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Resilience as a Space Enhancement Strategy in  
the Xixing Historic and Cultural Area,  
Hangzhou City, China

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# **Resilience as a Space Enhancement Strategy in the Xixing Historic and Cultural Area, Hangzhou City, China**

A Dissertation Submitted for the Degree of Master

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## **Abstract**

Historic and cultural areas are important carriers of a city's cultural heritage and regional characteristics because of their unique historical and artistic values. The enhancement of the spatial resilience of old historic and cultural areas is an active exploration of how China's old historic and cultural areas can cope with the impact of urbanization, and a positive response to the great importance currently attached to the regeneration of historic and cultural areas in China. At present, the relatively fragile physical and social spaces of most historic and cultural areas in China are unable to cope with the demands of modern lifestyles, which has led to problems of ageing infrastructure, population loss, declining landscape and cultural heritage, resulting in great uncertainty about the development of the community. Therefore, it is urgent to explore ways to help old historic and cultural areas to cope with the disturbances of urbanization and to transform their development.

Resilience theory offers new ideas and approaches to the transformation of historic and cultural areas in a new era. A review of the literature reveals that research on resilience theory has expanded from the traditional natural disaster perspective to a comprehensive perspective, exploring the adaptive and transformative capacity of communities in the context of social structural change. However, because the research interest only started in recent years, the existing research on resilient community spaces in China only covers a single area, mainly new communities and ordinary old communities, and no systematic design strategy for resilient spaces has been constructed to guide future design practices in the old historic and cultural area. Therefore, this study translates the abstract "resilience theory" into concrete "resilient space characteristics" and finally supports the further revitalization and development of the historic and cultural area by reorganizing and integrating various elements inside, and also breaking the rigid structure of the original part to give it spatial resilience.

This thesis is divided into five chapters. The first chapter is the introduction, which explains the background, aims and significance of this study, and defines the concepts of "historic and cultural area", "resilience theory", and "spatial enhancement". The second chapter systematically reviews the previous research on the "historical and cultural area", "resilience theory", and "spatial enhancement", and defines the research method and technical framework of this dissertation. Chapter 2 reviews the previous

research on resilience theory and historic and cultural areas, summarizes the extension of resilience theory in the new era and the current research deficiencies in the academic field, and sorts out the basic characteristics that the old historic and cultural area resilience space should have. The third chapter takes Xixing historic and cultural area as an example to conduct field research and summarizes its development and the specific problems it faces nowadays. Chapter 4 analyzes the feasibility and necessity of applying the resilience theory to the Xixing historic district, clarifies the elements of the spatial resilience enhancement strategy system of the old historic and cultural area and its mechanism, and finally constructs the strategy system. Chapter 5 is the spatial enhancement design practice, which applies the above strategy system to the Xixing historic district by using the urban design method, and explains how the strategy system is applied to the spatial enhancement of the old historic district from the engineering resilience and social resilience. Finally, the thesis concludes with a review of the relevant research results, followed by a description of the shortcomings of the research results and the prospects for future research.

There are two research results in this dissertation: firstly, the development lineage and existing problems of the historic and cultural area of Xixing; Secondly, the strategy system of spatial resilience enhancement of the historic and cultural area of Xixing.

**Keywords:** resilience theory; Xixing Historic and Cultural Area; space enhancement design

## 摘要

历史文化街区因其所具备的独特历史价值和艺术价值,成为一个城市文化底蕴和地域特色的重要载体。对历史文化街区空间的韧性进行提升,既是对我国历史文化街区如何应对城镇化冲击这一问题的积极探索,也是对我国高度重视历史文化街区更新改造工作的积极回应。目前,我国多数历史文化街区相对脆弱的物质空间和社会空间不能应对现代生活方式革新的要求,由此引发了基础设施老化、人口流失、风貌衰退、文化难以传承的问题,导致街区的发展具有极大的不确定风险。因此,当下亟待探索出能够助力历史文化街区从容应对城镇化扰动、实现转型发展的路径。

韧性理论为历史文化街区在新时代的转型发展提供了新的思路和途径。通过文献综述可以发现,学界对韧性理论的研究已经从传统的自然灾害视角拓展到综合视角,探讨社区在社会经济结构变化背景下的适应和转型能力。但与此同时,由于研究起步较晚,国内现有关于社区韧性空间的研究覆盖面较为单一,主要以新建社区和普通老旧小区为主,对于我国存量较少、地域文化属性较强的历史文化街区,尚未建构出系统性的韧性空间设计策略以指导未来的设计实践。因此,本研究把抽象的“韧性理论”转译为具体的“韧性空间特征”,通过对历史文化街区内部各种要素的重组和整合,打破原有部分已经僵化的固有结构以赋予其空间以韧性的特征,从而支持历史文化街区进一步的复兴和发展。

本论文一共分为五章。第一章为绪论,阐释了本研究的背景、目的和意义,对后文所涉及到的“历史文化街区”、“韧性理论”和“空间提升”等概念加以限定,并明确了本文的研究方法与技术路线。第二章系统回顾了前人关于韧性理论和历史文化街区的研究,总结了韧性理论在新时代的延申和学界当下的研究不足,并梳理了历史文化街区韧性空间应具备的基本特征。第三章以西兴历史文化街区为例进行实证研究,总结了其发展脉络和当下面临的具体问题。第四章首先分析了韧性理论应用于西兴历史街区的可行性和必要性,明确了历史文化街区空间韧性提升策略体系的要素组成及其作用机制,并最终构建了该策略体系。第五章是空间提升设计实践,运用城市设计的方法将上述策略体系应用于西兴历史街区,从工程韧性和社会韧性系统阐述了该策略体系具体如何应用于老旧历史街区的空间提升工作。最后是论文的结论部分,首先梳理了相关的研究成果,其次说明了研究成果存在的不足之处,以及对未来研究的展望。

本文有以下两点研究成果:其一是总结了西兴历史文化街区的发展脉络和现存问

题; 其二是构建了西兴历史文化街区空间韧性提升的策略体系, 并将其运用至城市设计实践。

**关键词:** 韧性理论; 西兴历史文化街区; 空间提升设计

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# Chapter 1: Introduction

## 1.1 Background

### 1.1.1 Policy

Historic and cultural areas are important carriers of a city's cultural heritage and regional characteristics, and because of their unique historic and artistic values, many cities use them as city icons to enhance the identity of citizens and tourists to the city. At the same time, for a country, historic areas can not only be used as tourism resources to enhance social and economic development but also to strengthen the country's cultural soft power and continuously improve its comprehensive national power in the competitive international environment. Therefore, the Chinese government attaches great importance to the conservation and regeneration of historic areas.

Since the foundation of the People's Republic of China, the protection of historic and cultural areas in China has also gradually increased. First of all, it is the continuous improvement of the protection scope, which is reflected in the initial identification of single heritage buildings, to the protection of their surrounding historic environment, and then to the attention to a wider range of intangible cultural heritage, forming an effective protection framework of three dimensions: heritage buildings, historic and cultural areas and historic and cultural cities. Since the Ministry of Housing and Urban-Rural Development of the People's Republic of China announced the first batch of 30 historic and cultural areas in 2015, by the end of 2021 the total number of historic and cultural areas identified across the country has reached more than 1, 200, and the total number of historic buildings has reached 57, 500<sup>[1]</sup>. In addition, the increase in

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<sup>[1]</sup> Ministry of Housing and Urban-Rural Development of the People's Republic of China. Housing and urban-rural construction high-quality development conference graphic recording. [EB/OL]. <https://www.mohurd.gov.cn/xinwen/jryw/202202/20220224764632.html>

protection is also reflected in the continuous construction of China's historic and cultural areas protection system. A set of complete and continuously improved legal systems has been built from the country to local cities, and various protective regulations, ordinances and opinions have been announced successively. For example, in 2008, the Chinese government promulgated The Regulations on the Protection of Historic and Cultural Cities, Towns and Villages, providing mandatory legal protection for historic areas<sup>[2]</sup>; in 2021, the State Council issued *The Opinions on Strengthening the Protection and Heritage of History and Culture in Urban and Rural Construction*, emphasizing the principle of combining protection and utilization, constantly promoting the maintenance and repair of historic buildings, complementing the infrastructure within historic and cultural areas, improving the capability of disaster resistance, and making full use of the value of historic and cultural resources<sup>[3]</sup>.

### 1.1.2 Society

With its spontaneous growth of living environment, the historic area has been able to reflect the traditional pattern and unique appearance of the local area in a more realistic and complete way in the changing times<sup>[4]</sup>. However, in the context of rapid urbanization, historic and cultural areas are in decline and marginalized due to their own closed external space and constrained internal space; firstly, the population explosion exceeds the capacity of traditional living space, and the quality of living is greatly reduced. In addition, with the changes in social and economic development, the established physical space cannot meet the implantation of modern lifestyles, resulting in the withering of social space and population loss, making a considerable part of historic and cultural areas face decline.

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<sup>[2]</sup> State Council of the People's Republic of China. Regulations on the Protection of Famous Historical and Cultural Cities and Towns and Villages[Z]. 2008

<sup>[3]</sup> General Office of the CPC Central Committee. Opinions on strengthening historical and cultural protection and inheritance in urban and rural construction[Z]. 2021

<sup>[4]</sup> Bao Wei. Ancient village architecture and landscape renewal design [J]. China Construction, 2011(09): 120-121

In the attempts to change the historic areas, the residents' independent renewal often lacks orderly control, and the method of large-scale demolition and construction is undoubtedly unable to make the areas sustainable, while the traditional architectural pattern and public spaces that are completely restored as old are also unable to adapt to the new situation and new needs in modern life. Residents' recognition of historic and cultural areas continues to decline, and the area lacks the ability to develop sustainably. Based on this, it has become an irreversible requirement to find more adaptable renewal strategies to incorporate new urban functions into the community and to make space in the historic areas of the city truly enhanced and sustainable.

### **1.1.3 Subject**

With the rapid advancement of urbanization, the types of urban risks faced by historic areas are also increasing. In addition to the disaster risks of the original natural ecology, the resilience risks of unsustainable development reflected by the decline of historic areas have gradually drawn the attention of urban governors. As the basic unit of urban risk management, the community is also the landing point of resilient space construction. Research and practice on "resilient spaces" in developed countries started earlier, emphasizing both community space enhancement and adaptation to external risks, and fully mobilizing government departments, social capital and community residents to participate. After long-term research and practice, certain progress has been achieved, and the positive influence of using resilience theory to achieve sustainable development has been recognized by academia.

As a theory of "adapting to external pressure " and "self-renewal", resilience theory has become an important tool for urban planners to improve the resilience of community and can effectively solve the problem of space vulnerability faced by old communities to solve the dilemma of old communities' renewal. Its guidance for the space enhancement of old communities includes two specific aspects: the first is to strengthen the physical space so that the community system can resist external

disturbance; the second is to strengthen the social space to help the community system obtain the ability to actively adapt and turn shocks into advantages in order to promote the sustainable development of the community. In addition, the resilience theory can also contribute to the sustainable development of historic and cultural areas with the longer history and stronger culture.

## **1.2 Research aims and significance**

### **1.2.1 Research aims**

Community is the basic unit of a city, and unique communities with outstanding cultural attributes such as historic and cultural areas have attracted much attention. In the current context of the previous rapid urbanization, most historic and cultural areas are facing the disturbance of surrounding urbanization, which brings about aging infrastructure, population loss, the decline in traditional architectural styles, and difficulty in passing on intangible culture. The development of these areas is subject to significant uncertainty risks.

Based on this, this dissertation focuses on the inadaptability and unsustainable development trend of historical and cultural districts in the face of the negative impact of urbanization in the surrounding areas. In order to enhance the space system's resistance to the disturbance in historic and cultural areas, this dissertation explores how to apply resilience theory to rebuild and enhance the spatial resilience of old communities from the perspective of urban design practice, taking Xixing Historic and Cultural Area as an example. To achieve this aim, the later part of this research attempts to answer the following three questions in order to guide the space enhancement practice of historic areas.

- ① What are the essential characteristics of "resilient systems" from the perspective of urban planning?
- ② What are the current vulnerabilities in the Xixing Historic and Cultural Area, and

what caused them?

③ What is the space enhancement strategy system for a historic and cultural area from the perspective of resilience? How to implement it into space enhancement design?

## **1.2.2 Research significance**

### **(1) Theoretical significance**

At present, the research on resilient space construction in China is mainly focused on newly built communities and ordinary old communities. However, less research has been conducted on the old residential historic community that are more vulnerable, and no theoretical system has been formed yet. If the resilient construction method of ordinary communities is continued, it will inevitably destroy the unique physical environment of historic and cultural areas. At the same time, the research results of resilience theory have played a positive role for community spaces to cope with natural ecological disturbances such as rain and flooding, but the research on communities coping with future unsustainable development risks is relatively weak.

Therefore, on the basis of previous research, the theoretical value of this study is to relate characteristics of resilience to the space enhancement of the historic and cultural areas, and to build a theoretical system for space resilience enhancement for these areas based on the continuation of its traditional physical space and traditional culture, which to a certain extent contributes a valuable supplement to the theoretical system of resilient community construction.

### **(2) Practical significance**

In recent years, the Chinese government began to adjust the mode of economic development. Along with the economic development from high speed to high-quality development, China's urban construction activities also change from "massive construction" to "stock planning", and the regeneration of historic and cultural areas has become an important issue in urban governance. At the same time, the space enhancement strategy of communities based on the resilience theory also provides

new ideas for the current planning and construction activities. Therefore, this dissertation enhances the quality of historic and cultural areas under the perspective of resilience to solve the current problem related to their unsustainable problems caused by surrounding urbanization, and to make these areas conform to the current policy orientation of urban development.

As one of the ten historic and cultural areas in Hangzhou, Xixing was an important water trading and transporting center, carrying a rich regional culture. However, at the same time, the vulnerability of its current physical space and social economy can represent most of the historic and cultural areas that in urgent need of regeneration due to the aging infrastructure and aging population. Therefore, based on the field research of the Xixing community, the practical significance of this dissertation is to predicts its future development and implements the space resilience enhancement strategies for the historic and cultural areas into urban design practice in order to help it develop sustainably. Meanwhile, this dissertation can also provide a reference for the future space enhancement of other historic areas.

## **1.3 Research objects and design boundary**

### **1.3.1 Research objects**

#### **(1) Resilience theory**

The term "resilience" originally referred to the ability of a system to maintain its stability and sustainability in the face of external disturbances. The meaning of "resilience" has undergone several transformations in different disciplinary contexts. In the field of engineering, "resilience" refers to the ability of an object to return to its initial state despite physical deformation by external forces; in the field of ecology, "resilience" emphasizes the ability of an object not only to return to its original state but also to reach a new equilibrium with external shocks; and In the related field of social sciences, the interpretation of "resilience" is mainly from the perspective of sustainable development, focusing on the system's ability to adapt and make changes in response

to stress, thus the resilience perspective in this field is also called "social resilience" or "social resilience".

This study focuses on the "engineering resilience" and "social resilience" paradigms, which are highly relevant to historic and cultural areas, and explores the characteristics of resilient systems to construct a design strategy system for public space enhancement in historic and cultural areas in order to promote the sustainable development of these areas.

## **(2) Historic and cultural areas**

According to *The Law of the People's Republic of China on Protection of Cultural Relics*<sup>[5]</sup>, a historic and cultural area is a specific scale of land area that carries important humanistic, artistic and scientific values in tangible or intangible form, and reflects the traditional appearance and lifestyle of the local area during a certain historic period. To a certain extent, the definition of historic area can be regarded as a combination of "history", "culture" and "area". Firstly, a historic area has a recognized historic and cultural value as opposed to a modern area; secondly, a historic area is different from a single heritage building that also has a certain historic value, as it also includes a certain number of traditional residential buildings and public spaces such as squares, landscapes and streets between buildings.

## **(3) Space enhancement design**

The landing point of this research is to design the space of the historic and cultural area by eliminating certain aspects of the existing environment and adding new spaces, in order to solve the problem of the physical environment and social economy, and to achieve sustainable development in this area. Based on this, the "space enhancement" in the later chapters focuses on the following two objects. The first is the outdoor public space, including the traditional streets, community gardens, corner squares in the

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<sup>[5]</sup> National People's Congress. Law of the People's Republic of China on the protection of cultural relics[Z]. 2005

historical and cultural area, and the outdoor open space with strong historical and cultural attributes such as ancient sites, ancient canal, and waterfront walkways that reflect the characteristic local culture of the district; the second is the architectural space, in compliance with the relevant protection regulations of the historical and cultural district, the original buildings in the historical and cultural district are preserved, renovated or demolished and newly built to accommodate the functions in line with the future development of this area.

### 1.3.2 Design boundary

Located in Binjiang District, Hangzhou, Zhejiang Province, China (figure1-1), Xixing is one of the ten historic and cultural areas specified in The Protection Planning of Hangzhou Historic and Cultural City, with a core protection area of 12 hectares. There are more than 150 existing buildings in the community, mainly 1 to 3-story traditional residential buildings with recognizable traditional architectural appearances and low commercialization.



Figure 1-1 Geographical location of Xixing historic and cultural area  
(Source: made by the author)

Considering the integrity of the design, the geographical boundary of this research is adjacent to Gutang Road in the north, Chunbo Road in the south, Tieling Garden in the west and Guanhe Apartment in the east, covering a total area of 14.2 hectares, which is slightly larger than the core protection area of historic and cultural area (figure1-2).

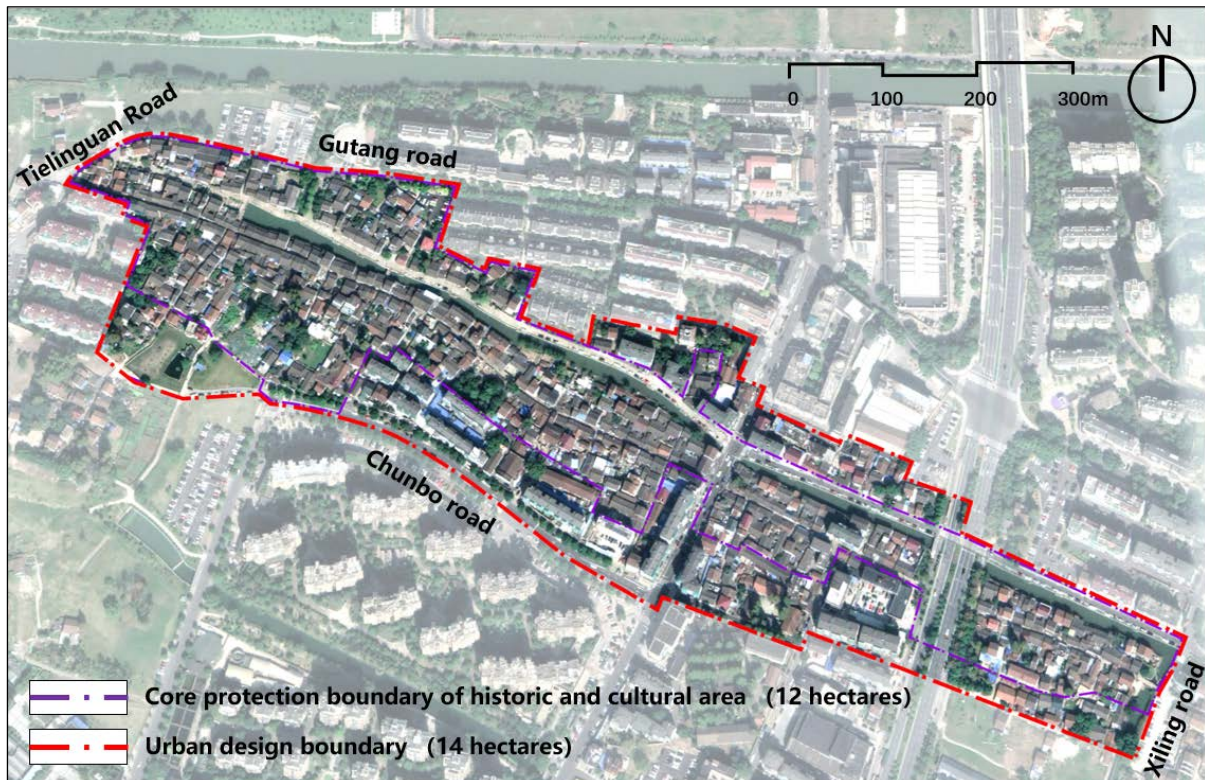


Figure 1-2 Design boundary of Xixing historic and cultural area  
(Source: made by the author, base image comes from Google Map)

## 1.4 Research methods and framework

### 1.4.1 Research methods

#### (1) Literature review

Concerning the space enhancement in historic and cultural areas from the perspective of resilience theory, this research mainly searches and organizes relevant academic materials on resilience theory, historic and cultural areas and space enhancement, from China and other countries, including journals, dissertations and conference publications. By summarizing the development and status of relevant theoretical research, this research finally draws out the latest progress and research deficiencies in related fields.

#### (2) Field Research

The primary data of this research comes from field observation, measurement, aerial photography, questionnaire survey, and resident interviews in Xixing Historic and

Cultural Area. Through the analysis of the above data, the third chapter obtained the characteristics of spaces and the residents' urgent needs, which can support the subsequent design practice, making the design results more scientific and practical.

### **(3) Data analysis and generalization**

By analyzing of the field research data of the Xixing Historic and Cultural Area, the current problems of the physical space and social economy of this area are summarized, and the applicability of the resilience theory applied to the space enhancement is also clarified, so as to support the building of the resilience strategy system in the fourth chapter.

### **(4) Urban design Practice**

After building the space enhancement strategy from the literature review and field research, the fifth chapter implements it into practice with the urban design working method by closely integrating with the superior planning policies and reasonably predicting the future development direction. In addition, the urban design practice uses architectural plans and diagrams to show the overall structure and the detailed design of Xixing after the enhancement of space.

### 1.4.2 Research framework

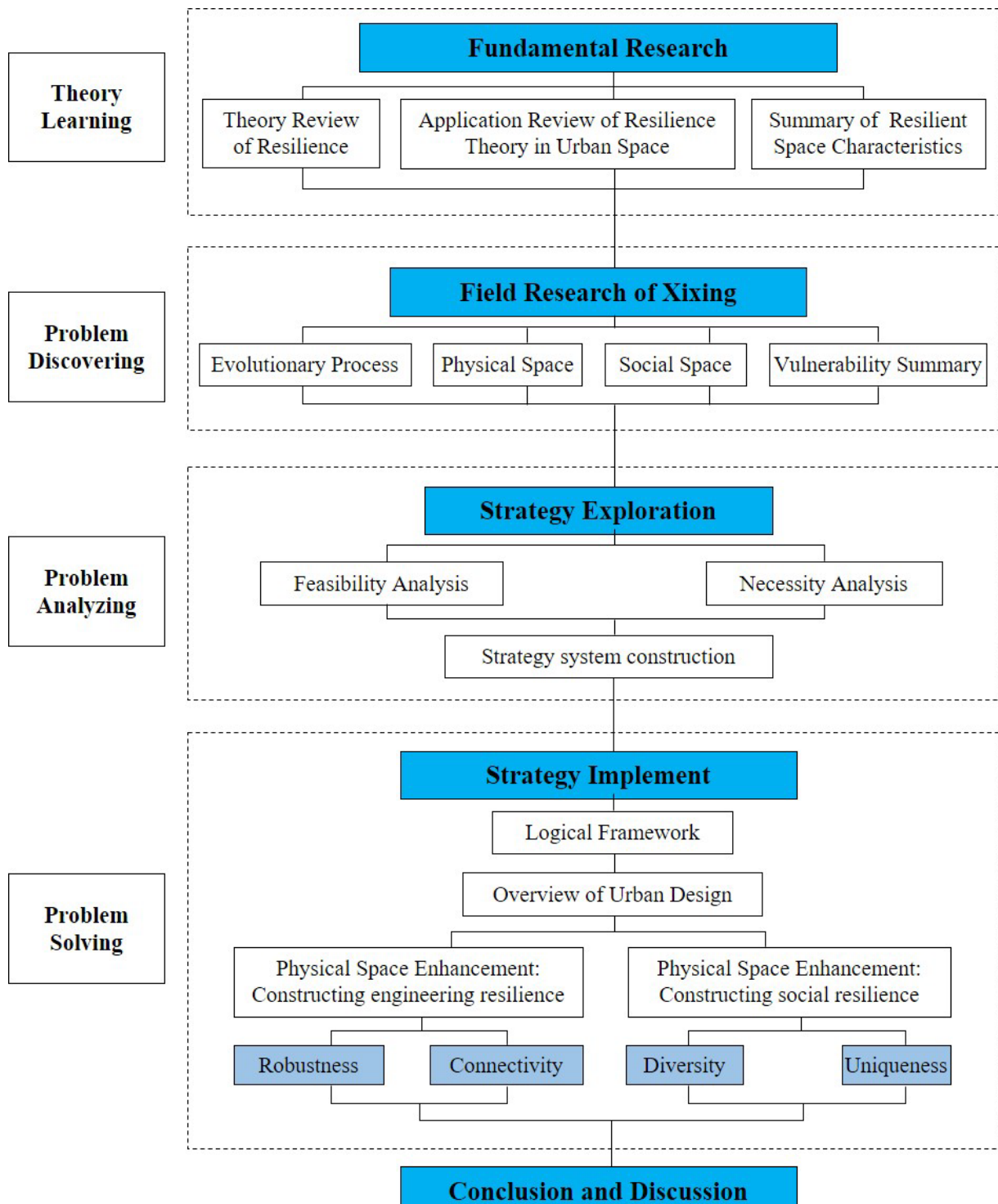


Figure 1-3 Research framework of the dissertation (source: made by the author)

## **Chapter 2: Fundamental Research**

In recent years, a large amount of literature on "resilience" has emerged in academia, and new research perspectives such as "cultural resilience" and "economic resilience" have been proposed and put into practice. Nowadays, the concept of "resilience" has been gradually extended from the simple description of physical properties to a more systematic system. Although the use of the term "resilience" has not yet been standardized among different disciplines, but it can provide a new approach to regional development and policy making in China today.

The design of spatial enhancement of historic and cultural area from the perspective of resilience requires adequate basic research. In this chapter, through the method of literature review, the connotation and extension of resilience theory, the application of resilience theory in urban space, and the characteristics of resilient space in historic and cultural area, the current research progress and deficiencies are sorted out in order to support the theory of this dissertation.

### **2.1 Literature review of resilience theory**

After nearly 50 years of development, resilience theory has become an impressive academic field, and its extension and connotation are still being enriched today. In this section, on the basis of clarifying the original concept of "resilience", three classical paradigms in the evolution of resilience theory are sorted out, and the essential characteristics of the resilience space in the historic and cultural area that is the focus of this paper are summarized.

#### **2.1.1 Connotation of resilience**

##### **(1) Origin of the concept**

According to Alexander's research of etymology, the term "resilience" was firstly derived from the Latin word "resilio", with the roots "re" and "silio" meaning "to go back" and "to jump" respectively, which means the object is able to jump back to the original

state. Later on, this term was used to indicate that a system is capable of recovering from surrounding shocks to its original state<sup>[6]</sup>.

## **(2) Phases of resilience**

The academia analyzes from the perspective of the whole cycle of the system response to risk, and clarifies that resilience is a long-term slow dynamic process, which is roughly expressed in three stages: prevention before the disaster, emergency response during the disaster, and recovery after a disaster. The prevention phase refers to the construction of the system resilience system, enhancing the system's anti-disturbance capacity, increasing the total amount of system absorption of disturbances, and reducing the occurrence of risk events. The response phase mainly refers to the role of system resilience in the process of disaster occurrence can quickly respond to the impact of the disaster and reduce the possibility of disaster". The recovery phase refers to the phase when the system is able to guarantee rapid adaptation to new changes and transformation to establish a new system due to the role of the system's transformation capability.

