives the pedestrian a pleasant, relaxed, and good sense of space, while an improper scale creates a perception of space that is either oppressive or empty [错误!未找到引用源。]. Yoshiharu Ashihara proposed the first scale to accurately measure the perception of the size of roads by using the ratio between road widthand height (D/H) to evaluate the relationship between the spatial size of the road and the psychological perception of the pedestrian [错误!未找到引用源。], which provides us with a valid method of quantifying morphology that is still of great importance in the study of urban form today.

The relationship between the perceived relationship between height and width and the perception of experience is compiled in the following table:

Tbale 4.7 The Relationship between Street Height to Width Ratio and Perception

D/H	Perception	Source
D/H >1	As the ratio increases a sense of distance is gradually created	Aesthetics of the street
D/H >2	Creates a sense of expansiveness	
D/H<1	As the ratio decreases a sense of proximity is created	
D/H = 1	There is a sense of proportionality between height and width Da Vinci thought that width and height were equal, i.e. DH 1 was ideal	
H/D≤1/2, ratio close to 1/2	Pedestrians can easily survey the full extent of the buildings across the street, with the sky and the building surface occupying an equal portion of the view, and a certain sense of enclosure can be felt. The smaller the height-to-width ratio, the less enclosed the streetscape appears, and the more discrete and expansive the feeling.	Related papers
1/2≤H/D<1	The effect of the space division is the most pleasant, neither overwhelming nor empty, it gives the pedestrian an introverted, concentrated and intimate feeling. The effect of the street space in this scale range is most often used by designers.	
1<H/D<2	The pedestrian's view of the upper part of the building is somewhat limited, and the overall spatial experience conveys a strong sense of cohesion that creates a certain feeling of constraint the closer one gets to the building.	
H/D≥2	At this point, the vertical perspective is 60°, the street space is high and narrow, and the pedestrian's field of vision is restricted, limited to a narrow area, with a strong	

sense of trepidation and even uncertainty.

Source: Self-drawn by the author

In the Baroque period, the mediaeval proportions were reversed and the width of the street was twice the height of the building, i.e. D/H ~ 2. Even today, in the side streets of Italy, there are narrow alleys with D/H < 0.5, and the traditional ratio between the sidewalk and the "outside area" in Kyoto is a comfortable width of about D/H = 1.3, which can be considered a successful example of "human measure". A successful example of "human measure".

In this paper, the ratios between the height and width of the roads are calculated and counted, and a plan is drawn to show the schematic ratios between the height and width of the 12 roads in the present situation in Lijiao village.

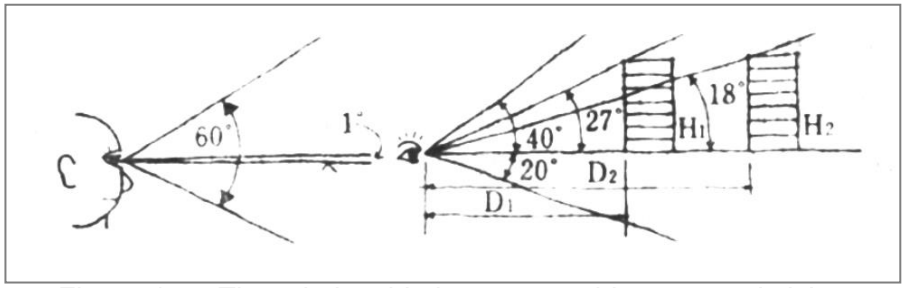


Figure 4.7 The relationship between architecture and vision

Source：Aesthetics of the street

One of the applications of D/H is the relationship between the distance D of the building to the viewpoint and the height H of the building as an object when viewed as a "figure". According to the 19th century German architect H. Martens, if one looks forward at an elevation angle of 40° and views the sky at the top of the building, the distance D between the building and the viewpoint is the ratio D/H = 2 to the height H of the building, and the elevation angle is 27°, which gives a view of the building as a whole. According to the "Vitruvian Architects' Manual of Urban Planning in the United States" by W. Hegemann and E. Peets, the building can be seen in its entirety only when the distance (D1) is approximately twice the height of the building (H1). It is therefore not an exaggeration to say that there are only a few places where the building can be adequately viewed from a distance of two to three times its height. The arrangement of the building from the front with a viewing angle of 2 to 3 times its height (D/H = 2-3) was a technique used in Europe after the Renaissance when building roads 错误!未找到引用源。.

Tbale 4.8 Lijiao Village Street Width And Building Height Sampling Statistics Along The Street

S	Fusiyue Street	Nanan Street	East Street	Wuyuehou Street

Sample No.	Width(m)	Height(m)	Width(m)	Height(m)	Width(m)	Height(m)	Width(m)	Height(m)
Sample 1	28.0	3.0	6.0	3.0	5.0	6.0	5.0	6.0
Sample 2	27.0	6.0	5.0	6.0	7.0	3.0	4.0	9.0
Sample 3	27.0	9.0	11.0	9.0	9.0	6.0	6.0	6.0
Sample 4	2.0	3.0	11.0	3.0	13.0	3.0	6.0	9.0
Sample 5	10.0	9.0	10.0	3.0	10.0	9.0	5.0	9.0
Sample					10.0	18.0		

6 Sample				10.0	9.0		
7							
Sample No.	Lijiao Street		Wuyue Street		Huanxiufang Street		Sanyuexin Street
	Width(m)	Height(m)	Width(m)	Height(m)	Width(m)	Height(m)	Width(m)	Height(m)
Sample 1	12.0	6.0	13.0	6.0	14.0	7.5	13.0	9.0
Sample 2	10.0	9.0	9.0	3.0	13.0	4.5	6.0	12.0
Sample 3	9.0	9.0	9.0	10.5	11.0	15.0	3.0	9.0
Sample 4	12.0	6.0	20.0	7.5	14.0	6.0	7.0	6.0
Sam			4.0	18.0	10.	3.0		

ple				0				
5 Sample		8.0	15.0	7.0	6.0			
6 Sample		7.0	9.0					
7								
Sample No.	Shuiji Street		Dashi Street		West Street		Yiyue Street	
	Width(m)	Height(m)	Width(m)	Height(m)	Width(m)	Height(m)	Width(m)	Height(m)
Sample 1	7.0	9.0	17.0	4.5	5.0	6.0	9.0	7.5
Sample 2	5.0	10.5	7.0	7.5	11.0	9.0	4.0	9.0
Sample 3	5.0	7.5	17.0	6.0	5.0	10.5	3.0	7.5

Sample	6.0	7.5	13.0	9.0	5.0	7.5	7.0	3.0
4 Sample	17.0	6.0	8.0	9.0	5.0	7.5		
5 Sample	9.0	6.0	5.0	4.5	8.0	4.5		
6 Sample			7.0	9.0				
7								

Source: collated and drawn by the author

Tbale 4.9 Street Height To Width Ratio In Lijiao Village(D/H)

Sample No.	Fusiyue Street	Nanan Street	East Street	Wuyuehou Street	Lijiao Street	Wuyue Street
Sample 1	9.3	2.0	0.8	0.8	2.0	2.2
Sample 2	4.5	0.8	2.3	0.4	1.1	3.0
Sample 3	3.0	1.2	1.5	1.0	1.0	0.9
Sample 4	0.7	3.7	4.3	0.7	2.0	2.7
Sample 5	1.1	3.3	1.1	0.6		0.2
Sa			0.6			0.5

mple 6 Sample 7			1.1			0.8
Average	3.7	2.2	1.7	0.7	1.5	1.5
Sample No.	Huanxiufang Street	Sanyuexin Street	Shuiji Street	Dashi Street	West Street	Yiyue Street
Sample 1	1.9	1.4	0.8	3.8	0.8	1.2
Sample 2	2.9	0.5	0.5	0.9	1.2	0.4
Sample 3	0.7	0.3	0.7	2.8	0.5	0.4

Sample 4	2.3	1.2	0.8	1.4	0.7	2.3
Sample 5	3.3		2.8	0.9	0.7	
Sample 6	1.2		1.5	1.1	1.8	
Sample 7				0.8		
Average	2.1	0.9	1.2	1.7	0.9	1.1

Source: collated and drawn by the author

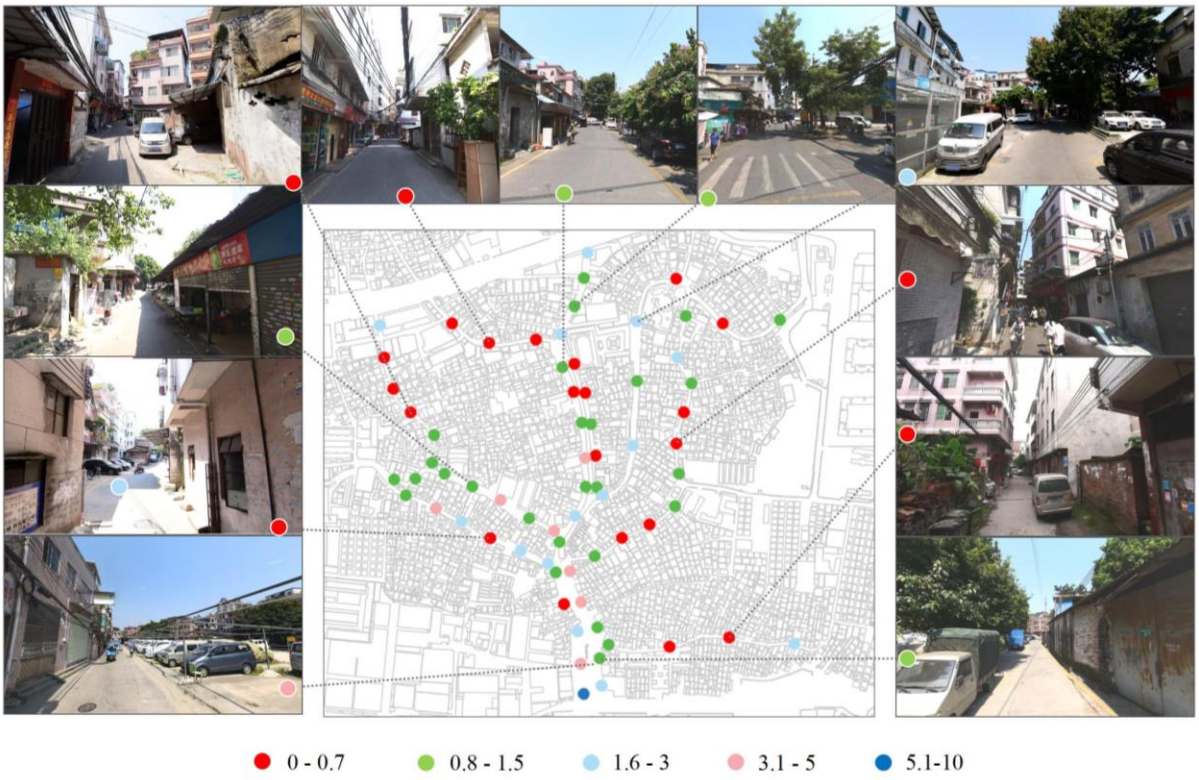
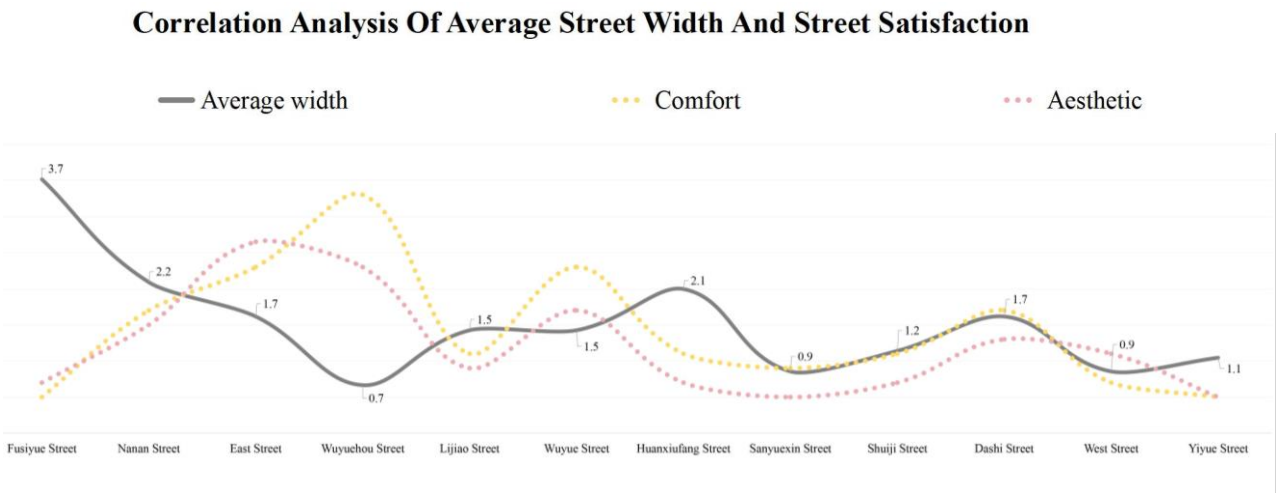


Figure 4.8 Map of the height to width ratio of streets in Lijiao Village
Source: Self-drawn by the author



Correlation Analysis of Average Street Width and Street Satisfaction
Source: Self-drawn by the author

4.2.3. Interface

(1) Flatness of the Street Interface

B. Rudolphsky says about the Italian road: "The road cannot exist where there is nothing, that is, it cannot be separated from its environment. In other words, the street must be accompanied by the buildings that surround it. The complete street is a coherent space. The main thing is the continuity and rhythm of the environment. A

street is a street precisely because of the buildings that line it. Skyscrapers and empty lots cannot be cities [错误!未找到引用源。] Therefore, the interface between the buildings that enclose the street is the subject of study. Based on the problems of the current road crossing in Lijiao village, the author proposes the concept of "flatness" of the road crossing, expressed as the ratio of the difference between the total length of the road and the circumference of the road, based on the current CAD drawings "based on CAD drawings. The greater the value for flatness, the greater the difference between the total length and the circumference of the road, and the more level the interface.

Tbale 4.10 **Analysis Of The Street Interface In Lijiao Village**

Street	Total length (m)	Circumference (m)	Flatness
Fusiyue Street	219	528	4.87
Nanan Street	205	526	3.53
East Street	359	791	9.84
Wuyuehou Street	226	470	25.11
Lijiao Street	146	328	8.11
Wuyue Street	760	1634	13.33
West Huanxiufang Street	286	685	5.06
Sanyuexin Street	243	523	13.14
Shuiji Street	321	760	5.44
Dashi Street	292	677	6.28
West Street	271	626	6.45
Yiyue Street	395	847	13.86

Source: collated and drawn by the author

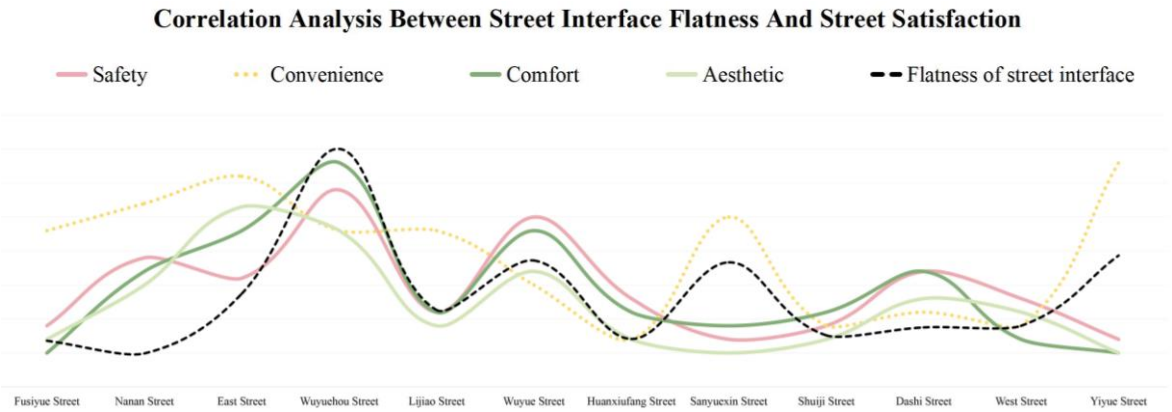


Figure 4.9 Correlation Analysis Between Street Interface Flatness and Street Satisfaction
Source: Self-drawn by the author

The following conclusions can be drawn from the line diagrams:

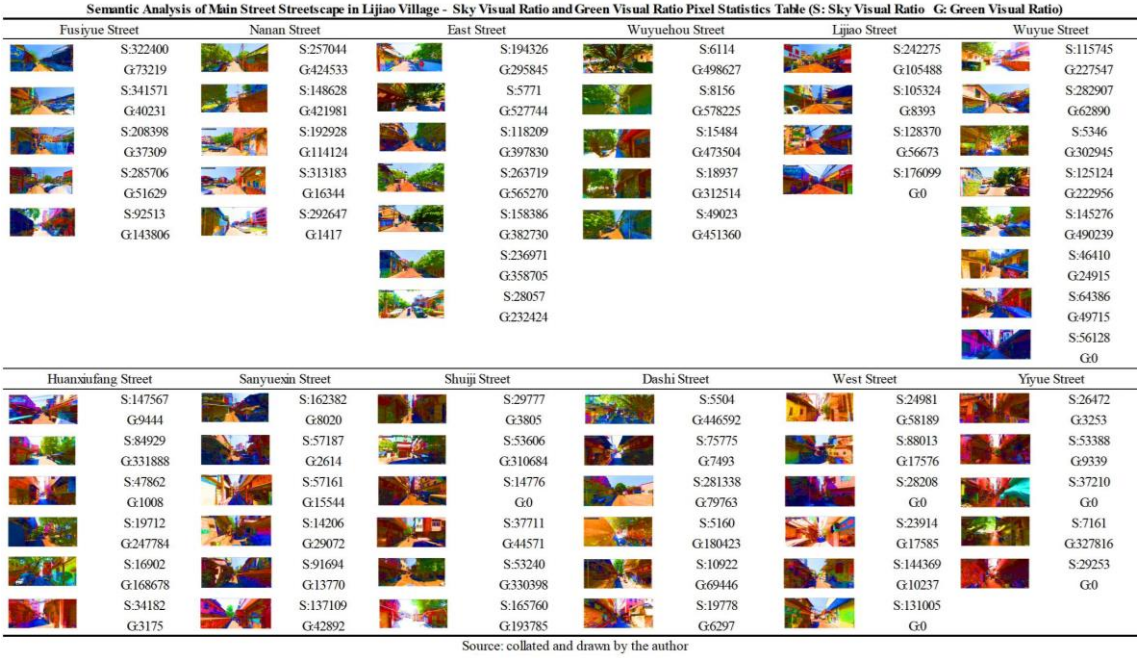
a. Road surface evenness correlates strongly with road satisfaction, e.g., Wuyuehou Road, which has the highest satisfaction level, also has the highest road surface evenness; Fusiyue Road, which has the lowest satisfaction level, also has lower road surface evenness;
b. For example, Wuyuehou Street, Wuyue Street, which has the highest satisfaction level, also has the highest satisfaction level; Fusiyue Street, which has the lowest satisfaction level, also has the lowest satisfaction level. Street, West Street, Demand;
c. Roads where the correlation between road surface flatness and satisfaction with the road is weak need to be examined for the more important factors influencing satisfaction with the road.

(2) Street Width to Bilding Width ratio

According to the survey results, in addition to D/H $\leqslant$ 1, W/ D $\leqslant$ 1 is also very important. In this case, W refers to the width of the storefront, i.e., the rhythm of the street facing the direction of travel. If W is smaller than the dimension D, the street looks lively. This lively atmosphere can be suddenly interrupted by buildings with large facades in narrow streets. If a large facade is needed, it is possible to divide it. The facade can be divided into sections of W/T < 1 to bring variety and rhythm to the building. It is therefore important to maintain the overall rhythm of the street by dividing the facade.

4.2.4. Landscape

Using 50 m as the basic sampling unit, street photos were taken along 12 major streets at 50 m intervals in Baidu Street View, and the percentage of green view and percentage of sky in the image were calculated using pixel points.