## **(3) Doctrinal branches**

Resilience is actually a collection of capabilities<sup>[7]</sup>. So far, within the development of resilience theory, academia has formed "recovery theory", "adaptive theory", "learning ability theory" three views to explain the abilities that a resilient system should have.

The recovery theory focuses on how a system recovers to a steady state after a disaster. The AIRR<sup>[8]</sup> believes that the ability of a community system to recover quickly depends on the restarting of work by community residents and the full recovery of education; Timmerman, in his study of resilience model construction, points out that

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<sup>[6]</sup> Alexander D.E. Resilience and disaster risk reduction: an etymological journey[J]. Natural hazards and earth system sciences, 2013, 13(11): 2707-2716

<sup>[7]</sup> [2] Liu Yanping, Wang Huifei, Qian Hongwei, et al. Urban resilience: A study of connotation and evaluation system[J]. Disaster Science, 2019, 34(01):8-12

<sup>[8]</sup> American Institute for Regional Research

resilience can be measured in terms of demographic structure, economic structure and property rights<sup>[9]</sup>; Simin et al., in the process of sorting out the concept of resilience, argue that the steady state of a system is a composite state, and it is due to the cooperation of the elements in the system that the system can coexist with the disturbance or transform to other states or recover when it is disturbed<sup>[10]</sup>. By building an evaluation system for the social resilience framework of villages in Baise, Guangxi, Zhan<sup>[11]</sup> et al. concluded that addressing population loss, aging, and per capita industrial structure imbalance would make the system more resistant and resilient to the outside world.

Adaptive theory focuses on the ability of a system to continuously adapt to external disturbance, reflecting the adaptive characteristics of resilience. Li et al. proposed that adaptability in a system can respond to environmental changes in the system and make adaptive responses by adjusting its own structure or parameters<sup>[12]</sup>; Nelson et al. argue that adaptive capacity is the process by which a system continuously adjusts and adapts to changes in its environment, and that the strength of adaptive capacity measures the system's ability to rebuild<sup>[13]</sup>; the UNISDR<sup>[14]</sup> defines adaptive capacity as the ability of a system to structurally or functionally withstand disturbance in the face of external pressure through resistance or self-organization; in a study on the spatial

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<sup>[9]</sup> Timmerman P. Vulnerability, resilience and the collapse of society review of models and possible climatic applications[M]. Toronto: Institute for Environmental Studies, 1981

<sup>[10]</sup> Ximing Dawudi, Cao Kang, Wang Jinjin, Tao Shuchen. Resilience Planning: The Concept of Bond or the End of the Road[J]. International Urban Planning, 2015: 8-12

<sup>[11]</sup> Zhan Wei, Zhang Dongning, Wang Lu, Zhang Min, Chen Chaolong. Research on Village Development and Layout from the Perspective of "Social-Ecological Resilience": Taking Youjiang District, Baise City, Guangxi as an Example[J]. Small Town Construction, 2022, 40 (04): 23-31

<sup>[12]</sup> Li Ting, Liu Zengrong. Adaptability in complex systems[J]. Journal of Zhejiang Normal University (Natural Science Edition), 2006, 29(04): 410-413

<sup>[13]</sup> Nelson D.R. Adger W.N, Brown K. Adaptation to environmental change: Contributions of a resilience framework[J]. Annual Review of Environment and Resource, 2007, 32(01): 395-419

<sup>[14]</sup> United Nations International strategy for Disaster Reduction

resilience of Dutch cities, Lu et al. compare the traditional concept of engineering resilience and social resilience to "keeping one's feet dry" and "living with water" respectively, arguing that the former is prone to failure in an unpredictable risk environment, while the latter regards the response to stress as a dynamic adjustment and adaptation process, focusing on the sustainability of the system<sup>[15]</sup>.

The learning theory emphasizes the ability of systems to self-organize and learn to adapt. According to Jordjevic et al, the essence of resilience is the ability of a system to learn from past disasters in order to improve to a better state<sup>[16]</sup>. Ross believes that human society should not be passive in the face of impending disasters, and that the essence of resilience lies in community residents organizing themselves and learning from themselves to strengthen their ability to respond to disasters<sup>[17]</sup>. According to the Committee on Environment and Natural Resources for Sustainability's Panel on Disaster Reduction, resilience is the ability of social systems to maintain their normal development by resisting disasters or introducing new ways of functioning, and to learn how to protect themselves based on previous disaster experiences.

Although the focus of the above-mentioned representative views is different, they all have similar interpretations of the meaning of resilience, that is, they all emphasize that resilience is reflected in the ability of the system to absorb external disturbances, while being able to seek a stable state through self-learning and innovating. Based on the clarification of the connotation of resilience, the next section will clarify the focus of different paradigms of resilience, with a view to further clarifying which paradigms are

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<sup>[15]</sup> LU P, Stead D. Understanding the notion of resilience in space planning. a case study of Rotterdam, the Netherlands[J]. *Cities*, 2013, 35: 200-212

<sup>[16]</sup> Djordjević S, Butler D, Gourbesville P, et al. New policies to deal with climate change and other drivers impacting on resilience to flooding in urban areas: the CORFU approach[J]. *Environmental Science & Policy*, 2011, 14(7): 864-873.

<sup>[17]</sup> Ross H, Berkes F. Research approaches for understanding, enhancing, and monitoring community resilience[J]. *Society & Natural Resources*, 2014, 27(8): 787-804

applicable to the spatial enhancement of the historic and cultural area.

### **2.1.2 Evolution of resilience**

In the middle of 19th century, along with the transition from an agricultural to an industrial civilization, the term "resilience" was widely used in the natural sciences to describe the ability of a metal to recover to its original state after a force has been applied to it and then withdrawn, focusing on the ability of simple systems to recover quickly and efficiently to their initial state. In the middle of 20th century, "resilience" was commonly applied in psychology and psychopathology to measure the recovery of patients after trauma. And in 1973, the Canadian ecologist Holling, in his famous article *Resilience and Stability of Ecological Systems*, first used "resilience" <sup>[18]</sup>. Since the 1990s, the application of resilience theory has transformed from natural ecosystems to social-ecological systems. In 2001, Holling further applied the concept of resilience to describe human social systems in his book *Panarchy: Understanding Transformations in Human and Natural Systems* <sup>[19]</sup>. The evolution resilience have undergone revisions and refinements before and after, enhancing the breadth and depth of resilience theory and providing important theoretical support and insights for people to understand resilience, and thus the methods of resilience enhancement in urban construction.

#### **(1) Engineering resilience**

Engineering resilience started in engineering-related science fields, such as materials science and mechanical engineering. The engineering resilience paradigm, which regards resilience as the ability to recover to an initial state, was firstly used to describe the concept of resilience because it is close to everyday life and easy to understand. However, in the process of development, its application area has been extended beyond engineering mechanics to other systems with characteristics of engineering

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<sup>[18]</sup> Holling C S. Resilience and stability of ecological systems[J]. Annual Review of Ecology and Systematics, 1973: 1-23

<sup>[19]</sup> Holling C.S, Gunderson L.H. Resilience and adaptive cycles[M]. Island Press, 2001

resilience.

The basic definition of engineering resilience is the ability of the system to recover quickly and effectively to the initial state after being disturbed, and the measure of resilience is the rate at which the system recovers to the initial state, in other words, the strength of toughness can be quantified by the recovery rate; Berkes et al. believe that engineering resilience should also focus on the stability around the established equilibrium state, i.e., the ability of the system to resist external disturbances<sup>[20]</sup>; Wang et al. also emphasized that engineering resilient systems should have a low probability of collapse and be able to recover quickly to normal levels even in the collapsed state . In conclusion, the engineering resilience paradigm emphasizes that a resilient system has one and only one stable state, i.e., the initial state; the rate at which the system recovers to the initial state is a measurement for its resilience strength.

## **(2) Ecological resilience**

In the 1980s, as the concept of resilience was applied to different research fields, the drawbacks of the traditional engineering resilience paradigm, which was single and rigid, gradually emerged. Inspired by the study of nature, ecologists believe that after an external disturbance, a system may not only change its structure and gradually return to its original state, but also reach a new equilibrium with the external disturbance in the process of restoring the original state after the structural change, or even reach an equilibrium with the external disturbance directly without structural change to form a new steady state. This view is similar to the operation law of ecosystem, thus it is called ecological resilience, and is mainly applied in the field of biological research.

The first application of the concept of resilience to the study of ecosystems was made by the Canadian ecologist Holling. In his revision of traditional engineering resilience,

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<sup>[20]</sup> Berkes F, Folke C. Linking social and ecological systems for resilience and sustainability[M]. Cambridge University Press, 1998

proposed for the first time that a system usually absorbs a certain amount of disturbance before changing its own structure, and that this ability to absorb disturbance should be one of the criteria for evaluating the strength of resilience<sup>[21]</sup>; Berkes et al. also propose that the equilibrium of a system is not unique, but can exist in multiple<sup>[22]</sup>; Guixian Liao et al. similarly argue that ecological resilience emphasizes the ability of a system to remain stable without regard to whether its state changes<sup>[23]</sup>. From this perspective, both ecological resilience and traditional engineering resilience emphasize that the system should eventually reach a state of equilibrium after disturbing but the latter only supports a single, original state of equilibrium, while the former recognizes diverse states of equilibrium (Figure 2-1).

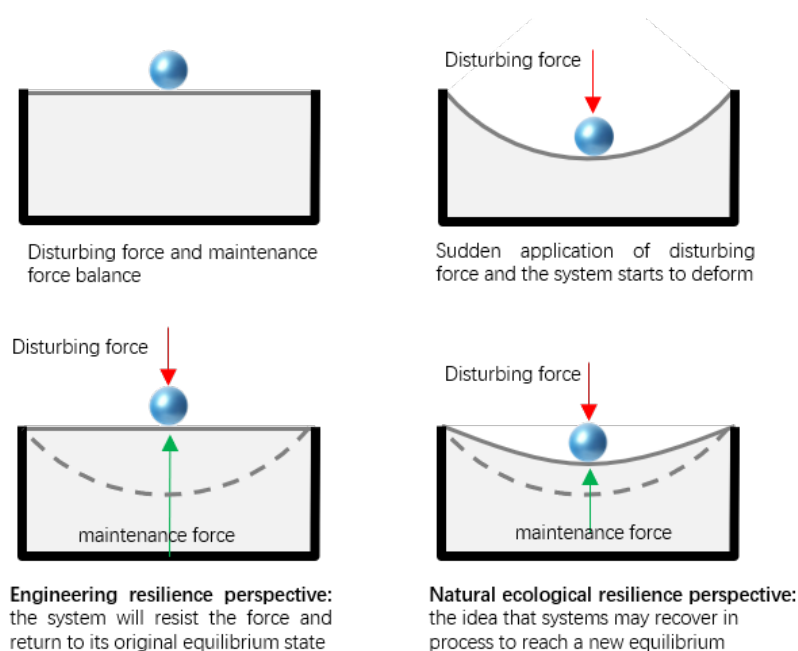


Figure 2-1 Comparison between engineering resilience and ecological resilience  
(Source: made by the author)

### (3) social resilience

<sup>[21]</sup> Holling C S. Resilience and stability of ecological systems[J]. Annual Review of Ecology and Systematics, 1973: 1-23

<sup>[22]</sup> Berkes F, Folke C. Linking social and ecological systems for resilience and sustainability[M]. Cambridge University Press, 1998: 13-20

<sup>[23]</sup> Liao Guixian, Lin Hejia, Wang Yang. The theory of urban resilience to carry floods: The foundation of another planning practice[J]. International Urban Planning, 2015(2): 36-47

Social resilience is also known as social resilience. Based on the original paradigm of ecological resilience, a new perspective of social resilience has been proposed as the understanding of the mechanisms of the system and its surrounding environment has deepened. Social resilience undermines the excessive pursuit of equilibrium and emphasizes the sustainable capacity of human social ecological systems to adapt to change, self-adjusting, and self-learning when facing highly uncertain future pressures. In China and other countries, some of the representative scholars on social resilience include Walker, Folke, and Li. Walker et al. proposed that resilience should be regarded as the ability of social-ecological systems to adapt and transform after disturbance, rather than just a simple process of returning to the initial state<sup>[24]</sup>; Falk et al. similarly focus on the sustainable characteristics of resilience, suggesting that resilient systems should be adaptive and transformative<sup>[25]</sup>; Li et al. argue that social resilience comes from "adaptive cycle", which emphasizes the self-organizing capacity of systems<sup>[26]</sup>.

As suggested by Li et al. above, the essence of social resilience is in fact derived from the adaptive cycle theory constructed by Gunderson and Holling. According to Gunderson et al., systems exhibit four phases after being exposed to surrounding disturbance, namely the exploitation phase, the conservation phase, the release phase, and the reorganization phase<sup>[27]</sup> (Figure 2-2). First is the exploitation phase, in which the system is flexible in its choices and organization, absorbs the surrounding elements and moves in a traced direction, showing a high growth potential and a high level of resilience; when the system enters the conservation phase, the internal connectedness

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<sup>[24]</sup> Walker B, Holling C.S, Carpenter S.R, et al. Resilience, adaptability and transformability in socio-ecological systems[J]. *Ecology and Society*, 2004, 9(2): 5

<sup>[25]</sup> Folke C, Carpenter S R, Walker B, et al. Resilience thinking: Integrating resilience, adaptability and transformability[J]. *Ecology and Society*, 2010, 15(4): 3-9

<sup>[26]</sup> Li Zhigang, Hu Zhouwei. Urban Resilience Research: Theory, Experience and Reference[J]. *China Famous Cities*, 2021, 35(11): 1-12

<sup>[27]</sup> Gunderson L.H. Adaptive dancing: Interactions between social resilience and ecological crises[M]. Cambridge University Press, 2003

of the system increases, the function gradually stiffens, the growth potential decreases, and signs of decline arise; in the release phase, the system grows rapidly until chaotic collapse due to the need to break the original connectedness to make the elements flow again; in the fourth reorganization phase, the original structure is broken and the system gets the opportunity to creatively reorganize and enter the growth phase again. Based on this framework, the urban design for space enhancement in historic and cultural areas is in the release stage, and space design techniques are needed to reorganize the districts and promote their ability of sustainable development.

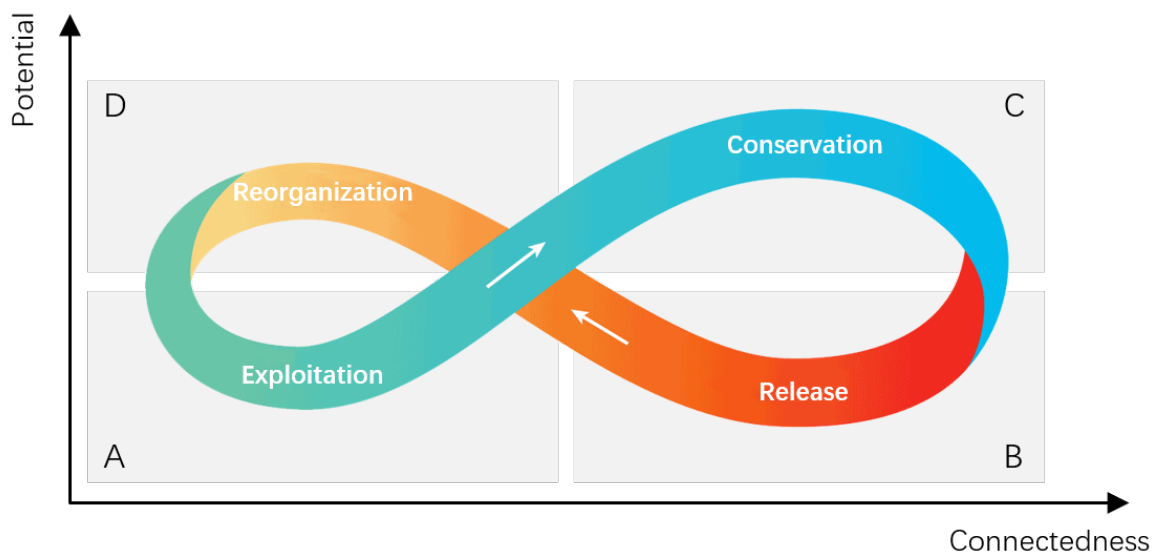


Figure 2-2 Four phases of adaptive circle  
(Source: made by the author, according to reference [62])

#### (4) Comparison of three resilience paradigms

Based on the above review, it is clear to conclude that ecological resilience recognizes a diverse state of equilibrium compared to engineering resilience, while social resilience incorporates a cyclical and dynamic vision compared to ecological resilience. The relationship between engineering resilience, ecological resilience, and social resilience is progressive, reflecting the different depth of understanding of the concept of resilience in the academia (Table 2-1).

In contrast, engineering resilience and social resilience, which are based on engineering and adaptive cycle theory, are the main theories of reference for this study because of the need for infrastructure renewal and development transformation in the historic and cultural area.

Table 2-1 Comparison of the three resilience paradigms  
(Source: made by the author, according to reference [16])

<b>Resilience Paradigm</b>	<b>Measurement</b>	<b>Equilibrium state</b>	<b>Foundation</b>
Engineering Resilience	The rate at which the system returns to its original state after disturbing	Single equilibrium state	Engineering
Ecological resilience	The level of the shock absorbed before the system is subjected to structural changes	Multiple equilibrium states	Ecology
Social-Ecological Resilience	The ability of the system to adjust itself and adapt to disturbance	No equilibrium state pursued	Adaptive Cycle

### 2.1.3 Definition refinement

At present, there is no an uniform definition of resilience in the academia, but combining the above studies on the connotation and evolution of resilience and comparing the definitions of resilience by various scholars (table), we can find that, based on the original concept of resilience, the cognitive trend of resilience in the academia is from emphasizing the ability to react quickly in the face of shocks to focusing more on the recovery, adaptability and creativity of the system in the face of shocks.

Therefore, combined with the historic and cultural area which is the focus of this paper, the term resilience is defined in this study as the ability of a system to maintain its own stability and transform its development before and after being subjected to external disturbances.

### **2.1.4 Brief summary**

The term resilience first refers to the ability of an object to jump back to its original state, and with the development of the times, three views of "recovery ability", "adaptive ability" and "learning ability", the three resilience paradigms of "engineering resilience, " "ecological resilience, " and "social resilience", have been developed over time. Combining the evolution of the above connotation of resilience and the research trend of academia, this paper defines resilience as the ability of a system to maintain its own stability and transform its development when it is disturbed by the outside world.

## **2.2 Application review of resilience theory in urban space**

In recent years, resilience theory has become a hot topic in the field of urban research, and the related research objects mainly include resilient cities, resilient communities and resilient spaces. Therefore, this section will also review the application of resilience theory in from a city perspective to a space perspective.

### **2.2.1 Resilient city**

#### **(1) Definition**

In the 1990s, resilience theory was introduced to the study of social ecological systems. In 1999, the IRA<sup>[28]</sup> was established to study the motivation of urban social ecological systems. In 2001, the concept of "resilient city" emerged for the first time in academia, marking the formal introduction of resilience theory into the field of urban research.

Since there is no consensus on the definition of resilient city in academia, this study compares some representative views from 2005 to 2021 (Tables 2-2) and proposes the definition of resilient city in this dissertation: resilient city refer to city that is able to maintain its functions and structures undamaged and sustainable through the interaction of their own physical and social systems, even if they are subject to external disturbance.

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<sup>[28]</sup> The International Resilience Alliance

Table 2-2 Comparison of definitions of resilient city (source, made by the author)

Year	Scholar or organization	Specific definition
2005	International Resilience Alliance	A city that can absorb and resolve external disturbance while maintaining the original key structure and function <sup>[29]</sup>
2008	Cutter et al.	A city that can absorb external influences and have the ability to respond to disasters and adapt afterwards <sup>[30]</sup>
2013	Wamsler et al.	A city that can establish coping mechanisms before a disaster, reduce sensitivity to disasters during a disaster, and establish recovery mechanisms after a disaster <sup>[31]</sup>
2016	Shen	A city capable of responding to uncertain disturbances through reasonable preparation and buffering, and achieving normal operation of public safety, social order and economic construction <sup>[32]</sup>
2018	Qiu	A city that can cope with future economic, social, technological and infrastructural uncertain risks and maintain its essential functions and characteristics after the disaster occur <sup>[33]</sup>
2021	Tan et al.	A city that has the ability to adapt in the future through self-organization in the face of totally unpredictable future shocks and pressures <sup>[34]</sup>

## (2) Related research in China and other countries

There are two main research directions for resilient cities in countries other than China, one is "planning for resilient cities" and the other is "resilient urban planning system".

<sup>[29]</sup> Resilience Alliance. Urban Resilience Research Prospectus. [EB/OL].

[http://www.resalliance.org/index.php/urban\\_resilience](http://www.resalliance.org/index.php/urban_resilience)

<sup>[30]</sup> Cutter L.S, Barnes L, Berry M, et al. A place-based model for understanding community resilience to natural disasters[J]. Global Environmental Change, 2008, 18(04): 598-606

<sup>[31]</sup> Wamsler C, Brink E, River A.C. Planning for climate change in urban areas: From theory to practice[J]. Journal of cleaner production, 2013, 50: 68-81

<sup>[32]</sup> Shen Jiake. Discussion on Residential Area Planning and Design Based on Resilience Characteristics[J]. Housing Technology, 2016(08): 11-16

<sup>[33]</sup> Qiu Baoxing. Resilient Urban Design Methods and Principles Based on Complex Adaptation System Theory[J]. Urban Development Research, 2018, 25(10): 1-3

<sup>[34]</sup> Tan Zhuolin, Lu Ming. Early warning, response and recovery: A study on planning strategies for responding to public health emergencies from the perspective of resilient cities[J]. Western Journal of Human Settlements, 2021(04): 59-65

At present, the former is mostly studied from the natural disaster prevention and mitigation, and the pioneer countries, such as the United States and Japan, have relatively mature theoretical systems and experiences. The United Nations released the *Hyogo Framework of Action* in 2005, advocating planning resilient cities to face climate change and natural disaster risks<sup>[35]</sup>; in 2013, the Rockefeller Foundation selected the world's 100 most resilient cities, proposed four dimensions of evaluation: health and wellbeing, economy and society, infrastructure and environment, and leadership and strategy, with twelve specific evaluation indicators<sup>[36]</sup>. In terms of "resilient urban planning system", Jabareen's framework for resilient city planning (Figure 2-3) is a representative example of a practical approach to resilient city construction<sup>[37]</sup>.

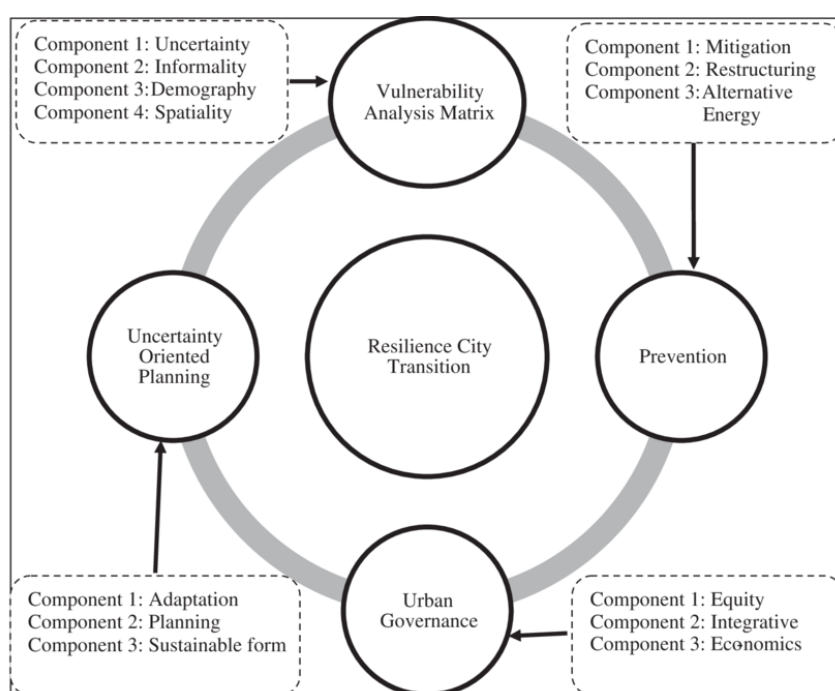


Figure 2-3 Resilient urban planning system (source: reference [54])

<sup>[35]</sup> United Nations. Conventions and Declarations Search System. [EB/OL].  
<https://www.un.org/en/documents/treaty/files/A-CONF-206-6.shtml>

<sup>[36]</sup> Rockefeller Foundation. City Resilience Framework. <https://www.rockefellerfoundation.org/wp-content/uploads/100RC-City-Resilience-Framework.pdf>

<sup>[37]</sup> Jabareen Y. Planning the resilient city: Concepts and strategies for coping with climate change and environmental risk[J]. *Cities*, 2013(31): 220-229

In China, the research on both "planning for resilient cities" and "resilient urban planning system" is in the initial stage, but there are still many scholars who have actively carried out the localization attempt of resilient cities in the context of China's unique policy system and economic structure. Based on the concept and characteristics of resilient cities, Huang et al. built a conceptual framework for resilient urban planning in four dimensions: vulnerability analysis and evaluation, uncertainty-oriented planning, urban governance, and resilient action strategies<sup>[38]</sup>; Li et al. summarized the overall objectives and uncertainty risk identification optimization principles and strategic suggestions for resilient cities in China based on combing the theory and evolution of resilient cities; Chen et al. discussed how to integrate the concept of resilient city planning at three levels: master planning, special planning, and detailed planning, taking into account the latest policy orientation of land spatial planning in China<sup>[39]</sup>.

### **(3) Spatial characteristic of resilient city**

For research of resilient city characteristics, Ahern et al. suggest that resilient cities should have five elements, namely complexity, connectivity, diversity, modularity, and adaptive planning and design<sup>[40]</sup>; based on Ehren's study, Allan et al. added four additional characteristics: innovativeness, effective feedback, rich capital reserve, and strong service capacity of the ecosystem<sup>[41]</sup>; Shao believes that since cities are typical social ecological systems, the main characteristics of resilient cities should be similar to those of resilient systems, so two characteristics of adaptability and diversity are

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<sup>[38]</sup> Huang Xiaojun, Huang Xin. A preliminary study on resilient city and its planning framework[J]. Urban planning, 2015, 39(02): 50-56

<sup>[39]</sup> Chen Zhiqian, Hu Jianshuang, Wang Huawei. Reflections on the integration of resilient city planning concept into the territorial spatial planning system[J]. Planner, 2021, 37(01): 72-76

<sup>[40]</sup> Ahern J. Planning and design for sustainable and resilient cities: Theories, strategies and best practices for green infrastructure[M]. Hoboken: John Wiley and Sons, 2010

<sup>[41]</sup> Allan P, Bryant M. Resilience as a framework for urbanism and recovery[J]. Journal of Landscape Architecture, 2011, 6(2): 34-45

proposed<sup>[42]</sup>; Zahra et al. argue that robustness, uniqueness, diversity and connectivity contribute to the evolution of resilient spaces based on an analysis of the physical and social elements of cities<sup>[43]</sup>; Qiu et al. propose that a resilient city should include six elements: subjectivity, diversity, autonomy, redundancy, slow variable management, and identity, through a critique of traditional urban disaster prevention thinking and a study of resilient city design methods<sup>[44]</sup>; in the process of describing urban vulnerability, Zhai Guofang et al. purposefully proposed six characteristics of resilient cities, which are dynamic equilibrium, compatibility, mobility, flatness, buffer capacity and redundancy<sup>[45]</sup>.

Thus, it is clear that although the extraction of characteristics of resilient cities varies among scholars, but focuses on the characteristics of pluralistic compatibility, sufficient reserve capacity, and efficient mobility, i.e., connectivity and diversity, within the urban system. Unlike the traditional static urban planning, resilience theory provides a new dynamic perspective for urban governors to control the complex and uncertain characteristics of urban systems <sup>[46]</sup>. In the next subsection, the perspective of the review will shift from the macroscopic city to the mesoscopic community, summarizing the current research progress of resilient communities and their spatial characteristics.

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<sup>[42]</sup> Shao Yiwen, Xu Jiang. Urban Resilience: Conceptual Analysis Based on International Literature Review [J]. *International Urban Planning*, 2015, 30(02): 48-54

<sup>[43]</sup> Zahra S, Partovi P, Behzadfar M. Space Resilience in traditional bazaars; case study: Esfahan Qeisariye Bazaar[J]. *The Monthly Scientific Journal of Baghe Nazar*, 2017(52): 49-58

<sup>[44]</sup> Qiu Baoxing. Resilient Urban Design Methods and Principles Based on Complex Adaptation System Theory [J]. *Urban Development Research*, 2018, 25(10): 1-3

<sup>[45]</sup> Zhai Guofang, Zou Liang, Ma Donghui, et al. How cities are resilient [J]. *Urban Planning*, 2018(2): 42-46, 77

<sup>[46]</sup> Shi Manjiang, Cao Qi. Research progress and improvement measures of resilience theory from the perspective of urban and rural planning[J]. *Western Journal of Human Settlements and Environment*, 2019, 34(06): 32-41

### 2.2.2 Resilient community

#### (1) Definition

Similar to resilient cities, there are different definitions of resilient communities based on different focuses. The first is Ahmed's study of community members' perceptions of social change, which defines a resilient community as one that is able to deploy resources to promote the physical safety and psychological development of its residents during and after the disturbance<sup>[47]</sup>; Hu et al. focus on community emergencies and thus define resilient communities as those that have the ability to mobilize internal and external resources and apply them to the entire process of pre-disaster prevention and post-disaster recovery<sup>[48]</sup>; in a study on the emergency governance capacity of the Covid-19; Wang et al. defined a resilient community as one that is able to quickly deploy resources and return to normal by its own strength in resisting disasters, and has the comprehensive capacity to innovate during disaster response learning<sup>[49]</sup>.

To sum up, there are two consensuses in the academia regarding the understanding of resilient community: first, a community that have a certain amount of resource reserves; second, a resilient community have the ability to deploy the reserved resources to resist and adapt to disturbances. Therefore, based on this dissertation's focus on the long-term demographic, economic, and environmental disturbances of urbanization, the focus of future space enhancement should be to enhance the space resource reserve of communities, with the aim of resisting and adapting to such disturbances.

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<sup>[47]</sup> Ahmed R, Seedat M, Niekerk A.V, Bulbulia S. Discerning community resilience in disadvantaged communities in the context of violence and injury prevention[J]. *International Journal of Modern Physics*, 2014, 34(3): 386-408

<sup>[48]</sup> Hu Man, Hao Yanhua, Ning Ning, et al. New trends in emergency management: comparative analysis of assessment tools for community resilience[J]. *China Public Health Administration*, 2016, 32(01): 27-29

<sup>[49]</sup> Wang Shifu, Li Ziming. Resilient Community Building Strategies for Strengthening Emergency Governance Capabilities——Inspiration from the Novel Coronavirus Pneumonia Epidemic[J]. *Planner*, 2020, 36(06): 112-115

## **(2) Related research in China and other countries**

At present, overseas research on resilient communities is mostly based on the evaluation system and improvement practices. In terms of evaluation methods, the CRSI<sup>[50]</sup> has constructed a framework for assessing resilience based on seven elements, namely, population, ecology, governmental services, infrastructure, community competitiveness, economy, and social development, through a study of community composition. and social; Toseroni et al. classify the evaluation phases of resilient communities into prevention, mitigation, feedback, and recovery according to the general process of pre-disaster, in disaster, and post-disaster<sup>[51]</sup>; Maru et al. use GIS<sup>[52]</sup> to visualize and evaluate community resilience<sup>[53]</sup>. The Community Resilience Institute developed a community resilience system in 2011 and applied it to eight pilot communities. The pilot communities were assisted in six phases, including decision-making team organization, performance assessment, vision and goal setting, action planning, action assurance mechanisms, and maintenance and monitoring of the plan<sup>[54]</sup>; in 2014, the Lane Cove community in Australia built a multifunctional, interactive, adaptive and sustainable public space based on limited community resources, successfully addressing the vulnerability of the human and natural environment.

At present, China's research on resilient community enhancement mainly focuses on theoretical research, and the research trend has changed from the original single "

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<sup>[50]</sup> Community Resilience System Initiative Steering Committee. Final Report: A roadmap to increased community resilience[M/OL]. <https://s31207.pcdn.co/wp-content/uploads/2019/08/CRSI-Final-Report.pdf>

<sup>[51]</sup> Toseroni F, Romagnoli F, Marincioni F. Adapting and reacting to measure an extreme event: A methodology to measure disaster community resilience[J]. *Energy Procedia*, 2016(95): 491-498

<sup>[52]</sup> Geographic Information System

<sup>[53]</sup> Maru Y.T, Smith M.S, Sparrow A, et al. A linked vulnerability and resilience framework for adaptation pathways in remote disadvantaged communities[J]. *Global Environmental Change*, 2014(28): 337-350

<sup>[54]</sup> Peng Chong, Guo Zuyuan, Peng Zhongren. Theoretical and practical progress of community resilience in foreign countries[J]. *International Urban Planning*, 2017, 32(04): 60-66

Disaster prevention indicators implementation " to "space enhancement" and "normalization of disaster prevention". Gao et al. analyze the dialectical relationship between resilient cities and ecological restoration, and propose a method for planning and designing resilient communities by shaping public space, sharing facilities, building smart communities, and protecting ecological structure, all of which are applied to her design practice of a residential district in Tianjin<sup>[55]</sup>; starting from the vulnerability research of three residential communities in Beijing, Xu analyzed the vulnerability characteristics of community buildings, facilities, environment and capital<sup>[56]</sup>; based on the idea of "integration of normal times and epidemic", Yu et al. build a framework for assessing resilient communities with the goal of integration of physical and social economy, and concluded that the specific planning and design guidelines for resilient communities are to enhance the resilience of space, facilities, environment, governance and capital<sup>[57]</sup>; Lan et al. point out that in addition to physical space, structure, process, capacity, and cultural resilience are also important sources of community resilience<sup>[58]</sup>; based on a study of old communities in the context of urbanization, Bai et al. propose regeneration strategies in terms of facilities, spaces and services to achieve a healthy and sustainable community development<sup>[59]</sup>; learning from the planning practice of New York's resilient communities, Zhong proposes that resilient community planning in metropolis starts from two main aspects, namely

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<sup>[55]</sup> Gao Ying, Feng Xiangyuan, Li Ruofan. Research on the Planning and Design Method of Resilient Community under the Concept of "City Double Repair" [C]. 2017 Collection of Urban Development and Planning, 2017: 1039-1046

<sup>[56]</sup> Xu Manchun. Empirical Research on Community Disaster Vulnerability under the Concept of Disaster Resilience[J]. Planner, 2019(05): 94-98

<sup>[57]</sup> Yu Yang, Wu Rongrong, Tan Xin, et al. Urban Resilient Community Construction and Planning Response Combined with Pandemic[J]. Planner, 2020, 36(06): 94-97

<sup>[58]</sup> Lan Yuxin, Zhang Xue. Community Resilience and Its Realization Path: Based on the Perspective of Modernization of Governance System[J]. Administrative Management Reform, 2020(7): 73-82

<sup>[59]</sup> Bai Xiaodan, Tan Shaohua, Yang Chun. Exploration of Community Space Environment Renewal Strategy Based on Resilience Concept: Taking Beijing Dongtiying Community as an Example[J]. Residential District, 2021(04): 20-26

physical space planning and social planning, with the aim of strengthening the effective supply of public service facilities and enhancing the risk identification capacity of the community<sup>[60]</sup>.

On the one hand, the theoretical framework of resilient community planning has been initially established in the Chinese academia, but on the other hand, since the research interest just starts in recent years, the existing research orientation only cover a single area, mainly newly built communities and ordinary old settlements, so there is a lack of research on the resilience enhancement strategies of old historic and cultural areas with strong regional and cultural attributes. In the next subsection, the review will continue to shift the perspective from the community to the space and explore its characteristics.

## **(2) Spatial characteristic of resilient community**

For the research on the characteristics of resilient communities, Shen et al. concluded that resilient communities have different characteristics in the three phases of pre-disaster, in-disaster response and post-disaster (Table 2-3)<sup>[61]</sup>; in their study of community resilience infrastructure, Liu et al. point out that connectivity, multi-factor coordination, landscape beautification and whole-process renewal are essential building principles<sup>[62]</sup>; Sun Li et al. proposed a space resilience enhancement strategy for public spaces in old communities based on characteristics such as robustness, diversity, adaptability and self-organization<sup>[63]</sup>; Xu and Jiang et al. emphasize the important role of community capital resilience, i.e., strengthening residents' sense of

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<sup>[60]</sup> Zhong Xiaohua. New York's Resilient Community Planning Practice and Several Discussions [J]. International Urban Planning, 2021, 36(06):32-39

<sup>[61]</sup> Shen Jiake, Wang Yuncai. Urban Community Planning and Design Framework Based on Resilience Characteristics [J]. Landscape Architecture, 2017(03): 98-106

<sup>[62]</sup> Liu Feng, Liu Yuan, Zhou Xiangyu. Research on the Function Improvement Strategy of Community Green Infrastructure Based on Resilience Theory [J]. Garden, 2019(07): 70-75

<sup>[63]</sup> Sun Li, Tian Li. Strategies for improving spatial resilience of old urban communities based on resilience characteristics [J]. Beijing Planning and Construction, 2019(06): 109-113

belonging<sup>[64][65]</sup>; Zhang considers robustness, openness, inclusiveness and organicity as the resilient characteristics of community space<sup>[66]</sup>. Wang et al. constructed a framework for assessing the resilience of community spaces, taking one of the communities in Nanking as an example, and pointed out that connectivity, redundancy, diversity and lack of quality are the reasons for its lack of resilience <sup>[67]</sup>.

Table 2-3 A framework of community resilience characteristics constructed by Shen  
(Source: reference [29])

Phase	Aims	Temporal Characteristic	Spatial Characteristic
Before disaster	Anticipate and prepare	Ahead of time	Redundancy and diversity
During disaster	React and respond	Consistency and timeliness	Decentralization and self-organization
After disaster	Recovery and learning	Long term	Adaptability and Collaboration

As a result, the spaces of resilient communities also emphasize efficient spatial mobility and compatibility. In addition, the robustness of facilities is also a key concern for resilient communities. In the next section, the review will continue to shift from the meso-community to the micro-resilient space, and explore its characteristics based on a review of its spatial conservation and utilization history.

<sup>[64]</sup> Xu Manchen. An Empirical Study on Community Disaster Vulnerability under the Concept of Disaster Resilience [J]. Planner, 2019, 35(05): 94-98

<sup>[65]</sup> Jiang Xiaoshan, Zhang Chunyang, Wu Zichao. Analysis of Guangzhou Community Resilience Characteristics from the Perspective of Public Health [J]. Residential District, 2021(01): 37-44

<sup>[66]</sup> Zhang Lingyue. Analysis of spatial resilience characteristics and enhancement strategies of urban old communities [C]. Spatial Governance for High Quality Development - Proceedings of the 2021 China Annual Urban Planning Conference (01 Urban Safety and Disaster Prevention Planning). 2021:83-91

<sup>[67]</sup> Wang Qiang, Zhang Mengjie, Xiang Hongyan. Research on Community Public Space Optimization Strategy from the Perspective of Resilience—Taking the Xincun Community of Nanjing City as an Example [C]. Spatial Governance for High-quality Development—Proceedings of the 2021 China Urban Planning Annual Conference, 2021: 487-496

### 2.2.3 Resilient space of historic and cultural area

The work of conservation and utilization to historic and cultural area spaces has been carried out for a long time, and various conservation models have different characteristics, and the related basic theoretical research has been enriched continuously. This section firstly compares the conservation and utilization models of historic and cultural areas in China and other countries, and provides references for the urban design of Xixing Historic and Cultural Area in the following section. Finally, it is by summarizing the characteristics and drawbacks of the existing research trends that the innovation of design strategies in the following part of this dissertation is motivated.

#### (1) Review of conservation and utilization to historic and cultural area space

##### ① Progresses in other countries other than China

With the advent of the second industrial revolution at the end of the nineteenth century, the productivity of Western countries was greatly enhanced, and the industrial countries, represented by the United States, carried out the construction of modern cities in full swing. In this context, many historic and cultural areas were demolished and rebuilt because they did not meet the needs of future development, and the urban landscape was dramatically changed. However, at the same time, many scholars noticed the unique cultural value of historic and cultural areas and started to try some cultural conservation work, and the idea of historic and cultural area conservation and utilization gradually gained attention in the academia. During this period, two representative documents were *The Historical Monuments Act* promulgated by French government and the *Athens Charter* adopted by the CIAM<sup>[68]</sup> in 1933, which initiated a new era of the protection and utilization of individual historical buildings.

The outbreak of the Second World War caused unprecedented damage to the city, with many historic and cultural areas falling into ruin and being replaced by modern

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<sup>[68]</sup> International Congresses of Modern Architecture

buildings and roads in the post-war reconstruction. By the 1960s, with the advancement of research and practice, the academia began to realize that the conservation of historic and cultural areas should not be limited to single buildings, but should be extended to entire area. In 1964, the ICOMOS<sup>[69]</sup> adopted the Venice Charter, which clearly proposed the protection of the entire historic and cultural area environment, supporting that the historic and cultural area is the common heritage of mankind and the witness of history. Since then, countries have issued local conservation regulations (Table 2-4). Under the guidance of the spirit of these conferences and documents, many cities, such as Bologna, Italy and Paris, France, have achieved great success in the conservation of historic and cultural areas. The conservation of historic and cultural areas then entered a new period with a more complete theoretical system.

Table 2-4 Important documents for the conservation and utilization of historic and cultural area from 1960s to 1990s (source: made by the author)

Year	Government or organization	Document name	Main content
1962	French Government	Malraux's law	Strictly managing the demolition and construction of historic districts
1964	ICOMOS	Venice charter	Emphasizing the holistic conservation of historic streets and putting forward the first concept of historic areas
1966	Japanese Government	Ancient City Preservation Law	Conserving of historically significant buildings, relics, communities and the appearance of the entire ancient capital
1976	UNESCO	Nairobi Recommendation	Clearly putting forward the conservation principles and a number of regulatory strategies for historic areas
1987	ICOMOS	Washington charter	Emphasizing the importance of resident participation, a complete description of the scope of the historic area, preservation methods
1999	CIAM	Beijing Declaration	Combining dynamic habitat concept with historic area conservation

<sup>[69]</sup> International Council on Monuments and Sites

Since the 21st century, international research perspectives and results on the conservation and utilization of historic districts are becoming diversified, dynamic and sustainable, such as emphasizing the importance of public participation and the equal importance of cultural and economic revitalization.

## ② Progresses in China

Space conservation and utilization of historic and cultural area in China, although the timeline does not overlap with that of developed countries, are similar in the transformation of conservation and utilization concepts, both transitioning from the protection of single buildings to historical environmental protection. In 1930, a cultural heritage protection-related law promulgated in China by the Nanking National Government, namely *The Cultural Relics Preservation Law*, but this law paid less attention to immovable cultural relics such as buildings. The protection of architecture and historic and cultural areas in China began after the foundation of the People's Republic of China and can be divided into embryonic period, developing period, and mature period.

From the 1950s to the 1980s is the embryonic period of China's historic and cultural area conservation work, this period is mainly based on single building conservation. As a large number of ancient buildings destroyed in the war, in 1950, the Central People's Government issued *The Instructions on the Protection of Ancient Cultural Buildings*, which stipulated that historical building relics and their appendages should be protected and not demolished at will. In 1961, the State Council issued *The Interim Measures for the Protection and Management of Heritage Building*, which is China's first comprehensive national heritage protection regulations, has determining the first list of 180 national key heritage buildings. At this point, China's protection system for single heritages buildings initially formed. In the following 20 years, the theoretical and practical work related to the protection of historic and cultural areas was stagnant due to the political turmoil. In conclusion, this period mainly focuses on protecting practice, and lacks of theoretical research. Besides, due to the need of post-war economic recovery and industrial construction, some tragedies occur from time to time, for

example, the demolition of Beijing's city walls.

It was not until 1982 that Chinese State Council approved *The Request on the Protection of Historic and Cultural Cities* and announced the first list of historic and cultural cities. Since then, relevant documents on the protection of historic and cultural cities were issued one after another, marking a developing period for the protection of historic and cultural area. In 1986, for the first time Chinese State Council clearly put forward the concept of "historic and cultural area", taking whether it has an area that can represent the traditional style of the city as one of the criteria for reviewing a national historical and cultural city. In 1996, famous experts and scholars from all over the world held the "International Symposium on Historic and Cultural Area Conservation" in Huangshan City, Anhui Province, which emphasized the importance of historic and cultural areas and their related conservation principles and measures. And this Symposium also marks the related conservation work of historic and cultural areas in China was expanded from the single building to the related regional level.

From the 1990s to the present, the protection work has been deepened comprehensively, and a three-dimension protection system of "historic and cultural city, historic and cultural area, and single heritage building" has been built. During this period, the term "historic and cultural area" was clearly defined, conservation institutions at all levels were established, related conservation regulations and utilization methods became increasingly mature, and the new conservation concept of people-oriented, economic revitalization, and integration into the city gained popularity.

This subsection has obtained the progresses of the conservation of historic and cultural areas in western countries and in China, and also the process of the change of conservation method (Table 2-5). The next subsection starts to summarize the recent models of historic and cultural area space conservation and utilization in China, compare their advantages and drawbacks, and provide reference for the urban design of Xixing Historic and Cultural Area in the following section.

Table 2-5 Periods and representative documents of conservation and utilization of historic and cultural areas in China (source: made by the author)

Phase	Year	Authority	Document name	Significance
Embryonic	1950	Central People's Government	The Instructions on the Protection of Ancient Cultural Buildings	It is stipulated that the remains of historical buildings and their appurtenances shall be protected and shall not be demolished at will for the first time in the new China
	1961	State Council	The Interim Measures for the Protection and Management of Heritage Building	China's first comprehensive national cultural relics protection regulations, identifying the first list of 180 national key heritage buildings
, Developing	1982	State Council	The Request on the Protection of Historic and Cultural Cities	Announcing the first list of historic and cultural cities, marking a period of developing for the protection of historic districts
	1986	State Council	List of S Famous Historic and Cultural Cities	For the first time, the concept of "historic and cultural area" was clearly introduced
	1996	International Symposium on Historic and Cultural Area Conservation	No document was passed	Emphasizing the importance of the historic area and discuss its related conservation principles and measures
Mature	2002	The National People's Congress	The Law of the People's Republic of China on the Protection of Cultural Relics	The "historic district" is clearly defined
	2005	Ministry of Housing and Urban-Rural Development	Historical and Cultural City Protection Planning Specifications	Three dimensions of protection have been formed for heritage building, historic and cultural area, and historic and cultural cities
	2015	National Cultural Heritage Administration	Notice on the Announcement of the First List of Chinese Historic and Cultural Area	Identifying the first list of 30 historic and cultural areas
	2018	State Council	Opinions on Strengthening the Protection and Inheritance of History and Culture in Urban and Rural Construction	Emphasis on complementing the infrastructure within the historical and cultural district, improving disaster prevention, mitigation capabilities, and giving full play to the value of historical and cultural resources

**(2) The risk of lack of resilience in the contemporary historic and cultural area**

In the study of conservation and renewal of historic and cultural area, Yuan et al. pointed out that the aging of housing infrastructure and social structure of historic and cultural area are the main problem it faces<sup>[70]</sup>; Based on a study of the vulnerability of the historic and cultural area in Tianjin, Lu et al. suggest that the problem of historic areas is mainly the lack of engineering resilience at the physical level and the lack of social resilience at the immaterial level<sup>[71]</sup>; Zheng et al. suggest that the risk to the historic and cultural area lies in the loss of authenticity and the original social structure of the community for short-term economic benefits<sup>[72]</sup>; Wang<sup>[73]</sup>, Wei<sup>[74]</sup> and Tang<sup>[75]</sup> argue that the lack of firefighting capacity makes historic and cultural area lack of resilience; Li et al. argue that most of China's historic districts are made of brick and wood materials, which are at greater risk in terms of conservation continuity, and that the lack of safety and resilience is a challenge for the future of historic and cultural areas<sup>[76]</sup>; In a study on the conservation and renewal of a district on Gulangyu Island, Hao argued that the residential historical community has shown a lack of infrastructure

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<sup>[70]</sup> Yuan Qifeng, Cai Tianshu, Huang Na. Protection and Renewal of Historic Districts from the Perspective of Resilience: Taking Shantou Small Park Historic District and Foshan Zumiao Donghuali Historic District as Examples[J]. Planner, 2016, 32(10): 116-122

<sup>[71]</sup> Lu Rui, Shi Jin, Lan Xu. Construction of the evaluation index system of "fragility-resilience" in the historical and cultural area of Tianjin[J]. Journal of Tianjin Urban Construction University, 2020, 26(01):20-25+38

<sup>[72]</sup> Zheng Hao, Tang Xiaotian. Research on the Development Strategy of Idle Context Space in the Old City under the Background of "Resilient City"—Taking Pingjiang Historic District as an Example[J]. Architecture and Culture, 2021(02):180-181

<sup>[73]</sup> Wang Jiangbo, Zhi Tianqu, Na Jingwen, et al. Research on the toughness evaluation method of fire engineering in historical and cultural area——Taking Nanjing Lotus Pond as an example[J]. Journal of Safety and Environment:2022(07):1-10

<sup>[74]</sup> Wei Pengli, Wan Jie. Analysis of Influencing Factors of Fire Safety Resilience in Historic District Based on ISM[J]. Industrial Safety and Environmental Protection, 2022, 48(04):51-56

<sup>[75]</sup> Tang Li. Research on fire planning of historical and cultural area from the perspective of resilience [D]. Qingdao University of Technology

<sup>[76]</sup> Li Yunyan, Wang Ziyi, Shi Ling, et al. The practice of disaster prevention in Japan's historical and cultural area from the perspective of resilience and its enlightenment to my country[J]. International Urban Planning, 2022(06):1-22

and a shock on the traditional cultural atmosphere in the process of rapid urban development<sup>[77]</sup>.

From the above, it is clear that for most historic and cultural areas, the key risk they face is not the natural disasters that traditional resilience theories focus on, but the impact of surrounding urbanization processes, their aging infrastructure and social structures are not enough to maintain stability and transform its development, and these areas face the risk of unsustainable development and decay.

## **(2) Spatial characteristic of resilient historic and cultural area**

As mentioned in the previous section, Academia's current urban renewal studies based on resilience perspective mainly focus on ordinary old communities and less on historic and cultural area, among which the following studies are representative. Ma took the public space of historic and cultural area as the research object and used the hierarchical analysis method to construct an evaluation model to obtain three characteristics of public space in historic and cultural area: robustness, accessibility and aesthetics<sup>[78]</sup>; Learning from the progressive urban regeneration practice of Beijing's Baita Temple community, Li et al. suggest that socio-spatial restructuring, cultural revitalization, and reconstruction of residents' interaction networks can promote a more resilient historic area, and the revitalization of community culture is the focus of the resilience enhancement of the historic and cultural area<sup>[79]</sup>; based on the perceived resilience of residents in the Pingjiang Historic District of Suzhou, Shao Jialin also constructs a resilience assessment system for historic and cultural areas,

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<sup>[77]</sup> Hao Haiyan. Research on the Protection and Renewal of Neicuoao Area of Gulangyu Island from the Perspective of Resilience Theory[J]. *Industrial Design*, 2022(05):92-94

<sup>[78]</sup> Ma Yuheng. Resilience Evaluation of Public Space in Pingjiang Historic District [J]. *Chinese and Foreign Architecture*, 2020(08): 42-43

<sup>[79]</sup> Li Zihao, Wan Shanlin, Liu Yuhan. An Analysis of the Renewal Model of Historical and Cultural Districts from the Perspective of Resilience: Taking Baitasi District in Beijing as an Example [C]. *Spatial Governance for High-Quality Development——Thesis of the 2021 China Urban Planning Annual Conference Episode (02 Urban Update)*, 2021: 54-64

proposing to enhance resilience through both social and cultural aspects<sup>[80]</sup>.

In summary, the resilient space of the historic and cultural area focuses on the construction of its cultural characteristics and the reproduction of its cultural vitality, while paying attention to the conventional characteristics such as the compatibility of the system, sufficient reserve capacity, and the robustness of the facilities.

#### **2.2.4 Brief summary**

At present, the application of resilience theory to the historic and cultural area is mainly reflected in three levels, namely, resilient cities, resilient communities, and resilient spaces. Among them, the resilient historic and cultural area emphasizes the robustness of facilities, the efficient flow of spatial elements, the compatibility and the reproduction of cultural vitality within the system. However, it is noteworthy that the existing studies cover a single area, mainly new communities and ordinary old communities, and there is a lack of research on the resilience enhancement strategies of old historic and cultural areas with strong regional and cultural attributes, which is not enough to help them face the risk of unsustainable development in the future.

### **2.3 Characteristics of resilient space in historic and cultural areas**

On the one hand, resilient space is generally considered to be a space that can resist external disturbances and has the ability to absorb and control, reorganize and innovate, and actively adapt to changes<sup>[81]</sup>, in this dissertation, resilient spaces refer to architectural spaces and outdoor open spaces that can directly or indirectly help communities adapt to external disturbances and transform their development, including traditional streets, community gardens, corner squares, water areas, historical sites, etc. On the other hand, resilience theory is complex, so the study of

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<sup>[80]</sup> Shao Jialin. Research on Resilience Assessment and Improvement Strategies of Pingjiang Historic District in Suzhou [J]. Urban Housing, 2021, 28(12): 46-48

<sup>[81]</sup> Tian Li. Research on Renovation Strategies of Old Community Space Based on Resilience Theory[D]. Master Thesis. Beijing University of Civil Engineering and Architecture, 2020

resilience enhancement strategies often relies on more easily understood and practical resilience characteristics<sup>[82]</sup>.

There is a variety of characteristics in resilient spaces, and this dissertation focuses on some of the spatial characteristics that have a strong correlation with the historic and cultural area space. Based on the review of existing research results in the previous section, this dissertation focuses on four aspects of resilient community spaces, namely robustness, connectivity, diversity, and uniqueness, in terms of the stability and solidity of the system's internal facilities, efficient spatial flow, the compatibility of various elements, and the reproduction of cultural vitality.

### **2.3.1 Robustness**

The spatial robustness of historic and cultural areas can be used as a measure of the overall strength of a system, i.e. its ability to resist external risks. This is expressed as the ability of a system to withstand a given level of stress without deterioration or loss of function. When a system is subjected to a perturbative shock, robustness is considered to be the key measure of the system's ability to recover, and it is only necessary to measure the robustness of the system to reflect the degree of resilience of the system. If the system is robust, i.e., if it has a bottom line that can prevent the system from collapsing in response to a perturbation, the system will be less likely to fail and losses will be reduced gradually, and the system can be maintained at its current level or restored to its original level by mobilizing existing resources, giving the system a chance to rejuvenate.