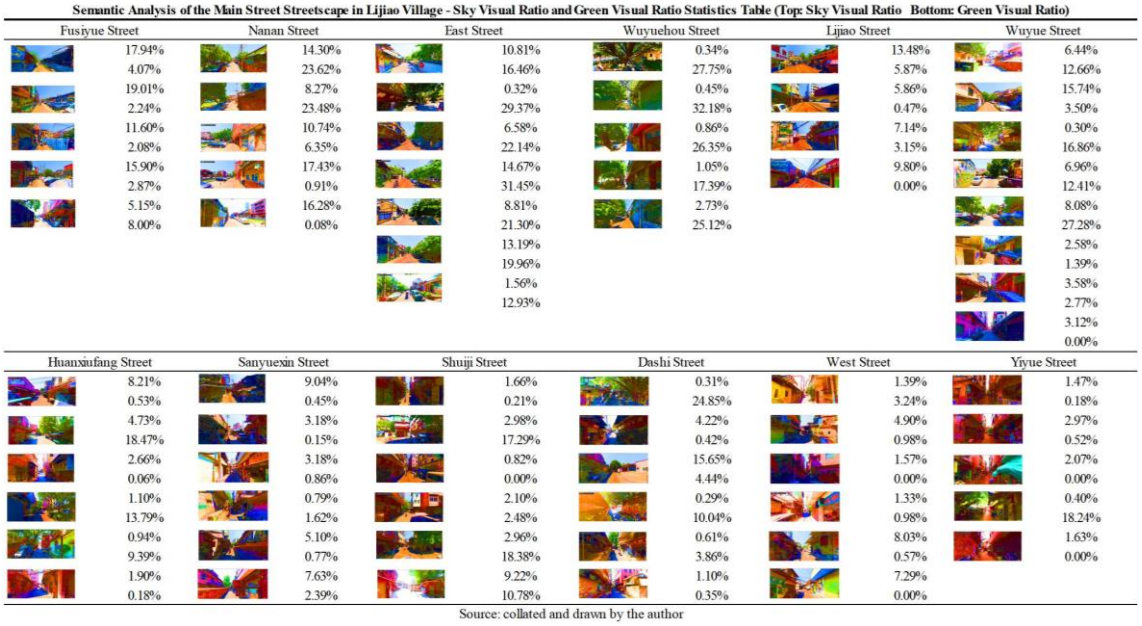
Semantic Analysis of Main Street Streetscape in Lijiao Village - Sky Visual Ratio and Green Visual Ratio Pixel Statistics Table (S: Sky Visual Ratio G: Green Visual Ratio)

Fusiyue Street	Nanan Street	East Street	Wuyuehou Street	Lijiao Street	Wuyue Street
S:322400 G:73219	S:257044 G:424533	S:194326 G:295845	S:6114 G:498627	S:242275 G:105488	S:115745 G:227547
S:341571 G:40231	S:148628 G:421981	S:5771 G:527744	S:8156 G:578225	S:105324 G:8393	S:282907 G:62890
S:208398 G:37309	S:192928 G:114124	S:118209 G:397830	S:15484 G:473504	S:128370 G:56673	S:5346 G:302945
S:285706 G:51629	S:313183 G:16344	S:263719 G:565270	S:18937 G:312514	S:176099 G:0	S:125124 G:222956
S:92513 G:143806	S:292647 G:1417	S:158386 G:382730	S:49023 G:451360		S:145276 G:490239
		S:236971 G:358705			S:46410 G:24915
		S:28057 G:232424			S:64386 G:49715
					S:56128 G:0

Huanxiufang Street	Sanyuexin Street	Shuiji Street	Dashi Street	West Street	Yiyue Street
S:147567 G:9444	S:162382 G:8020	S:29777 G:3805	S:5504 G:446592	S:24981 G:58189	S:26472 G:3253
S:84929 G:331888	S:57187 G:2614	S:53606 G:310684	S:75775 G:7493	S:88013 G:17576	S:53388 G:9339
S:47862 G:1008	S:57161 G:15544	S:14776 G:0	S:281338 G:79763	S:28208 G:0	S:37210 G:0
S:19712 G:247784	S:14206 G:29072	S:37711 G:44571	S:5160 G:180423	S:23914 G:17585	S:7161 G:327816
S:16902 G:168678	S:91694 G:13770	S:53240 G:330398	S:10922 G:69446	S:144369 G:10237	S:29253 G:0
S:34182 G:3175	S:137109 G:42892	S:165760 G:193785	S:19778 G:6297	S:131005 G:0	

Source: collated and drawn by the author

Figure 4.10 Semantic Analysis of Sky Visual Ratio and Green Visual Ratio - A
(S: Data of Sky Visual Ratio G:Data of Green Visual Ratio)
Source: Self-drawn by the author



Semantic Analysis of the Main Street Streetscape in Lijiao Village - Sky Visual Ratio and Green Visual Ratio Statistics Table (Top: Sky Visual Ratio Bottom: Green Visual Ratio)

Fusiyue Street	Nanan Street	East Street	Wuyuehou Street	Lijiao Street	Wuyue Street
17.94% 4.07%	14.30% 23.62%	10.81% 16.46%	0.34% 27.75%	13.48% 5.87%	6.44% 12.66%
19.01% 2.24%	8.27% 23.48%	0.32% 29.37%	0.45% 32.18%	5.86% 0.47%	15.74% 3.50%
11.60% 2.08%	10.74% 6.35%	6.58% 22.14%	0.86% 26.35%	7.14% 3.15%	0.30% 16.86%
15.90% 2.87%	17.43% 0.91%	14.67% 31.45%	1.05% 17.39%	9.80% 0.00%	6.96% 12.41%
5.15% 8.00%	16.28% 0.08%	8.81% 21.30%	2.73% 25.12%		8.08% 27.28%
		13.19% 19.96%			2.58% 1.39%
		1.56% 12.93%			3.58% 2.77%
					3.12% 0.00%

Huanxiufang Street	Sanyuexin Street	Shuiji Street	Dashi Street	West Street	Yiyue Street
8.21% 0.53%	9.04% 0.45%	1.66% 0.21%	0.31% 24.85%	1.39% 3.24%	1.47% 0.18%
4.73% 18.47%	3.18% 0.15%	2.98% 17.29%	4.22% 0.42%	4.90% 0.98%	2.97% 0.52%
2.66% 0.06%	3.18% 0.86%	0.82% 0.00%	15.65% 4.44%	1.57% 0.00%	2.07% 0.00%
1.10% 13.79%	0.79% 1.62%	2.10% 2.48%	0.29% 10.04%	1.33% 0.98%	0.40% 18.24%
0.94% 9.39%	5.10% 0.77%	2.96% 18.38%	0.61% 3.86%	8.03% 0.57%	1.63% 0.00%
1.90% 0.18%	7.63% 2.39%	9.22% 10.78%	1.10% 0.35%	7.29% 0.00%	

Source: collated and drawn by the author

Figure 4.11 Semantic Analysis of Sky Visual Ratio and Green Visual Ratio - B
(S: Sky Visual Ratio G: Green Visual Ratio)
Source: Self-drawn by the author

Tbale 4.11 Semantic Analysis of Main Street Streetscape in Lijiao Village - GreenVisual Ratio Statistics Table

Street	Fusiyue Street	Nanan Street	East treet	Wuyuehou Street	Lijiao Street	Wuyue Street
Sample 1	4.07%	23.62%	16.46%	27.75%	5.87%	12.66%
Sample 2	2.24%	23.48%	29.37%	32.18%	0.47%	3.50%
Sample 3	2.08%	6.35%	22.14%	26.35%	3.15%	16.86%
Sample 4	2.87%	0.91%	31.45%	17.39%	0.00%	12.41%
Sample 5	8.00%	0.08%	21.30%	25.12%		27.28%
Sample 6			19.96%			1.39%
Sample 7			12.93%			2.77%
Sample 8						0.00%
Average value	3.85%	10.89%	21.94%	25.75%	2.37%	9.61%
Minimum value	2.08%	0.08%	12.93%	17.39%	0.00%	0.00%
Maximum value	8.00%	23.62%	31.45%	32.18%	5.87%	27.28%

Street	Huanxiufang Street	Sanyuexin Street	Shuiji Street	Dashi Street	West Street	Yiyue Street
Sample 1	0.53%	0.45%	0.21%	24.85%	3.24%	0.18%
Sample 2	18.47%	0.15%	17.29%	0.42%	0.98%	0.52%
Sample 3	0.06%	0.86%	0.00%	4.44%	0.00%	0.00%
Sample 4	13.79%	1.62%	2.48%	10.04%	0.98%	18.24%
Sample 5	9.39%	0.77%	18.38%	3.86%	0.57%	0.00%
Sample 6	0.18%	2.39%	10.78%	0.35%	0.00%	
Sample 7						
Sample 8						
Average value	7.07%	1.04%	8.19%	7.33%	0.96%	3.79%
Minimum value	0.06%	0.00%	0.00%	0.35%	0.00%	0.00%
Maximum value	18.47%	18.38%	18.38%	24.85%	3.24%	18.24%

Source: collated and drawn by the author

Tbale 4.12 Semantic Analysis of Main Street Streetscape in Lijiao Village - Sky Visual Ratio Statistics Table

Street	Fusiyue Street	Nanan Street	East treet	Wuyuehou Street	Lijiao Street	Wuyue Street
Sample 1	17.94%	14.30%	10.81%	0.34%	13.48%	6.44%
Sample 2	19.01%	8.27%	0.32%	0.45%	5.86%	15.74%
Sample 3	11.60%	10.74%	6.58%	0.86%	7.14%	0.30%
Sample 4	15.90%	17.43%	14.67%	1.05%	9.80%	6.96%
Sample 5	5.15%	16.28%	8.81%	2.73%		8.08%
Sample 6			13.19%			2.58%
Sample 7			1.56%			3.58%
Sample 8						3.12%
Average value	13.92%	13.40%	7.99%	1.09%	9.07%	5.85%
Minimum value	5.15%	8.27%	1.56%	0.45%	5.86%	0.30%
Maximum value	19.01%	17.43%	14.67%	2.73%	13.48%	15.74%
Street	Huanxiufang Street	Sanyuexin Street	Shuiji Street	Dashi Street	West Street	Yiyue Street
Sample 1	8.21%	9.04%	1.66%	0.31%	1.39%	1.47%
Sample 2	4.73%	3.18%	2.98%	4.22%	4.90%	2.97%
Sample 3	2.66%	3.18%	0.82%	15.65%	1.57%	2.07%
Sample 4	1.10%	0.79%	2.10%	0.29%	1.33%	0.40%
Sample 5	0.94%	5.10%	2.96%	0.61%	8.03%	1.63%
Sample 6	1.90%	7.63%	9.22%	1.10%	7.29%	
Average value	3.26%	4.82%	3.29%	3.70%	4.09%	1.71%
Minimum value	0.94%	0.82%	0.82%	0.29%	1.33%	0.40%
Maximum value	8.21%	9.22%	9.22%	15.65%	8.03%	1.47%

Source: collated and drawn by the author

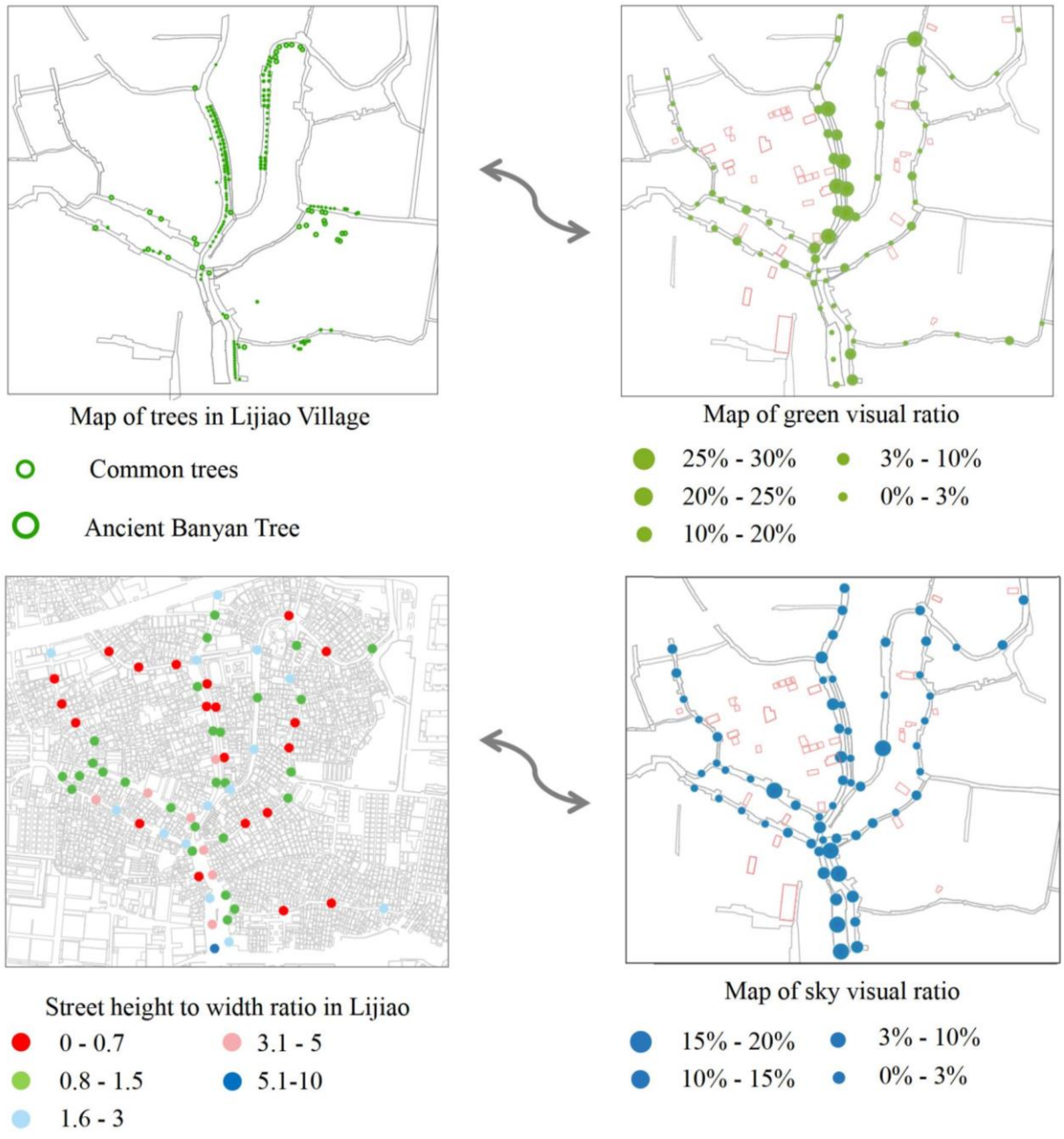


Figure 4.12 Analysis of green looking ratio and sky Visual ratio in lijiao village
Source: Self-drawn by the author

Correlation Analysis Between Average Green & Sky Visual Ratio and Street Satisfaction

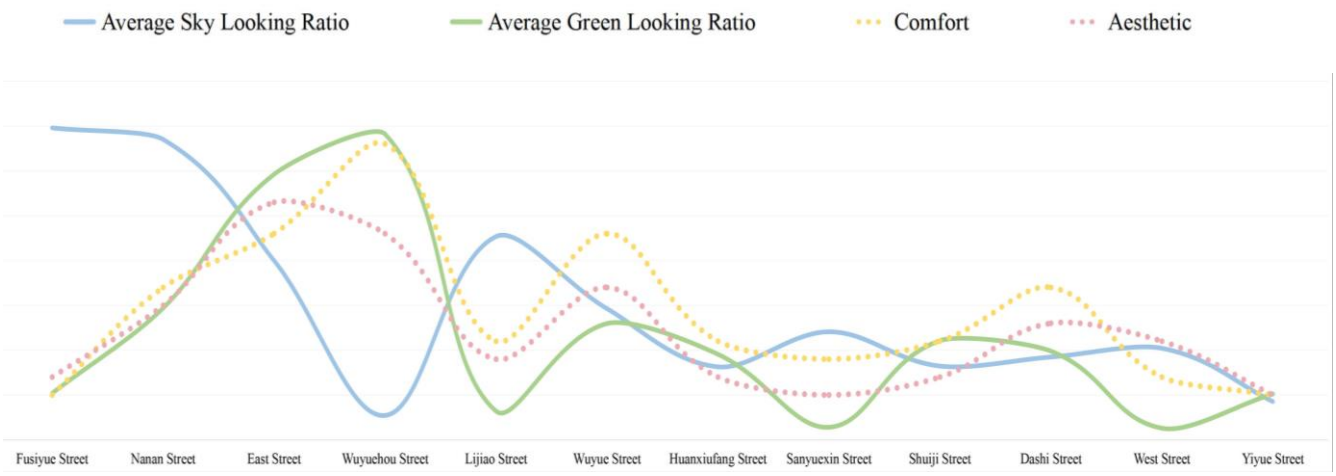


Figure 4.13 Correlation Analysis Between Average Green & Sky Looking Ratio and Street Satisfaction
Source: Self-drawn by the author

Tbale 4.13 Semantic Analysis Of Main Street Streetscape In Lijiao Village - Sky Visual Ratio & Green Visual Ratio

Type	Fusiyue Street	Nanan Street	East Street	Wuyuehou Street	Lijiao Street	Wuyue Street
Average Green Looking Ratio	3.85%	10.89%	21.94%	25.26%	2.37%	9.61%
Average Sky Looking Ratio	13.92%	13.40%	7.99%	1.09%	9.07%	5.85%
Total	17.77%	24.29%	29.94%	26.34%	11.44%	15.46%
Type	Huanxiufang Street	Sanyuexin Street	Shuiji Street	Dashi Street	West Street	Yiyue Street
Average Green Looking Ratio	7.07%	1.04%	8.19%	7.33%	0.96%	3.79%
Average Sky Looking Ratio	3.26%	4.82%	3.29%	3.70%	4.09%	1.71%
Total	10.32%	5.86%	11.48%	11.02%	5.05%	5.50%

Source: collated and drawn by the author

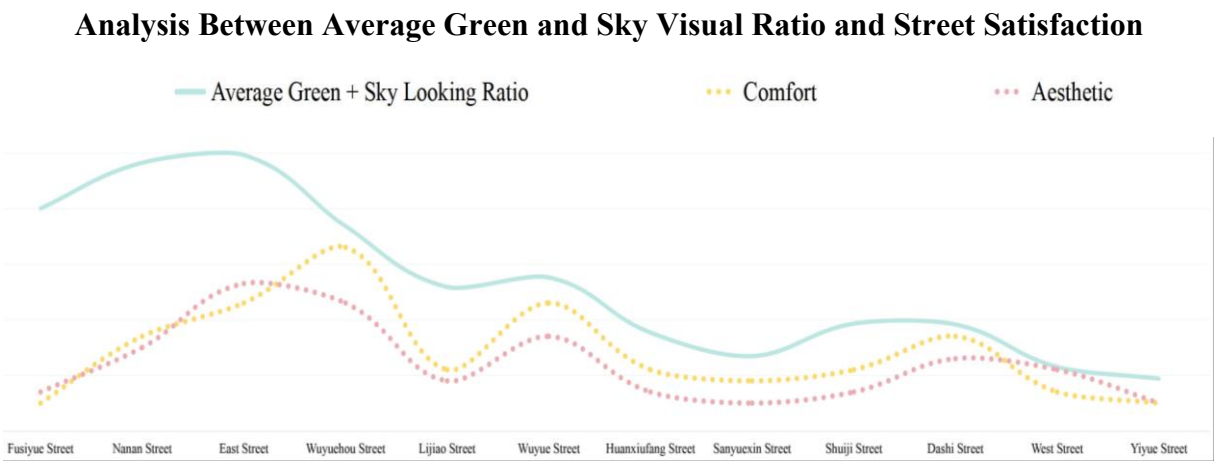


Figure 4.14 Correlation Analysis Between Average Green and Sky Visual Ratio and Street Satisfaction
Source: Self-drawn by the author

The following conclusions can be drawn from the statistical results.

a. Streets with higher rates of greenery are generally more comfortable
b. Streets with too high a sky rate have poor aesthetics and comfort.
c. Streets with larger old trees, such as Wuyao Street and Da Shi Street, have slightly higher street aesthetics and amenity even though the streets generally do not have high greenery.
d. Demolition of buildings along streets with low sky and greenery can be considered for streets with low sky and greenery.
e. Streets with high sky rates and low greenery, such as Vice Siyao Street, need to focus on a comprehensive design.

4.2.5. Comparison of Twelve Street Indicators

The results of the sample survey were summarised and the width, width error, aspect ratio, gradation, green percentage, and sky percentage of the 12 streets were summarised in radar charts that provide a clearer view of the differences and characteristics of each street to provide an updated reference base for planning.

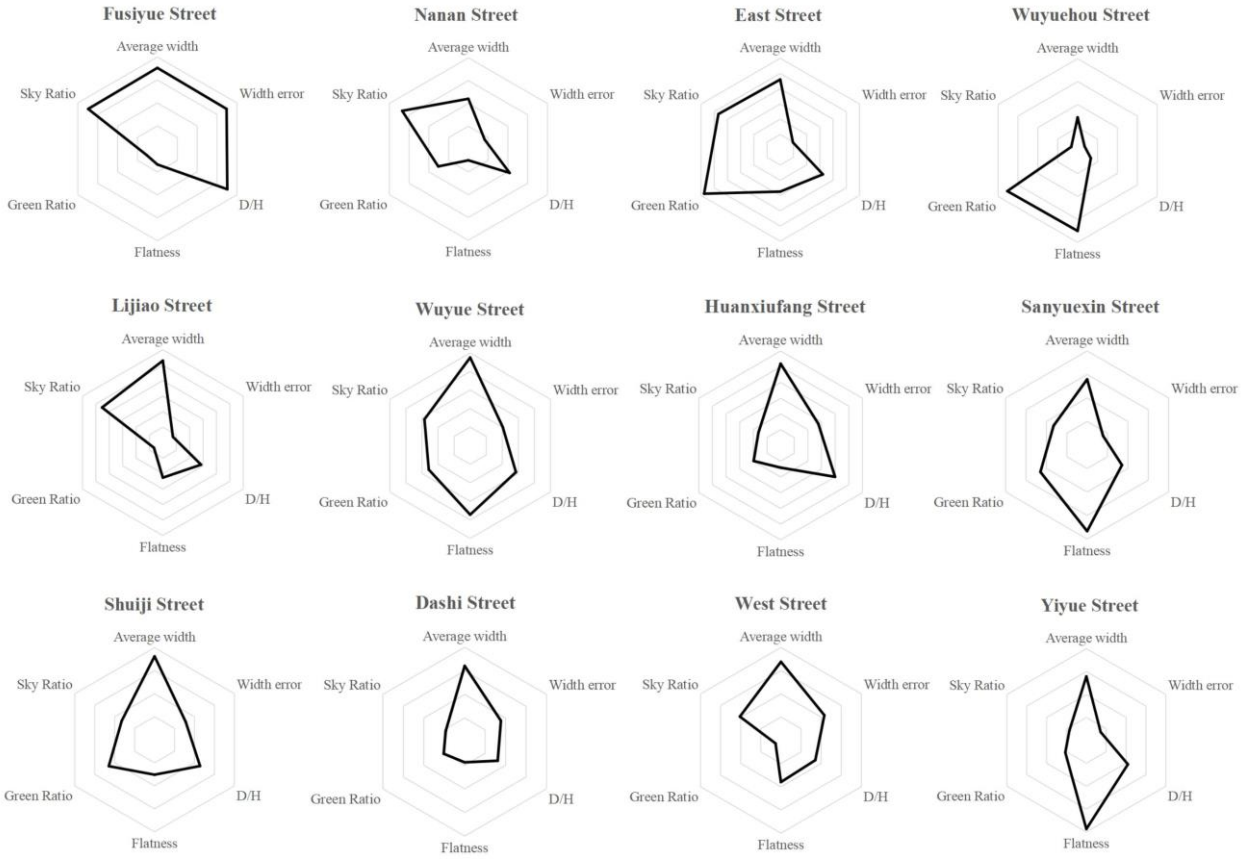


Figure 4.15 Comparative Radar Map of Important Indicators for Twelve Streets in Lijiao

Source: Self-drawn by the author

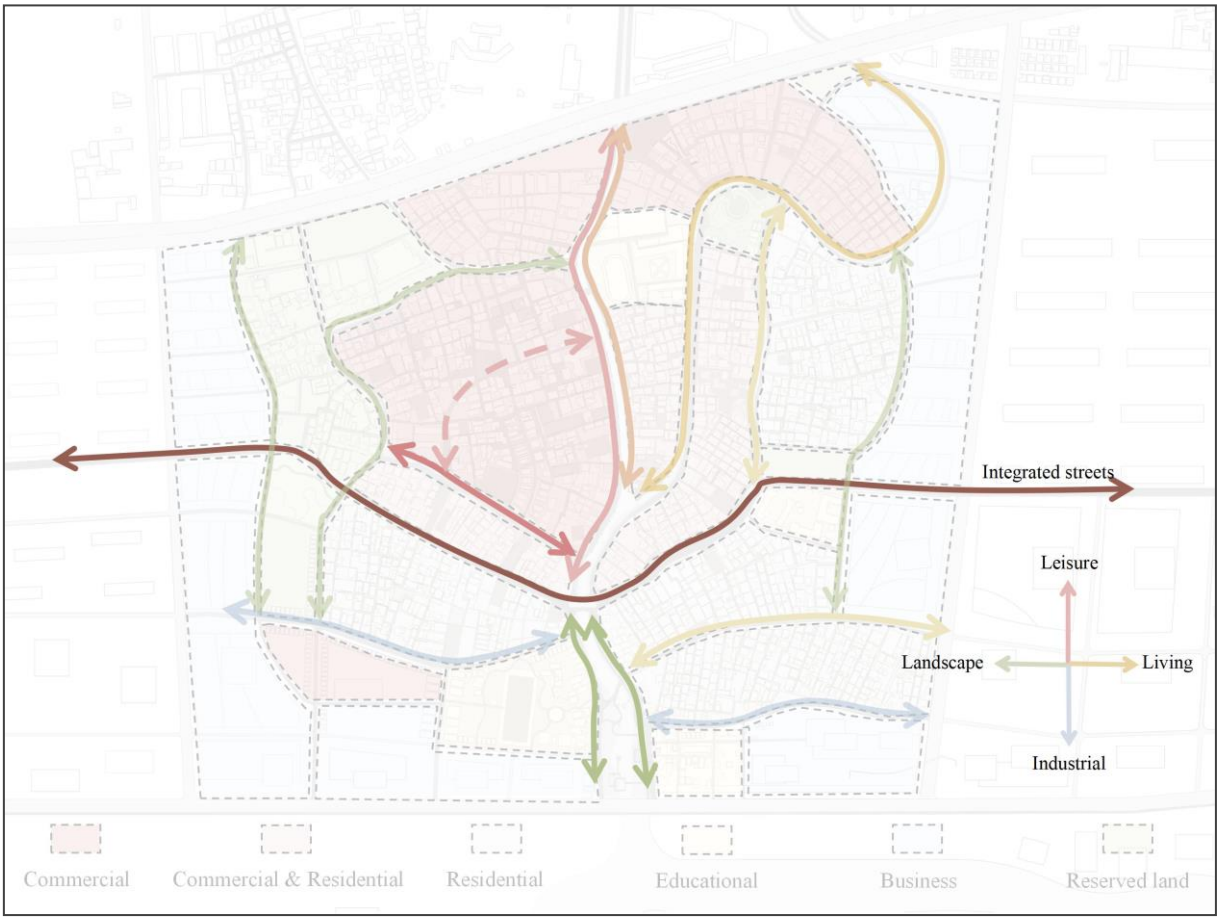


Figure 4.16 Street type classification
Source: Self-drawn by the author

4.3. Strategic Study

4.3.1. Space Optimization

"Pocket parks," also called pocket parks, are primarily parks or open spaces in cities that are smaller. Pocket parks are often scattered throughout the city, in nooks and crannies where they are needed, and provide an important public space for the people around them. In fact, the various small green spaces, community parks, or street gardens that surround us are common examples of "pocket parks." In different countries and regions, they are sometimes called mini parks, intimate parks, etc. In general, the characteristics of "pocket parks" are very clear: they are not limited in size and are generally small; they are usually located in cities where there are no large parks nearby; they are spaced apart and are always located where they are needed. It is these characteristics of the "pocket park" that make it an oasis in the desert of the concrete jungle of the city with its high-rise buildings, increasing the amount of greenery to a certain extent while meeting the need for parks and public

spaces where people can spend time in high-density cities. The enclosed nature, the proximity to the street, the ease of access, the integration with the street or the fact that it is part of the street are the advantages of the "pocket park".