### **2.3.2 Connectivity**

The spatial connectivity of the historic and cultural area is reflected in the interconnection of the spaces that undertake various disaster prevention functions in the community, which are jointly guided to provide the community with disaster

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<sup>[82]</sup> Lu Yuwen, Zhai Guofang, Shi Yijun, et al. The concept of resilience in Dutch spatial planning and its enlightenment [J]. International Urban Planning, 2020, 35(01):102-110

prevention and emergency channels, material security channels, and information feedback channels to ensure the efficiency of the community emergency response. Therefore, the spatial connectivity of historic and cultural area is manifested in two aspects: firstly, streets are interconnected, and all paths in the community are connected smoothly to ensure the efficiency of emergency evacuation. In addition, as the terminal system of the city, the community should be connected with the higher level of the city system, which is reflected in the number of entrances and exits of the community and whether they are connected with the city roads, in order to ensure the safe transfer of community residents and the security of community information and materials. Secondly, open space connectivity, open space with disaster prevention function provides space for interaction and rest for residents in normal times, and emergency place for residents in disaster environment.

### **2.3.3 Diversity**

The spatial diversity of the historic and cultural area refers to the diversity of public spaces in the community, and the combination of multiple functions in the same space to meet the different needs of residents. The related literature concludes that "the more diverse the community public space environment and the more satisfied the residents are, the higher the satisfaction residents will obtain<sup>[83]</sup>". Therefore, the spatial diversity of old communities should also be led by the needs of community residents, providing residents with diverse spatial places that serve different age levels. On the other hand, the spatial diversity also lies in the complex land use pattern within the community, and the diverse types and balanced layout of public service facilities.

### **2.3.4 Uniqueness**

In historical and cultural continuity, a place with uniqueness represents a certain narrative of local life, reflecting the history, culture, economic background, social

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<sup>[83]</sup> Liu Han. Research on the improvement of street space quality in the north west area of the old city of Beijing [D]. Beijing University of Civil Engineering and Architecture, 2020

development background and customs of the community; it can also be a cultural place reshaped in the process of community development. These places are the product of the development of the community with the times, meeting the new cultural needs, interaction needs and activity needs of the residents, and reflecting the spirit of the times and the community.

### 2.3.5 Brief summary

In the study of resilient community construction and planning, Yu et al. categorized the objectives of resilient space enhancement as the enhancement of physical space and social space, where physical space refers to the facilities and material environment of the historic district, and social space refers to the cohesion, identity and healthy socio-economic structure of the residents<sup>[84]</sup>. Combining this classification and according to the role of different characteristics in the resilience system and the mechanism of the characteristics, this dissertation tries to classify robustness and connectivity as the physical space characteristics of the historic and cultural area, in order to enhance its reserve capacity before the shock and emergency response capacity during the shock; classify diversity and uniqueness as the social space characteristics of the historic and cultural area, in order to enhance its ability to organize itself and transform and develop after shocking.

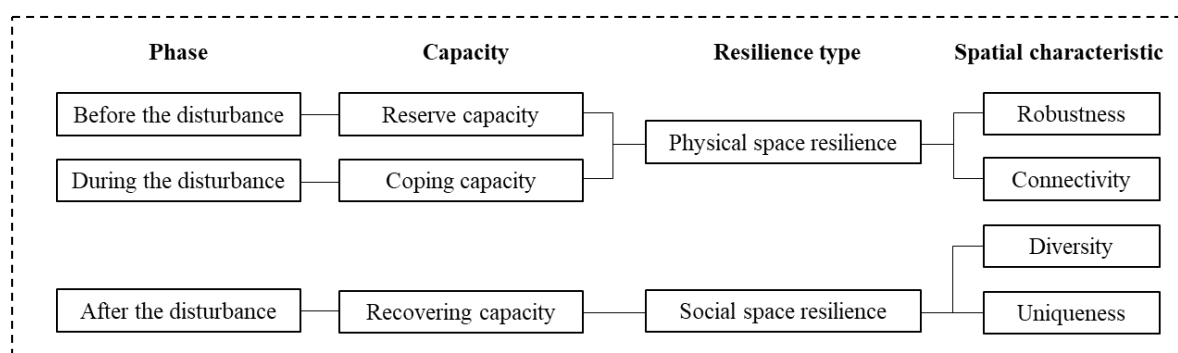


Figure 2-4 Classification of spatial characteristics of resilience (source: made by the author)

<sup>[84]</sup> Yu Yang, Wu Rongrong, Tan Xin, et al. Urban Resilient Community Construction and Planning Response Combining Pandemic and Epidemic[J]. Planners, 2020, 36(06):94-97

## **2.4 Discussions of fundamental research**

### **2.4.1 The extension of the resilience in the new era**

After the transformation of engineering resilience, ecological resilience and social resilience, the concept of "resilience" has been gradually extended from a simple description of physical properties to an important concept of sustainable development, emphasizing the ability of a system to maintain its own stability and transform development before and after external disturbances. The enhancement of a system's resilience is essentially a process of sorting out the various elements of the system, breaking down some of the elements whose functions and structures have become rigid, and introducing new elements with resilient characteristics to support the further revival and development of the historic and cultural area.

### **2.4.2 Disaster faced by historic and cultural areas**

The introduction of the concept of resilience into urban spatial construction was initially based on the consideration of natural disaster prevention and recovery, but from the definition of resilience itself, natural disasters are only one of the larger disturbances, so many scholars have begun to shift from a single perspective of natural disasters to a comprehensive perspective, exploring the ability of communities to adapt and transform their development under economic and social structural changes. For the conservation and utilization of the historic and cultural area, the key risk is not the natural disasters that are the focus of traditional resilience theory, but the aging infrastructure and social structure that are not sufficient to maintain the stability and transformation of the community in the process of urbanization, and therefore the community faces the risk of unsustainable development and decay.

### **2.4.3 Shortcoming of research on resilient historic and cultural area**

On the one hand, the domestic academia has initially established the theoretical framework of resilient community planning, and has achieved certain research results. However, on the other hand, due to the late start of the research, the existing research objects cover a single area, mainly new communities and old communities, and there

is no systematic resilient spatial design strategy constructed to guide the future design practice for the old historic districts with less stock and stronger regional cultural attributes. Therefore, the future spatial enhancement of historic districts should respond positively to the resilience construction.

#### **2.4.4 Characteristics of resilient space**

Resilience theory provides a new dynamic perspective for urban governors to deal with complex and highly uncertain urban systems. When urban planning scholars study the application of resilience theory in urban space, they often express the complex resilience theory into more understandable and practical resilience features.

Based on the literature on resilient cities, resilient communities and resilient historic and cultural area resilient spaces, this dissertation extracts four characteristics of resilient spaces in historic and cultural area, namely, robustness, connectivity, diversity and uniqueness.

### **2.5 Case study**

#### **2.5.1 Shennong old street, Taiwan, China**

##### **(1) Background**

Shennong Old Street is located in the Wujiao Port area of Tainan City, Taiwan Province, with a total length of about 300 meters and a width of about 4 meters, and was an important commercial place for loading and unloading goods and trading in Wujiao Port. The traditional urban fabric and many historical buildings from the Qing and Japanese rule periods have been preserved on the street, making it an important area for exploring Tainan's regional culture and urban space.



Figure 2-4 Case study scope of Shennong Street  
(Source: Tainan Urban Development Bureau)



Figure 2-5 Shennong Old Street after regeneration  
(Source: Internet)

In the late 19th century, due to political factors, the Japanese Provisional Government cut off trade between Taiwan and the mainland, and the commercial status of Shennong Street declined rapidly; after the war in 1945, the commercial center of Tainan City shifted and the industrial form changed, and the street and its surrounding area gradually declined into an old urban area; in 1999, local residents were eager for the future sustainable development of the community, and the Tainan Chikan Culture and History Studio moved into Shennong to carry out a plan namely "neighborhood sustainable development. During the regeneration process, the residents, the government, and the studio reached a consensus on the "regeneration and application of local culture," and according to the adaptive transformation of buildings and public spaces, cultural implantation, and cultivation of a sense of belonging, the goal of resilient enhancement was achieved, which successfully led to the regeneration and sustainable development of the area (Figure 2-4 and Figure 2-5).

## (2) Strategy

### ① Urban fabric weaving

The urban planner extracts the original spatial form and scale, weaves the broken fabric on both sides of the existing old street, and continues the continuity and unity of the street interface. In addition, on the premise of maintaining the traditional spatial structure, the existing buildings of low value in the neighborhood are removed, and

open spaces such as pocket garden and public activity venues are arranged in combination with historical buildings to enhance the sense of community atmosphere.

## ② Adaptability enhancement of architectural space

First, the house was reinforced according to its safety level, for example, the decayed Qing Dynasty wooden beams were reinforced with I-beams to increase the overall strength of the house. In addition, based on the modern functional requirements of the building, the architect removed the original second floor slab and used a new independent frame system to open up the vertical space (Figure 2-6).

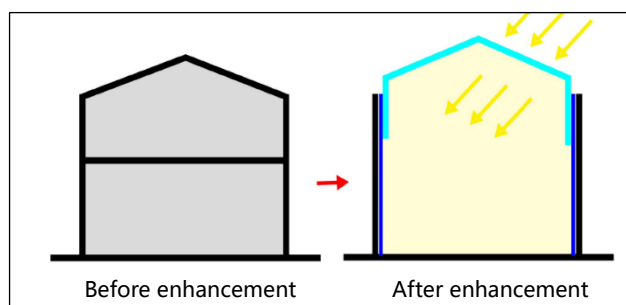


Figure 2-6 Building adaptive strategies  
(Source: reference [\*)]

## 2.5.2 Lane Cove Community, Australia

### (1) Background

In the context of aging physical space and weak sense of neighborhood, in 2014, the community of Lane Cove, Australia, integrated its limited resources to create a resilient public space with adaptable, diverse, and interactive services with the aim of enhancing community vitality and sustainability (Figure 2-7).

### (2) Strategy

#### ① Diversified public space

The diverse public activity areas, including staging areas, performance areas, and recreation areas, make the community park a flexible area that can be used to provide a variety of informal recreational activities for residents. At the same time, the community's ability to cope and adapt to future uncertainty and disturbance is enhanced by the diverse zoning, which also allows for a variety of options for future fire paths, evacuation sites, and redundant facilities.

## ② Sustainable and Interactive Infrastructure

The former sustainable infrastructure includes a series of facilities based on low-impact development concepts, including rain gardens, permeable paving and other environmental friendly facilities. The latter are recreational and service facilities represented by amphitheatres, central fountains, and



Figure 2-7 Aerial view of diverse and sustainable public space (source: Internet)

small marketplaces. These elements interact with each other to enhance the residents' sense of belonging and the community's ability to self-organize, and to recover and adapt quickly when the community is disturbed by the outside world.

## 2.6 Summary of the chapter

The first section of this chapter introduces the origin and evolution of resilience theory, clarifies the conceptual origin, phases of resilience and abilities of resilience theory, and sorts out the evolution of resilience paradigm from engineering resilience, to ecological resilience, and then to social resilience. On this basis, based on the historical and cultural area of interest, resilience is defined as the ability of a system to maintain its stability and transform its development in the face of external disturbances.

Secondly, the second section explores the application of resilience theory in urban space by using a literature review approach, from macro resilient cities, to meso-resilient communities, to micro-resilient spaces in historic and cultural area, and further summarizes the current research shortcomings and relevant resilient spatial characteristics.

Besides, the third section of this chapter refines, interprets and classifies the characteristics of resilient spaces summarized in the previous section, and paves the way for the construction of a resilient space enhancement strategy system for the

historic and cultural area in the following chapters.

After the above basic research, this chapter concludes with a review of the relevant basic research, which illustrates the extension of the concept of resilience in the new era, clarifies the main disasters faced by the historic and cultural area in the present, identifies the shortcomings of the present research, and summarizes the characteristics of the resilience space.

In the next chapter, the study turns to the actual object of study, the Xixing Historic and Cultural Area, and conducts a field study with the aim of obtaining a large amount of first-hand information and summarizing the current problems of the area.

## Chapter 3: Field research of Xixing Historic and Cultural Area

Xixing is not only a historic and cultural area, but also an old residential community to be renovated. On the one hand, it has been selected as an important node in the World Cultural Heritage List of the Grand Canal because it has played an important trade and shipping function in history and carried a rich canal trade culture. However, at the same time, the community is currently facing the problems of aging physical space and social weakness, and is in urgent need of quality improvement work. This chapter aims to further clarify the current vulnerability and causes of the Xixing Historic and Cultural Area through a review of its development history and current situation, and to pave the way for the next chapter to explore the relevance of resilience theory to the area.

### 3.1 Evolutionary process

Hangzhou City, where the Xixing Historic and Cultural Area is located, has been an important city with trading and transporting function since the Sui and Tang Dynasties, and has had a significant impact on the circulation of supply and exploration of the world in ancient China. In ancient times, the fleet of ships departing from Hangzhou



Figure 3-1 Location of Xixing in Hangzhou  
(Source: made by the author, base image comes from Google Map)

could transport supplies to the major cities along the Beijing-Hangzhou Canal to the north and spread culture to Japan and Korea along the East Zhejiang Canal to the east. Xixing Historic and Cultural Area is located in Xixing Street, Binjiang District, Hangzhou City (figure 3-1), and is one of the ten historic and cultural areas specified in *The*

*Protective Planning of Hangzhou Historic and Cultural City.* Due to its location of the westernmost end of the East Zhejiang Canal, Xixing historically served as a transit center town for the Beijing-Hangzhou Canal and the East Zhejiang Canal, and has a unique canal culture. The existing buildings in the core protection area of this area are more than 150, mainly traditional residence of 1 to 3 stories, with good recognizability and low commercialization (figure 3-2).



Figure 3-2 Actual condition of Xixing historic and cultural area  
(Source: aerial view comes from Internet, the rest are self-photographed)

Historically, the geographical location of the Xixing Historic and Cultural Area has given it the function of a water transportation center, which in turn has contributed to the development of the area and shaped its basic form. However, over the past century, the area has undergone a process of decline, which can be divided into four periods: "military town", "trading and transporting center", "isolated island" and "world heritage node".

### **3.1.1 Embryonic period: military town**

According to archaeological excavations, the Xixing area on the south bank of the Qiantang River has been densely populated with rivers and lakes since ancient times. During the Zhou Dynasty, the ancient town of Xixing was born as a military settlement and gathered a stable population, start to function as a town; during the Spring and Autumn Period, the State of Yue formally built a city in Xixing, which was then called Guling, and later built the "Shan Yin waterway" to connect Xixing with Zhe Dong due to military needs and Xixing began to function as a military transportation town; in the Later Liang Dynasty, Guling was renamed Xixing and the old city was expanded; in the Southern Song Dynasty, Xixing became a military pass around the capital, and known as "the Greatest pass in eastern Zhejiang".

### **3.1.2 Prosperous period: trading and transporting center**

During the Ming and Qing dynasties, thanks to its superior geographical location, and relatively stable political environment, Xixing Pass continued to grow in population and goods transit, and its function gradually transitioned from a military town to a commercial transit center, becoming one of the most important commercial towns of the Grand Canal system at that time. The Xixing Canal also plays the role of a fast waterway connecting eastern Zhejiang with the Qiantang River and even the Central China, allowing the grain, tea, herbs, silk, livestock and other kinds of materials from eastern Zhejiang to be transported to cities along the canal in the north. In 1842, the Qing government opened five ports for commerce, and the Xixing, because it is located in the middle of Shanghai and Ningbo port, experienced a boom in commercial transit transport business. According to historical records, during this period, Xixing was a prosperous city with a large number of merchants from the north and south, and goods from the east and west had to transit here, both sides of the canal were covered with "Guotang" buildings, and the large number of "Guotang" logistics buildings also marked the heyday of Xixing.

### 3.1.3 Decline period: isolated urban island

In the 1920s, since the opening of the highway between Xiaoshan and Shaoxing, the shipping business of the canal in eastern Zhejiang began to decrease. At the end of the 1950s, the highway and railway in eastern Zhejiang developed into a system, and the decline of Xixing was further accelerated. In 1996, Hangzhou City established the Binjiang District, and the Xixing Historic and Cultural Area was included in this district. At the beginning of the 21st century, Hangzhou implemented the strategy of cross-river development, and the Binjiang district entered the stage of high-speed urbanization, while the Xixing historic and cultural area was gradually reduced to an isolated urban island for various reasons (Table 3-1).

Table 3-1 Evolutionary process of urban fabric in and around the Xixing from 1960 to the present (Black color represents traditional fabric and red represents modern fabric; source: made by the author)













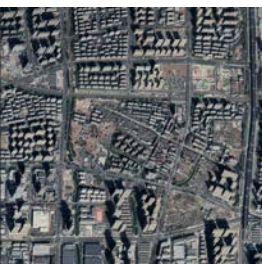

Year	Background	Characteristic	Satellite image	Urban fabric
1960	The early stage of the foundation of PRC, the roads and railways around Xixing developed into a system	The original plain settlement in East China, with a dense water network and villages distributed along the river		
1980	At the early stage of reform and opening up, infrastructure was built around the Xixing Historic and Cultural Area	New waterway was built near Xixing, and a large volume of modern buildings appeared around it.		
2000	At the initial stage of urbanization, Hangzhou implemented the cross-river development strategy	Road network density increases, the original village fabric begins to shrink, and the modern building fabric expands		

Table 3-1 Evolutionary process of urban fabric in and around the Xixing from 1960 to the present  
(Continued from the previous page)

Year	Background	Characteristic	Satellite image	Urban fabric
2005	In the period of high-speed urbanization, massive demolition operations were carried out around Xixing	The original complete fabric of the Xixing was cut by the road network and further surrounded by modern buildings		
2010	A large number of housing and infrastructures were built around Xixing at the stage of high-speed urbanization	The road system around the old town continued to improve and the traditional fabric is further shrunken		
2015	High-speed construction activity near Xixing is completed, and the core area of it is strictly protected.	The traditional fabric has stopped shrinking, but is completely surrounded by modern fabric		
2022	In the high-quality development period, massive demolition stops and construction around Xixing	The fabric of Xixing Historic and Cultural Area is completely declined to an isolated urban island		

### 3.1.4 Opportunity period: world heritage node

In 2005, the Hangzhou Government listed Xixing historic and cultural area as one of the ten historic and cultural areas in Hangzhou because it is an important witness of Hangzhou's canal culture, delineated the protection boundary of the core area, and subsequently included it in the Grand Canal World Cultural Heritage application project (figure 3-3 and 3-4). Since then, this area has gradually completed some basic

protection and regeneration works, including the display and utilization of historical sites, dredging of canal, reinforcement of cultural preservation buildings, thus the overall appearance has been greatly improved compared with the state years ago. In 2014, the Xixing Historic and Cultural Area was successfully included in the World Heritage List, and it is positioned as a center of water transportation and supply distribution in eastern Zhejiang Province, and as a carrier of Hangzhou's regional and water transporting culture.



Figure 3-3 Location of the Zhedong Canal, the Beijing-Hangzhou Grand Canal and the Sui-Tang Grand Canal

(Source: made by the author, base image comes from Internet)



Figure 3-4 Location of the end of the Zhedong Canal where Xixing is located

(Source: made by the author, base image comes from Internet)

The development of Xixing Historic and Cultural Area is relatively clear and has experienced the process of transformation from prosperity to decline. As one of the World Cultural Heritage sites of the Grand Canal, although this area has undergone some environmental improvement works, the whole historic and cultural area has not yet been well-conserved and well-utilized, and its development is still stagnant. And further systematic space enhancement work is needed to help Xixing achieve a sustainable development.

## 3.2 Physical space

This section sorts out the current conditions in the community by field observation, mapping and distributing questionnaire, with the aim of concluding the current problems of the community.

### 3.2.1 Historic remain

#### (1) Material remains

Xixing has a long history and rich material remains, and there are more than twenty historic conservation units, historic buildings and heritage sites from national to municipal level (Table 3-2), mostly dating from the late Qing Dynasty and early Republic of China, which mainly serve residential functions at present. Among the historical remains, the Guotang Construction Group (Figure 3-5), which occupy the main part, are well preserved in terms of quantity, and they have witnessed the rise and decline of this area. The existing Guotang Construction Group consists of two parts, namely the Guotang Buildings and the Xixing Pier, most of which are distributed in the west side of Xixing.



Figure 3-5 Distribution of the Guotang Construction Group (source: made by the author)

Table 3-2 Statistical table of the existing historic remain in Xixing (source, made by the author)

Name	Protective level	Construction time	Current condition	Current use
Guan River	National	Around 500 B.C.	Well-preserved	Residence
Yongxing water gate	National	Around 900 A.D.	Ruined	Protection
Building No.112, Guanhe Road	National	Late 19th Century	Well-preserved	Residence
Building No.105, 106, 107, Guanhe Road	National	Late 19th Century	Well-preserved	Residence
Building No.102, 103, 104, Guanhe Road	National	Late 19th Century	Well-preserved	Residence
Yurenyuan Guotang Building	National	Late 19th Century	Mediocre-preserved	Residence
Xiehengxiang Guotang Building	National	Late 19th Century	Well-preserved	Residence
Wang house, Xixing Street	National	Late 19th Century	Well-preserved	Residence
Shenweiquan Guotang Building	National	Late 19th Century	Well-preserved	Residence
Zifu Ancient Bridge	Municipal	Late 19th Century	Mediocre-preserved	Passing
Wuzi Ancient Bridge	Municipal	Late 19th Century	Mediocre-preserved	Passing
Yu house, Xixing Street	Municipal	Late 19th Century	Well-preserved	Residence
Sun house, Xixing Street	Municipal	Late 19th Century	Well-preserved	Residence
Yang house, Xixing Street	Municipal	Late 19th Century	Well-preserved	Residence
Sheng house, Xixing Street	Municipal	Late 19th Century	Well-preserved	Residence
Building No.175, 183, Xixing Street	Municipal	Early 20th Century	Well-preserved	Residence
Simei house, Xixing Street	Municipal	Early 20th Century	Mediocre-preserved	Residence
Building No.403, 405, 407, Xixing Street	Municipal	Late 19th Century	Mediocre-preserved	Residence
Building No.409, Xixing Street	Municipal	Early 20th Century	Well-preserved	Residence
Tieling Pass	District	Around 900 A.D.	Ruined	Protection
Xixing Post	District	Late 19th Century	Ruined	Protection

## ① Guotang Building

Historically, the East Zhejiang Canal could not be connected to the Qiantang River due to the hydrological terrain and reached its end at Xixing Historic and Cultural Area, so supplies from the East Zhejiang region needed to be unloaded in the Xixing and then transferred overland to the Qiantang River and then northward again (Figure 3-6). Based on this, the Guotang Buildings, which provided logistic services such as porters and vehicles, was created.

Table 3-3 Statistical table of the existing Guotang Buildings (source: reference [67])

Name	Structure	Plan	Notes
Building No.112, Guanhe Road	wood and brick	Two entries and three bays	A residential building with dwellings in the front and store in the back, the exterior wall is heavily damaged, and the courtyard is well preserved, with slate paving.
Building No.105, 106, 107, Guanhe Road	wood	Two entries and three bays	A residential building with dwellings in the front and store in the back, and with small blue tile roofs and screen gables on both sides. There is only a small lane between the store and dwelling
Building No.102, 103, 104, Guanhe Road	wood and brick	Three entries and three bays	A residential building with dwellings in the front and store in the back, the partition door adopts openwork lattice heart, and is carved with exquisite historical story reliefs
Yuren Yuan Guotang Building	wood and brick	Two entries and three bays	A residential building with dwellings in the front and store in the back, the facade along Guanhe Road is in Chinese and Western styles, and all three windows have Western-style window covers
Xiehengxiang Guotang Building	wood	Three entries and three bays	A residential building with dwellings in the front and store in the back, the largest cross-pond line in Xixing.
Wang house, Xixing Street	wood	Two entries and three bays	A residential building with dwellings in the front and store in the back, The main entrance is a Chinese-style Shikumen, the patio is paved with bluestone slabs, and there is a river port in the backyard
Shenwei quan Guotang Building	wood and brick	Two entries and three bays	A residential building with dwellings in the front and store in the back, The river port is well preserved. Its river-facing feature is the epitome of modern Hebu commercial buildings

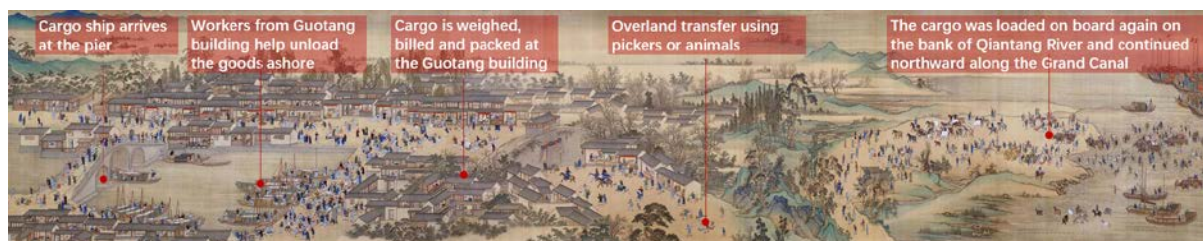


Figure 3-6 Steps of cargo transfer to Qiantang River  
(Source: made by the author, base image comes from the Palace Museum)

The first Guotang Building in Xixing appeared in the Wanli period of the Ming Dynasty, and by the end of the Qing Dynasty, the number of Guotang Buildings in Xixing was as many as 73, each providing logistics services for specific goods only, such as grain, tea, tobacco, herbs, and so on. The existing Guotang Buildings were mainly located on both sides of the Xixing Canal, mainly serving residential functions, with small facades, and with wooden traditional dwellings in the front and store in the back (Table 3-3).

## ② Xixing pier

Xixing Pier is located on the west side of the historic and cultural area and is the end of the East Zhejiang Canal. The pier mainly consists of the water surface for stopping boats, loading and unloading steps and Yongxing Water Gate, and the current situation is relatively well preserved (Figure 3-7 to 3-10). Among them, the Yongxing Water Gate is a water links the East Zhejiang Canal and Qiantang River, originally a weir dam, changed to a water gate in the 15th year of Wanli, Ming Dynasty, mainly for regulating the water level and improving water quality, and then lost its function as a water gate due to the diversion of Qiantang River. The Yongxing Water Gate is about 3 meters long and 2 meters wide, and the stone structure is well preserved.

The ancient canal that ends at the Xixing Pier is called the Guan River, which is about 960 meters long in the Xixing section and is an important channel connecting the eastern part of Zhejiang Province with the Beijing-Hangzhou Grand Canal. Because it ends at Xixing, it is also called Xixing Canal and Cao Canal in ancient times. On the south side of the Guanhe River is the Xixing Old Street, which used to be the ancient track road from Shaoxing to Xixing, now it is the most important traffic passage in the district.