(1) Boundary Requirements

The Aesthetics of the Street states that in terms of spatial composition, the following four conditions must be present for a square to be worthy of its name:

a. A square with a clear boundary line that can be 'pictorial', preferably the external wall of a building rather than a wall that simply blocks the view;

b. A "shaded" corner with a well enclosed space;

c. paved surfaces up to the boundary space areas are well defined and can easily form a "graphic";

d. the surrounding buildings have a certain unity and harmony, with good D/H proportions.

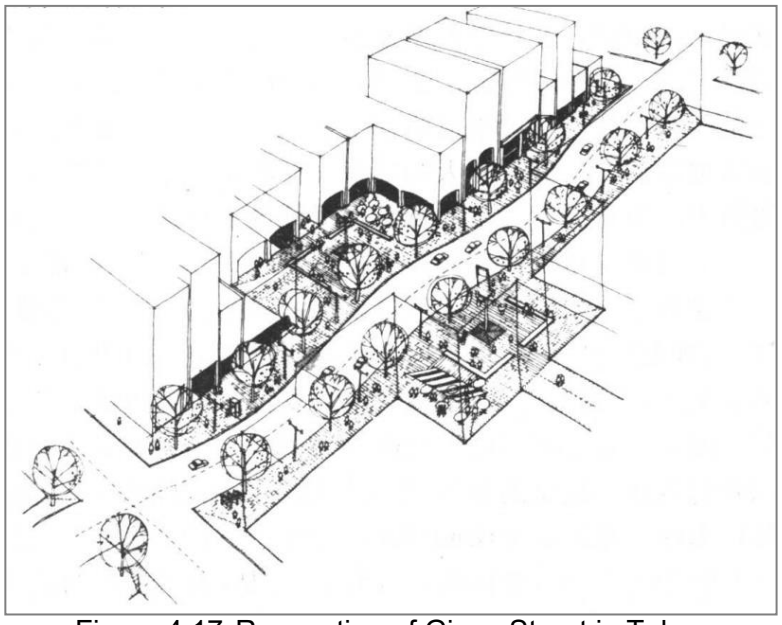


Figure 4.17 Renovation of Ginza Street in Tokyo
Source:Aesthetics of the street

Yoshinobu Ashihara, in his study of plaza space, also places great emphasis on "shadowy" space. For example, the "dark corner" is the space set back on the inside of a hill, and the "sunny corner" is the space protruding on the outside of a hill. In the exterior, the "positive corner" space is easy to create, while the "negative corner" space is difficult to design in terms of the relationship between the street and the building. It is not completely impossible to create a "shaded" space. It is possible to set back the buildings facing the street and, if possible, also set back the buildings on the opposite side and use the space created there not simply as a parking lot or something similar, but in the sense of actively creating a street square for the public.

Here the "aesthetics of the street" is necessary to beautify the street and make it attractive.

(2) Strategies for Optimising Space

Boundary effect: popular staging areas are generally areas along the building façade and the transition zone between one space and another, where both spaces can be seen at the same time. In a study of popular staging areas in Dutch residential areas, psychologist Derk de Jonge developed a characteristic theory of boundary effects. He points out that the edges of forests, beaches, shrubberies, clearings, etc. are preferred staging areas, whereas open fields or beaches are not visited unless the edge areas are crowded. This phenomenon can also be observed in urban areas. One is less exposed when one is around a building than when one is outdoors, and one does not obstruct anyone or anything. In this way, one can see everything while being less exposed and reducing one's personal space to a semicircle in front of oneself.[错误!未找到引用源。] .When one's back is protected, it is easier to observe and react when others can only walk in front of one, and this sense of security encourages people to stay.When choosing where to stay, people usually opt for spatial boundaries, a phenomenon called the "boundary effect." Through behavioural observation, it is easy to find that people also stay in the street space at spatial boundaries such as walls, under trees and pillars. When people stay at the boundaries, they can dominate the whole space without disturbing the flow of pedestrians in the space, and it is also quite quiet and discreet to stay there. The space in the border zone allows you to observe the situation with your back to the building, without fear of danger coming from behind.

Figure 4.18 Examples of boundary effects
Source:Humane places: guidelines for the design of urban open spaces

Figure 4.19 Examples of boundary effects
Interaction space - the "boundary effect" and its sufficient conditions

a. The piano effect: inside a building, guests often look for a piano, furniture or a corner in the border area to rest on. The same is true for outdoor areas, where pedestrians often look for places such as columns, flowerbeds, seating, trees, or sculptures in the perimeter areas. Such places are clearly delineated and not just a random spot on a wall. Having your back to a wall makes you feel low and safe, and if there is a flower bed or column next to it, the pedestrian does not feel isolated. Boundaries on the street are the most popular areas to stop, while boundaries with support and trust are more active.

Figure 4.20 Examples of the piano effect
Source:Interaction space - the "boundary effect" and its sufficient conditions

Figure 4.21 Examples of the piano effect
Source:http://www.panoramio.com/photo/25241219

b. The niche effect: Among the elements of the street facade, the niches of the walls are the most attractive places to stay. In such niches it is easy to find a place to rest: a place to lean back, protected from the weather and sun and with a good view. Standing and resting in a small niche, you are half-screened from the outside world and have the opportunity to look around and hide, looking from a small space into a large space.

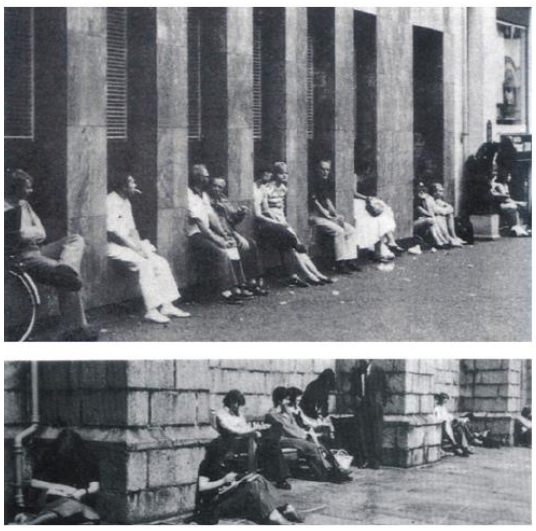


Figure 4.22 Examples of the recess effect
Source:http://www.panoramio.com/photo/25241219

4.3.2. Surface Renewal

(1) Pavement

In Townscape, Cullen argues that the design of the floor is as important as the design of the walls. The floor is a continuous and unified interface that organises and

coordinates the relationship between architecture and public space, engages the senses, and influences physical and conscious movement through pattern and texture. The Legs and Wheels article on landscape design focuses its illustrations on ground texture and pattern. Different tactile sensations of the ground suggest different transport functions, both to regulate traffic and to enliven urban spaces. As Cullen suggests in his notes to Focus on The Floor, "The floor itself is a dynamic scene ... The pattern breathes life into it.

In March 1952, Cullen noted in Common Ground that public life in the twentieth century had been compressed to the extreme, with city squares either converted to parking lots or occupied by traffic circles. Whether they are village squares or market squares, their essence should be a shared space. He reiterates the role of the ground-level landscape in reinforcing pedestrian primacy and enhancing the amenity of a place, arguing that "enclosures" are an important means of creating a visually coherent space.

Streets in the historic district are for residential use, and therefore pavements with good skid resistance, permeability, and resiliency are chosen to facilitate walking. In addition, pedestrians are the users and viewers of the streetscape, and an attractive paving landscape will make walking pleasant. Small-scale paving provides a sense of intimacy and comfort, the colour of the paving should harmonise with the surrounding environment, the use of repetitive patterns provides rhythm to walking, and the detailed design of local paving enhances the cultural connotation of the historic district. The boundary of the street, which can increase pedestrians' sense of safety, is also a definition of pedestrian and vehicular space and can be delineated by elevation changes or by altering the paving material.

Considering numerous national and international examples of street pavement, the author summarises the following feasible strategies for the renewal of Lijiao Village.

a. Single material pavement

Suitable for general roads, riverside paths, landscaped paths, exclusive driveways, etc. Flat pavements made of a single material often give a sense of calm and serenity and can be used for lifestyle roads.

Figure 4.23 Single material paving type A - flat
Source: Collected and categorised by the author from images on the internet

Figure 4.24 Single material paving type B - uneven
Source: Collected and categorised by the author from images on the internet

Figure 4.25 Single material paving type C - flat division type
Source: Collected and categorised by the author from images on the internet

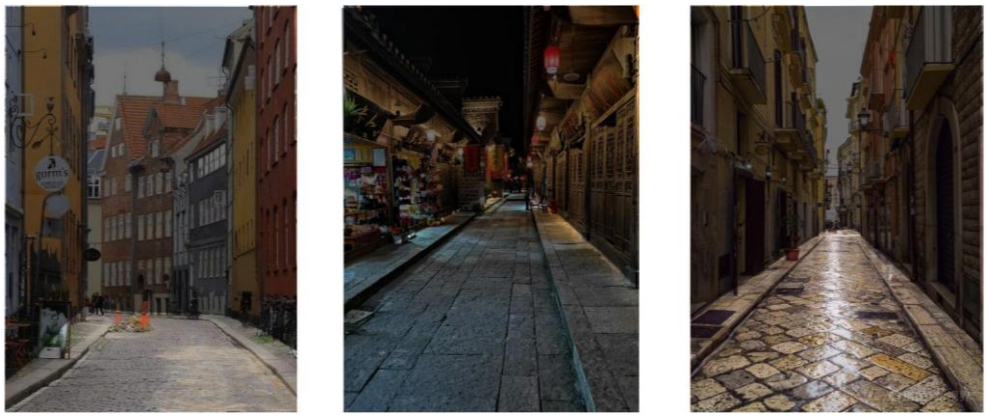


Figure 4.26 Single material paving type D - Vertical division type
Source: Collected and categorised by the author from images on the internet

b. Multi-material pavement

A variety of paving materials provides a richer visual experience, and the changing treatment of the paving at the entrance to the stores in the old town of Nantou is a kind of guide suitable for streets with a large number of stores.

The materials are mainly bluestone slabs, granite chippings, bricks and stones, with masonry, stone chippings, pebbles and various broken porcelain and ceramic tiles often used as auxiliary materials.

Figure 4.27 Multi-material paving type A - evenly divided
Source: Collected and categorised by the author from images on the internet

Figure 4.28 Multi-material paving type B - Irregularly divided
Source: Collected and categorised by the author from images on the internet

c. Creative Pavement

The Aesthetics of the Street vividly describes the unique interest generated by the paving of the ground: "On another occasion, when I came to St. Mark's Square with Italians I had met in Venice, along with their children, the children enjoyed playing Montaigne Blind along the pattern of the paving of the square." The description of the paving game immediately took me back to my childhood when paving, originally done to beautify the sidewalk, could also become a child's game.

Creative paving often serves not only aesthetic purposes, but rather the purpose of increasing pedestrian enjoyment of the street and attracting traffic.

Figure 4.29 Multi-material paving type A - Embellished
Source: Collected and categorised by the author from images on the internet

Figure 4.30 Multi-material paving type B - full paving type
Source: Collected and categorised by the author from images on the internet

Based on the requirements for the regeneration planning of Lijiao village, the design of the streetscape paving was carried out in the following steps:

a.Divide the areas and plan the paving of each area qualitatively according to the type of road, road environment, and travel speed requirements.

b. Determine the combination of materials according to the width and length of the road and the visibility features.

c. Increase pattern design, such as placement of historic and cultural elements, interesting intersection design, etc.

(2) Facade

Cullen uses page design techniques such as depth of field and contrast, as well as design elements such as colour and text, to engage with walled landscapes in the city. In The Wall, he writes, "When walls are seen as images, they are in large part an abstract painting that no longer seems trivial or empty." The text goes on to say, "Suppose we are a painter invited to remodel the house and put aside the brushes and paints. According to the author, a pedestrian-friendly façade design is different from what is usually understood as façade design in architecture. Normally, facade design or stylistic design in architecture must be innovative and surprising, and emphasise the overall sense of form, but in a street perspective, the form of buildings along the street must be consistent, and the goal is to create a good street atmosphere and focus on the experience of the outdoor space. There are more constraints on the design of renewal, and a targeted renewal strategy must be established based on the current situation.

The renewal of the building facades along the street should be carried out in the following steps, taking into account the characteristics of the current landscape of Lijiao Village.

In conjunction with the previous research for this paper, a qualitative design for each street in Lijiao Village was developed after a comprehensive analysis of the character of the streets in Lijiao Village. From the perspective of pedestrian friendliness, the quality of the second floor is extremely important to the pedestrian experience, and the design should simultaneously address the problems of the current second floor in Lijiao Village, taking into account the character of the street and the renewal of the second floor.

Based on the observation of a large number of actual streets, the author summarises the following three street interfaces that can be applied to the renewal of streets in Lijiao Village: pure commercial streets, combined commercial and residential streets, and lifestyle streets.

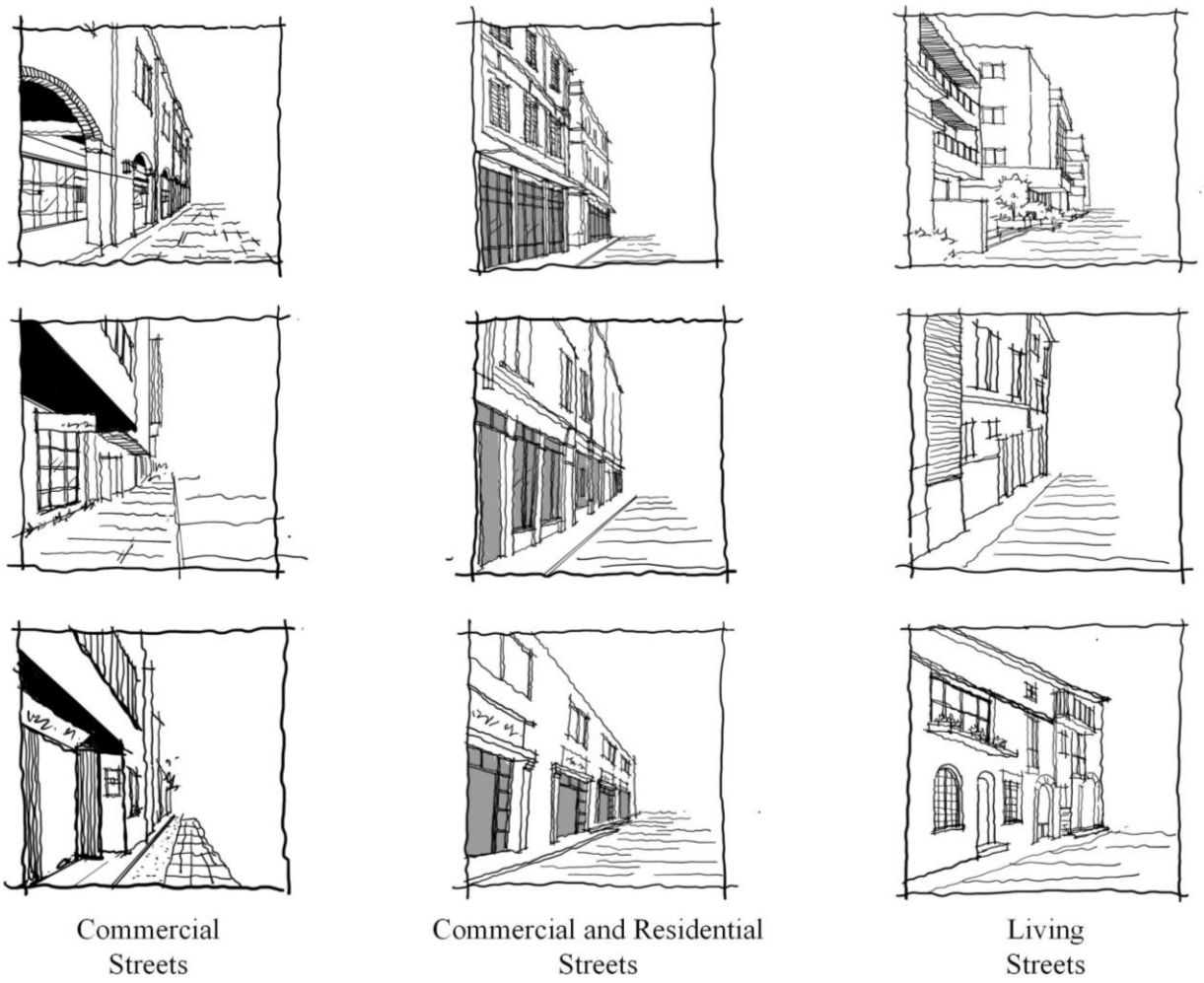


Figure 4.31 Street Renewal Strategy
Source: Self-drawn by the author

The buildings are interconnected and form the main facade of the street. The design of the facade, as an important part of the design, should achieve an organic combination of visual aesthetics and rational function, there are different methods and means. The composition of the elements studied differs from one perspective to another, for example, at the meso level, the main focus is on the wall, plinth and roof. and roofs, but at the micro level, the study must be detailed doors, windows, stairs, balustrades and so on. The design of the façade The design of the façade must also take into account the harmony of the building with its environment and the appropriate transition between The design of the façade must also take into account the harmony of the building with its environment and the appropriate transition between The design of the façade must also take into account the harmony of the building with its environment and the relationship between the interior and exterior of the building to attract people's attention [错误!未找到引用源。] .

4.3.3.**Elemental decoration**

In the book Aesthetics of the Street Clock, billboards are referred to as the second contour line of architecture, and in the discussion in this section, street decoration and the arrangement of plants on the building facade are included in the second contour line of architecture along with billboards. Related to the issue of the linguistic landscape of Lijiao Village in Chapter 1, several strategies for optimising billboards are also proposed.

(1) Decorative outline

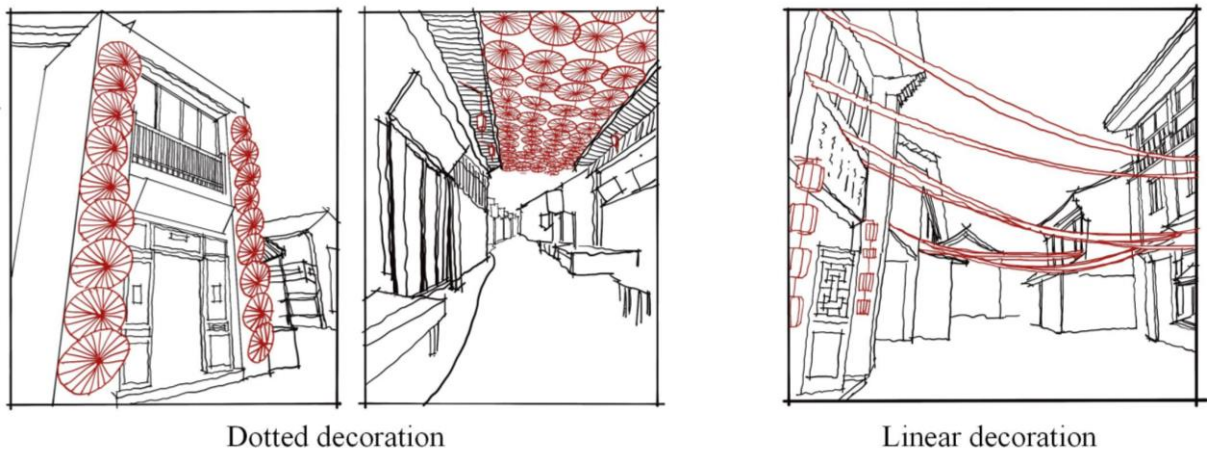


Figure 4.32 Second contour line - decorative contours in Luoyang, China
Source: Self-drawn by the author from photographs

(2) Plant outline

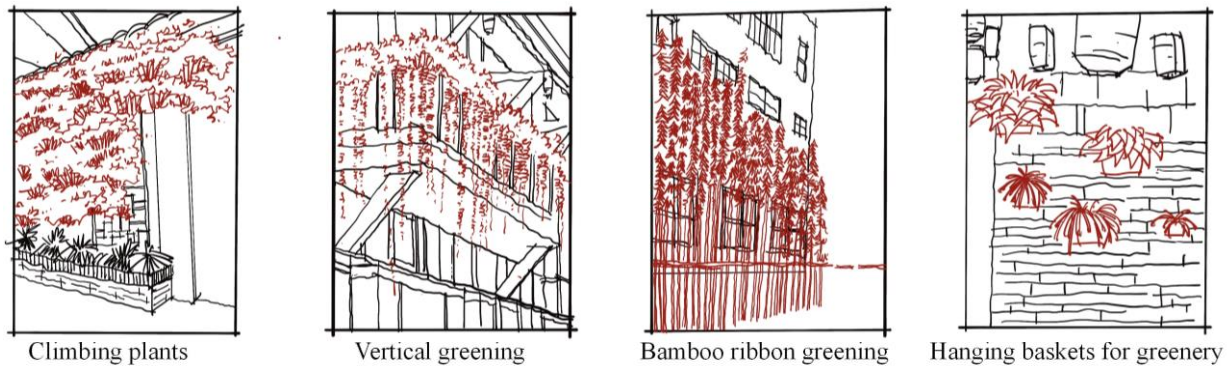


Figure 4.33 Plant profile type
Source:Self-drawn by the author from photographs

(3) Linguistic landscape

The information function of the linguistic landscape on the street is mainly manifested in the cognitive function, the adaptation function, the interactive function and the indication function, and the weakening of the information function of shop signs is the trend in the naming of signs in recent years [错误!未找到引用源。].The wide diversity of businesses in urban villages requires a variety of strategies for the linguistic

landscape in the renewal process, as certain local industries must be maintained while new businesses are added, and there are different levels of consumption among businesses.

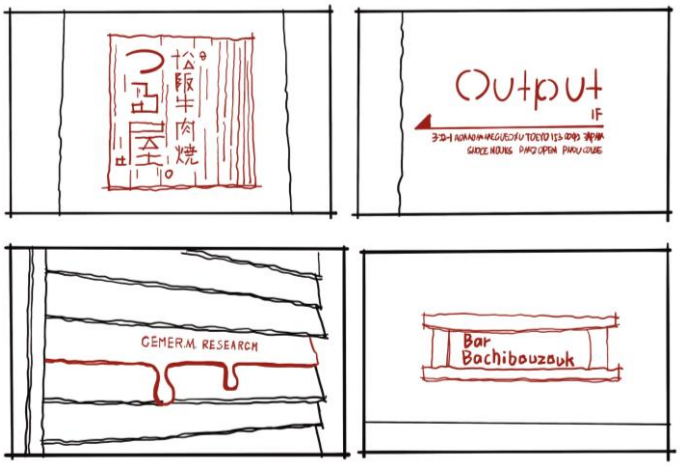


Figure 4.34 Language landscape type - small and delicate
Source:Self-drawn by the author from photographs

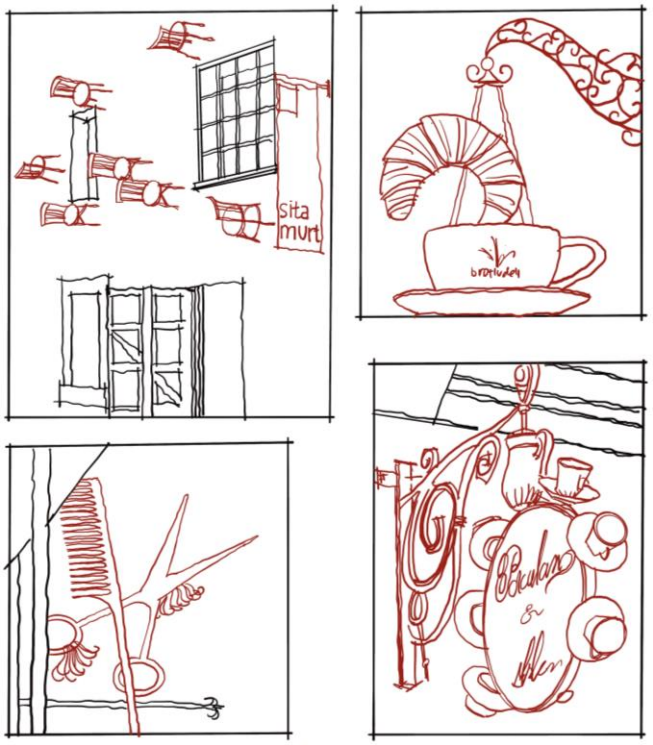


Figure 4.35 Type of linguistic landscape - figurative
Source:Self-drawn by the author from photographs

Figure 4.36 Type of linguistic landscape - attached
Source:Self-drawn by the author from photographs

The symbolic function of the linguistic landscape in urban villages is most evident in the association of the linguistic landscape with the social and cultural psychology and status of consumers, and the shaping of the sense of belonging is also an important manifestation of the symbolic function of the linguistic landscape.

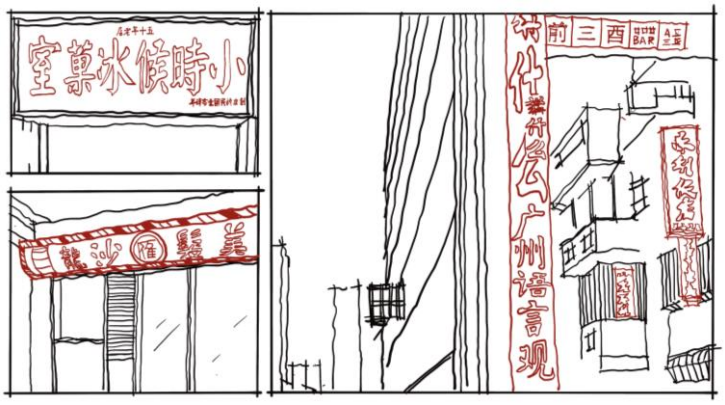


Figure 4.37 Type of linguistic landscape - Regional
Source:Self-drawn by the author from photographs

Tbale 4.14 Billboard installation requirements

Outdoor advertising parallel to the facade of a building	The distance between the surface of the billboard protruding from the wall must not exceed 0.3 m, and the distance between the light box and the screen LED protruding from the wall must not exceed 0.5 m. When designing the perimeter of the advertisement, the connection with the structural line of the building should be fully taken into account, and the style should be harmonious and uniform
Attached to the wall of the building	The distance between the billboard and the boundary of the house wall shall not be less than 1 metre.
Attached to a lintel at ground floor level	The lower end of the advertisement shall not be lower than the lower edge of the codified floor or overhanging elevated portion, and the vertical distance from the floor shall not be less than 3.0 metres; the upper end shall not be higher than the lower edge of the second floor window, and the total height shall not exceed 3 metres
Attached to a ridge or gable	The vertical distance between the bottom of the advertisement and the ground must not be less than 3.0 m (the placement of advertising is prohibited if this condition can not

Advertising perpendicular to the main façade of a multi-storey building	be met) and the thickness must not exceed 0.3 m. Only within the boundaries defined by the specific plan Building along the street where the bribe is often less than 3 metres from the red line of the street, no outdoor advertising perpendicular to the wall The upper edge of the advertisement shall not be higher than the upper edge of the upper window parapet of the building to which it is attached or the lower edge of the daughter wall of the roof, and it shall not be higher than 24 feet from the ground, and the lower end shall not be less than 4.5 feet from the ground The lower end shall not be less than 4.5 metres from the ground level and the lower end shall not be lower than the bottom edge of the riding or overhanging elevated section The outer edge of the advertisement shall not be more than 1.5 metres from the external wall of the building (structure) and shall not exceed 1/10 of the width of the road surface; the distance from the wall of neon lights, light boxes and LED displays shall not exceed 0.5 metres; the thickness of other advertising signs shall not be greater than 0.3 metres The horizontal spacing between adjacent advertisements must not be less than 6 metres or corresponding to the building openings
Advertising perpendicular to the eaves of the Riding	Outdoor advertisements perpendicular to the external walls of buildings (structures) may be produced in the form of neon lights, light boxes, etc. New forms and materials are encouraged Outdoor advertising on the same building or building complex should be uniform in terms of the distance between the outer edge and the outer wall of the building and the height of the lower edge above the ground, and the shape and choice of materials of the advertising should be harmonized Where the height of the rider is less than 6 metres, the vertical distance between the lower end of the advertisement and the ground shall not be less than 3 metres When the height of the roof is greater than or equal to 6 metres, the vertical distance between the lower part of the advertisement and the ground shall not be less than 4.5 metres Adjacent advertisements should correspond to building openings The width of the advertisement shall be the same as the width of the corridor, and shall not exceed the outer wall of the building, and the thickness shall not be greater than 0.3m

Self-drawn by the author based on the Guangzhou Road All-in-One Manual [错误!未找到引用源。]

Tbale 4.15 Prohibition of billboard installation

General prohibitions	On the roof of a building (including the top of a podium), or to adjust the height of a building's gable wall for the installation of a signboard Closure of building façade windows and entrances for the purpose of signage Installation of glass in street level buildings Endangering the safety of buildings or using dangerous or unauthorised buildings to set up Installation on the connecting wall between two buildings (except for the first floor pedestrian link)

Parallel wall outdoor signage	On the residential portion of a commercial/residential building or mixed-use building (except for building name signs)
	Prohibit the erection of outdoor signboards against and between columns on the ground floor of buildings Prohibited in streets and fire escapes up to 4 metres above and within 4 metres wide
Outdoor signage on vertical walls	Prohibited in buildings over 24 metres in height and in tower sections of high-rise buildings
	Prohibited on the mountain wall of a building
	Exterior signs with large vertical walls may not be placed on buildings along streets that are less than 10 feet from the red line of the street

Self-drawn by the author based on the Guangzhou Road All-in-One Manual 错误!未找到引用源。

Chapter5 Urban Design of Lijiao Village

5.1. “Lijiao · Hourglass”

The hourglass refers to time, and the phrase "Lijiao - Hourglass" on the one hand means to turn back the clock, on the other hand it is also an expression of restraint. Lijiao village will soon cease to exist in the face of intense urban development. "Sometimes holding back is like holding the sand in your hand: the tighter you hold it, the faster it will be lost."

The design of the pedestrian-friendly streetscape renewal of Lijiao Village focuses on both macro and micro aspects, starting with the restoration of important waterways according to the historical context, the demolition and restructuring of buildings based on the identification of optimization targets, the adaptation of various elements of the street interface in conjunction with the results of the study, and finally the design of more detailed scenarios in conjunction with design strategies.

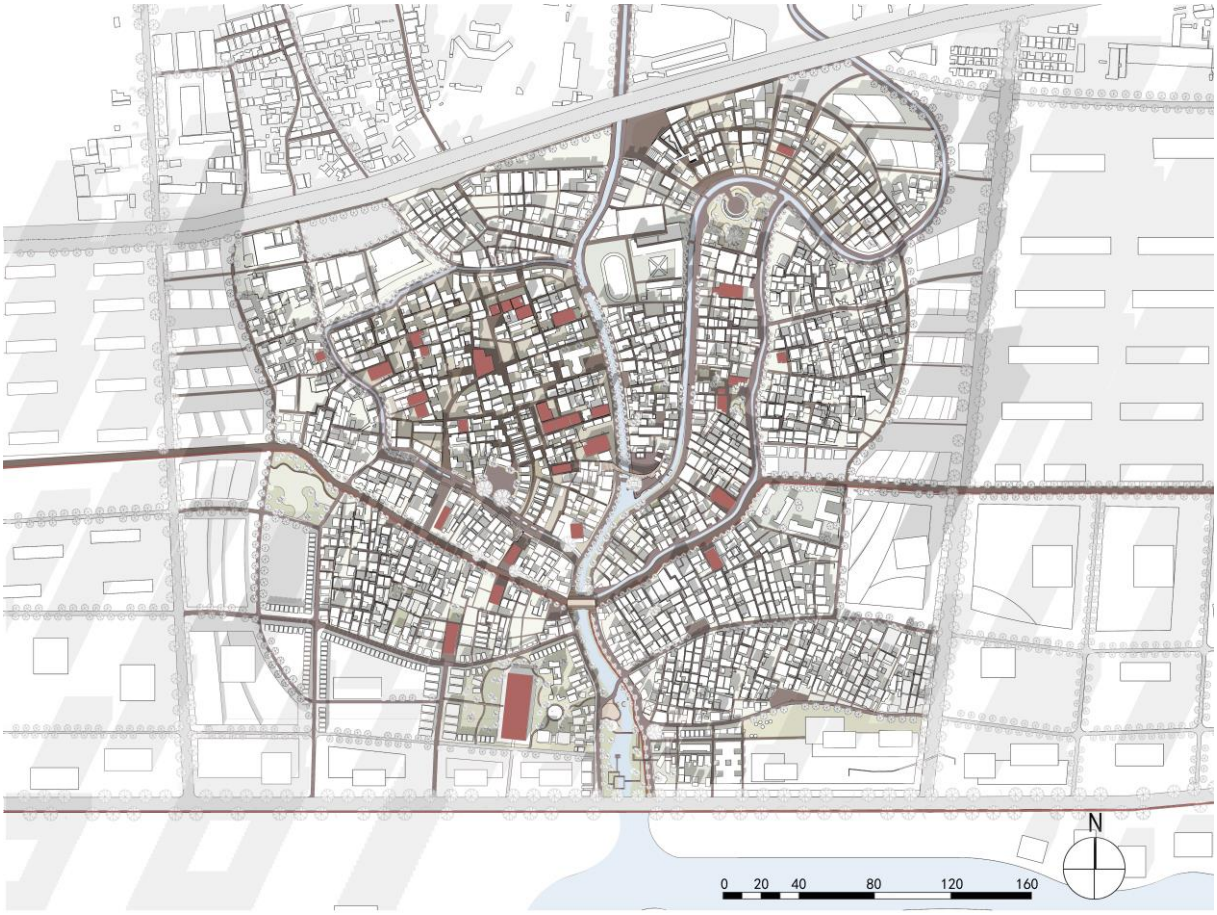


Figure 5.1 Master Plan of Lijiao Village
Source: Self-drawn by the author

Recognisable entrance areas will be created along the main streets and a series of iconic public squares will be integrated into the site to create a varied 'sequential landscape' and enhance the recognisability of the pedestrian zone.

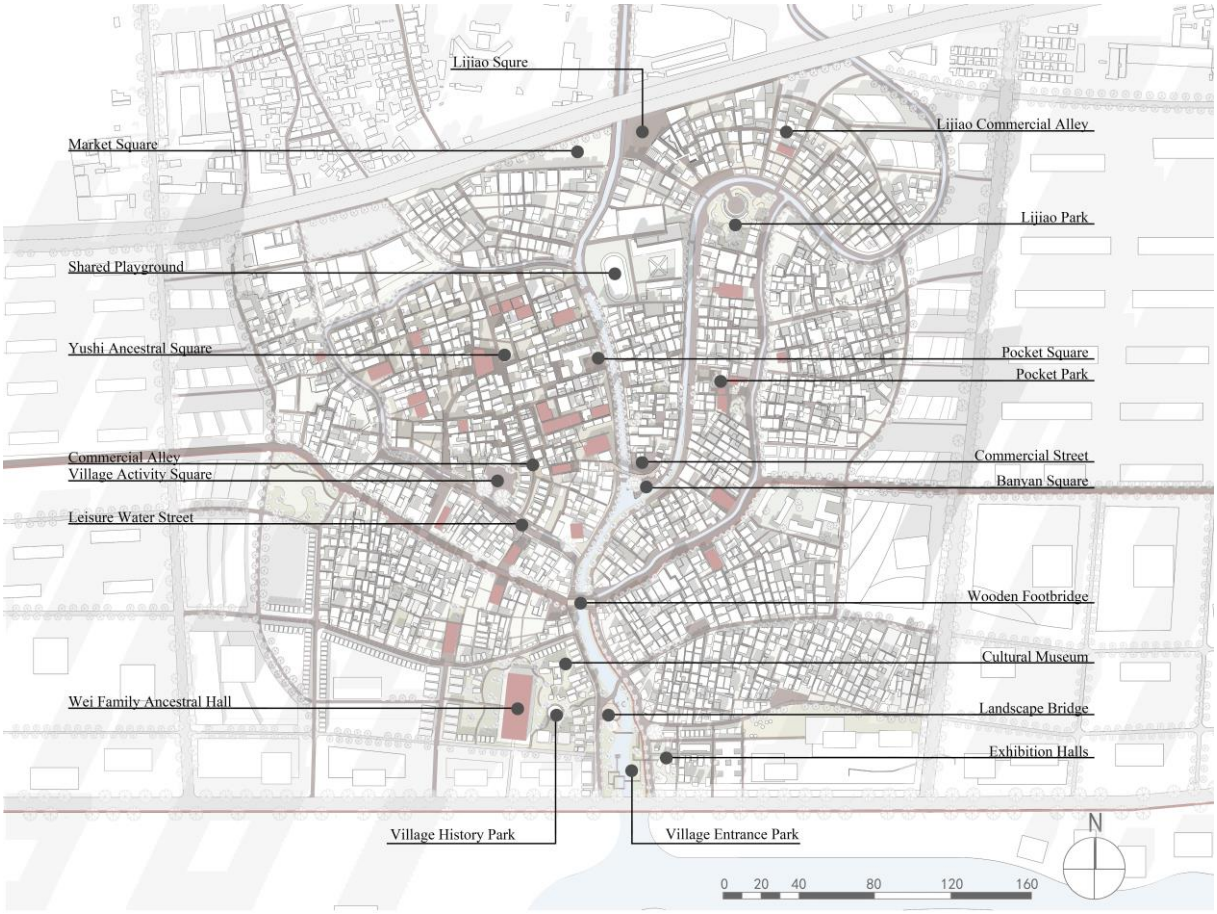


Figure 5.2 Sequential Streetscape Design in Lijiao Village
Source: Self-drawn by the author

Figure 5.3 Aerial view of Lijiao Village
Source: Self-drawn by the author

The design of the skyline is based on the results of the competition in Chapter 1, with decreasing building height in the areas near Lijiao Village, creating a ring around the village and ensuring that individual high points in Lijiao Village have a view corridor to the Pearl River.

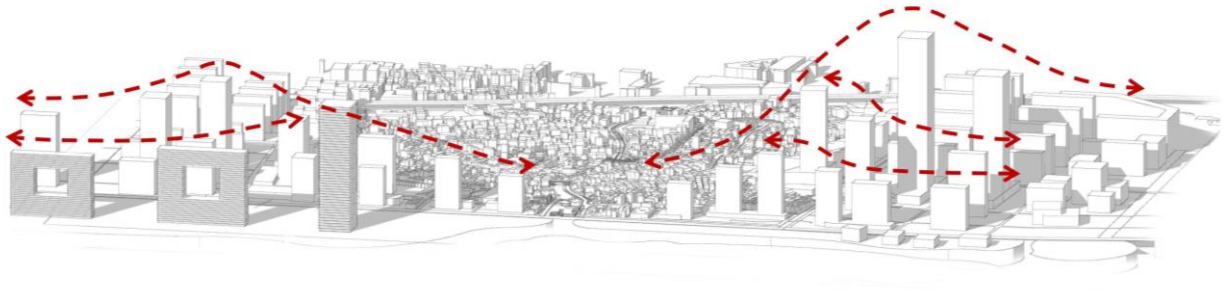


Figure 5.4 Skyline Analysis
Source: Self-drawn by the author

5.2. Overall planning

5.2.1. Water System Planning

Based on the historical context described in the first sheet of the study, the redesign of the water system is an important first step in the regeneration of Lijiao Village. The original Lijiao River will be used as the main river to connect with the back channel of the Pearl River, restore the waterways of Wuyue, Sanyue and Shuiji Streets, and connect with Haizhu Lake to restore the impression of a Lingnan water village while solving the problem of water supply and drainage in and around the ancient Lijiao

Village. In Fusiyue Street and Nanan Street, a large waterfront area will be used to create an ecological landscape park, and in Dashi Street, a more interesting recreational street will be created in conjunction with the water system to improve the liveliness of the neighbourhood with a variety of shoreline designs, create a multi-level experience space for pedestrians, and contribute to the regulation of the pedestrian microclimate.

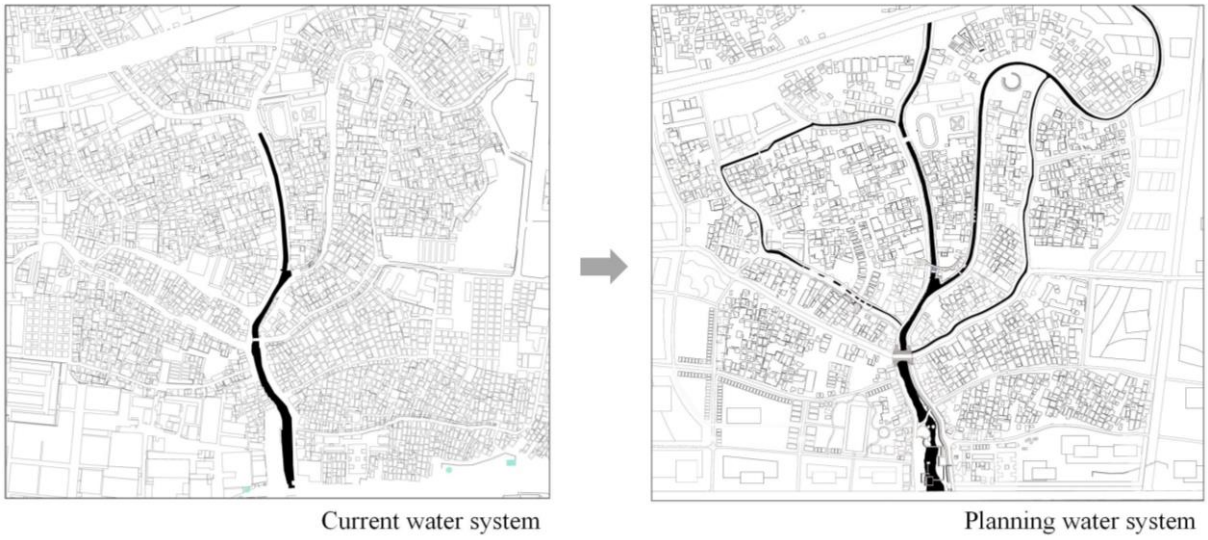


Figure 5.5 Water system design
Source: Self-drawn by the author

5.2.2. Functional Planning

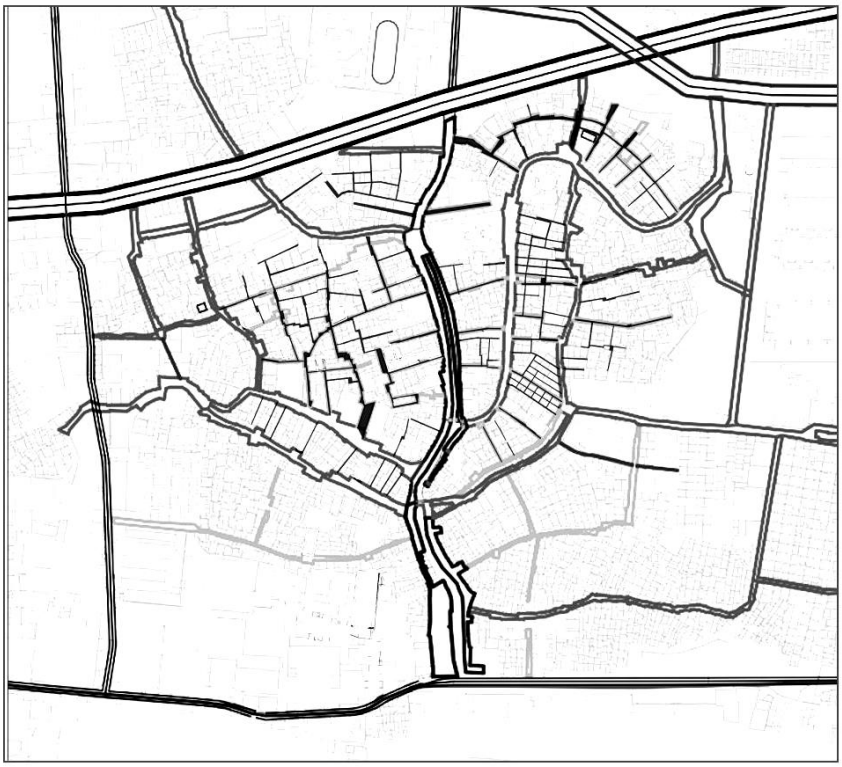
According to the findings in Chapter 1, Lijiao Village has great potential for commercial development, but as a village, the residential atmosphere is also an essential element of the landscape, so the central area of Lijiao Village is dominated by commercial and residential functions. The planning of commercial areas is mainly determined by the density of the distribution of historically protected buildings and the distribution of neighbourhood vitality; cultural and educational areas are developed around the current elementary school, kindergarten and the most valuable ancestral hall of the Wei clan; at the same time, due to the limited content of the design, part of the buffer area is used as reserved building land, including parking lots and green areas; the periphery is used as commercial land in conjunction with the upper plan. Up to this point, the different streets should have different characteristics due to the distribution and type of water system.