Figure 3-7 Composition of Xixing Pier  
(Source: made by the author, base image comes from Internet)



Figure 3-8 Aerial view of Xixing Pier  
(Source: reference [\*)]

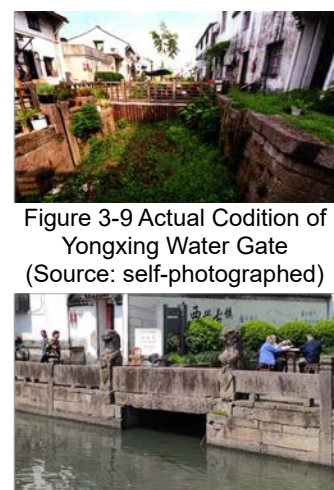


Figure 3-9 Actual Condition of Yongxing Water Gate  
(Source: self-photographed)



Figure 3-10 The end of the Xixing pier  
(Source: self-photographed)

## (2) Intangible heritage

According to *Annals of Xiaoshan County*, the history of Xixing lanterns began in the Southern Song Dynasty and are a unique traditional handicraft, which is complex and demanding, and cannot be copied elsewhere (table3-4). In 2005, Xixing lantern was listed as a protected project of traditional handicrafts in Hangzhou and was included in the list of intangible cultural heritage of Zhejiang Province. The lighting function of Xixing lanterns once played an important role in the shipping of the East Zhejiang Canal. Cargo ships and merchants entering Xixing at night need to rely on lanterns for lighting, so Xixing's shipping industry and lantern industry promote each other. In the old days, the largest number of stores in Xixing were lantern stores, except for Guotang Buildings.

Table 3-4 Statistical table of intangible heritage in Xixing  
(Source: made by the author, photos from the Internet)

	Lantern	Blessings	Weaving	Embroidery
Protective level	Provincial	Municipal	Municipal	District-level
Category	Handicraft	Folklore	Handicraft	Handicraft
Real photo				

Lantern making was once a craft and a family side business for women in Xixing, but at present, there are only 50 seniors who can make lanterns in Xixing, so this traditional skill is facing the risk of being lost.

### **3.2.2 Traffic system**

In terms of urban vehicular traffic, the accessibility of Xixing Historic and Cultural Area is acceptable, and the whole community is basically surrounded by municipal roads (Figure 3-11). To the north of the area is Gutang Road, a two-lane municipal road with a current red line width of 12 meters; similarly; to the west is Tielingguan Road, with a 7 meters red line width, and the government plans to expand it in the future to connect with Gutang Road; near the south side of Xixing is Chunbo Road, a two lane road with a 14 meters current red line width; Xixing Road and Guling Road pass through the community, both of which are road with a red line of 14 meters and 34 meters, respectively.

For public transportation, the Xixing Historic and Cultural Area is also well located. The metro is an important way for local residents to travel and tourists to come and go. Line 1 Hangzhou metro passes through Jiangling Road and Binan Road, and there are two subway stations on Binan Road, Xixing Station and Binkang Road Station, which are both about 300 meters away from the area, so the Binan Road Street on the south side will be the main flow of tourists to the area in the future. However, it is also worth noting that the pedestrian environment between the community and the metro station is poor at the moment, mainly unused urban land, which needs to be further connected in the future.

For pedestrian traffic, the external pedestrian traffic in the Xixing Historic and Cultural Area is mainly the sidewalks attached to the city roads, while the internal pedestrian traffic system is the traditional street space, waterfront walkway and corner square of Xixing, but the pedestrian experience is poor due to the unordered construction and random piling of debris by residents.

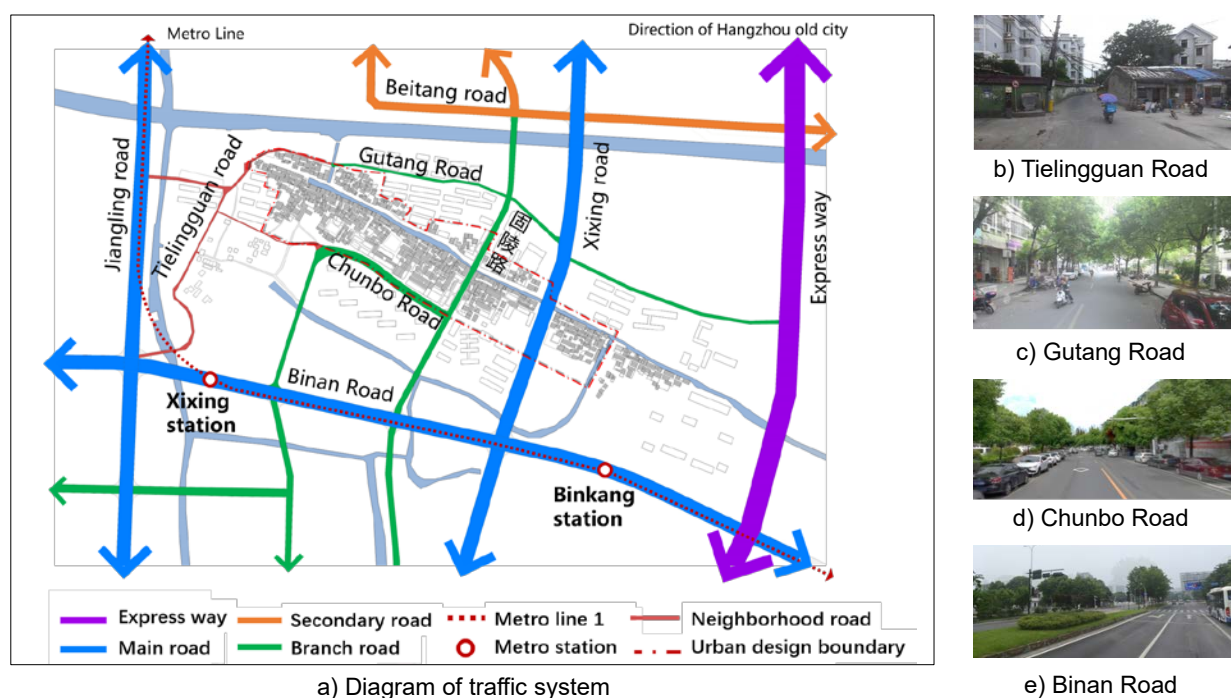


Figure 3-11 Current situation of traffic system around Xixing  
(Source: made by the author, photos are self-photographed)

### 3.2.3 Public space

#### (1) Pier construction

The first type of public space is the the Pier construction (figure 3-12), mainly located on the west side of the ancient town (figure 3-13), consisting of the cargo unloading stairs, the small river port, the Yongxing Water Gate, the walkway along the river and the cargo distribution square.

The cargo unloading stairs are places where cargoes were loaded and unloaded after berthing at the old Xixing Quay, but in its present state it has largely lost its shipping function and is an open space with no fixed function. The other side of the stairs is adjacent to the Gutang Buildings, so that goods can be quickly transferred; the small river port is built against the shore, and there are a large number of them along the canal, in addition to the function of mooring small boats, it is also a place for residents to get water, wash and communicate; the Yongxing Water Gate is a sluice gate linking the East Zhejiang Canal and the Qiantang River and its function was lost when the Qiantang River was diverted. The Yongxing Water Gate is approximately 3 metres long and 2 metres wide, and the structure of it is well-preserved; the walkway along the river

is a pavement of 5-7 metres in width, made of stone slabs, on the north side of the Xixing Canal. It is also an open space with no fixed function, often used by residents for parking and drying clothes.



Figure 3-12 Composition of Xixing Pier  
(Source: made by the author)



Figure 3-13 Distribution of public spaces of Xixing Pier  
(Source: made by the author)

## (2) Traditional streets

The traditional streets of Xixing Historic and Cultural Area is a fishbone shape (Figure 3-14), and the street systems can be divided into main street and secondary alleys. Parallel to the canal, the main street, also namely Xixing Street is the main skeleton and the most important commercial and transportation routes in this area, with a width of about 3 to 4 meters and mainly carrying pedestrian traffic and a small number of battery motorbikes; secondary alleys are perpendicular to the main street, about 2 meters wide, with a characteristic of "high walls and narrow alleys". The streets are connected to the surrounding urban roads and mainly serve the residents to enter their homes and a small amount of pedestrian traffic. Overall, the current fishbone street system pattern of the community is clear, but the connectivity is relatively poor, which is reflected in the serious phenomenon of piling debris on the streets. Besides, there are many broken roads, leading to traffic obstruction.



Figure 3-14 Traditional street system (source: made by the author, photos are self-photographed)

### (3) Corner square and community garden

Corner squares and community gardens are widely distributed in the community (figure 3-15 and 3-16), with the former being the most numerous public space in the community, varying in size from 30-150 square meters and widely distributed, mainly used for greening, parking, drying clothes, growing vegetables, etc. There are two community gardens in Xixing, with similar sizes and an average area of about 500 square meters. Garden 1 is located in the center of the old town, near Xixing Street and the canal, with convenient transportation and a strong cultural atmosphere, and contains a historic pavilion, which is highly used by residents. Garden 2 is close to the city road, and only greenery is arranged, lacking resting facilities for residents to stay, so the usage rate is low.



Figure 3-15 Distribution of corner squares and community gardens  
(Source: made by the author)



Figure 3-16 Current status of corner squares and community gardens  
(Source: self-photographed)

### 3.2.4 Architectural condition

#### (1) Current land use

The function of Xixing Historic and Cultural Area is mainly residential, there is no separate commercial retail building and the business format is relatively weak. In addition, the building density is as high as 40.5%, and the comfort is poor.

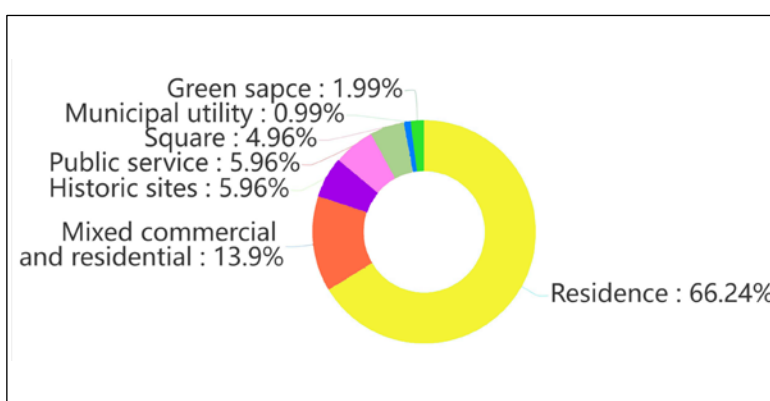


Figure 3-17 Statistical graph of current land use  
(Source: made by the author)

Among them, the residential building covers an area of about 95, 140 square meters, covering 66.24% of all the current buildings, mostly 1 to 3-story traditional dwellings, which are distributed in various parts of the community; the commercial and residential function building covers the second largest area, accounting for 14%. However, the commercial format in Xixing is relatively low-end, and there is no trace of the development of cultural industries. One type of the commercial formats are small shops such as barber shops and canteens operating in traditional residences, and the other type is a multi-storey residential building built in the 1990s along Chunbo Road and Guling Road; heritage buildings accounted for 6%, scattered throughout the community; administrative office buildings also accounted for 6%, mainly distributed in the periphery of the community, such as the Binjiang District Administrative Law Enforcement Brigade, Xiling Community Council, Binjiang District Market Supervision Bureau, etc., most of them are modern buildings; squares accounted for 5%, only two similarly sized community gardens. The rest of the building functions also include utility, green space, etc., which accounts for a relatively small percentage (figure 3-17 to 19).

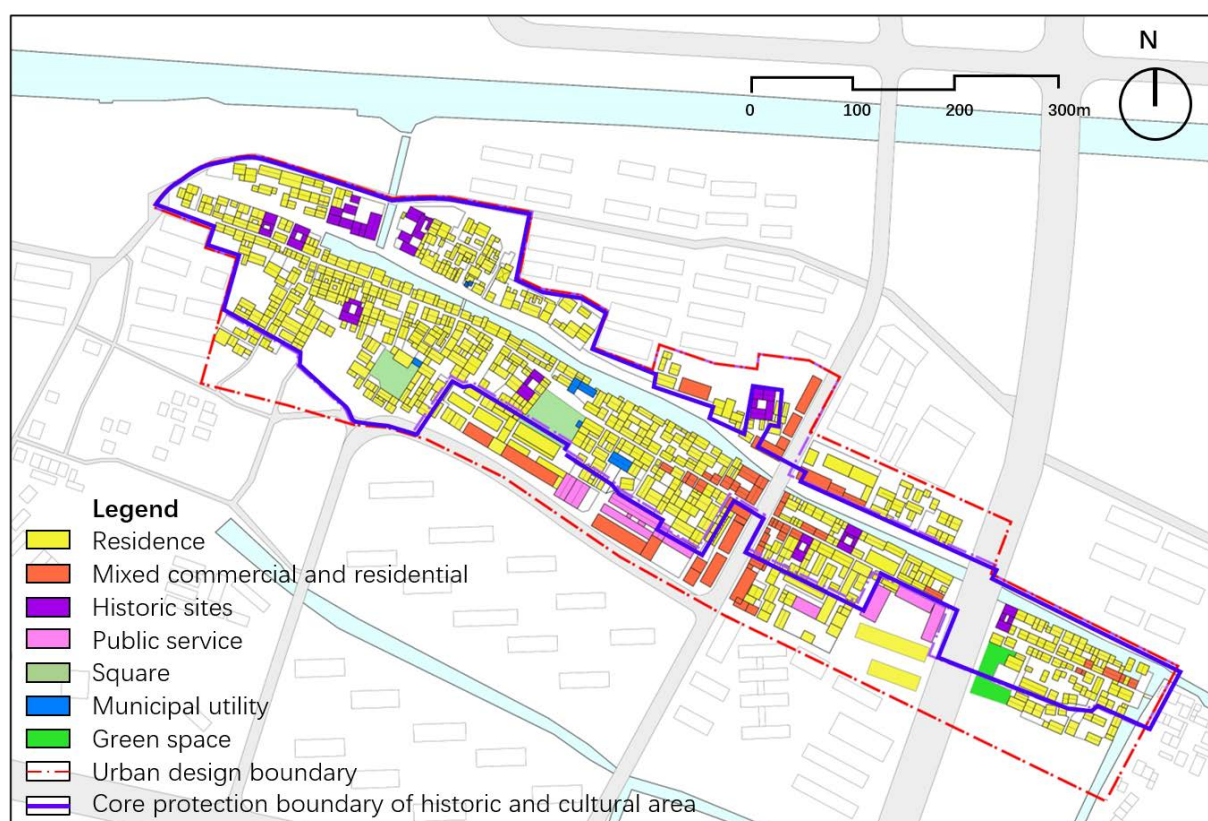


Figure 3-18 Map of the current land use in Xixing (source: made by the author)



Figure 3-19 Typical examples of different functional buildings (source: self-photographed)

## (2) Building age

The buildings within the urban design boundary are generally built long ago and can be divided into four categories according to their age. The first category is the buildings built in the late Qing Dynasty, covering 6% of all the current buildings, most of which are protected Guotang Buildings, distributed on both sides of the canal, well preserved and still playing a residential function; the buildings constructed in the Republic of China period (1911-1949) account for 29%, mostly distributed along the canal and both

sides of Xixing Street, most of which maintain the traditional residential architectural appearance, but the overall quality is poor and needs to be restored; the buildings built between 1949 and 1978 accounted for the highest percentage of 43%, retaining a certain amount of traditional residential architecture and style, but most of the construction quality still relatively poor; 22% of the buildings built after 1978, with different styles, the main part of which are multi-story residential buildings built in the 1990s (figure 3-20 and 3-21).

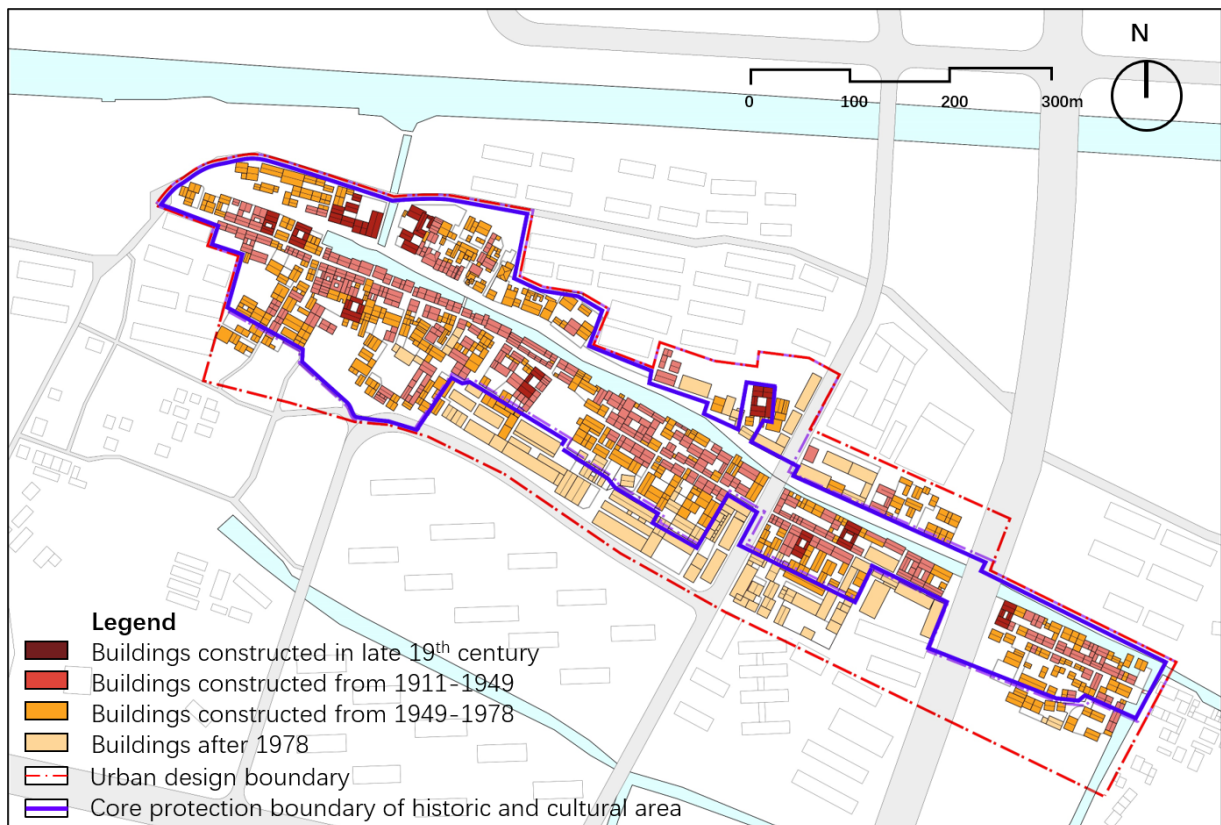


Figure 3-20 Map of the building age in Xixing (source: made by the

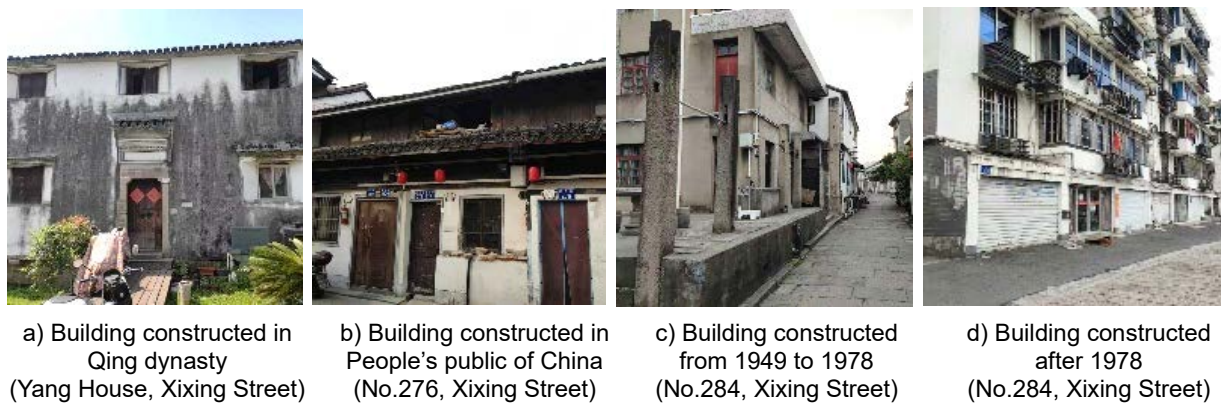


Figure 3-21 Examples of typical buildings constructed in different age (Source: self-photographed)

### (3) Traditional architectural appearance

The overall architectural appearance within the urban design of the community is good, but in recent years, due to the serious phenomenon of private construction, the quality of the whole community style is showing a declining trend, and the style can be divided into four categories according to the appearance of buildings (figure 3-22 and 3-23).

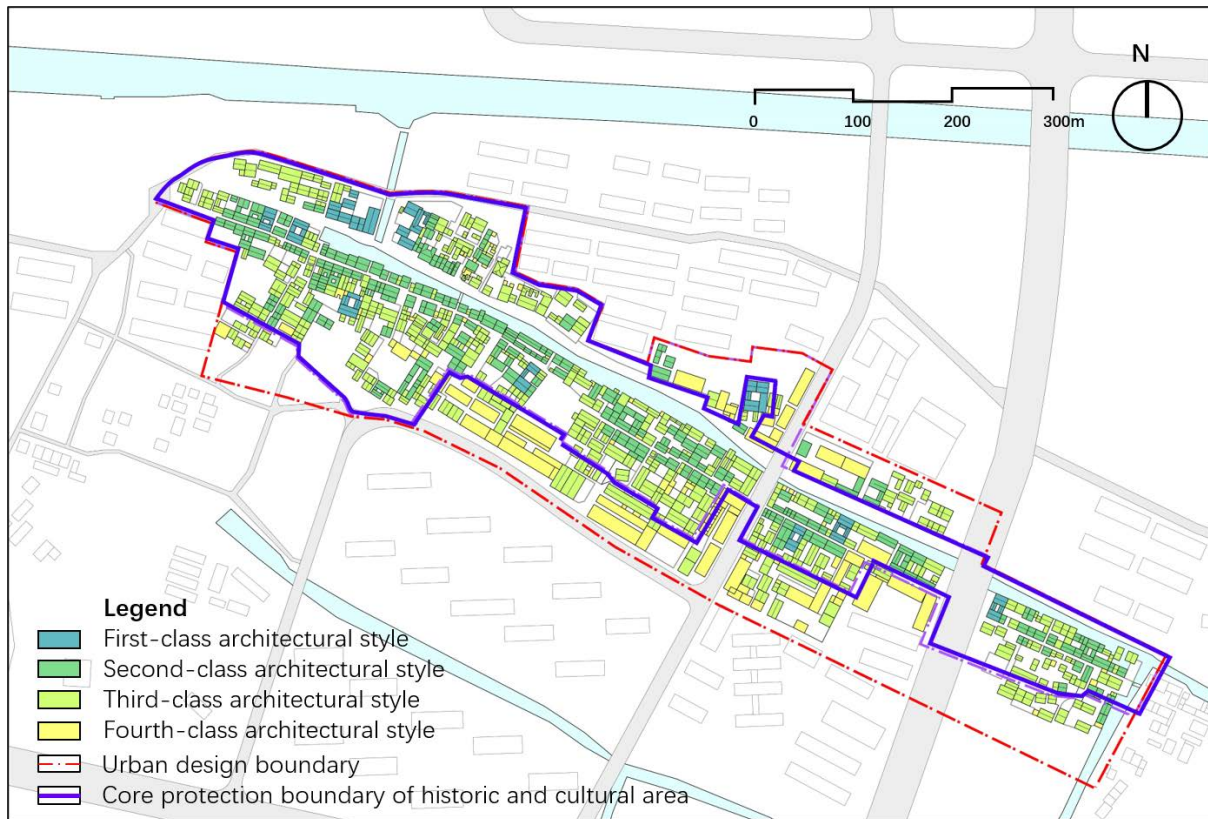


Figure 3-22 Map of the architectural style in Xixing (source: made by the author)



Figure 3-23 Examples of typical buildings in different architectural appearance (Source: self-photographed)

The first category is the well-preserved heritage buildings and some high-value traditional buildings, which occupy 6% of all the current buildings; the second category is the traditional buildings whose original style is basically preserved, and whose doors,

windows, walls and appearance are damaged to a certain extent, as well as other buildings that do not conflict with the traditional style, all of them accounts for 28% of all the buildings; the third category, accounting for 43% of all the buildings, refers to the original building style that is basically preserved, but doors, windows, walls and the appearance suffer a large degree of damage, or doors and windows have been replaced and the characteristics of traditional buildings are lost, as well as new buildings with poor appearance; the fourth category, accounting for 23% of all the buildings, refer to modern buildings that have greater negative impact on the traditional appearance of buildings, as well as the traditional building whose appearance is seriously damaged.

#### (4) Building height

The trend of building height within the urban design area of Xixing is low inside and high outside. The buildings in the inner part of the community near the canal and Xixing Street are mainly for residential functions, so most of the buildings are traditional residential buildings or modern residence of one to three stories in height, which



Figure 3-24 Map of the building height in Xixing (source: made by the author)



Figure 3-25 Examples of typical buildings with different number of floors (source: self-photographed)

occupy 84% of all the current buildings. The remaining buildings with four or more storeys, account for 16% of the total area, are multi-story residential buildings built at the end of the last century, mainly distributed along Guling Road and Chunbo Road (figure 3-24 and 3-25).

### (5) Building quality

Most of the ordinary residential buildings within the urban design boundary are in need of restoration due to poor construction quality, unsatisfactory preservation. In Xixing, the building quality is divided into three classes: good, average and poor.

Among them, buildings with good building quality refer to those with well-preserved appearance, well maintained structure, and main roofs, walls, load-bearing frames and columns that can be used for a long time without repairing, these buildings accounts for 25% of all building area in Xixing; buildings with average architectural quality refer to buildings with certain damage in appearance, and the structure, roofs, walls and columns that need certain repairs before they can continue to be used, these buildings accounts for 63% of all building area. The building with poor architectural quality refers to the building with poor structural maintenance and serious damage, or the building that were built without order, accounting for 13% of all building area (figure 3-26 and 3-27).



Figure 3-26 Map of the building quality in Xixing (source: made by the author)

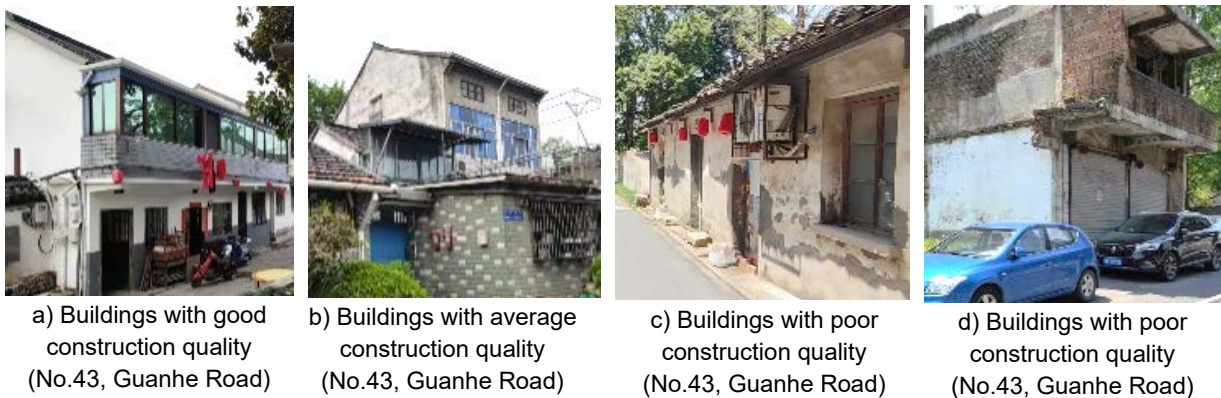


Figure 3-27 Examples of typical buildings with different building quality (source: self-photographed)

### 3.3 Social space

#### 3.3.1 Population

##### (1) Age structure

Xixing Historic and Cultural Area is a residential-oriented community. By the end of 2020, the total resident population within the urban design boundary of Xixing Historic and Cultural Area is 3, 859 people, with a total number of about 1, 107 households and the population density are 275 people/hectare.

In terms of the age structure of the resident population, the Xixing Historic and Cultural Area shows a more serious aging phenomenon and a lack of vitality for subsequent development.

Based on the information

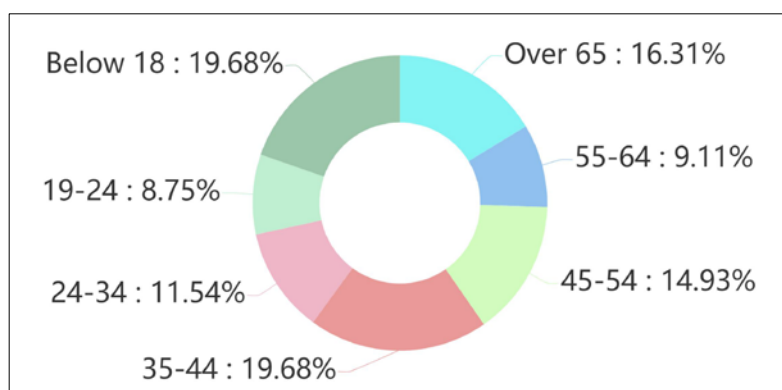


Figure 3-28 Age Structure of the resident population  
(Source: graphic made by the author, data provided by the residential committee)

from local residential committee (figure 3-28), 16.3% of the local population is over 65 years old and 19.68% is under 18 years old. According to the *Population Aging and its Social economy Consequences* promulgated by the United Nations in 1956, when the number of people over 65 years old in a country or region accounts for more than 7% of the total number, it means that the country or region has entered an aging society. Therefore, the population of Xixing Historic and Cultural Area has already shown an aging trend. In addition, the aging tendency is increasing, which also reflects the population loss problem in the historic and cultural area of Xixing.

## (2) Educational level

In terms of education level (figure 3-29), more than half of the residents have junior high school education or below, and the overall education level of the resident population is not

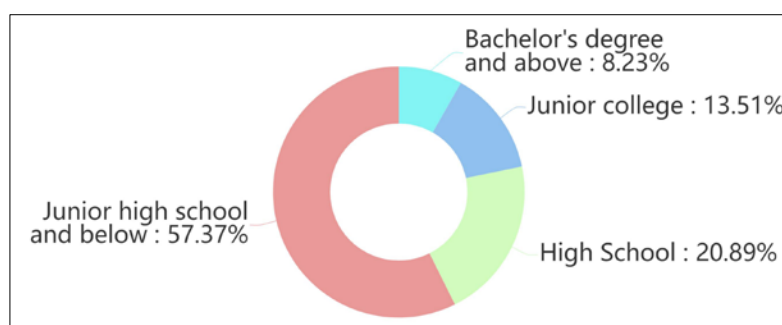


Figure 3-29 Educational level of the resident population  
(Source: graphic made by the author, data provided by the residential committee)

high, which is not conducive to the sustainable development of the community in the future. The reasons for this are the loss of local young adults to foreign countries in search of education and job opportunities, and the influx of migrant workers, who are mainly engaged in labor-intensive jobs, into the community as permanent residents.

### (3) Source of residents

In terms of the source of population, the Xixing historic and cultural area has a high percentage of foreigners. According to the statistics of local residential committee, the local household population of the community is 2003, and the foreign population is 1856, accounting for as much as 48.1%. There are three reasons for the high percentage of foreign population, one is social reasons, a large number of foreign laborers entered Hangzhou Binjiang District in the past to seek job opportunities; the second is geographical location, Xixing Historic and Cultural Area is relatively convenient for public transportation; the third is the ability to pay, the lower rent in Xixing matches the lower economic payment level of foreign population. In this trend, the Xixing Historic and Cultural Area carries a gradually increasing foreign population, a significant increase in population density, and a low level of education of the resident population Figure.

### (4) Occupation structure

In terms of the types of occupations held by the resident population of Xixing (figure 3-30), 19.79% of them are retired seniors, and nearly a quarter of the population

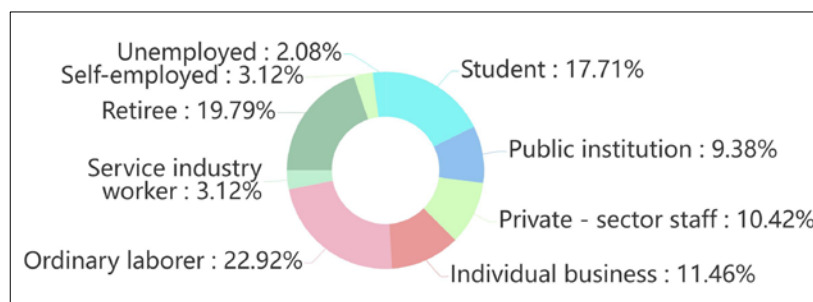


Figure 3-30 The types of occupations of resident population  
(Source: graphic made by the author, data provided by the residential committee)

are migrant workers engaged in manual labor at construction sites around the district; on the other hand, only 3.12% of the resident population in Xixing are engaged in service-oriented industries, reflecting from the side that the development of the local cultural and retail sector is not in line with the positioning of the historic and cultural area.

### 3.3.2 Industry

With the Xixing historic and cultural area changing from prosperity to decline for more than a century, its industries have changed dramatically from shipping and logistics services to rentals. The aging and depopulation problems in the Xixing and the influx

of foreigners have given rise to the rental industry, however, due to the poor living conditions, the average rent in the area is about 37% lower than that of other communities in the same area. In addition to rental industry, a small number of local senior citizens in the Xixing Historic and Cultural Area are also engaged in traditional handicraft production, but it is not a large-scale industry.

### 3.3.3 Building ownership

In Xixing, there are two categories of building ownership, which is privately owned property and publicly owned property (figure 3-31). Most of the private buildings in Xixing are inherited by the residents' ancestors or bought in the later period, covering 89% of all the current buildings, which are mainly used for self-occupation and rental; the publicly owned buildings are mainly modern buildings built at the end of the last century and the beginning of this century, accounting for 11% of the total building area, mostly used by administrative institutions, such as the Binjiang District Administrative Law Enforcement Brigade, Xiling Community Committee, Binjiang District Market Supervision Bureau, etc.

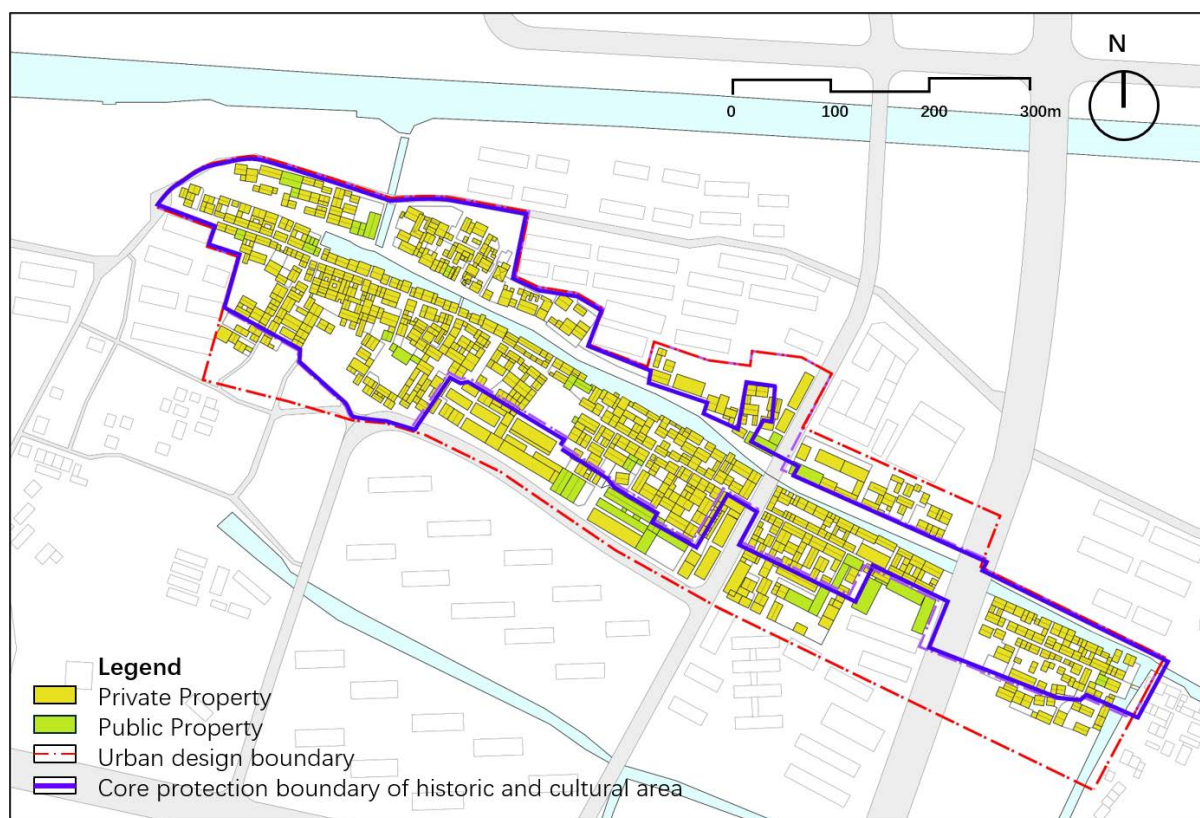


Figure 3-31 Map of the building ownership (source: made by the author)

### 3.4 Interview of residents

In this section, the interviewees are divided into three categories: natives, tourists and natives, each with 10 people. The purpose is to further obtain the physical space and social space of Xixing Historic and Cultural Area on the basis of on-site observation and statistics.

#### 3.4.1 Natives

The proportion of natives in Xixing Historic and Cultural Area is about 51.9% of the resident population. According to the interviewed residents, the main problems in physical space are that the residential conditions are not attractive enough for young people, and the living space is narrow, gradually aging, and needs regular maintenance; there is a lack of public service facilities such as education, medical care, and interaction; the streets are congested, and there are few green areas green spaces. In terms of social space, there is a lack of local jobs and a serious loss of population; the fast-moving foreign tenants have to some extent severed local community ties.

Table 3-5 Contents of interviews with natives (source: made by the author)

Interview Scope	Factors involved	Positive feeling	Negative feeling	High Frequency Description
Physical Space	Residential condition	4	6	The old houses are in line with the habits of the elderly; the living space is limited; they need a certain degree of maintenance;
	Public facilities	2	8	Children go to school and the elderly go to the doctor at a long distance; Community interaction is mostly on the roadside;
	Transporting facility	2	8	Congested streets and alleys; difficult to drive; small parking lots should be set up
	Greening	6	4	Improved compared to the past; more newly built concrete, less green space; No local job opportunities; Young people go out to earn money;
Social Space	Income level	2	8	No local job opportunities; Young people go out to earn money;
	Community network	4	6	Only communicate with locals; many unfamiliar faces, fast turnover of tenants;
	Cultural atmosphere	3	7	Communitys are old but still feel like old times; Traditional crafts are not profitable and no one wants to inherit them;

### 3.4.2 Tenants

Foreign tenants account for about 48.1% of the resident population in Xixing. According to their own life experience, the physical space problems reflected by this group are aging houses and possible fire hazards; congestion in streets and lanes, poor accessibility; practicality of open space is weak and lack of facilities to stay (table 3-6).

Table 3-6 Contents of interviews with tenants (source: made by the author)

Interview Scope	Factors involved	Positive feeling	Negative feeling	High Frequency Description
Physical Space	Residential condition	5	5	The rent level is ideal; the living space is cramped; there may be fire hazards;
	Public facilities	5	5	The necessities of life can basically meet the demand; the retail industry is fragmented;
	Transporting facility	3	7	Street congestion; difficult driving;
	Greening	6	4	Few green spaces; open space lacks facilities to stay;
Social Space	Income level	5	5	There are no job opportunities in the block; the income of the work opportunities outside the block is acceptable;
	Community network	3	7	Only communicate with co-workers; no contact with locals;
	Cultural atmosphere	5	5	Do not understand the local culture and therefore cannot feel it;

### 3.4.3 Tourists

In addition to the residents, foreign tourists are also an important perception group in the Xixing Historic and Cultural Area. According to tourists' feedback, the shortage of physical space lies in the imperfection of tourism facilities, such as homestays, businesses, and cultural display spaces; the shortage of social space is reflected in the weak cultural feelings, blurred historical space nodes and lack of interaction (table 3-7).

Table 3-7 Contents of interviews with tourists (source: made by the author)

Interview Scope	Factors involved	Positive feeling	Negative feeling	High Frequency Description
Physical Space	Residential condition	3	7	There are few high-quality homestays, and they are not happy to stay overnight; there may be fire hazards;
	Public facilities	4	6	lack of commercial facilities; lack of cultural facilities;
	Transporting facility	2	8	People and vehicles are mixed, and tours are affected; public transportation lacks guidance; tour lines should be effectively organized
	Greening	5	5	Lack of facilities to stay in open spaces;
Social Space	Income level	-	-	-
	Community network	6	4	Locals are more welcoming to tourists and willing to communicate;
	Cultural atmosphere	4	6	The historical buildings are inaccessible; the cultural features are not outstanding, and there is no plan to come again;

### 3.5 Vulnerability summary

Combined with the above description, the current problems of Xixing Historic and Cultural Area can be divided into two aspects: physical space and social space. Among them, the physical space of Xixing Historic and Cultural Area is defined as the material environment such as buildings, public space, traffic space and landscape resources, which can provide the necessary material basis for the daily life and production activities of the residents. The social space of the historic and cultural area refers to the age structure, household composition and economic income of the residents.

#### 3.5.1 Traditional physical space is not adapted to modern life

The decline of physical space makes the Xixing Historic and Cultural Area unable to accommodate modern lifestyles, which in turn brings about the problems of aging infrastructure and insufficient spatial connectivity (figure 3-32 and 3-33). Such spatial fragility weakens the ability of the community to resist the negative impact of surrounding urbanization.

### **(1) Decline of architectural function**

On the one hand, the decline of architectural functions in the community starts with the poor architectural quality of traditional buildings. Due to natural and man-made factors, some of the old houses are in disrepair, their structures and facilities have exceeded their service life and are on the verge of destruction, and the residents are more eager to build new houses than to repair the old houses, so the old houses are abandoned, restricted or misused. On the other hand, the aging of the building space is also reflected in the weakness of the fire protection function of the community, which is a major fire hazard and needs to be equipped with fire protection facilities.

### **(2) Congestion of open space**

Traffic space congestion is reflected in three aspects, namely, street congestion, lack of open space interconnection, and poor traffic connection between the neighborhood and the surrounding city. First of all, the problems of private construction, uncontrolled parking and miscellaneous piles in the neighborhood have led to the creation of cut-offs and intersections, which result in the congestion of streets, poor traffic flow and fire safety hazards. In addition, the existing open space is also not connected enough, as the main backbone of the canal open space is surrounded by high-density residential buildings, and there is no connection with the internal corner squares and community gardens of the neighborhood, resulting in the waste of public space resources. At the same time, there are few streets directly connected to external roads, which leads to the main traffic pressure falling on the main street Xixing Street, further aggravating the congestion of the street space.

## **3.5.2 Current social economy is not adapted to future development**

The social space aspects of Xixing's historic and cultural area are characterized by population age unbalance, historical and cultural fragmentation, and weak business format. As a result, the community is unable to adapt to the negative impact of urbanization around it.

### **(1) Unbalanced population structure**

The imbalance of population age structure and household composition of the residents in Xixing's historic and cultural area is a major problem, making the community less dynamic for future development. On the one hand, the poor infrastructure and low employment and education opportunities in the area have led to a serious out-migration of young local residents, resulting in a more serious aging phenomenon, with 16.3% of the local population over 65 years old, a demographic study showing that the area has entered a deep aging phase. On the other hand, the low rent level in the area attracts a large number of foreign workers, and the high density of foreign population contradicts with the low level of sanitation and municipal facilities, further deteriorating the living environment of the community.

### **(2) Lacking of public services**

The lack of public services in Xixing Historic and Cultural Area lies in the lack of open space and single land use. First of all, the lack of open space is reflected in the blurred space of the historical nodes represented by Xixing Pier, the fragmentation of the street corner squares and the frequent occupation of them, which leaves residents with no place for neighborhood interaction and public activities. In addition, the historical and cultural area is land-strapped and lacks corresponding public service facilities and commercial facilities, and the single residential land use cannot meet the public service and consumption needs of urbanization. At the same time, there are almost no tourism and cultural businesses in the area, and only small-scale retail and rental businesses can provide a meager economic income for the residents.

### **(3) Broken history and culture**

As one of the ten historic and cultural areas in Hangzhou, the current status of Xixing's historical and cultural fragmentation is not in line with its positioning. Among them, in terms of architectural style, Xixing has been eroded by multi-story modern buildings and private shacks in recent years, and the architectural appearance is gradually degraded, the urban fabric is broken, and the capital for future sustainable

development is being lost; in terms of tangible heritage, the heritage buildings are protected but not displayed and utilized, the atmosphere of the historic and cultural area needs to be created, and the foreign population lacks a sense of local identity. In terms of intangible heritage, the traditional skills represented by handicrafts is fading away.

### **3.4 Summary of the chapter**

In the first section of this chapter, the geographic location and development of the Xixing Historic and Cultural Area are firstly reviewed, and it is concluded that the advantageous geographical location has given the area the function of a trading and water transporting center, and this function has further promoted the development of the area and led the formation of its basic urban form. In addition, although the community has undergone some environmental improvement work, the current state of development is still relatively ordinary, and the entire historic and cultural area has not yet been protected and developed, and further spatial improvement is needed.

In the second section, by sorting out a series of current conditions such as historic sites, social structure, transportation system, public space and buildings, two core problems of the Xixing Historic and Cultural Area are identified: first, the traditional physical space is not adapted to modern life, which is reflected in poor architectural quality and traffic congestion in Xixing; the second is that the current social space is not suitable for future development, which is reflected in the imbalance of population age structure, the fragmentation of history and culture, and the weakness of traditional business format.

Based on the study of resilience theory in Chapter 2 and the actual condition of Xixing in Chapter 3, In the next chapter, this dissertation combines theory with practice, and connects the resilience theory with Xixing Historic and Cultural Area, so as to obtain the space enhancement strategy system of Xixing from a perspective of resilience.

## **Chapter 4: Exploration of Space Enhancement Strategy Based on Resilience Theory**

### **4.1 Feasibility analysis of the resilience theory applying to Xixing**

#### **4.1.1 Disturbance as the prerequisite to show resilience**

Metal can recover to its original form after being deformed by external pressure; forests will flourish again over time after suffering from fire; social economy can eventually return to the right track after self-adjustment in a crisis. Thus, it can be seen that the resilience of the system is interlinked with the outside world rather than existing in isolation. According to the basic research in Chapter 2, the social resilience does not pursue to return to the original state, but emphasizes that the system has the ability to cope with the negative impact caused by disturbance, and relies on its own reserve resources to adapt to the disturbance and achieve a dynamic equilibrium. Therefore, in this field, disturbance can be understood not only as a short-term blow from natural environment, but also be understood as the long-term and slow damage caused by social change, which makes the neighborhood space less resilient.

#### **4.1.2 Urbanization as the main disturbance to Xixing**

The old historic and cultural area is a special region integrating the functions of trade, production, life and socialization, which has an unbalanced population system, resource system, environmental system and economic system, forming a special social ecological system<sup>[85]</sup>. In the previous high-speed urbanization process, the old historic and cultural area represented by Xixing is struggling under the impact of various external disturbances, showing that the traditional physical space is not adapted to modern life and the current social economy is not adapted to future development. Therefore, in the future, the Xixing Historic and Cultural Area should take

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<sup>[85]</sup> Chai Hailong, Cheng Ai, Yu Xiaofang. Research on Old City Reconstruction and Renewal Based on Urban Resilience Theory[J]. Urban Journal, 2018, 39(01):90-94

the initiative to seek changes in order to develop a dynamic and sustainable controlling capacity to cope with external impacts.

After clarifying that the Xixing Historic and Cultural Area is a special social ecological system and that negative impact from urbanization is the main disturbance the Xixing Historic and Cultural Area is facing, in the next subsection, this study will continue to explore the significance of applying resilience theory to the space enhancement in Xixing Historic and Cultural Area.

#### **4.1.3 Inadaptability of Xixing to urbanization disturbance**

Faced with the long-term and slow impact of urbanization disturbance, the Xixing Historic and Cultural Area lacks the ability to resist and adapt to this disturbance, which makes this series of impacts evolve into damage to the community, such damage mainly includes physical space and social economy aspects (Table 4-1).

In terms of physical space, the damage of the disturbance is reflected in the inadaptability of the traditional physical space with modern life, which results in the weakening of the ability of the Xixing historic district to resist the disturbance of the surrounding urbanization. The reason is that although the street space and architectural space formed spontaneously in the early days of Xixing's historic and cultural area conformed to the passing and living habits of its specific historical period, in the present time, the traditional street and living scale can no longer meet the modern living needs, and when the needs cannot be met, the residents will try to expand the original confined space, resulting in a lack of spatial connectivity and further And making the already lack of public service facilities more in short supply, further intensifying the conflict between traditional space and modern demand.

In terms of social economy, the damage of the disturbance is reflected in the inadaptability of the current social economy with modern life, which results in a weakening of the ability of the Xixing to recover itself after the disturbance. In the context of the decline of the Xixing Historic and Cultural Area, the traditional economic

model has become unsustainable as the original trade and logistics functions have been replaced by the surrounding urban areas. The declining economic model has led to a decline in economic income and employment opportunities, resulting in the loss of population in the Xixing Historic and Cultural Area, which in turn has led to an aging population and an imbalance in the household composition, resulting in the blockage or severance of community networks. Original cultural relationships and customs are rapidly disintegrating, and the community lacks indigenous people to inherit its history and culture, leaving the local history and culture fragmented.

Table 4-1 The performance of inadaptability in Xixing in the face of urbanization disturbance  
(Source, made by the author)

Type of disturbance	Disturbed object	Performance of inadaptability	Result after disturbance
Physical space	Infrastructure	Aging and deteriorating buildings, space constraint	Weak fire prevention function, the neighborhood has large fire hazards
	Public space	Due to the tight land use in the neighborhood	Crowded streets and alleys, lack of open space interoperability, poor traffic connections between the neighborhood and the surrounding city, and no place for socializing
Social economy	Population structure	Lack of local employment and education opportunities	Local young and middle-aged people migrate out of the community, the community's population structure is aging, and the self-organization ability of the community is weakened.
	History and culture	Original network of community and cultural heritage are cut off	The historical atmosphere needs to be created, the outsiders do not identify with the local community, and the non-traditional culture is fading away.
	Traditional business format	The original business format is unable to compete with the surrounding new industries and new business	Loss of the original economic function of the old settlements, the traditional economic model is unsustainable and the economic income is low.

In summary, the Xixing historic and cultural area is not adapted to the long-term disturbance of the surrounding urbanization, showing the phenomenon of unsustainable development of declining physical space and fragile social space. In the next section, this paper will explain the limitations of traditional methods on the spatial enhancement of the historic and cultural area.

## **4.2 Necessity analysis of the resilience theory applying to Xixing**

### **4.2.1 Dilemma of traditional methods to Xixing**

The dilemma of the historic and cultural area is that the traditional physical space is not adapted to modern life, and the current social space is not adapted to the future development needs, while the traditional large-scale-demolishment and museum-style conservation model cannot take into account the transformation needs of the physical and social space, and is not sufficient to solve the dilemma of the revival of the historic and cultural area.

#### **(1) Large-scale-demolishment model**

Since the 1980s, China's economic development has accelerated, and people's demand for material and spiritual goods has gradually increased, which has directly contributed to a large number of historic and cultural area conservation and utilization practices. However, driven by this high demand, some developers have developed historic and cultural areas in a purely market-oriented way, resulting in distortion of historic and cultural areas. Firstly, they advocate to demolish a large number of buildings and keep only some of the cultural preservation buildings; secondly, they destroy the original functions and cultural heritage of the district, repair the historical resources, but move all the original residents out of the historical district, completely replacing the original functions for tourism and cultural entertainment.

This conservation of the neighborhoods does not take into account the traditional environment and historical values of the neighborhoods, and lacks the evaluation of the value of the neighborhoods, which leads to the destruction of the traditional spatial

pattern and historical environment of the neighborhoods by simply renewing and building them as tourism resources.

## **(2) Museum-style model**

The Museum-style conservation model opposes all reuse and redevelopment, which is based on the first principle of preserving the originality of public space and architecture in the neighborhood, and the second principle is influenced by the negative effects of unreasonable repairs, excessive tourism development and constructive destruction of heritage and neighborhoods in recent years. The reasons for this are out-fashioned concepts, unbalanced economic values, and backward technology, which have led to the gradual ossification of the concept of neighborhood and heritage conservation and the loss of the real social significance of the neighborhood and heritage. Without the replacement of new functions, new technologies, and new concepts of development, the neighborhoods and heritage have slowly degenerated into urban shantytowns.

The Museum-style conservation model is a slow depletion of the neighborhoods and heritage, and leads to missed opportunities for improvement and conservation.

### **4.2.2 Significance of resilience theory to sustainable development of Xixing**

As a theory that focuses on "resisting external disturbance", "dynamic equilibrium" and "self-regeneration", resilience theory has become an important tool for urban planning disciplines to improve the sustainable development of areas. It can effectively solve the problems of physical space and social economy vulnerability faced by the old community, so as to solve the dilemma of regeneration of the old historic and cultural area and help it development sustainably. For the Xixing Historic and Cultural Area, the guidance of resilience theory for its space enhancement work includes the following two implications:

① The first is to build engineering resilience, such as eliminating fire hazards, reinforcing traditional buildings, planning interconnected streets, etc., in order to enhance its physical space so that it can have sufficient reserve capacity and

emergency response capacity before and during the disaster.

② The second is to build social resilience, such as increasing public service facilities, balancing the population structure, and improving economic income, in order to make it capable of self-organization and transformation after the disaster.

In the next subsections, this dissertation will explore, based on a questionnaire survey, the real needs of residents in the context of urbanization disturbances, and provide a realistic basis for the application of resilience theory to the spatial enhancement of Xixing Historic and Cultural Area.

#### **4.2.2 Sustainable development demands of residents in Xixing**

In 2012, in order to cooperate with the application of the Grand Canal World Cultural Heritage, the relevant departments of Hangzhou and Binjiang District carried out an environmental renovation work on the Xixing Historic and Cultural Area. Based on the continuation of the existing residential function, the renewal work focused on the repair of cultural heritage buildings, the display of heritage sites, the dredging of canal, and improvement of facade, which improved the declining appearance of Xixing to a certain extent. However, according to the preliminary on-site observations and interviews with residents, the condition of the Xixing Historic and Cultural Area has not fundamentally changed, and the problems of aging infrastructure and population loss are still serious. In this context, this section aims to explore the residents' satisfaction on the environmental renovation work based on a questionnaire survey, in order to further clarify the residents' realistic needs.

##### **(1) Questionnaire design**

###### **① Principles**

The design of this questionnaire follows the principles of scientificity, completeness, understandability and logicity. The scientific principle means that the questions should be reasonable, closely related to the issues to be investigated in this study, and help to obtain effective conclusions through the survey results; the completeness

principle means that the questionnaire design should cover as much as possible the factors influencing the satisfaction of the previous environmental renovation work; the understandability principle requires a moderate number of questions, simple and common description of the questions, and no ambiguity; the logicity principle requires that the order of questions should be arranged logically and that no logical fallacies should occur in individual questions.