Figure 5.6 Function plan
Source: Self-drawn by the author

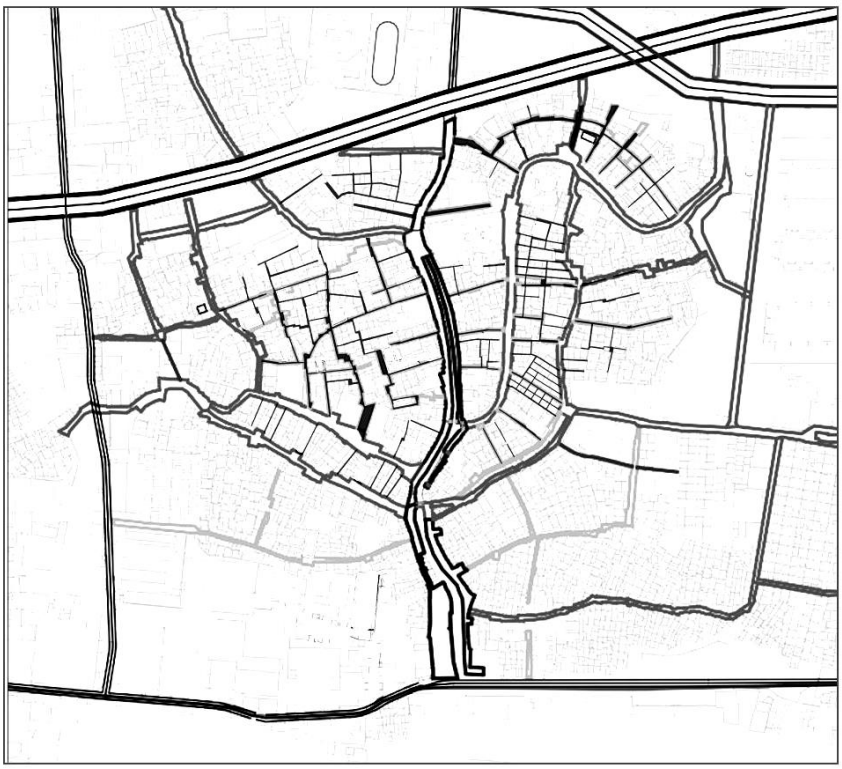
5.2.3. Street Network Design

The current road network in Lijiao Village has a number of problems, such as the problem of congested lanes analysed in Chapter 1 and the poor interconnectivity of roads, as noted in Chapter 3 by comparing the relationships in the lower part of the plan. In addition to the existing problems, one of the main conflicts that had to be resolved in the planning process was how to integrate the preserved Lijiao Village with the surrounding high-intensity commercial building development.

The new road network was designed so that, in addition to the main arterial roads, the principle of pedestrian priority would apply to traffic in most parts of Lijiao Village, with traffic having access only under special circumstances, and that some of the existing buildings along the roads would be demolished to meet the need for fire facilities.



Current street network



Current street network

Figure 5.7 Street network design
Source: Self-drawn by the author

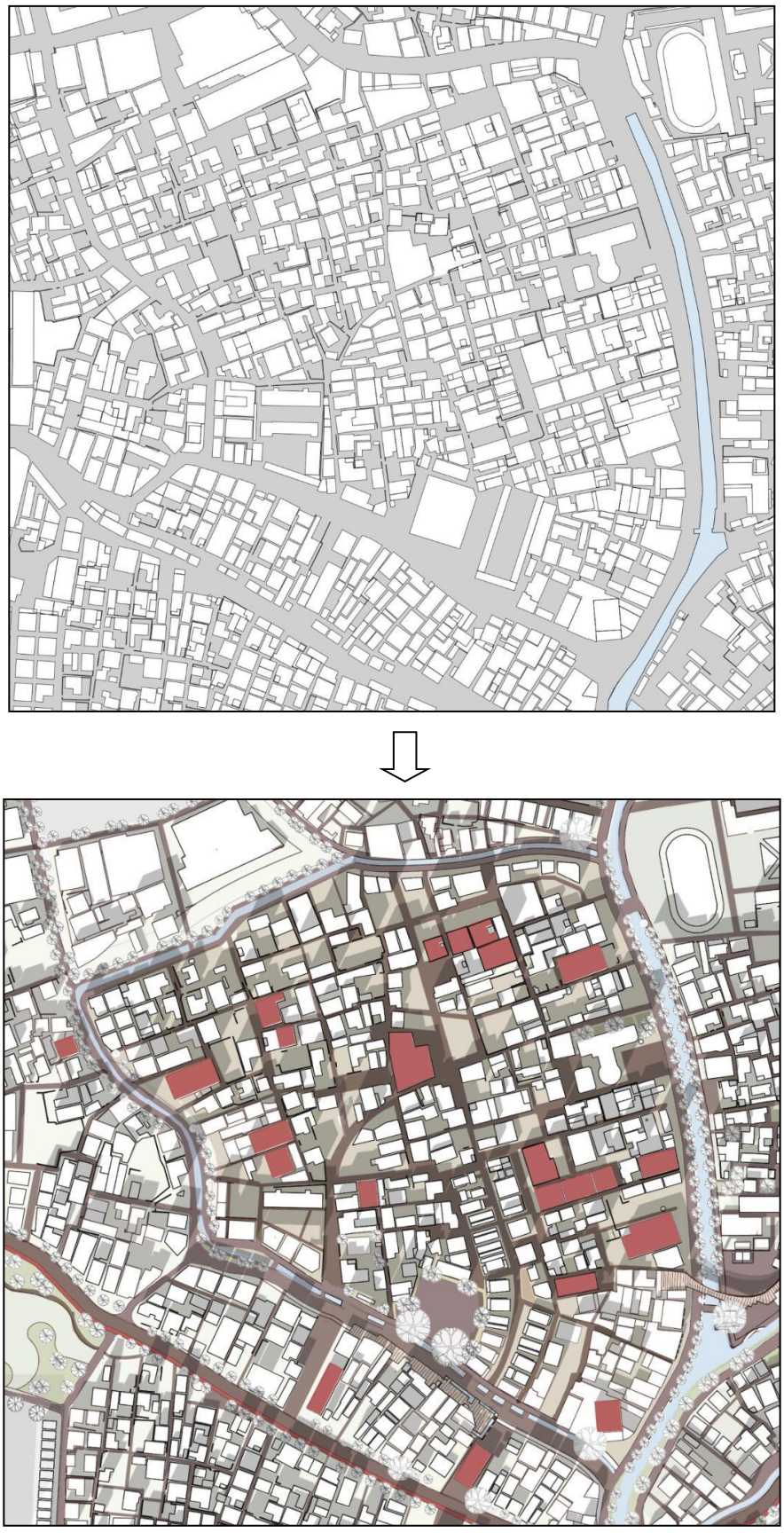


Figure 5.8 Street network design
Source: Self-drawn by the author

(1) Design of Road Systems for motor vehicles

The site study found that most of the open road space in Lijiao village is used for parking, which detracts from the streetscape and affects the pedestrian friendliness index. In the context of new energy vehicle development, the design of pedestrian friendliness is not to negate the use of motor vehicles altogether, but to create a more harmonious and orderly model for motor vehicles and people.

The case studies in Chapter 3 show that in neighbourhoods with better pedestrian design, parking for motor vehicles is often located on the periphery of the pedestrian zone. The analysis diagram POI also leads to the conclusion that the closer one is to a public transport stop, the lower the demand for parking spaces. After measuring on-site parking space in the research part of the study and considering the need for future growth in parking numbers, it is proposed to plan three central car parks around Lijiao village.

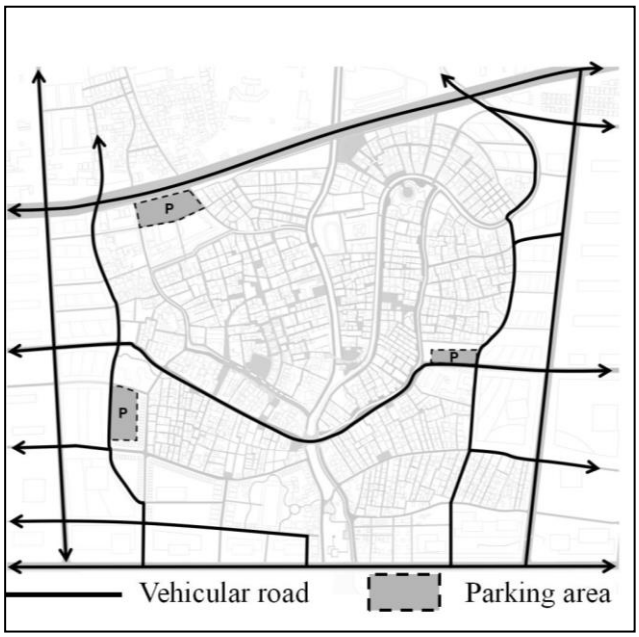


Figure 5.9 Road Systems for motor vehicles

Source: Self-drawn by the author

(2) Design of Street Systems Allow Motor Vehicles Under Special Circumstances

Taking into account the needs of firefighting and the daily needs of the residents of Lijiao Village, the roads that do not meet the fire access width will be widened to meet the needs of traffic access if necessary. With the exception of the river section, the road width will be a minimum of 4 m and a maximum of 7-9 m.

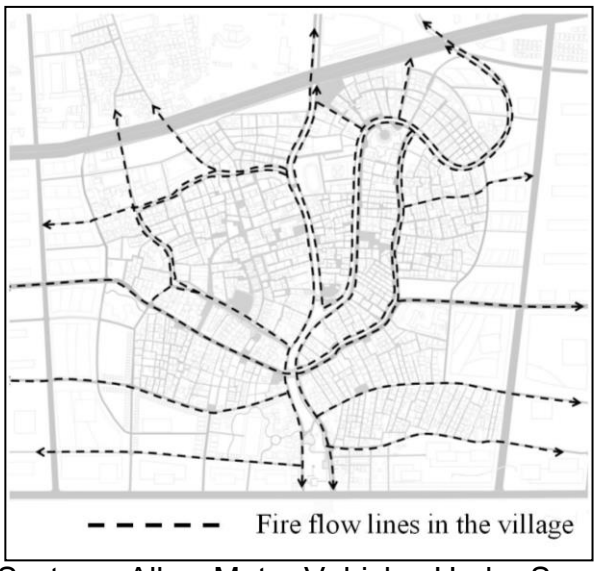


Figure 5.10 Street Systems Allow Motor Vehicles Under Special Circumstances
Source: Self-drawn by the author

(3) Design of Street Systems Allow Motor Vehicles Under Special Circumstances

The site study revealed that there is an acute shortage of bicycle parking in Lijiao village. The planning considered the entire road network more comprehensively and a comfortable environment for pedestrians could only be created if the needs were taken into account. Therefore, when planning the road system, a slow-movement system was established at the edge of the pedestrian zone to ensure better connectivity with the pedestrian system and public transport and to facilitate walking.

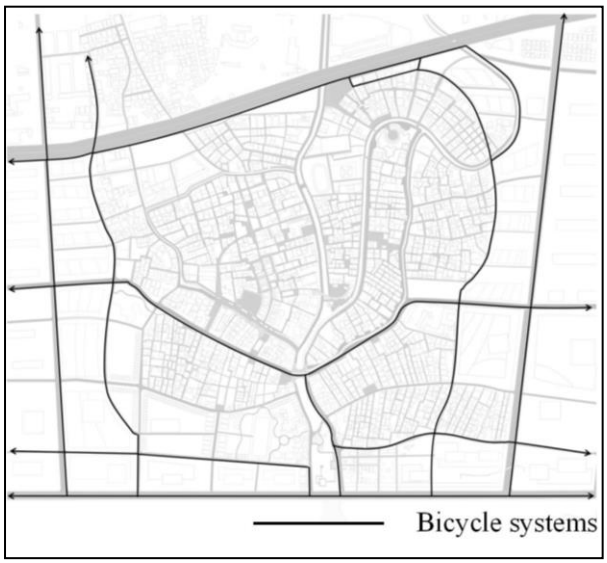


Figure 5.11 Bicycle System Design
Source: Self-drawn by the author

(4) Walking System Design

The design of the pedestrian system relies on the existing main streets to free up alleys that are blocked by walls and buildings. Using the 12 streets of the study as main streets, a complete pedestrian network was created by reorganising the alleys to create more walkable neighbourhoods.

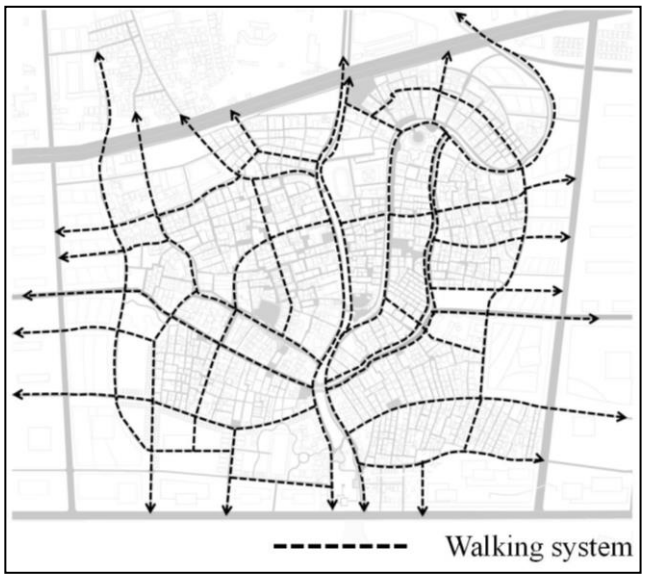


Figure 5.12 Walking System Design
Source: Self-drawn by the author

(5) Micro Transport System Planning Design

On the basis of the completed road system design, and in order to further improve the accessibility of residents within the project area, small circular bus routes have been added, connecting metro and bus stops where the analysis in Chapter 1 yielded a high level of passenger traffic.

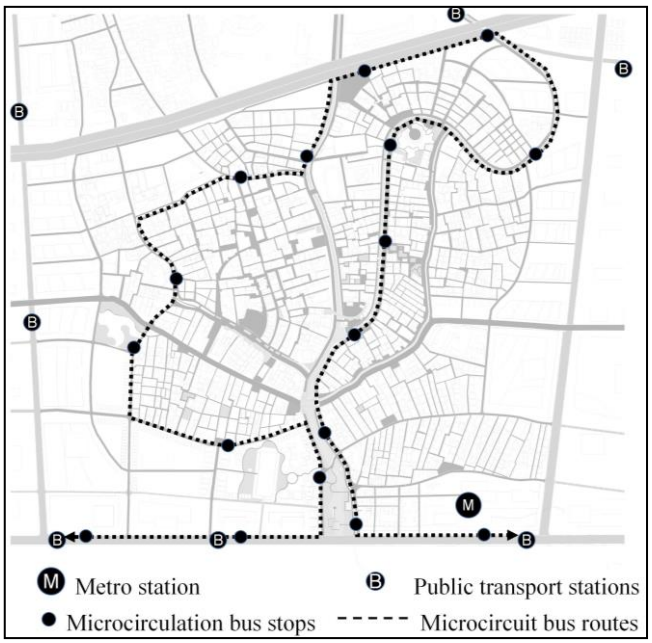


Figure 5.13 Micro Transport System Design
Source: Self-drawn by the author

5.2.4. Street Interface Design

(1) Buildings Removed to Ensure Street Access

The planning of the water network and the road network required the demolition of buildings in some areas to widen the roads, and the division of the water network and the nature of the roads also had a significant impact on the road profile. The

demolition of buildings is done in a specific order: in a pedestrian-friendly perspective, according to the intentions of the master plan and the requirements of access for firefighters 错误!未找到引用源。,some buildings along the streets that do not meet the requirements for the width of the driveway will be removed.

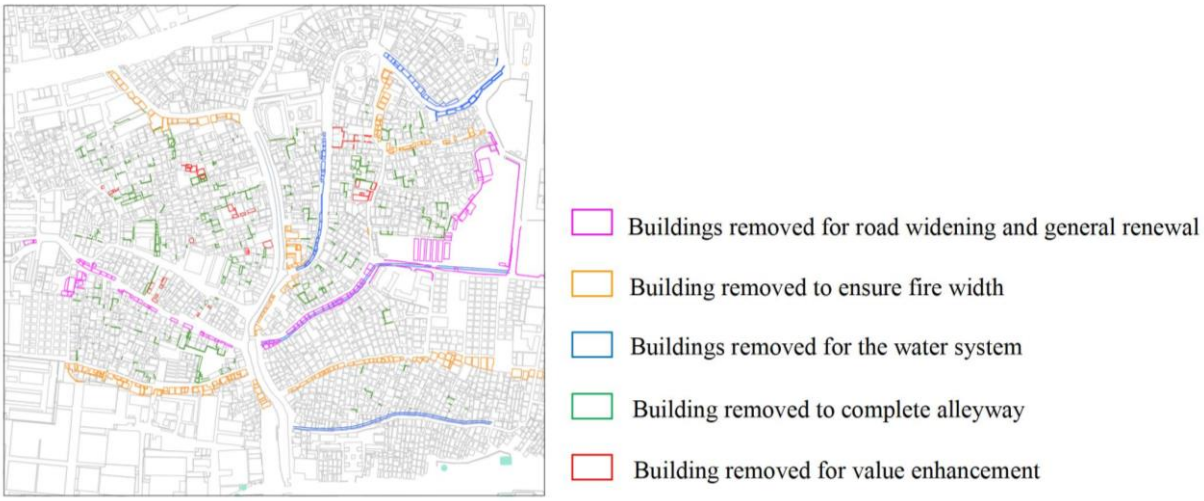


Figure 5.14 Buildings removed for streetscape regeneration
Source: Self-drawn by the author

(2) Buildings Design to Maintain the Scale of the Street

After some of the buildings were removed, new buildings were designed along the street interface to complete the street interface and maintain the small-scale character of the neighbourhood and to create an appropriate relationship between street height and width in conjunction with the height-width study.

The yellow areas in Figure 5.14 are the key conservation buildings, i.e. the parts of the building with high current value. The design connects the historic buildings through the organisation of public space and streets and landscaping, and brings out the value of the historic buildings in a pedestrian system.

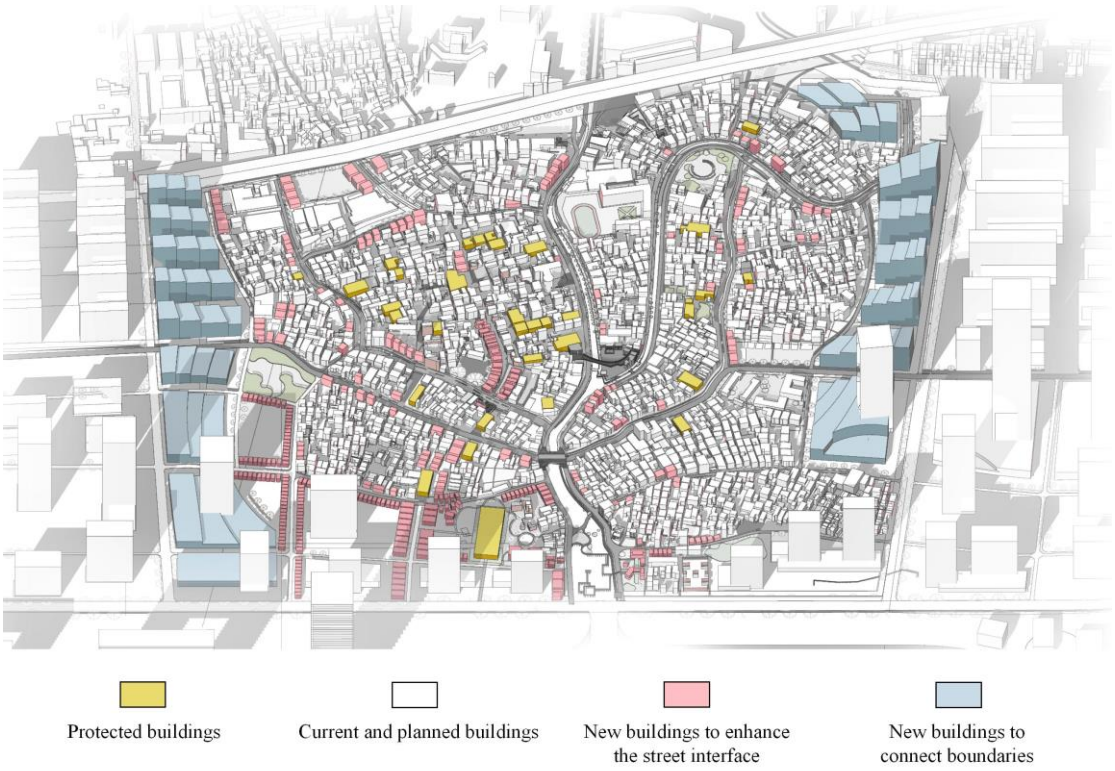


Figure 5.15 Buildings removed for streetscape regeneration
Source: Self-drawn by the author

5.3. Street Sections and Scene Design

(1) Street Sections Design

The ratio of height to width is always a key factor throughout the text. From the comparison of different scales of streetscape in Chapter 1, to the comparison of Venice, Suzhou Pingjiang Road and Nantou Old Town in Chapter 3, to the distribution of the height-to-width ratio of 12 streets in Lijiao Village in Chapter 4, it is clear that the height-to-width ratio is a very important factor influencing streetscape. In the design of the 12 road renewal projects, Lijiao village also has a larger overall road width due to the design of the water system. However, there is no specific theoretical knowledge on the optimal height-to-width ratio for roads with rivers. The height-to-width ratio is controlled by analogy with the road scale of Pingjiang Road in Suzhou.