## ② Content and scale

Zhao once conducted a survey of residents' satisfaction after space enhancement in four historic and cultural areas represented by Gongchenqiao and Qiaoxi areas. The indicators of residents' satisfaction were divided into expectations before environmental renovation and satisfaction after environmental renovation. Among them, the satisfaction after environmental renovation is further divided into four aspects: overall atmosphere satisfaction, residents' loyalty, physical environment satisfaction and social environment satisfaction<sup>[86]</sup>. Since the environmental renovation background and method of Xixing Historic District is similar to the above-mentioned historic and cultural areas, the questionnaire content of this survey is designed on the basis of slight tuning, and generally refers to the division of the above-mentioned resident satisfaction indicators.

There are two parts in this questionnaire. The first part is intended to collect basic information about the respondents, such as age, household registration, occupation, education level, etc. The second part is a survey of residents' satisfaction, which is conducted by scoring the satisfaction scores into five levels, with the scores from 5 to 1 representing "very high expectation", "high expectation", "average expectation", "few expectation" and "no expectation", while the scores of 5 to 1 for residents' satisfaction represent "very high satisfaction", "high satisfaction", "average satisfaction", "few satisfaction" and "no satisfaction".

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<sup>[86]</sup> Zhao Xianfeng. Research on Residents' Satisfaction in the Renewal and Renovation of Residential Historical and Cultural Districts in Hangzhou [D]. Zhejiang University, 2018

## (2) Investigation objects

This questionnaire focuses those who have experienced the environmental renovation work of Xixing Historic and Cultural Area in 2012, with no restrictions on household registration and occupation. Since most of the respondents were middle-aged and elderly, the questionnaires were distributed by hand in the field. Due to the age and education level of some respondents, some of the questionnaires were interviewed and finally recorded by the author. A total of 100 valid questionnaires were collected in this survey.

## (3) Data analysis

### ① Basic information

As shown in the figure below (Figure 4-1), in terms of the age structure of the population, the aging characteristics of the sample population are obvious, with 29% of the population over the age of 65 years old in this survey; in terms of occupational composition, the high proportion of the elderly population also leads to a high proportion of retirees, followed by workers with 22%; in terms of education level, the education level of the sample population is low, with about 42% of the sample population having received only primary school education or less; in terms of income level, there are more middle and low income people with a monthly income of less than RMB 3, 000, accounting for nearly 58% of the sample population.

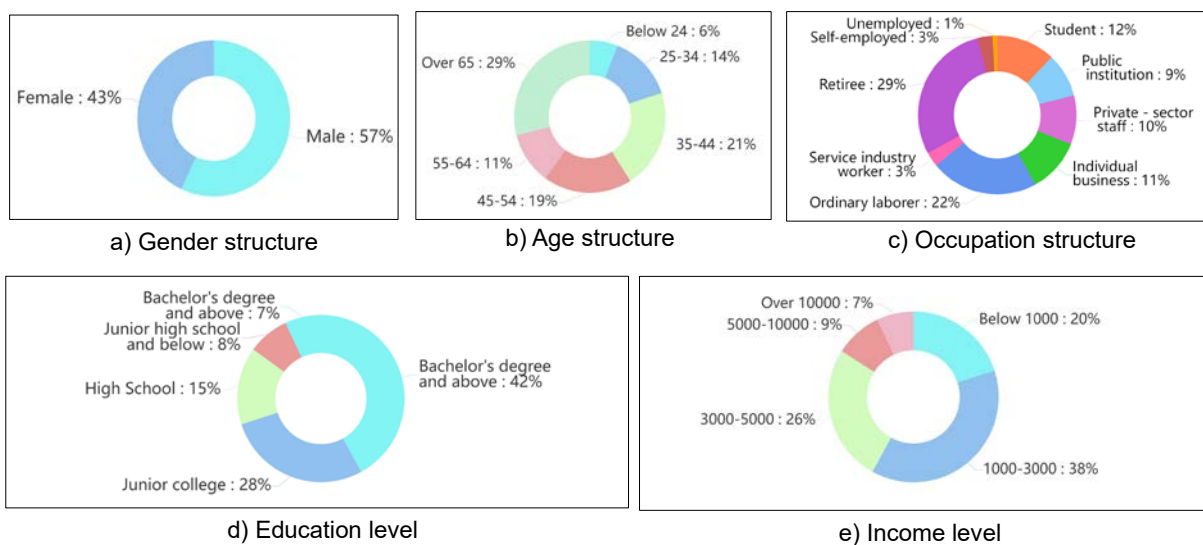


Figure 4-1 Statistical figure of the basic information of the survey sample (source: Self-drawn by the author)

## ② Expectation of residents before the environmental renovation

As shown in Table 4-2, the overall expectation of residents before environmental renovation reached a high score of 4.08, and 79% of the residents had good expectations (very high expectation and high expectation) before the renovation. Among them, in terms of physical space expectations, residents expect more improvement of Commercial facility, educational and cultural facility, entertainment facility, medical facility, and have average expectations for improvement of residential condition; in terms of economic and social expectations, residents have the highest expectations for income level improvement, and also expect more improvement of community network and cultural atmosphere.

Table 4-2 Statistical table of the survey of residents' expectations before the renovation  
(Source: made by the author)

Main class	Secondary class	5	4	3	2	1	Average
General expectation	—	34%	45%	16%	5%	0	4.08
Improvement of physical space	Residential condition	25%	24%	30%	11%	10%	3.43
	Commercial facility	30%	28%	18%	18%	6%	3.58
	Educational and cultural facility	28%	23%	31%	16%	2%	3.59
	Entertainment facility	28%	35%	17%	16%	4%	3.67
	Medical facility	21%	28%	33%	14%	4%	3.48
	Transporting facility	16%	26%	28%	19%	11%	3.17
	Greening	15%	24%	31%	18%	12%	3.12
Improvement of social economy	Income level	29%	34%	19%	12%	6%	3.68
	Community network	21%	25%	36%	14%	4%	3.45
	Cultural atmosphere	22%	26%	30%	13%	9%	3.39
	Public security	25%	22%	20%	16%	17%	3.22
	Community service	21%	16%	30%	17%	16%	3.09

### ③ General satisfaction

As shown in Table 4-3 the overall satisfaction level of the residents after the conservation and utilization renovation is to 3.28, although there is a large gap compared to the overall expectation of 4.08 before the renovation, it still shows that in general the residents' feelings of this renovation is biased towards satisfaction. However, on the other hand, the large gap still makes more than 50% of the people willing to move out of the community when conditions permit, indicating that many residents lack confidence in the future development of the community and seek a better living environment.

Table 4-3 Statistical table of residents' overall satisfaction and willingness to move out after renovation  
(Source: made by the author)

Type	5	4	3	2	1	Average
General satisfaction	17%	24%	37%	14%	8%	3.28
Moving out intention	18%	23%	35%	10%	14%	3.21

### ④ Residents' satisfaction in physical space after the renovation

As shown in Table 4-4, the aspects of the physical environment that residents were more satisfied with after the renovation were residential condition and greening. The highest level of satisfaction was in greening, with a score of nearly 3.6, and 59% of the residents were satisfied, indicating that the environmental improvement work had relatively obvious effects in this renovation. However, in terms of residential condition, transporting facility and public services, including commercial, educational, medical and entertainment facilities, the score is relatively low, and residents are clearly not satisfied. On the one hand, according to the residents' feedback, the renovation is mostly for the improvement of the outdoor environment and the restoration of the facade of the historical buildings, but not enough support for the restoration of the internal space of the traditional houses; on the other hand, the renovation has hardly promoted the public service facilities, and the residents originally had high expectations for them, which eventually led to the low satisfaction level.

Table 4-4 Statistical table of physical space satisfaction after renovation (source, made by the author)

Satisfaction class	5	4	3	2	1	Average
Residential condition	17%	21%	34%	11%	17%	3.10
Commercial facility	19%	18%	33%	22%	8%	3.18
Educational and cultural facility	20%	14%	37%	19%	10%	3.15
Entertainment facility	22%	12%	38%	12%	16%	3.12
Medical facility	19%	20%	32%	17%	12%	3.17
Transporting facility	21%	17%	30%	20%	9%	3.12
Greening	28%	31%	17%	19%	5%	3.58

## ⑤ Residents' satisfaction in social economy after the renovation

As shown in table 4-5, residents were satisfied with the security situation and community services after the renovation, with satisfaction scores of 3.78 and 3.66, respectively, but in terms of economic income, where residents highly concerned on, were less satisfied, with a score of 2.9, a large gap from the residents' original expectations. In addition, residents' satisfaction with community network and cultural atmosphere is low as well, indicating that the renovation has not significantly improved these two aspects.

Table 4-5 Statistical table of social economy satisfaction after renovation (source, made by the author)

Satisfaction class	5	4	3	2	1	Average
Income level	16%	14%	30%	24%	16%	2.90
Community network	23%	13%	32%	20%	12%	3.15
Cultural atmosphere	19%	12%	39%	22%	8%	3.12
Public security	27%	33%	33%	5%	2%	3.78
Community service	31%	29%	21%	13%	6%	3.66

#### **(4) Data analysis**

From the survey results, it can be seen that the residents of the Xixing Historic and Cultural Area are inclined to approve of the renovation work carried out by the government in 2012, but there is still a gap between the high expectations before the renovation and satisfaction after the renovation, resulting in a low loyalty of the residents to the community, the original residents included. Over 40% of the residents are willing to move when it is permitted, which indicates that a significant portion of the residents are pessimistic about the future sustainable development of the community, and there is a risk of further population loss. On the one hand, the reason is that this renovation has not changed the positioning of the community, and the original residential function has been continued, with relatively little commercial tourism development. On the other hand, this renovation work is mostly environmental improvement work, although the greening are greatly improved, but the residential condition, public service facilities are not improved, and the space for residents to participate is not expanded, which further reduces the rent level and living attraction of the community, and the community cannot attract the young population back in the future, and the culture is not inherited.

In conclusion, the residents, as an important part of the Xixing Historic and Cultural Area, also have a realistic need for sustainable development, mainly at the social space, represented by the improvement of public service and economic income, and at the physical space level, represented by the improvement of residential condition.

### **4.3 Construction of the space enhancement strategy**

#### **4.3.1 Elements of the strategy**

When urban planning scholars study the application of resilience theory in urban space, they often express the abstract resilience theory into more understandable and practical resilience characteristics. As summarized in Chapter 2 of this dissertation, a resilient system of urban spaces should include the characteristic of robustness,

connectivity, diversity and uniqueness.

As "space" is the core of urban design research, this dissertation for space enhancement in historic and cultural areas also starts from space design, so as to enhance the engineering resilience and social resilience of the historic and cultural area. The aim is to promote the sustainable development of the historic and cultural area. Combining the above characteristics of resilient system, this study proposes that the main strategy of the resilience construction of the physical space of the historic and cultural area is to enhance the robustness and connectivity, while the main strategy of the social resilience construction is to enhance the diversity and uniqueness of spaces.

### **4.3.2 Mechanism of the Elements**

#### **(1) Robustness**

Robustness means that the production and living space of the neighborhood should be able to adapt to the needs of urbanization while maintaining its original characteristics. In the past, the spatial pattern of the historic district was able to cope with the production and living style of the residents, but with the passage of time, most of the traditional buildings are characterized by difficulties in lighting and ventilation, poor structural quality and fire hazards, and their features of lacking robustness are difficult to meet the living and safety needs of urbanization.

At the city level, we can evaluate "demolition, conversion and retention" based on the results of the current study within the framework of the regulations for the protection of historic districts; at the community level, it is needed to plan the fire protection system to improve the disaster prevention and mitigation capacity; at the community level, carrying out structural reinforcement and style repair for the preserved buildings. At the space level, the buildings will be rehabilitated to meet the production and living functions of urbanization and eliminate fire hazards. The purpose of the above measures is to improve the adaptability of the neighborhood space, which on the one hand is to meet the basic housing needs of the residents and to improve the risk

resistance of the infrastructure, and on the other hand is to increase the land value and solve the problem of low income of the residents.

## **(2) Connectivity**

Connectivity refers to the clear and unobstructed traffic space system of the neighborhood, the interconnectedness and accessibility of the open space system, and the effective connection between the internal streets and external urban roads. When the demand is not satisfied, residents try to expand the existing space, resulting in crowded and poorly functioning traffic space, unstructured open space, insufficient orientation and blurred historical nodes.

At the city level, effectively connecting the internal traffic of the neighborhood with the surrounding urban roads is needed; at the community level, it is suitable to open up the cut-off roads while following the traditional street pattern, so that the streets and open spaces can be interconnected; at the spatial design level, improving the pedestrian experience and restoring the traditional street paths, and add parking facilities are necessary. Through the above approach, the outdoor public space of the neighborhood is expanded while the problem of non-interoperability between the traffic system and open space system is solved, and the disaster prevention and mitigation capacity can be improved.

## **(3) Diversity**

On the one hand, diversity refers to the variety of public service facilities in the district, their balanced layout, and their complex functions. In the past, many historic districts were actually characterized by a combination of functions, with some commercial, cultural, transportation or military functions mixed in with the dominant function of housing. However, due to the changes of the times, the diverse functions of many historic districts gradually disappeared and were replaced by a single residential function, and the lack of public services in the district created the problem of lack of vitality. On the other hand, diversity also refers to the need for diverse functions of the

neighborhood space for different age groups. Older historic districts are often accompanied by demographic imbalances such as aging population and loss of young adults, both because of the objective lack of quality education and employment resources in the area and because the spatial environment is homogeneous, unable to meet the needs of multi-income and multi-age groups. In the future spatial implementation of the neighborhood's diversity enhancement, the behavior preferences and scales of different age groups should be taken into account from the city level to the space level, in order to form a dynamic atmosphere of intergenerational co-prosperity.

In the future implementation of the neighborhood's spatial diversity, for the city level, first of all, can analyze the current functional groups within the historic district and the future functional groups planned for the surrounding areas, and provide additional living services according to the relevant regulation; For community level, according to the macro analysis of the balanced arrangement of multiple functional centers, and get the direction of land planning; for spatial design level, in the same functional area still follow the principle of functional complex and setting independent and intertwined spatial activity areas are designed to enhance their vitality. Based on the above approach, by strengthening the diversity of the neighborhood, it can meet the cultural and leisure needs of the residents in the new era, and at the same time, it can attract young people and optimize the age structure.

#### **(4) Uniqueness**

Uniqueness refers to the unique characteristics of the neighborhood space, the spirit of place, and the strong cultural atmosphere, which is the fundamental difference between historic districts and ordinary old neighborhoods. However, the erosion of architectural features, the fragmentation of architectural texture, and the blurring of historical nodes in many historic districts have led to a gradual loss of local identity among residents and foreign visitors.

In the spatial implementation of the future local enhancement of the neighborhood, the

city level identifies various conservation elements of the neighborhood and repairs the eroded traditional architectural fabric; the community level restores the open space nodes with historical value and plans tourism routes; the spatial design level enhances the characteristics of canal culture in the neighborhood and revitalizes the historical buildings. The purpose of the above measures is to create a good historical atmosphere in the community, enhance the residents' sense of identity and belonging to the neighborhood, and strengthen the self-organization ability of the community.

### 4.3.3 Summary of the strategy system

Based on the analysis of the elements of resilience strategy and its mechanism, this dissertation constructs the spatial enhancement strategy of historical and cultural area from two aspects of "building engineering resilience" and "building social resilience" respectively (figure 4-2) to enhance its physical space and social space, while strengthening its reserve capacity before the disaster, emergency response capacity during the disaster, and the ability of self-organization and transformation development after the disaster.

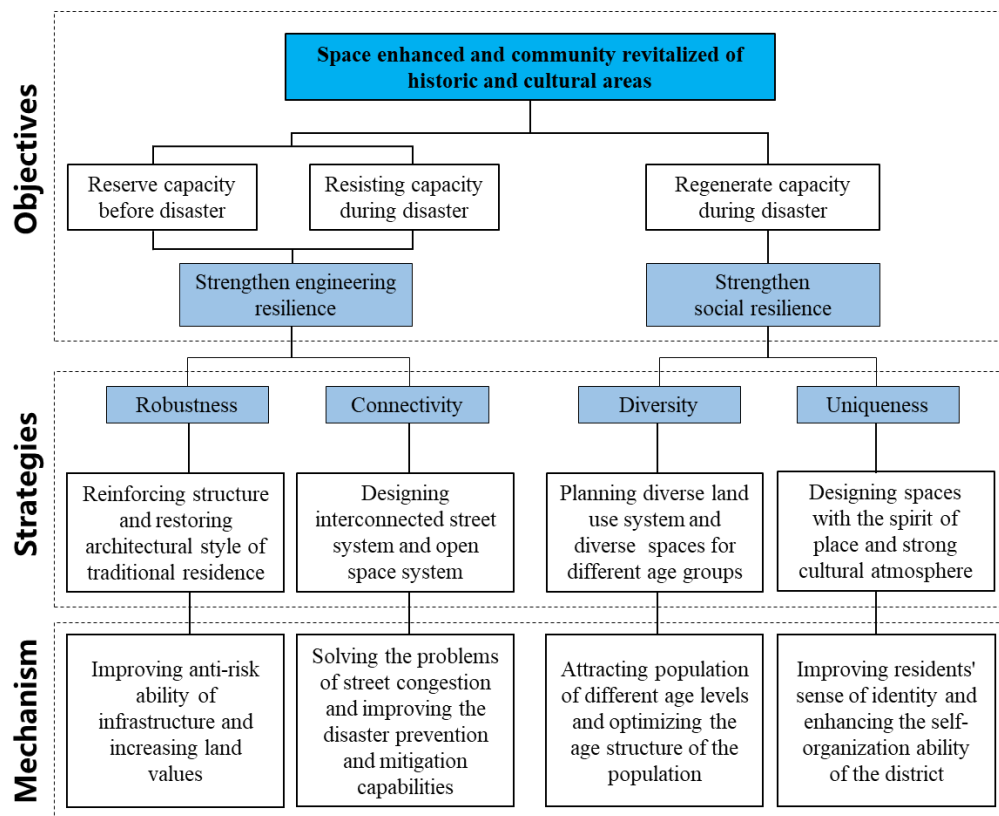


Figure 4-2 Strategy system of space enhancement (source: made by the author)

## **4.4 Summary of the chapter**

The first section of this chapter firstly argues that the application of resilience theory to the space enhancement of the Xixing Historic and Cultural Area is feasible, with the following three arguments: firstly, disturbance is the prerequisite for to show resilience; Secondly, urbanization is the main disturbance to the Xixing. Thirdly, Xixing shows inadaptability to urbanization disturbance

The second section argues that it is necessary to apply the resilience theory to the Xixing Historic and Cultural Area for two reasons: first, there is a dilemma of applying traditional methods to the revitalization of Xixing. Second, it is clear that there is guiding significance of resilience theory to sustainable development of Xixing. Third, residents of Xixing shows sustainable development needs.

Based on the above two sections, the third section constructs a space enhancement strategy for the historic and cultural area in terms of strengthening "engineering resilience" and "social resilience" respectively,

In the next chapter, this paper will use urban design approach to implement the constructed resilience strategy system into the design practice.

## **Chapter 5: Implement of Space Enhancement Strategy in Xixing**

### **5.1 Logical framework**

#### **5.1.1 Relevant design basis**

##### ***(1) Regulations on the Protection of Historic and Cultural Areas and Historic Buildings in Hangzhou City***

In 2013, the Hangzhou Municipal Government identified 26 historic and cultural areas, including 12 historic areas and 14 historic districts, and promulgated the *Regulations on the Protection of Historic and Cultural Districts and Historic Buildings in Hangzhou* in the same year. The regulation proposes that the protection and management of historic and cultural areas and historic buildings should follow the principles of scientific planning, classified management, effective protection and reasonable utilization, protect the authenticity, integrity and sustainability of historic and cultural heritage, and maintain the continuity of residents' lives <sup>[87]</sup>.

For the future design of the space enhancement of the Xixing Historic and Cultural Area, the regulations make the following relevant provisions: First, in the core protection of the historic and cultural area in addition to the necessary infrastructure and public service facilities, no new construction and expansion are allowed; second, no unauthorized changes to the historic and cultural area of the spatial structure. third, when reconstructing existing roads, the traditional pattern and spatial environment should be maintained or restored; fourth, when renovating existing buildings, their historic and cultural appearance should be maintained or restored, and no new buildings or structures should be built or expanded within the protection area of historic buildings.

Based on this, it is clear that the government is paying more attention to the historic and

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<sup>[87]</sup> People's Government of Hangzhou City. Regulations on the Protection of Historic and Cultural Areas and Historic Buildings in Hangzhou City[Z]. 2013

cultural areas and historic buildings in the center of the city, and has made many macro-control regulations on their development and protection. In addition, the specific regeneration measures for historic and cultural areas and buildings are no longer satisfied with repairing, but focus more on restoring the life style and activating the vitality of that area.

## ***(2) Implemental planning of the Grand Canal Culture Protection and Heritage Utilization in Hangzhou City***

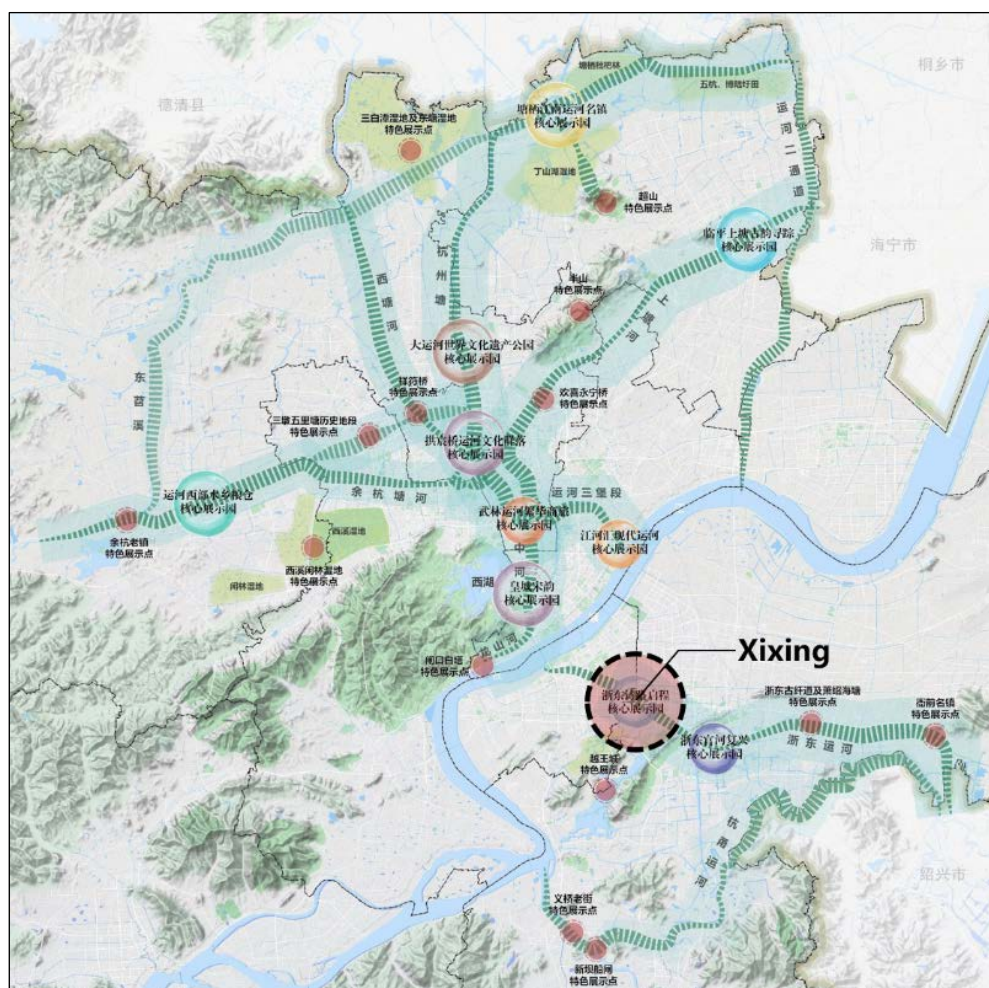


Figure 5-1 Planning structure of the Grand Canal in Hangzhou City  
(Source: website of Hangzhou Bureau of Planning and Natural Resources)

In October 2020, the General Office of Hangzhou Municipal People's Government issued the *Implemental planning of Grand Canal Culture Protection and Heritage Utilization in Hangzhou City*. The planning proposes to build a cultural development pattern of "one axis, two wings and ten areas" in the Hangzhou section of the Grand Canal (figure 5-1). Among them, the "one axis and two wings" refer to the "Grand Canal Cultural

Development Axis", "Jiangnan Canal Cultural Development Wing" and "East Zhejiang Canal Cultural Development Wing ". Xixing Historic and Cultural Area is in the "East Zhejiang Canal Cultural Development Wing" and the "East Zhejiang Core Exhibition Park", which are characterized by "access to the river and the sea and digital heritage". The planning requires the Xixing to take advantage of the East Zhejiang Canal and the digital heritage, discover the cultural connotation, and focus on digital economy, cultural creativity, tourism and leisure, so as to promote the construction of 5A tourism spot.

## (2) Planning of the National Cultural Park Grand Canal in Hangzhou City

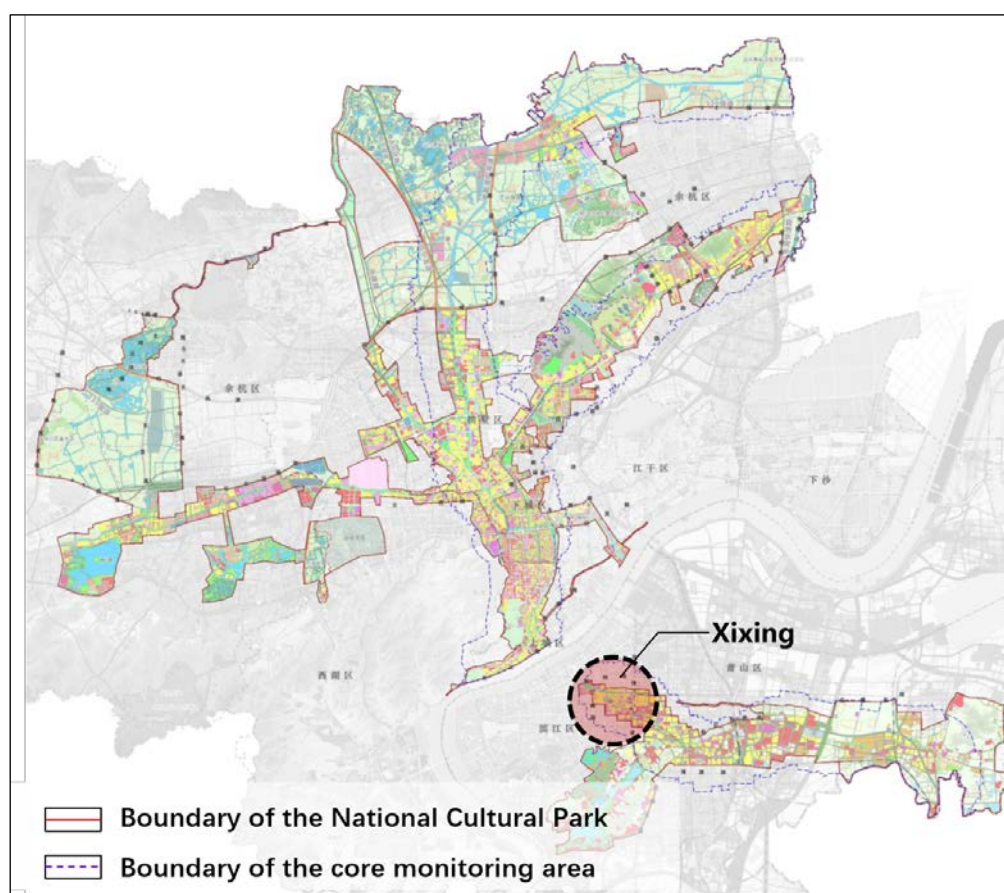


Figure 5-2 Boundary of the National Cultural Park  
(Source: website of Hangzhou Bureau of Planning and Natural Resources)

In June 2021, Hangzhou Development and Reform Commission promulgated the *Planning of Grand Canal Cultural Protection and Utilization and National Cultural Park Construction (Draft for Comments)*<sup>[88]</sup>, and the overall positioning of this park system

<sup>[88]</sup> People's Government of Hangzhou City. Planning of the National Cultural Park Grand Canal in Hangzhou City

is "the classic park of the Grand Canal National Culture, the most beautiful section of China's Grand Canal, and the core of China's Grand Canal culture, an ancient and modern culture exhibition window" (figure 5-2).