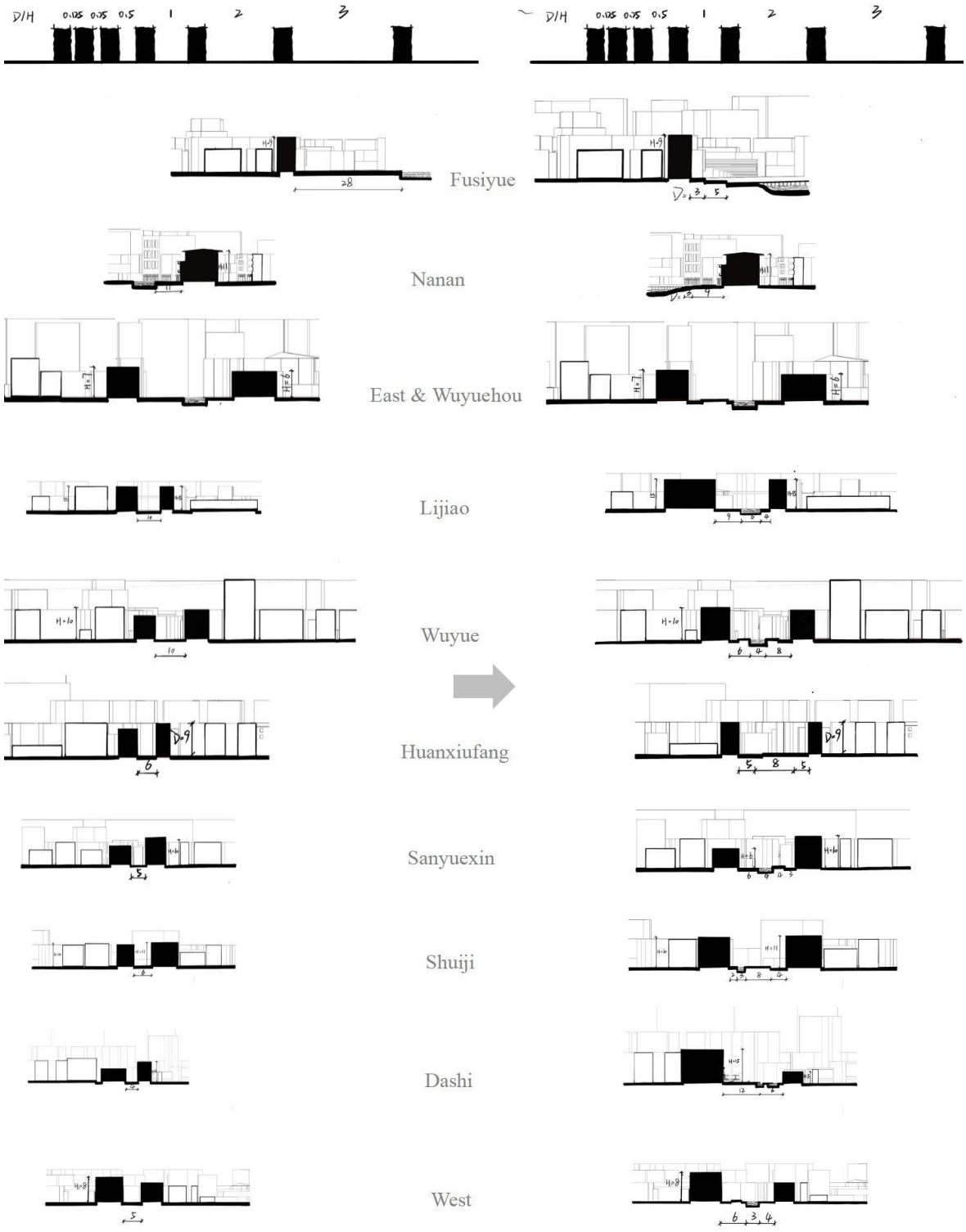
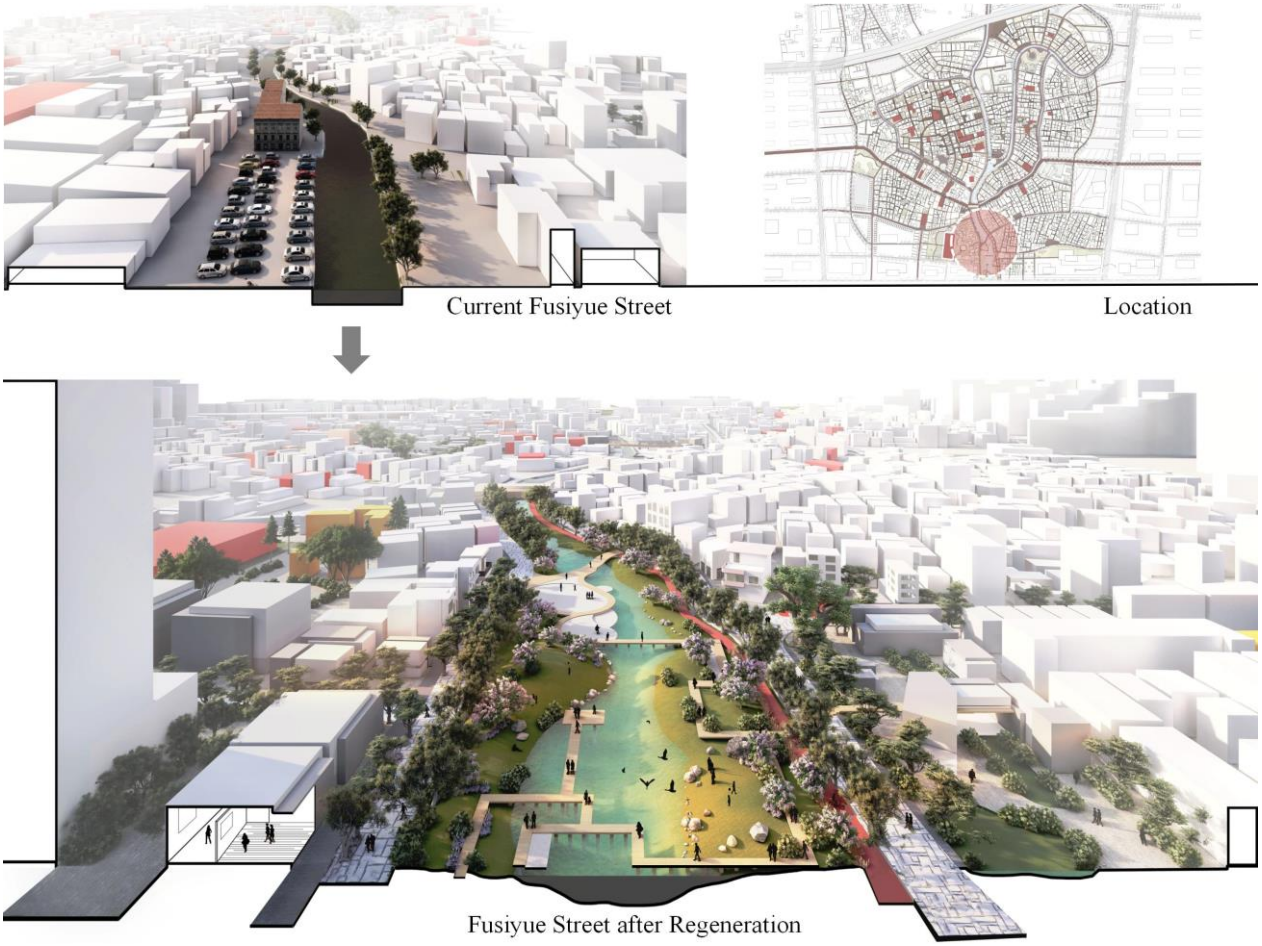


Figure 5.16 Comparison of street sections before and after design
Source: Self-drawn by the author

(2) Fusiyue Street，Eco-friendly street design

Fusiyue Street, as the main entrance interface to Lijiao Village and bordering the riverfront road, bears the burden of creating the gateway image of Lijiao Village and should be of a high quality. As most of Fusiyue Street is occupied by parking spaces, it blocks the use of the river as a landscaped surface and causes great damage to the streetscape. Due to the re-planning of the car park, the addition of micro-circulation buses and the planning of a slow moving system, and the fact that Fusiyue is within 500m of the Lijiao metro station, the street, which was originally encroached upon by motor vehicles, is combined with the river to create a water-friendly public pleasure park. With large scale landscaping as an important means of creating a high quality streetscape and a pleasant walking area, eco-friendliness will also be an aspect of promoting pedestrian friendliness.



Comparing the streetscape of Fusiyue Street before and after the transformation, one can see the role of ecological design on the streetscape and the walking experience. The ecology adds layers to the streetscape and makes the walking experience more comfortable and relaxing.

Figure 5.17 Comparison of Fusiyue Street before and after design
Source: Self-drawn by the author

The section design(Figure 5.17) creates a hilly topography at the entrance to the park and refines the landscape design to create small pedestrian areas in a large scale landscape. Trees are used to emphasise the pedestrian zone boundaries and maintain a sense of enclosure at a small scale.

Water-friendly chimneys and resting platforms are used in the design to create interesting and relaxing pedestrian zones. On the eastern side of Nanan Street, the abandoned buildings will be demolished and a pavilion will be planned to connect with the existing craft and garment industries in the area. The waterfront part of the promenade will be extended to the pavilion to attract people and combine different functions and spaces to enrich the streetscape and change the pedestrian experience.

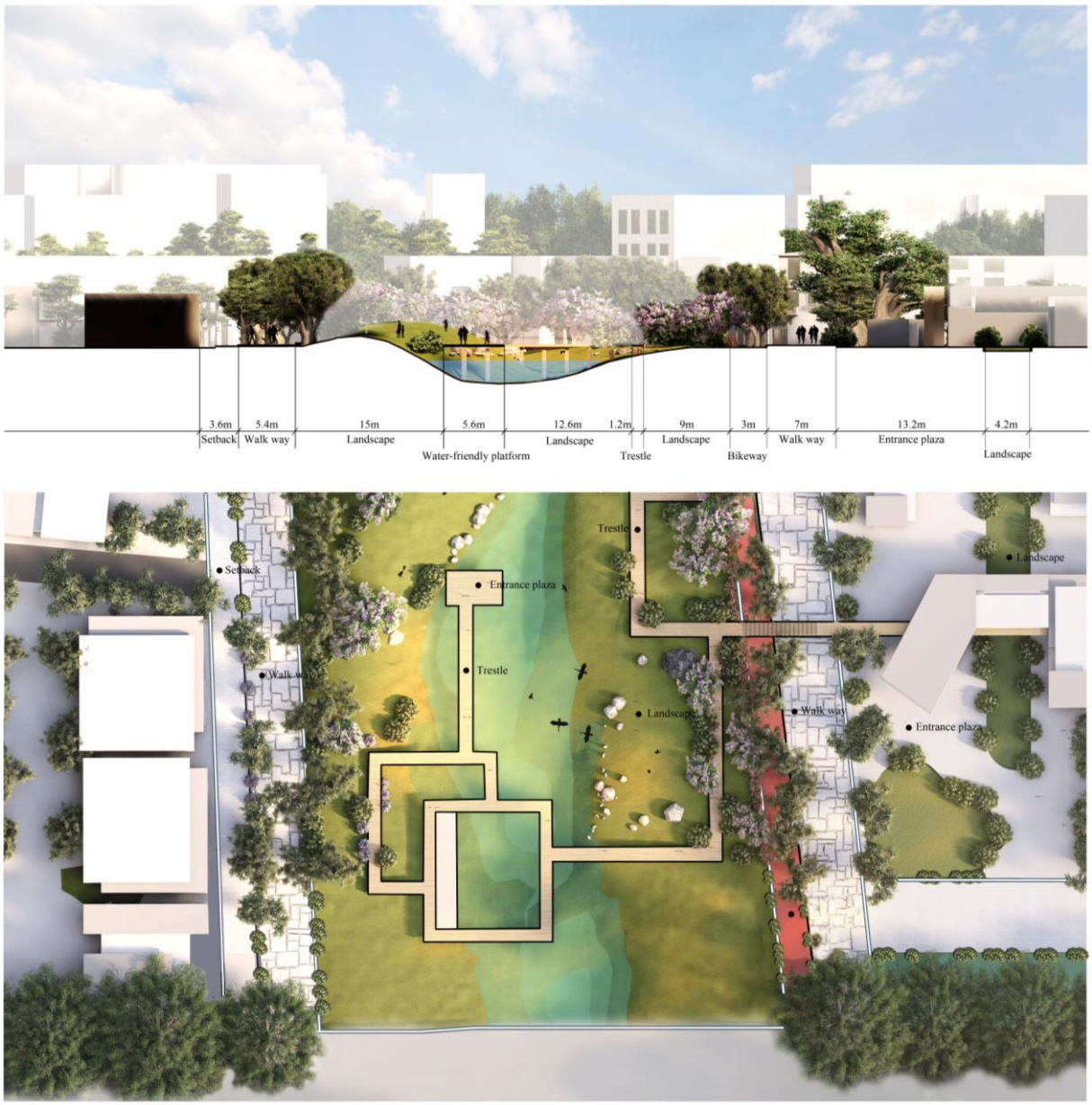


Figure 5.18 Plan and Section of Fusiyue Street
Source: Self-drawn by the author

(3) Dashi Street Design

Dashi Street is one of the few quiet streets in Lijiao Village, with patches of abandoned buildings and fences, and most of the stores along the street have been demolished and turned into motor vehicle parking sheds. Since the western part of Lijiao Village is planned to be more commercial in nature, the design of the street, combined with the stores along the street, has set up outdoor recreational platforms and dining spaces in combination with small landscapes. The main street interface has also been mainly wooden trestle, placed on top of the water system, forming an integral part with the square and commercial space to enhance the dwellability.

The transformation of Dashi Street was a bold exercise in creativity, and the streetscape was renewed with more than a slight adjustment of indicators in the visual dimension, but with a combination of streamlining and planning and bold design to create a new outdoor space. As you can see from the rendering of Dashi Street, the street has been transformed from a transit space into an unfortunately attractive public space.

Figure 5.19 Comparison of Dashi Street before and after design
Source: Self-drawn by the author

In profile, Dashi Street is composed of a variety of elements, with a recreational terrace surrounded by a pond and a pond of flowers, a main wooden pavement over the water system and a hollowed-out central section, and a pavement that continues the small alley at the boundary to separate the space of passage and the space of residence.

The plan (Figure 5.20) shows more details in the design of the street, such as the paving, the pond, the fountain and the seating, which make the street richer and more homely. The placement of the central flower pond in the street also considers the relationship to Banyan Square and the views from the alley that continue into the pavilion, creating a sequence of vistas.

The inclusion of street furniture in a casual street like Dashi Street makes the street rich and active, and the accumulation of such design materials helps the designers to create an attractive streetscape.

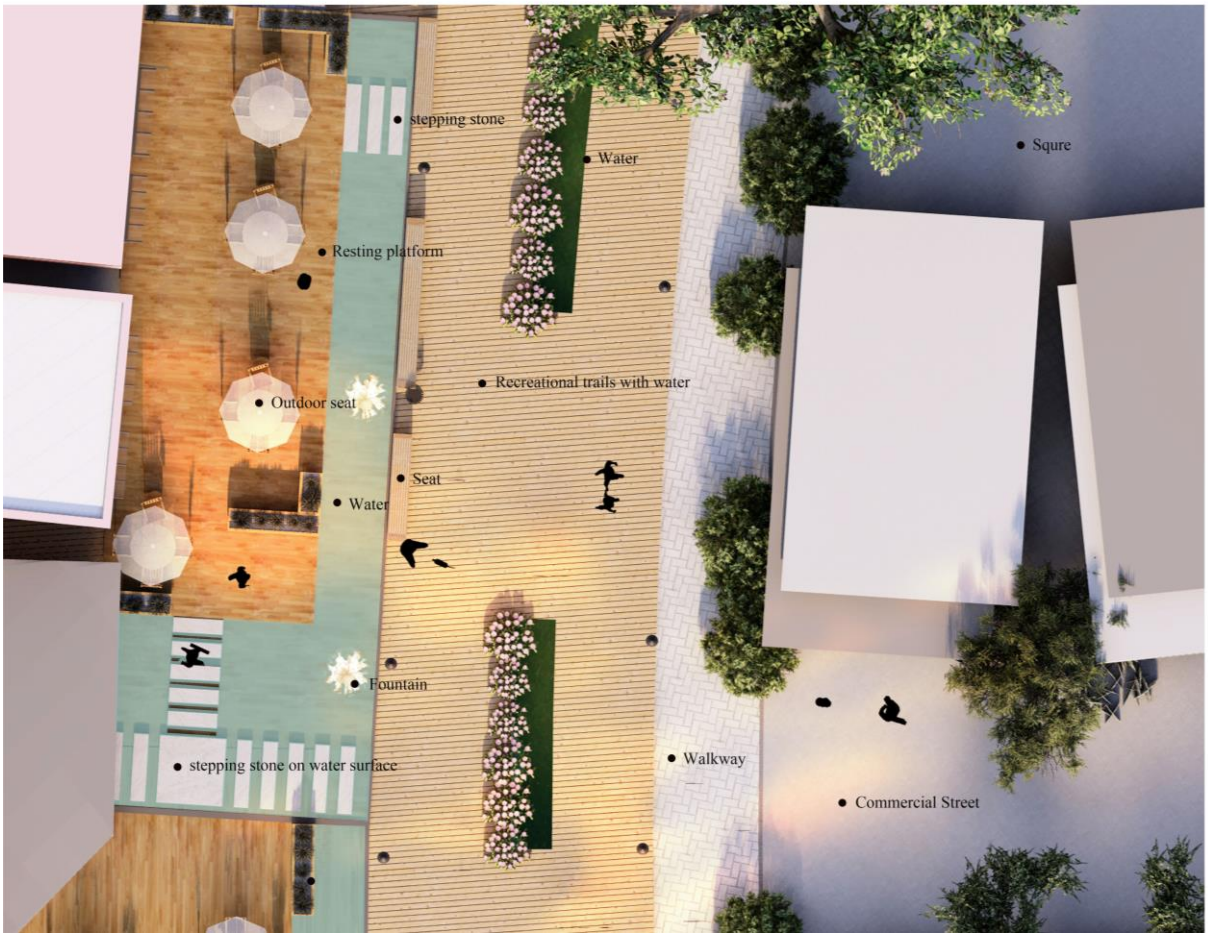


Figure 5.20 Plan and Section of Banyan Square
Source: Self-drawn by the author

(4) Banyan Square Design

Figure 5.21 Comparison of Banyan Square before and after design
Source: Self-drawn by the author

Figure 5.22 Plan and Section of Banyan Square
Source: Self-drawn by the author

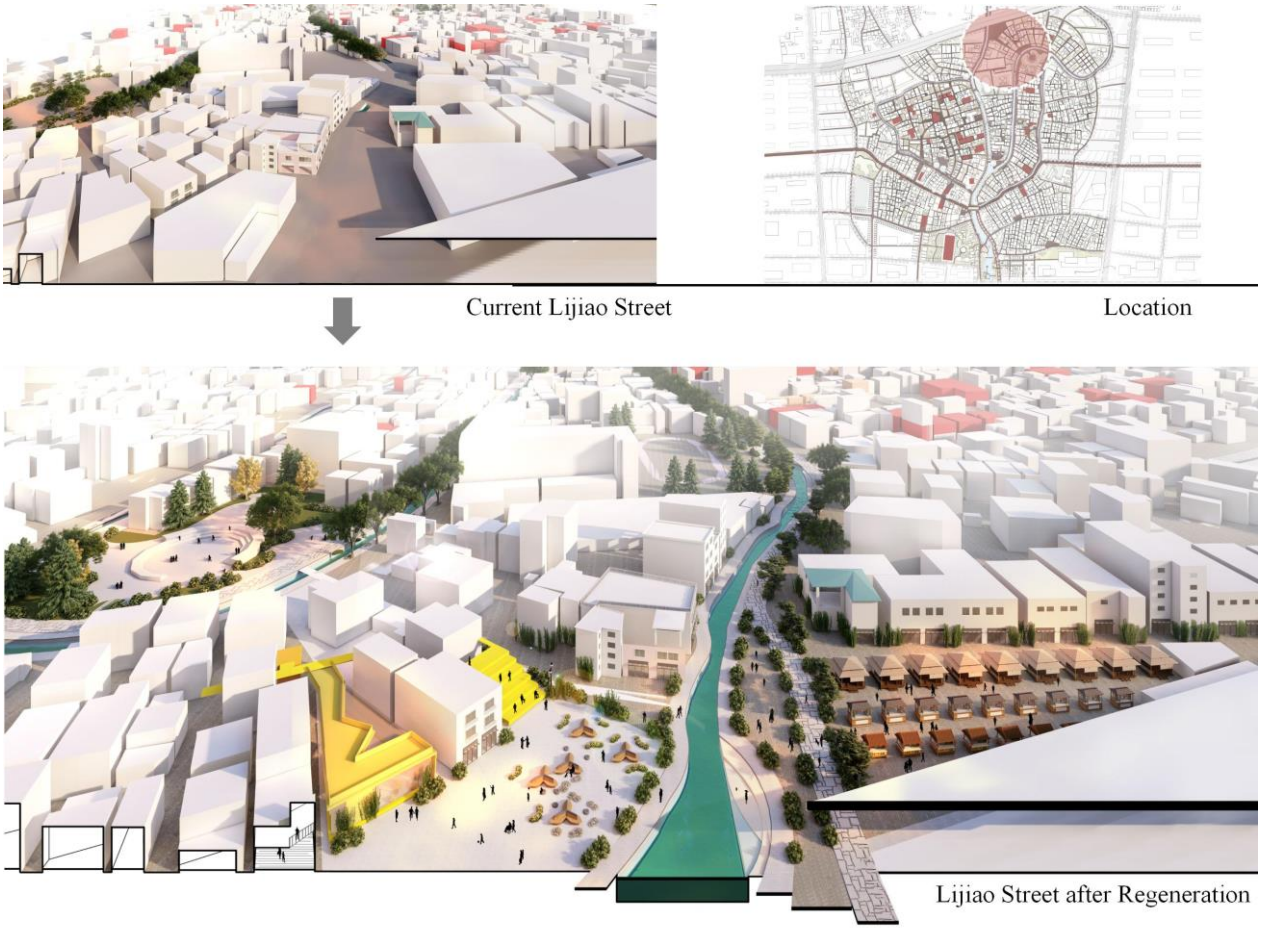


Figure 5.23 Comparison of Lijiao Street before and after design
Source: Self-drawn by the author

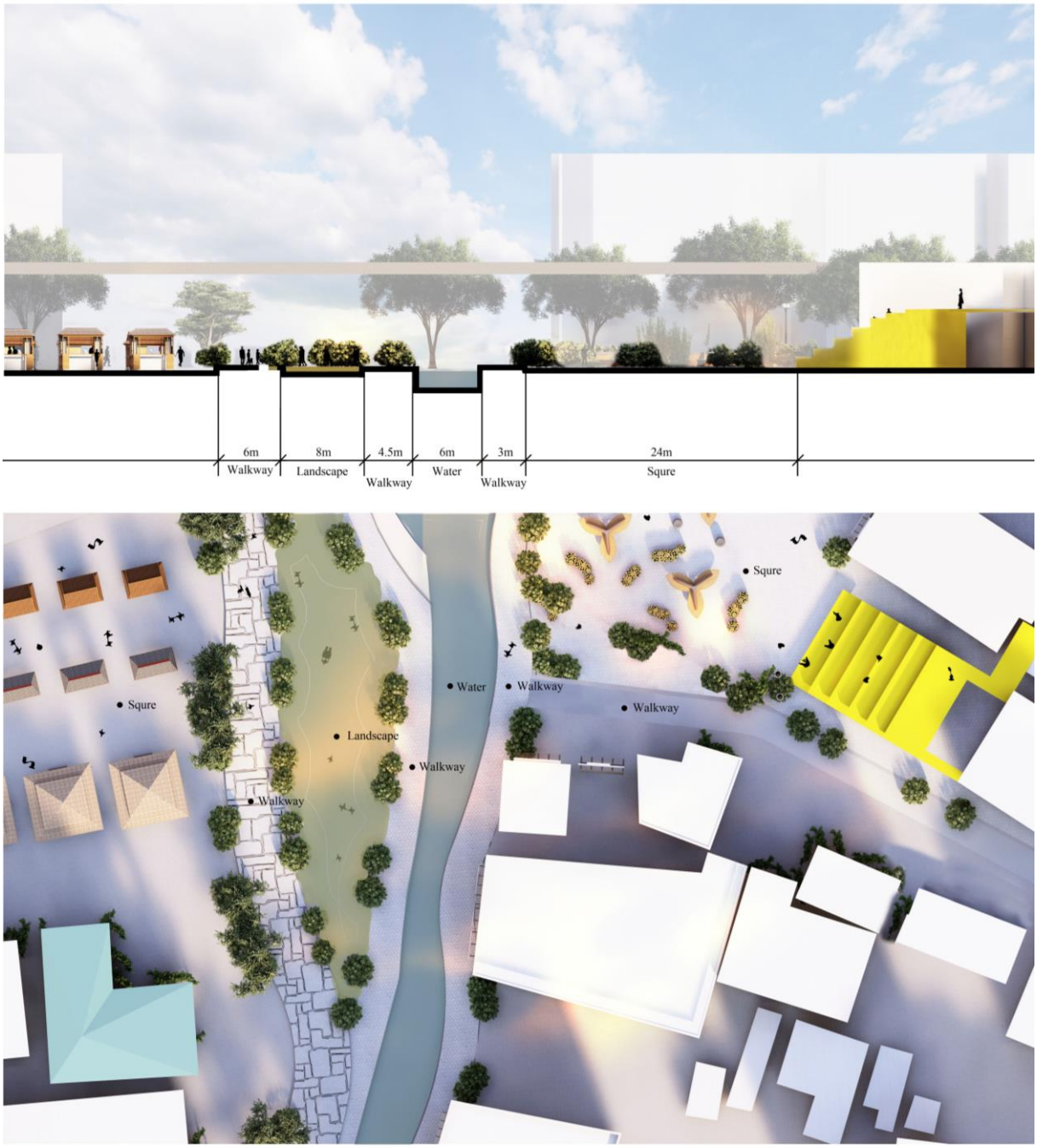


Figure 5.24 Plan and Section of Lijiao Street
Source: Self-drawn by the author

5.4. Sequential Streetscape Design

The serial vision is one of the four most commonly used theories in the Townscape movement and forms the basis of the urban perception advocated by Townscape and is also the characteristic theory of Townscape. "It is also Townscape's signature theory. The term "serial vision" first appeared in Cullen's book Townscape, but it was not Cullen who first introduced the idea of a "dynamic pedestrian perspective on perception." The idea has a historical kinship that goes back to the 18th century. Century. Cullen was not even the first or only of the many individuals involved in the Townscape movement to develop the idea. However, under the influence of his predecessors, Cullen was the best communicator of the idea, and the "sequential landscape" theory remains influential today.

In the early 1940s, Pevsner began to study London's urban space to uncover the visual ideas of 19th-century London city builders for the "visual reinvention" movement (later known as the "Townscape" movement). He commissioned a photographer to follow a predetermined route along Ladbroke Grove to analyse the visual character of London through photographs. The photographer took photographs at vantage points along a visual walking route based on a predetermined map to simulate the visual experience of a city walker.[2]

(1) Streetscacpe Regeneration of East Street

Figure 5.25 shows a hand-drawn drawing of the proposed streetscape renewal showing that the changes to the pavement give East Street a more rustic quality and are more compatible with the appearance of the protected buildings.

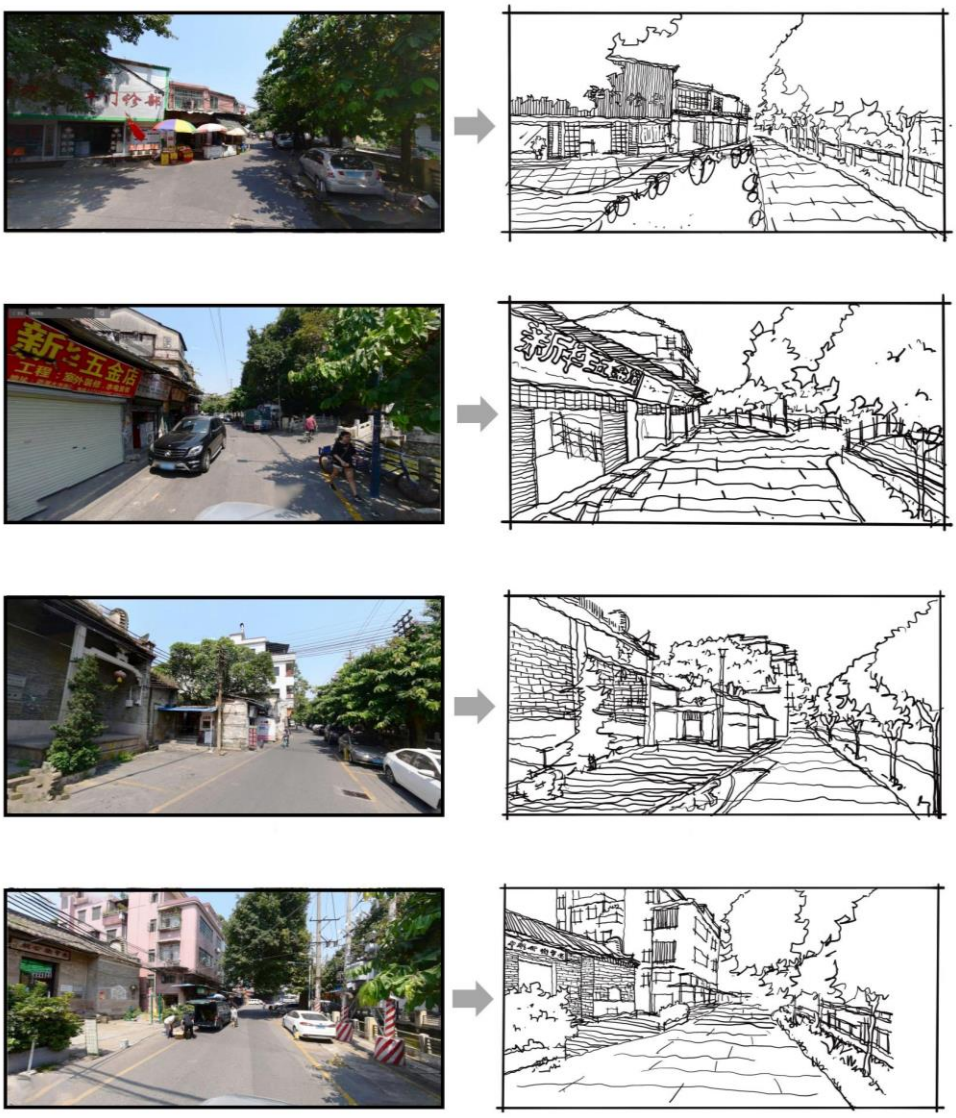


Figure 5.25 Streetscape Regeneration of East Street
Source: Self-drawn by the author

(2) Analysis of Approaches to Streetscape Regeneration

The study found that a high quality streetscape can create great pedestrian appeal despite the lack of street furniture and accessibility. This chapter uses the design strategies from Chapter 4 to enhance the attractiveness of streets through the creativity of designers.

In this section, seven representative intersections of street renewal in Lijiao Village are selected to illustrate the pedestrian-friendly approach to streetscape renewal. From south to north, these are the Village Entrance Park, the History Park, the Village Square, the Wooden Walkway, Lijiao Park and Lijiao Square.

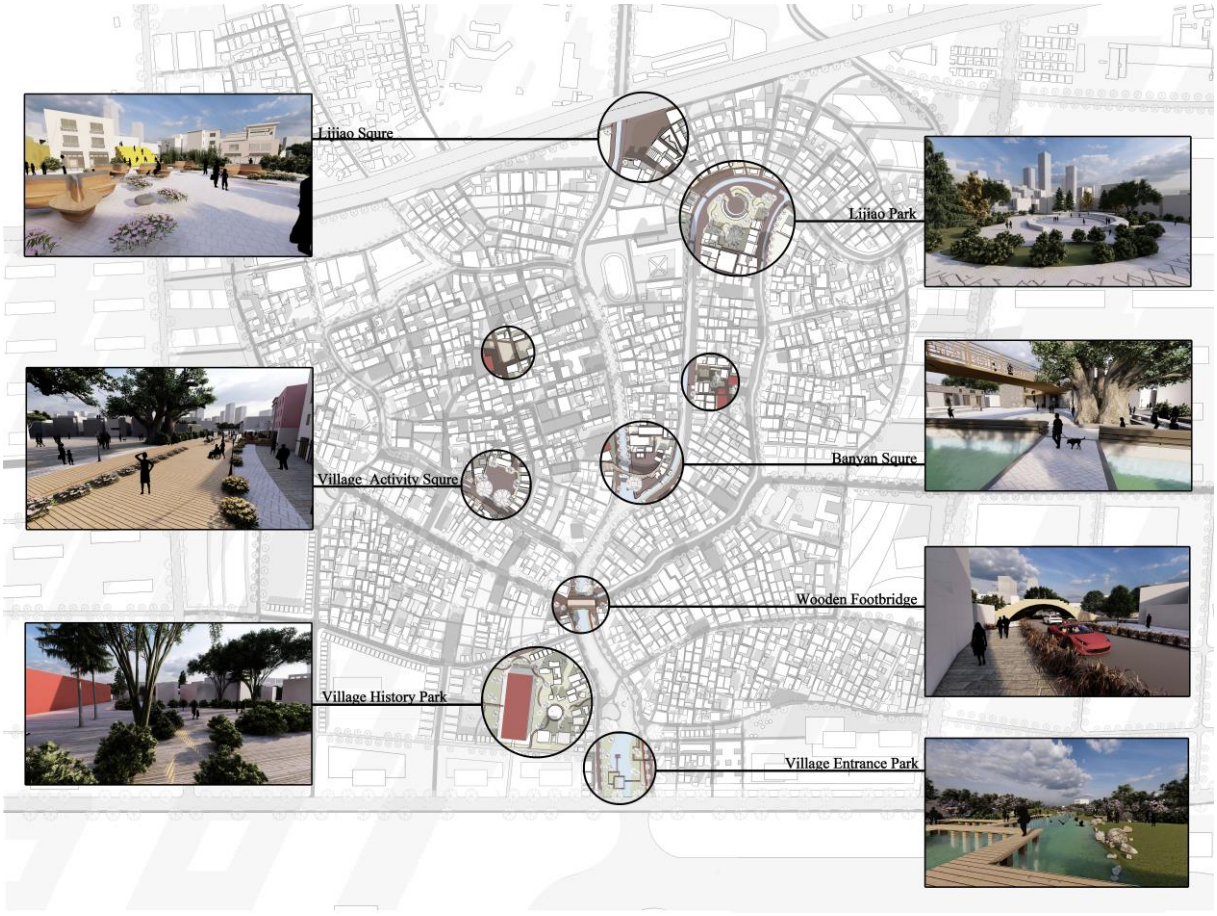


Figure 5.26 Sequential Streetscape Design in Lijiao Village
Source: Self-drawn by the author

(3) Lijiao Squre

In the area where Lijiao Street meets the elevated road, some of the buildings were demolished to create Lijiao Square, and special spaces such as a café and a grand staircase were installed to close the square. The purpose of the demolition is to open up the interface of the street with Lijiao Park and create a spatial connection between Lijiao Park and Lijiao Square.

A market area is planned on the west side of Lijiao Square. In addition to the aesthetic effect of the streetscape, the design of the streetscape should also fully consider the characteristics of the project. Certain functions and activities are planned in conjunction with human characteristics, and a pedestrian-friendly orientation also encourages human activities as part of the streetscape.

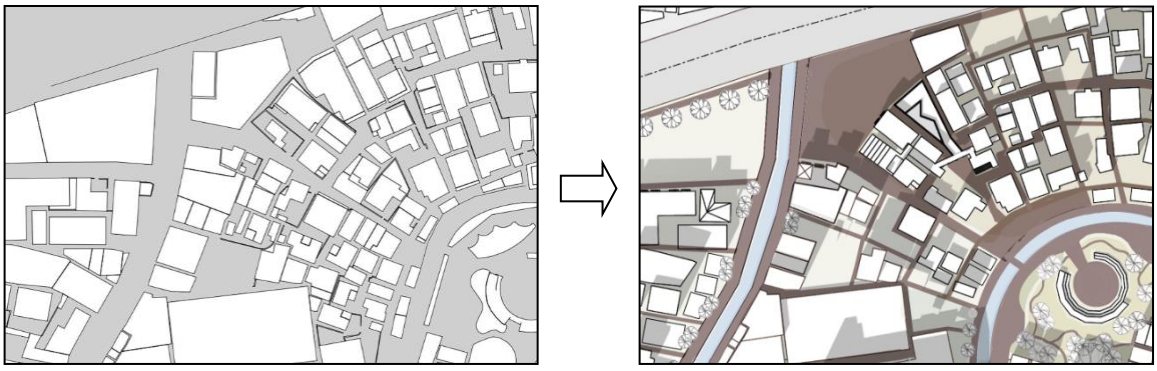


Figure 5.27 Comparison of the Lijiao Square Plan Before and After Design
Source: Self-drawn by the author

Figure 5.28 shows that the existing large-scale paved building causes congestion at the interface with the street and that the existing large-scale building is a temporary shop of poor architectural quality. If it were removed, the surrounding buildings would form a semi-enclosed square (Figure 5.29). The buildings along the two view corridors will also be demolished and converted into distinctive spaces such as a café and a relaxing grand staircase. At the first floor level, the reconfigured spaces will be connected by a connecting corridor that will direct pedestrian traffic from the square to the first floor and direct people's views towards Lijiao Park to activate Lijiao Park and extend the walkable paths.

Figure 5.28 The Current State of Lijiao Square
Source: Self-drawn by the author

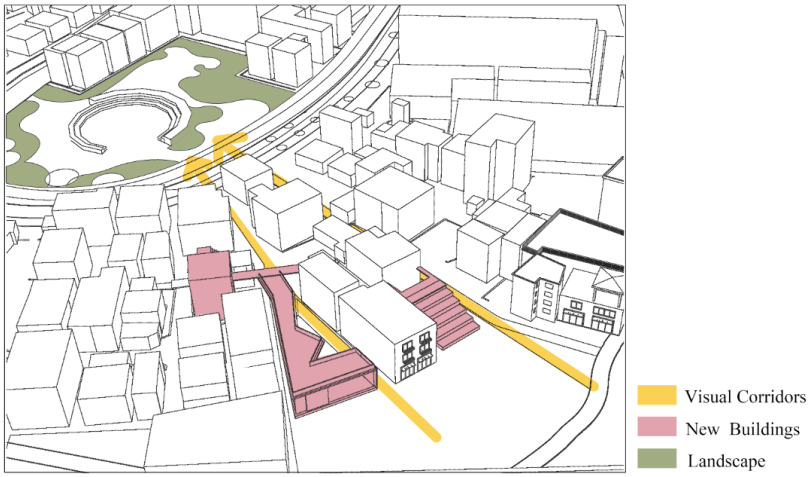


Figure 5.29 Lijiao Square after regeneration
Source: Self-drawn by the author

Figure 5.30 and Figure 5.31 show the streetscape from north to south on the east and west sides of Lijiao Street respectively, bordering Lijiao Square on the east side and the market area on the west side. The open spaces on both sides also present a different atmosphere due to their different uses.

Figure 5.30 Streetscape of Lijiao Street
Source: Self-drawn by the author

Figure 5.31 Streetscape of Lijiao Street
Source: Self-drawn by the author

Figure 5.32-5.34 shows a street view from the east and west sides of Lijiao Street, facing each other. The two sides of the street are one of the few areas in Lijiao village with open views.

Figure 5.32 Streetscape of
Source: Self-drawn by the author

Figure 5.33 Streetscape of
Source: Self-drawn by the author

Figure 5.34 Streetscape of
Source: Self-drawn by the author

(4) Lijiao Park

Lijiao Park was redesigned from its current state by removing the fence around the park and integrating Lijiao Park into the street, in accordance with the principles of pocket park design from the book Street Aesthetics, so that the park becomes part of the street as a landscape. At the same time, based on a study of the height-to-width ratio of the street and the flatness of the street surface, the surface around Lijiao Park

was completed so that it becomes a continuous semi-circular space with an appropriate height-to-width ratio.

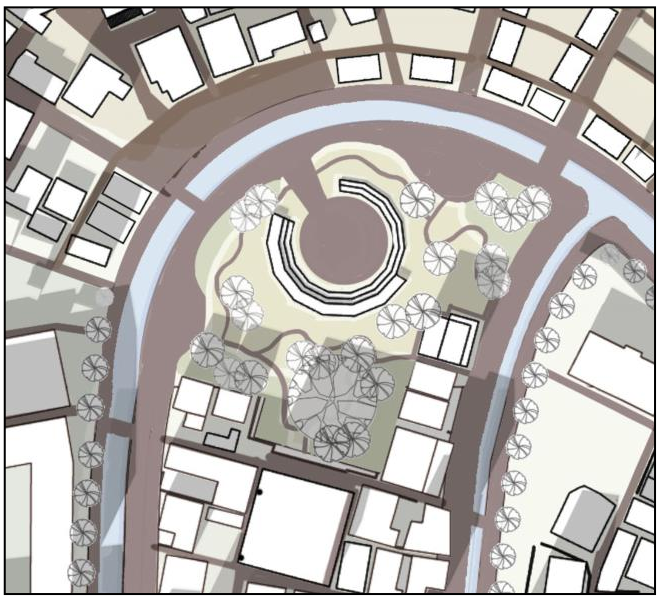


Figure 5.35 Comparison of the Lijiao Park Plan Before and After Design
Source: Self-drawn by the author

In the Lijiao Park section, some of the buildings along the road were demolished to widen the road and restore the water system. The widening of the road allows a greater view of Lijiao Park as a landscaped area. The double fencing of the water system and the buildings, as well as the design of an inverted enclosed gathering space within Lijiao Park, give Lijiao Park a greater degree of privacy and loitering opportunities.

Figure 5.36 Aerial View of Lijiao Park Design
Source: Self-drawn by the author

Lijiao Park is currently surrounded by a fence that separates the park from the street in a way that contradicts the design principles of the pocket park advocated in the street aesthetics mentioned in Chapter 4. In line with the design strategy summary of this thesis, the fence in Lijiao Village has been removed, the fence has been replaced with a green belt to emphasise the role of the boundary, and the street and park have been redesigned to integrate both into the streetscape and improve the mobility of the park while providing a sense of privacy and enclosure.

Figure 5.37 Current Streetscape of Lijiao Park
Source: Self-drawn by the author

Figure 5.38 Streetscape of Lijiao Park after design
Source: Self-drawn by the author

(5) Banyan Squre

Banyan trees dominate the streetscape in Lijiao village. At the junction of Banyan Squre, the buildings that were demolished as part of the reconfiguration of the waterway and the widening of the fire width have the opportunity to create a very distinctive triangular square. In conjunction with better landscape resources, a viewing gallery has been added to the vertical design, linking the two-storey buildings on either side of the riverbank, creating an iconic street junction in the centre of Lijiao Village.

Banyan trees dominate the streetscape in Lijiao Village. At the Banyan Squre junction, the buildings that were demolished as part of the reconfiguration of the waterway and the widening of the fire width have the opportunity to create a very distinctive triangular square. In conjunction with the improved landscape resources, a viewing gallery has been added to the vertical design, linking the two-storey buildings on either side of the riverbank, creating an iconic street junction at the centre of Lijiao Village.

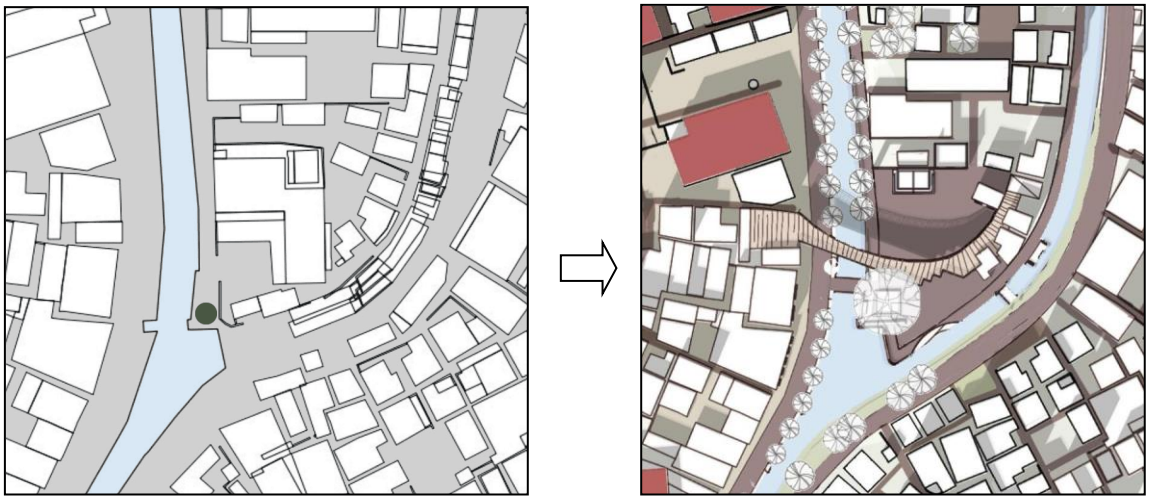


Figure 5.39 Comparison of the Banyan Square Plan Before and After Design
Source: Self-drawn by the author

Figure 5.40 Aerial view of Banyan Square
Source: Self-drawn by the author

Around the banyan tree, the same small-scale resting space as the current one is maintained. According to the design strategy study in Chapter 4, the resting space near the banyan tree is characterised by 'seclusion' and 'boundaries' and is a space that provides a sense of security.

Figure 5.41 Streetscape of The Entrance of Banyan Square
Source: Self-drawn by the author

Figures 5.42 and 5.43 show the streetscape as seen from East Street towards Banyan Square. The streetscape is enhanced by the design of the two-storey connecting corridor. The street paving consists of two main levels, a small brick buffer area in front of the shops and continuous stone paving. Flower ponds have been created along the edges of the river to create a visual sense of safety for pedestrians.

Figure 5.42 Streetscape of East Street-A
Source: Self-drawn by the author

Figure 5.43 Streetscape of East Street-B
Source: Self-drawn by the author

On the ground floor, the corridor is part of the streetscape; on the corridor, the ground floor is part of the streetscape. If the concept of streetscape is extended to include all outdoor areas with a transit function, the design of a streetscape takes on a higher visual dimension. Seen from the streetscape on the connecting corridor, the distant skyline of the buildings is part of the streetscape in addition to the delicate landscape nearby, and the design of the streetscape at a certain height involves the organisation of more landscape sequences.

Figure 5.44 Streetscape of the Connecting Corridor
Source: Self-drawn by the author

(6) Village Activity Square

To maximise the landscape value of the banyan trees in Lijiao village, an activity plaza has been created at this junction, utilising the village's fallow land. The square also serves as an important entrance interface for pedestrian traffic to the interior of the lane and the important heritage buildings. It is a transition point between the small lane and the larger recreational street and plays an important role in visually connecting the street to the lane.

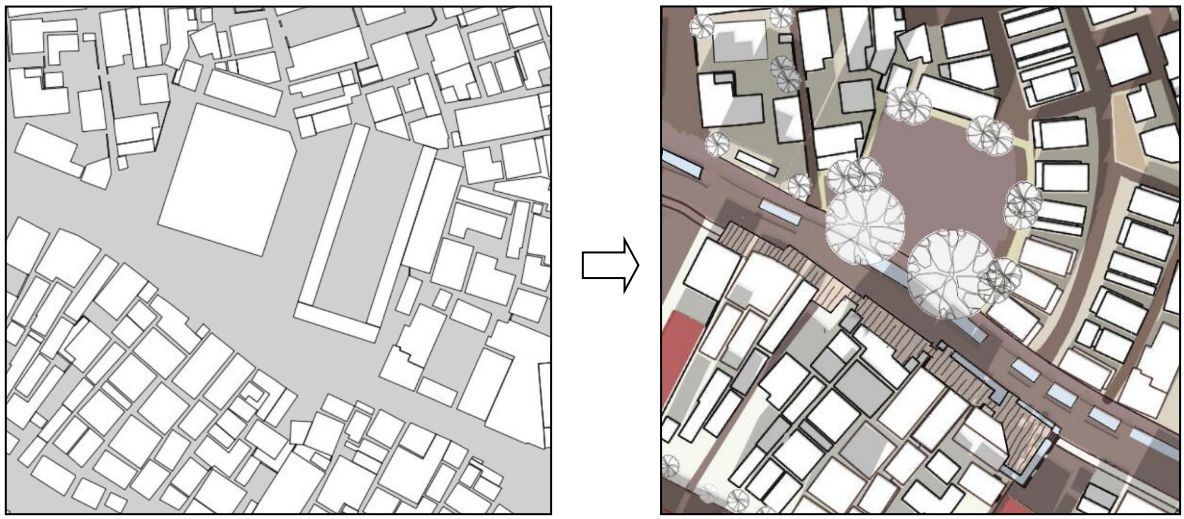


Figure 5.45 Comparison of the Village Acticity Squre Before and After Design
Source: Self-drawn by the author

Figure 5.46 and Figure 5.47 show the streetscape relationship between Village Activity Square and Dashi Street, where the presence of Dashi Street and Village Activity Square create more dwellability for each other and act as an important part of each other's streetscape.

Figure 5.46 Streetscape from the Village Activity Square towards the Dashi Street
Source: Self-drawn by the author

Figure 5.47 Streetscape from the Dashi Street towards the Village Activity Square
Source: Self-drawn by the author

(7) Wooden Footbridge

The streetscape of the Wooden Footbridge is dominated by bridges, which are intended to resolve the contradiction between car and pedestrian traffic and connect the two sides of the river as a highlight. Taking a cue from Venice and Suzhou Pingjiang Road, bridges are often a feature of the streetscape in neighbourhoods crossed by water and an important factor in the pedestrian experience.

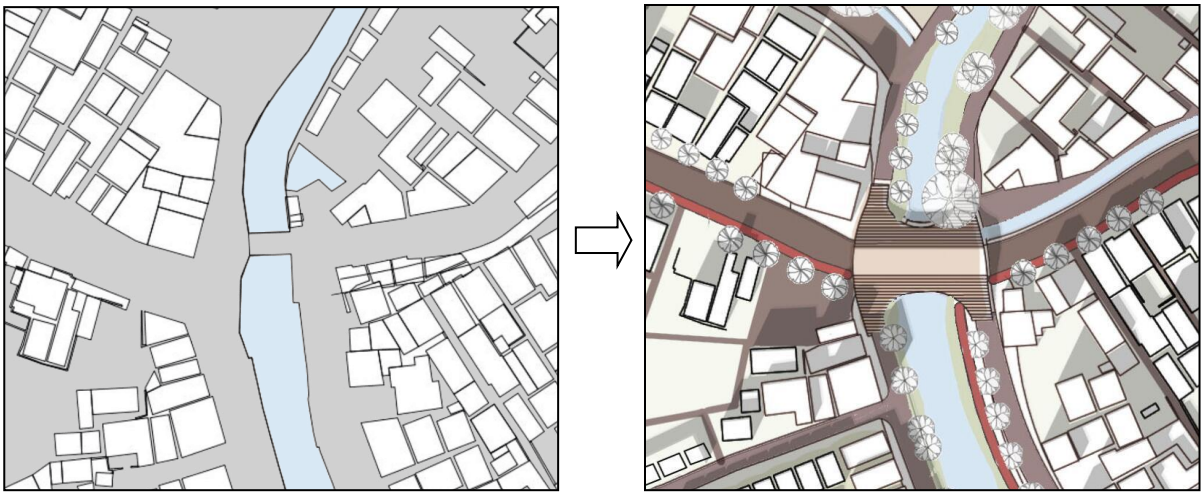


Figure 5.48 Comparison of the Crossroads Before and After Design
Source: Self-drawn by the author

Figure 5.49 Streetscape of Crossroads with Wooden Footbridge
Source: Self-drawn by the author

(8) Village History Park

The design is based on the 'Eight Views of Lijiao' scheme in Chapter 1, which forms a historical park for Lijiao Village around the Wei Ancestral Hall, the most valuable site in Lijiao Village. The small-scale buildings enclose the Wei Ancestral Hall and the historic park to maintain the continuity of the street interface.

Figure 5.50 Comparison of the Village History Park Before and After Design
Source: Self-drawn by the author

(9) Village Entrance Park

The current entrance area of Lijiao Village is occupied by car parks and the street quality of Fusiyue Street and Nanan Street in the entrance area is poor, with mostly closed fences and closed shop windows along the street surface, which is not very attractive for pedestrian traffic.

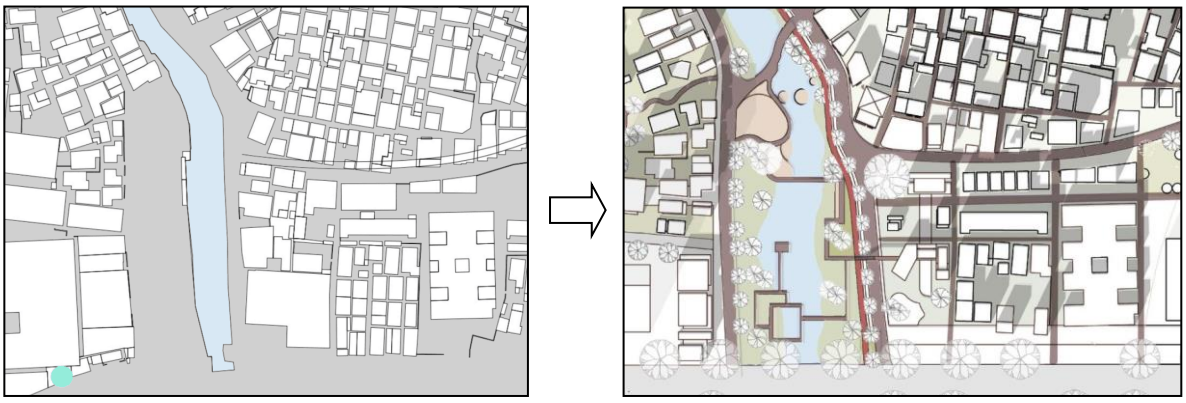


Figure 5.51 Comparison of the Village Entrance Park Before and After Design
Source: Self-drawn by the author

In the context of experiential consumption, consumers' experiences and feelings change as they wander through the pedestrian mall. The carefully designed spatial arrangement, the layered climax of the action, and the smooth and rational flow of traffic structure and vary the spatial sequence of the pedestrian area.

The arrangement of the plot connects the entrance space, street space, core space and urban space in an orderly manner, and then the space becomes more varied and complete through repetition, guidance, contrast and transition, creating a rhythm similar to that of a piece of music, such as "prelude - articulation - climax - conclusion".

Figure 5.52 Streetscape of
Source: Self-drawn by the author

Figure 5.53 Streetscape of
Source: Self-drawn by the author

The inclusion of pedestrian areas in the gardens as part of the streetscape, the grass path and the waterway both show an interesting pedestrian appeal. When renewing streets in any area, it is more important to balance a more creative design solution against a greater value judgement by using different streetscapes to increase

pedestrian attractiveness. In this way, renewal is not a mechanical implementation of the evaluation criteria, but a maximisation of the value and role of the designer.

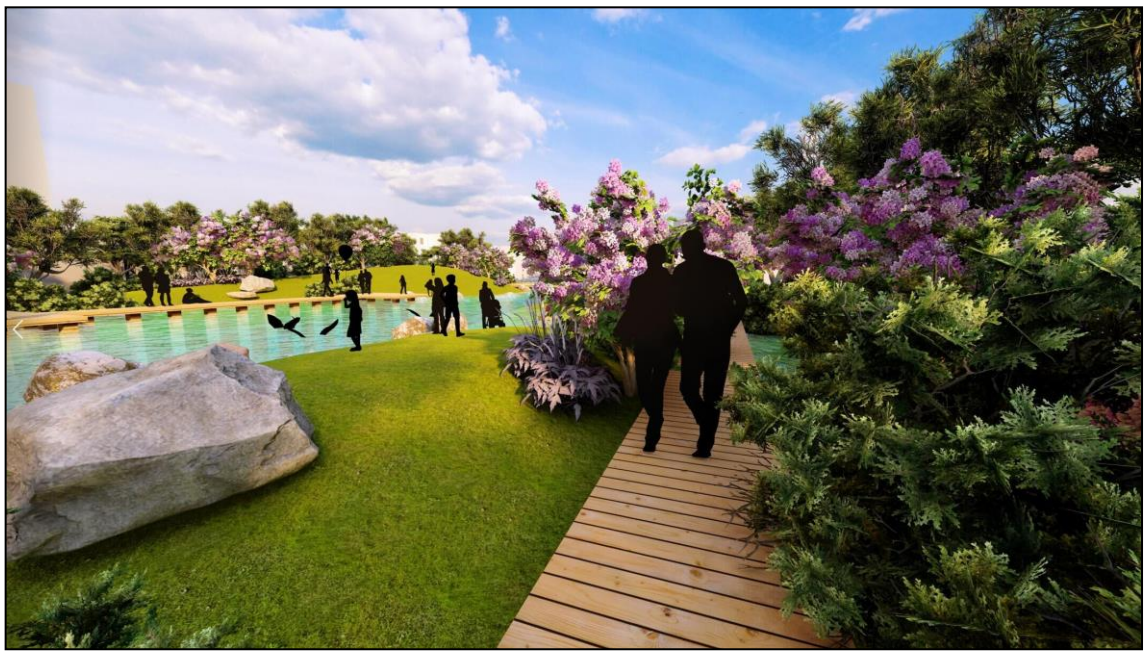


Figure 5.54 Streetscape of
Source: Self-drawn by the author

Figure 5.55 Streetscape of
Source: Self-drawn by the author

Reference

[1] He Jianxiang． The Invisible City [EB/OL].https://mp.weixin.qq.com/s/X2qKyM0gyL71o2Trqm9d_Q?scene=25,2018.

[2] He Shilin. A study of Gordon Cullen's idea of "townscape"[D]. Chongqing University, 2018.

[3] Zhou Jianhua.Research on the Humanized Design of the Trail in the Mountain City of Chongqing Yuzhong Peninsula[D]. Chongqing University, 2010.

[4] S Claris, D Scopelliti. Cities alive: towards a walking world.2016.

[5] Cai Yijun."Lijiao-Harbor"-A study on the conservation and renewal of traditional villages in Lijiao ancient village, Guangzhou[J]. Jushe,2017(24):46+158.

[6] Haizhu District Development and Reform Bureau. The 14th Five-Year Industrial Plan of Haizhu District (2021-2025) (Draft for Public Comments) [R]. Guangzhou: Development and Reform Bureau of Haizhu District, 2022.

[7] Guangzhou Urban Construction, Environment and Capital Work Committee. Urban design and detailed control plan of Haizhu Innovation Bay (Lixian Area) [R]. Guangzhou: Guangzhou Municipal People's Government,2019.

[8] Ke Yanlin. Research on the design of living streets based on landscape aesthetics [D]. Xiamen University,2018.

[9] Yang Honglie. Aesthetic exploration of the cultural landscape of banyan trees in Southern Guangdong - taking the ancient village of Lijiao in Guangzhou as an example[J]. Journal of Guangzhou City Vocational College,2019,13(01):1-7.

[10] Guangzhou Institute of Water Planning, Surveying and Design. Report on the demonstration of control line adjustment of Lijiao Chung in Haizhu District [R]. Guangzhou: Guangzhou Municipal People's Government,2014.

[11] Yang Honglie. The cultural significance of the "eight scenes of Lijiao" in the ancient village of Guangzhou [J]. Guangdong Garden,2016,38(06):17-22.

[12] KERR J. Definition and dimensions of walkabilitylM]// JENS B,SVEN S.

[13] Liu, Lianlian, Wei, Wen. International experience of walkability evaluation methods and tools[J]. International Urban Planning,2018,33(04):103-110.

[14] Jan Gale. Interaction and Space [M], Beijing: China Construction Industry Press, 2002.

[15] New Urbanist Association. Charter of New Urbanism [M]. Beijing:China Construction Industry Press, 2004 [23] (US) 2004.

[16] Wang Bin. Study on the optimization strategy of urban public space in Guangzhou old city metro station area from a pedestrian-friendly perspective [D]. South China University of Technology,2018.

[17] Measuring Urban Sprawl and Validating Sprawl Measures.nn Smart Growth America, 2014

[18] Carmen Hasclaw. Civilized Streets - A Guide to Traffic Stabilization. Beijing: China Construction Industry Press, 2008

[19] Peng Lei. Research on pedestrian friendliness of urban settlements in Wuhan [D]. Huazhong University of Science and Technology, 2015.

[20] Lu Ke, Pan Haixiao. The development of urban pedestrian transportation--improvement measures of urban pedestrian environment in Britain, Germany and the United States[J]. Foreign Urban Planning,2001(06):39-43+0.

[21] Kevin Lynch. Urban imagery [M]. Fang Yiping. Translation. Beijing:Huaxia Publishing House. 2001.

[22] Jane Jacobs J. The death and life of America's great cities [M]. Jin Hengshan. Translation. Nanjing: Yilin Publishing House. 2006.

[23] Alexander et al. The language of architectural patterns [M]. Wang, Listenou and Zhou, Xueming. Translation. Intellectual Property Press. 2002-02.

[24] Yoshiharu Ashihara, Aesthetics of the street [M], Beijing: China Construction Industry Press, 2002.

[25] Neubershütz. The Spirit of Place: Towards a Phenomenology of Architecture [M]. Shih Shik-Ming. Translation. Huazhong University of Science and Technology Press. 2010.

[26] William H. White. The social life of small urban spaces [M]. Ye Qimao and Ni Xiaohui. Translation. Shanghai Translation Press. 2016-03.

[27] Roger Transik. In Search of Lost Spaces - A Theory of Urban Design [M]. Zhu Ziyu et al. Translated. China Construction Industry Press. 2008-4.

[28] Hasclaw. Civilized Streets - A Guide to Traffic Stabilization [M]. Guo C.F., Chen Xiujuan et al. Translation. China Construction Industry Press. 2008-7.

[29] Jacobs. The great street [M]. Wang, Yujia and Jin, Qiuye. Translation. China Construction Industry Press. 2009-01-01.

[30] Michael Southworth, Ivan Ben-Joseph, Southworth, et al. Streets and the formation of towns [M]. China Construction Industry Press, 2006.

[31] Clive Mountfortin. Streets and squares [M]. China Construction Industry Press. 2004-06.

[32] Liu Dongyang. Elegy for the street [J]. Urban Planning, 1999, 23(3):3.

[33] Chen Danyan, Yu Xiaofu. The street that never widens [M]. Oriental Publishing Center, 2008.

[34] Hu Ying, Zhang Lin. The continuation of the spatial imagery of traditional streets and alleys [J]. Planner, 2003, 19(6):4.

[35] DAVIESA.Rating walkability by combining open data and crowd sourcing[EB/OL]. (2011-06-18)[2015-07-05]. http://walkonomics. com/blog/2011/06/rating-Walkability-open-data-crowdsourcing.

[36] What Are “Walkability” Scores and How Can I Use This Data?[EB/ OL]. (2015-08-18)[2015-09-01]. http://support.narrpr.com/hc/en-us/ articles/204963370-What-are-Walkability-scores-and-how-can-I-use-this-data-.

[37] SCHWARTZ A. How walkable is your neighborhood? this mapping data juggernaut now knows[EB/OL]. (2013-08-21)[2015-08-01]. http://www. fastcoexist.com/3015911/how-walkable-is-your-neighborhood-this-mappingdata-juggernaut-now-knows.

[38] What Is PERS?[EB/OL][2015-07-05]. http:// content.tfl.gov.uk/what-is-pers.pdf.

[39] Neighborhood Environment Walkability Scale - Youth (NEWSY)(EB/OL)[2015-07-05]. http:/ / sallis.ucsd.edu/Documents/Measures_documents/NEWS_Y_parent.pdf.

[40] Welcome to Measuring Walkability[EB/OL][2015-07-16]. http://levelofservice.com/ .

[41] Walk Score Methodology[EB/OL]. [2015-07-05]. https://www.walkscore. com/methodology.shtml.

[42] Ministry of Housing and Urban-Rural Development of the People's Republic of China, National Development and Reform Commission of the People's Republic of China, Ministry of Finance of the People's Republic of China. Guidance on strengthening the construction of urban pedestrian and bicycle transportation systems [EB/OL]. [2012-09-05].http://www.mohurd.gov.cn/wjfb/201209/t20120917_211404.htm1

[43] Natural Resources Defense Council. 2015 report on the evaluation of urban walkability in China [R].2016.

[44] Jarvis R K. Urban environments as visual art or as social settings?[J]. Town Planning Review,1980,51(1): 50.

[45] Moudon A V. A catholic approach to organizing what urban designers should know [J]. CPLbibliography, 1992,6(4):331-349.

[46] Zhang Jiantao. A Brief Analysis of Contemporary Western Urban Design Theory [J].Journal of Urban Planning, 2005(2):6-12.

[47] Lewis Mumford. The History of Urban Development Origins - Evolution and Prospects [M]. Beijing: China Construction Industry Press, 2005.

[48] Zhang Jia. Analysis of Urban Characteristic Spaces [D]. China Academy of Urban Planning and Design, 2014.

[49] Vanke Urban Institute, Wanlu Design. Nantou Ancient City Revitalization and Utilization Project [EB/OL]. https://www.gooood.cn/revitalization-and-utilization-project-of-nantou-old-town-china-by-bowan-architecture.htm ,2020-09-30

[50] Lu Rundong. A study on public space in Shenzhen urban villages based on the theory of figure-bottom relationship [D]. Shenzhen University,2017.

[51] Nie Yingtong. A study on the correlation between the spatial form of the ancient city of Nantui and its physical environment[D]. Harbin Institute of Technology, 2020. DOI:10.27061/d.cnki.ghgdu.2020.004159.

[52] Zhang Tianci. Research on Landscape Design of Historical Neighborhoods in the Context of Regional Culture [D]. Xi'an University of Architecture and Technology, 2015.

[53] Cheng Yu. A study on the contemporary practice of conservation and reuse of Venetian historical buildings [D]. Zhengzhou University, 2014.

[54] He Qing. Spatial perception of Pingjiang Road in Suzhou from the perspective of scale-space-behavior [J]. Architecture and Culture,2021(11):113-114.DOI:10.19875/j.cnki.jzywh.2021.11.043.

[55] Xu Jiong. Exploring the traffic planning of Venice's historic city [D]. Shenzhen University, 2020.

[56] Wang Zi Ling. Research on the traffic problems in urban village transformation [D]. Huazhong University of Science and Technology, 2020. DOI:10.27157/d.cnki.ghzku.2020.004155.

[57] Wang Qiao. Quantitative study of urban street space morphology [D]. Hunan University of Science and Technology,2014.

[58] Wang Yayun. Research on the design of commercial pedestrian street in the ancient city of Suzhou in the context of experiential consumption [D]. Suzhou University of Science and Technology, 2017.

[59] Xu Chang. Nantou ancient city experiment: a preliminary investigation of spatial cognition based on body perception theory [D]. Shenzhen University, 2020. DOI:10.27321/d.cnki.gszdu.2020.000419.

[60] Ye Pan. A study on the spatial vitality of streets and alleys in urban villages in Shenzhen from the perspective of daily life [D]. Harbin Institute of Technology, 2019. doi:10.27061/d.cnki.ghgdu.2019.001931.

[61] Ke Yanlin. Research on the design of living streets based on landscape aesthetics [D]. Xia men University,2018.

[62] Sun Xuyang. Research on urban colour planning based on locality [D]. Tongji University, 2006.

[63] Cullen G. The concise townscap e [M]. London: Routledge, 1971.

[64] Gosling D. Gordon Cullen: visions of urban design [M]. New York:John Wiley & Son Lt d,1996.

[65] Jan Gehl by Denmark. The humanized city [M]. Beijing: China Construction Industry Pr ess, 2010.

[66] Yang Bingyuan. Research on pedestrian-friendly street morphology design [D]. Chongqi ng University,2019.doi:10.27670/d.cnki.gcqdu.2019.002692.

[67] HallE T.The Hidden Dimension[M].New Y ork: Anchor Books,1990:126.

[68] Xu Leiqing. Ergonomics and environmental behavior [M]. Beijing: China Construction In dustry Press, 2006:110.

[69] Wen Tengfei. A study on the linear regional characteristic space of Suzhou under the visu al dimension of urban design - taking Shiquan Street as an example[J]. Architecture and Culture,2021(04):130-131. doi:10.19875/j.cnki.jzywh.2021.04.043.

[70] Song Fancheng. Study on the linguistic landscape of historical and cultural streets in Suzh ou [D]. Yangzhou University,2018

[71] Guangzhou Municipal Housing and Urban-Rural Development Committee, Guangzhou U rban Planning, Survey and Design Research Association, Hu Feng, Xu Haiyu, Lai Yongxi an. Design manual for all elements of urban roads in Guangzhou [M]. China Construction Industry Press,2018.

[72] Ministry of Housing and Urban-Rural Development of the People's Republic of China. D esign specification for urban road engineering (2016 edition) (CJI37-2012) [S]. Beijing:C hina Construction Industry Press,2016.