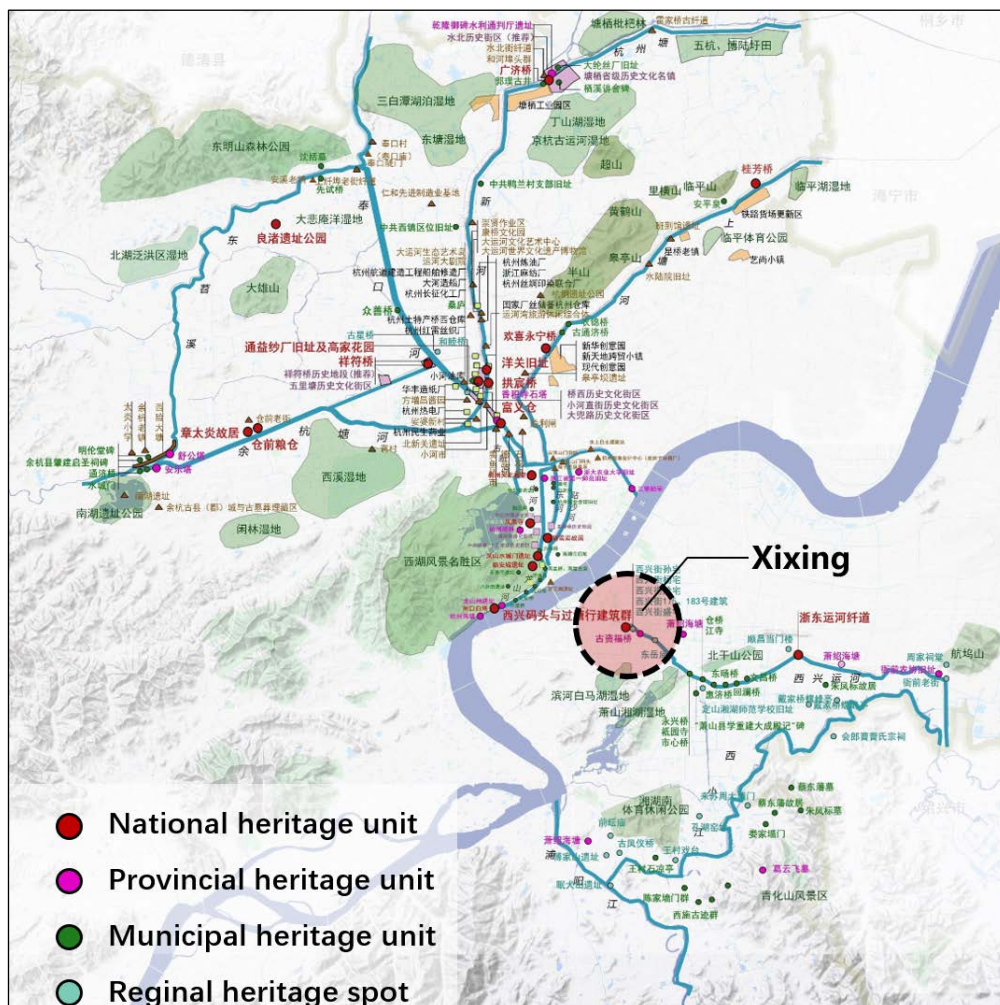


Figure 5-3 Summary of the cultural elements of the National Cultural Park  
(Source: website of Hangzhou Bureau of Planning and Natural Resources)

For the future design of the Xixing Historic and cultural area, the plan proposes to discover and protect the culture of the Xixing area, introduce special cultural and commercial facilities according to local conditions, and enhance the current business format of the whole area by enhancing important nodes. For example, constructing traditional hotel and digital museum of intangible culture based on the Guotang Buildings and traditional handcraft skills, respectively (figure 5-3).

#### (4) Regulatory Detailed Planning of Xixing Unit<sup>[89]</sup>

The Hangzhou Bureau of Planning and Natural Resources conducted a round of regulatory detailed planning for the Xixing and its surrounding areas in 2016 (figure 5-4), which had the following four main focuses first, delineating the core protection area of the historic and cultural area; second, replacing part of the industrial land (M1 land) on the eastern side of the Xixing and village construction land (H14 land) into commercial service facility land (B land); third, optimize the road network system around the historic and cultural area, and rebuild some narrow roads around the community to municipal roads; fourth, planning some parking facilities, street pocket parks, waterfront parks and other supporting facilities around the community. The above four guidelines have not been implemented yet, so the space enhancement design in the following part of this dissertation should also refers to the above guidelines.

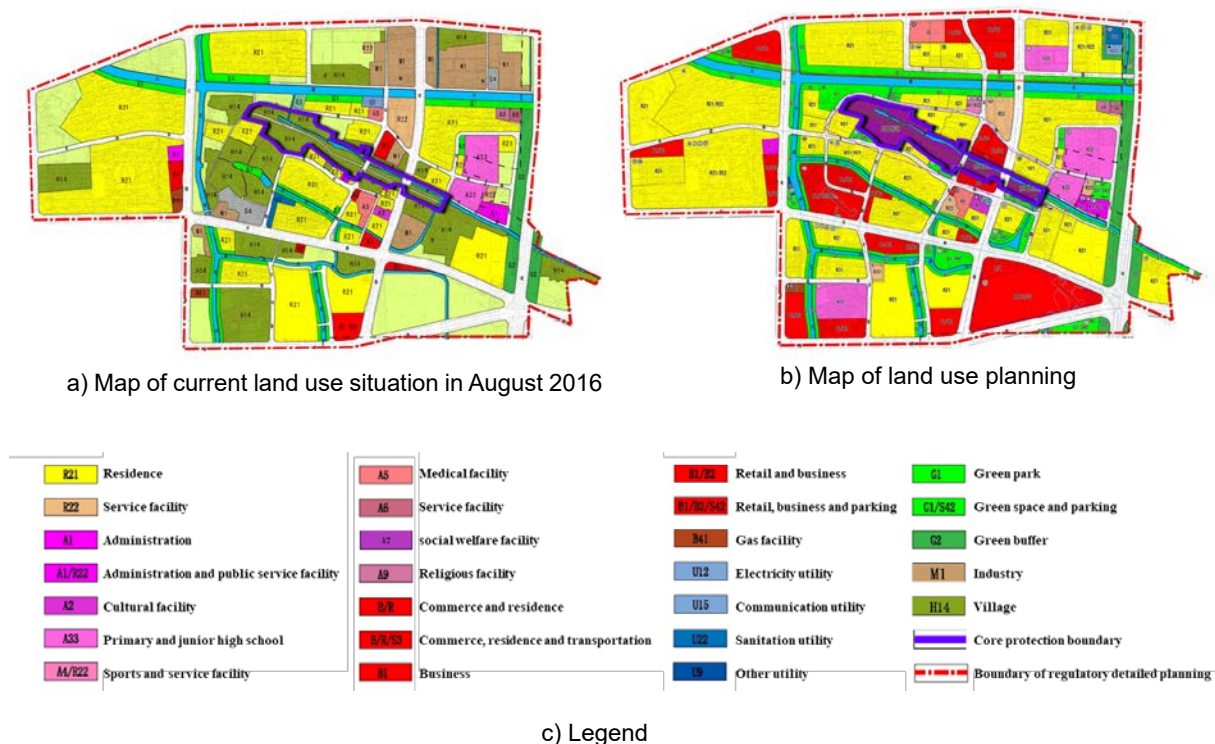


Figure 5-4 Map of the Regulatory Detailed Planning of Xixing Unit  
(Source: website of Hangzhou Bureau of Planning and Natural Resources)

<sup>[89]</sup> Hangzhou City Planning and Design Academy. Regulatory Detailed Planning of Xixing Unit[Z]. 2016

## **(5) Summary**

In the future, for the space enhancement of Xixing Historic and Cultural Area, the spatial design should comply with the requirements of the historic and cultural area protection regulations and the regulatory detailed planning for the protection of the historic and cultural area. On this basis, the industry can focus on the introduction of historical exhibition, cultural innovation, tourism and leisure businesses to meet the needs of residents and tourists while promoting the sustainable development of Xixing.

### **5.1.2 Developing position**

Xixing Historic and Cultural Area was historically positioned as "the water transportation and supply distribution center" of eastern Zhejiang, and "the carrier of Hangzhou's canal culture". However, under the impact of urbanization in the surrounding area, the original commercial trading and water transporting functions have disappeared. In addition, the aging of the community infrastructure and physical space, and the population loss, showing that the physical space do not matches the modern life and the social economy is not adaptive to the future development, and it is urgent to enhance the vitality of the community by spatial enhancement.

Based on the above development demands, the future space enhancement design of Xixing Historic and Cultural Area should not only focus on simple environmental renovation and "museum-style" conservation, but also need to seek new development strategy. While preserving its history and culture, it should also take the initiative to link up with the surrounding areas and cultivate new industries such as cultural exhibition, cultural retail, tourism, and traditional living, so as to resist and adapt to the impact of urbanization in the surrounding areas.

To sum up, this design positions the future Xixing Historic and Cultural Area as "a example of world cultural heritage where history and reality blend, industry and life flourish".

### **5.1.3 Developing goals**

According to the above positioning and the current problems of the Xixing Historic and Cultural Area, the goals of this design is to continue the traditional spatial pattern of the original area, protect the traditional culture, and use urban design methods to develop the Xixing into a historic area that integrating cultural exhibition, tourism and leisure, and traditional living functions, in order to enhance its physical space and social economy resilience, and finally achieve a sustainable development."

### **5.1.4 Urban design layout**

Based on the government's conservation and utilization planning, and the positioning of the Xixing historic and cultural area in the urban development, this urban design proposal applies the resilience strategy system that obtained in the previous section to the physical space and social economy enhancement of the district using the spatial design approach based on the perspective of resilience, and finally obtains the following urban design master plan and aerial view (Figure 5-7 and 5-8). The landing point for the physical space enhancement is connectivity and complexity enhancement, while the landing point for the social enhancement is uniqueness, adaptability and diversity.

In the next sub-section, this paper will elaborate on how the resilience strategy system can be implemented from the urban to the spatial dimension.

## (1) Master plan

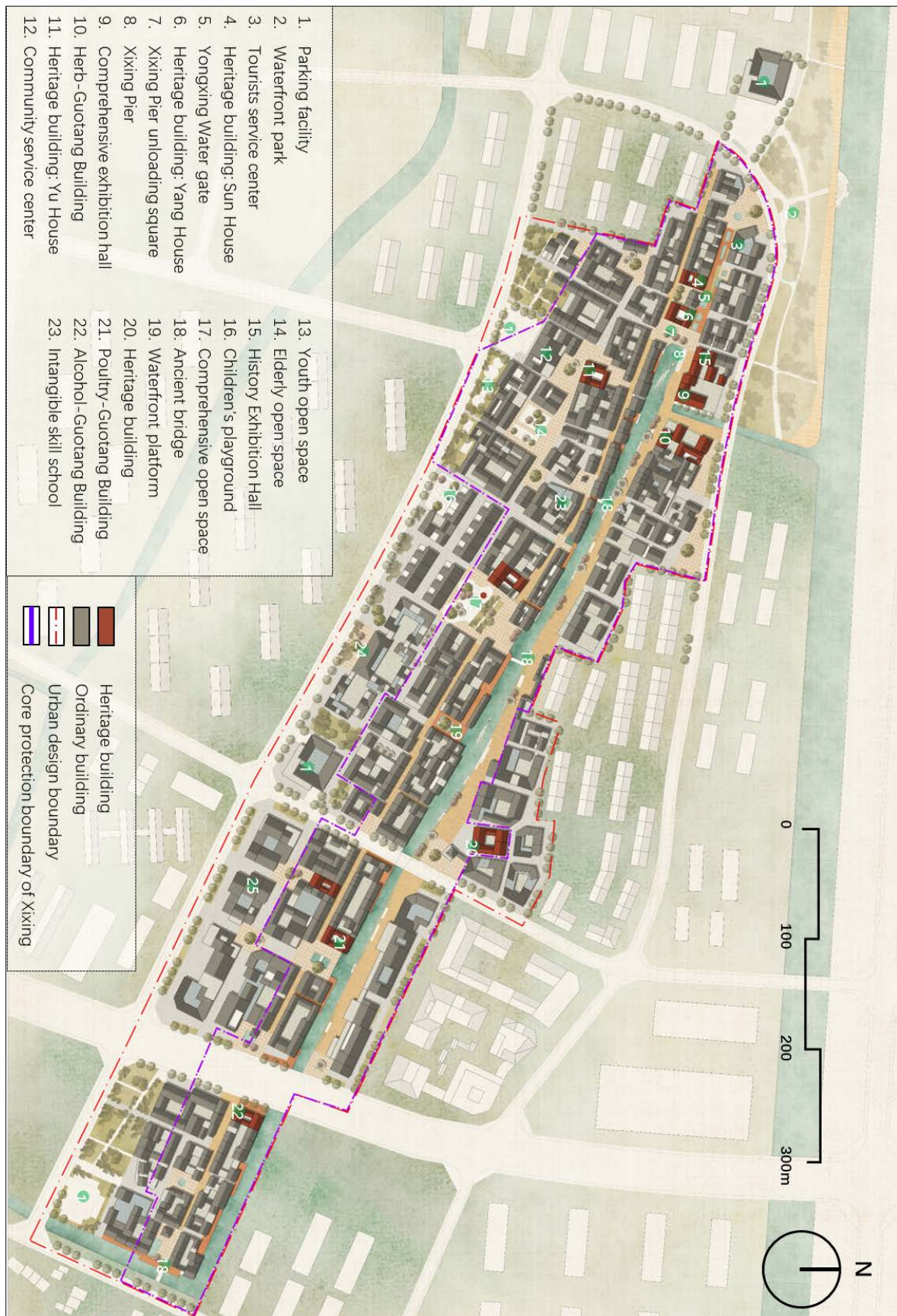


Figure 5-5 Master plan (source: made by the author)

(2) Aerial view



Figure 5-6 Aerial view (source: made by the author)

## **5.2 Strategies to enhance physical space: constructing engineering resilience**

The design of the physical space enhancement is to build up the engineering resilience of the neighborhood, which is expressed in the strengthening of the two spatial characteristics of robustness and connectivity, in order to enhance its reserve capacity before the impact and emergency response capacity during the impact.

### **5.2.1 Robustness enhancement**

The approach of neighborhood spatial diversity enhancement is divided into three dimensions: urban, community and spatial design, with the aim of strengthening the solidity of neighborhood spaces to meet the basic needs of residents in terms of life quality enhancement.

#### **(1) Urban dimension**

Based on the data of building quality, appearance, height, age and property ownership obtained from the empirical research in Chapter 3, the current buildings in the Xixing are comprehensively evaluated (Figure 5-7), and the final evaluation results can be divided into two categories of preservation and demolition (Figure 5-8), in combination with the relevant protection requirements and the needs of spatial design.

##### **① Building to preserve**

There are three types of measures to deal with the buildings that to be preserved. First, the heritage buildings and ordinary traditional buildings with the structure, layout, style and appearance not damaged or only partially damaged, should be protected, repaired and maintained; second, to according to the functional positioning of that area, the traditional-style buildings, with its structure, layout, style and appearance in a good condition, but the doors, windows, walls and appearance of a certain degree of damage, should be renovated; third, the modern buildings with good architectural quality, similar in height to traditional buildings, and difficult to be purchased, are preserved and transformed based on traditional appearance.

## ② Building to demolish

Most of the demolition buildings are modern buildings that have a significant negative impact on the traditional landscape, and traditional buildings that have been severely damaged in terms of architectural quality. There are four kinds of measures to deal with demolished buildings according to different design requirements. First, according to the functional positioning of the plot, the existing buildings are demolished and new traditional buildings are built to achieve the purpose of fabric weaving; second, on the basics of the requirement of widening or adding public activity space, some existing buildings are demolished; third, according to the demand of restoration of traditional streets, some existing buildings are demolished as street space; Lastly, based on the need of building reconstruction and restoration, some existing buildings are demolished as courtyard space.



Figure 5-7 Renewal evaluation of buildings (Source: made by the author)

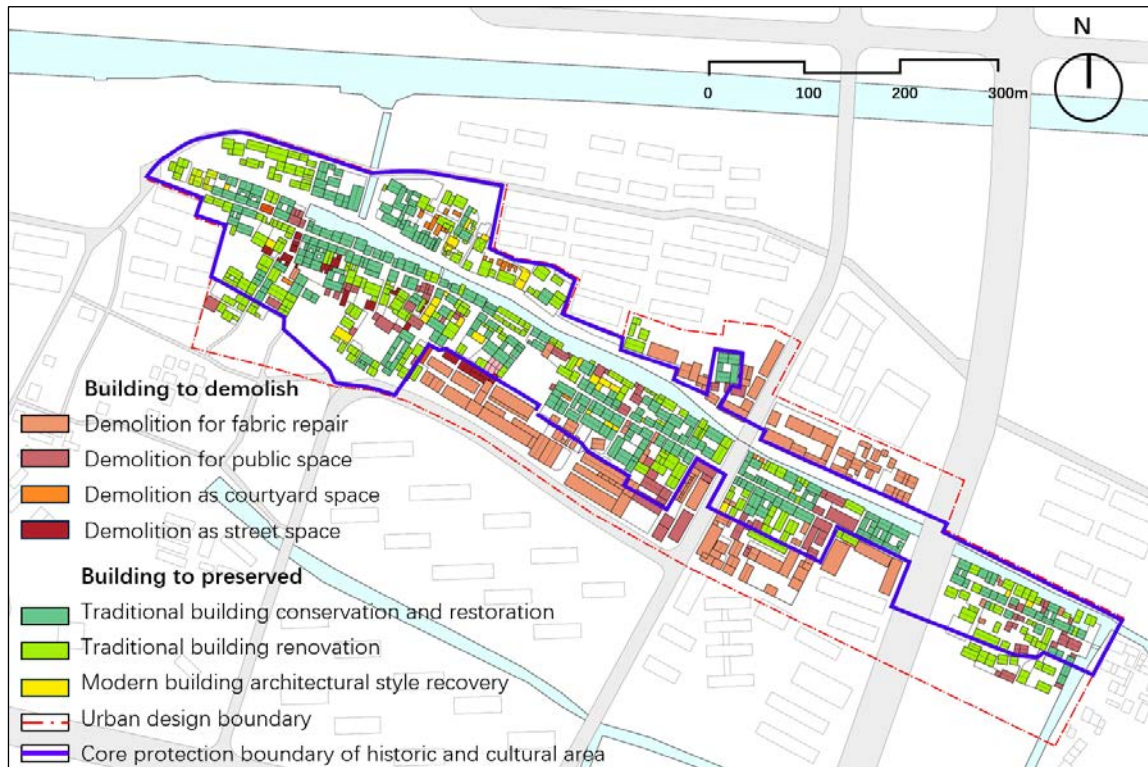


Figure 5-8 Map of buildings to preserve or demolish (source: made by the author)

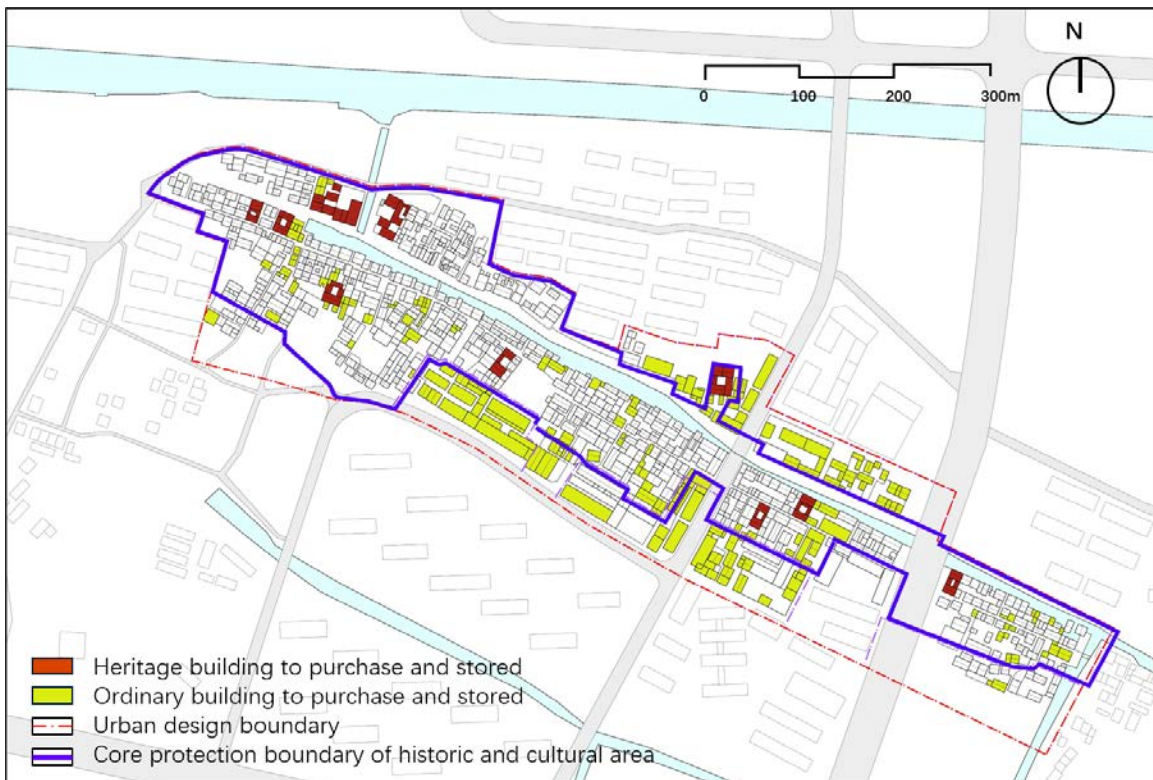


Figure 5-9 Map of the building need to be purchased and stored (source: made by the author)

In addition, according to the need for preservation and demolition of existing buildings, this study delineates the boundary of building storage (Figure 5-9). The buildings to be stored

can be divided into two categories, the first is the storage of ordinary residential buildings that need to be demolished, and the second is the storage of historical buildings that are still performing residential functions, for the purpose of facilitating the functional replacement and operational management of historic buildings at the later stage.

## (2) Community dimension

At the community dimension, the adaptability enhancement mainly addresses the problems of weak disaster prevention and mitigation capacity of the Xixing Historic and Cultural Area. The traditional spaces in historic area are usually more confined and cannot adapt to modern disaster prevention and mitigation needs.

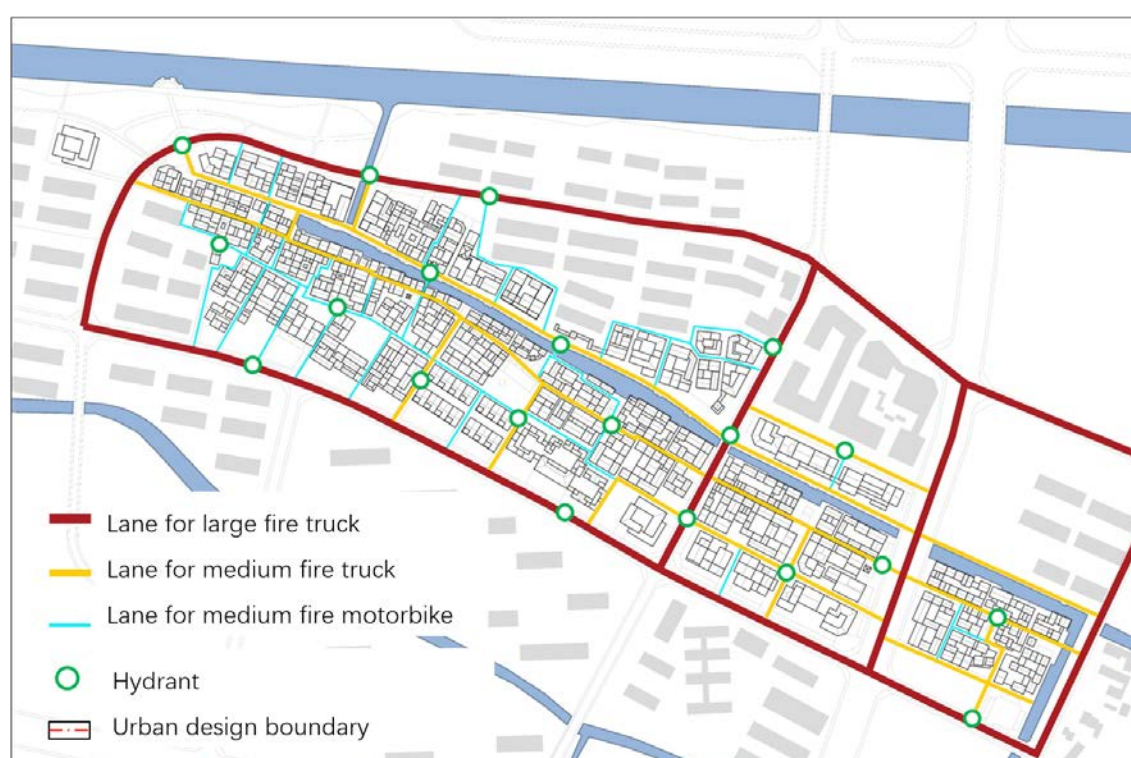


Figure 5-10 Map of fire prevention planning (source: made by the author)

Based on the relevant literature results, four elements of the future fire prevention system in Xixing are obtained: first, the urban roads around the district are planned as large fire lanes with a width of 4 meters or more for large fire engines; second, the traditional streets of 2 to 4 meters in the district are planned as medium-sized fire lanes for small fire truck access only; third, the streets and lanes less than 2 meters in the community are planned as small fire lanes for fire motorcycles only; fourth, the fire hydrants are

placed according to the service radius of 120 meters or less<sup>[90]</sup> (figure 5-26).

### **(3) Space design**

#### **① Structural reinforcement**

The traditional buildings in Xixing Historic and Cultural Area are mainly wood-jointed and load-bearing, and the maintenance walls are usually brick walls or mixed brick and stone walls. The lack of a reliable connection between the enclosure walls and the wooden structure and the poor synergy between them lead to the lack of stability of the house itself. The restoration work of the preserved buildings is based on the local traditional building materials and construction techniques, and appropriate reinforcement and renovation measures are taken to improve the safety and stability of the residential buildings while continuing the traditional architectural style and regional characteristics of the traditional houses. According to the field research of traditional houses in the neighborhood, the following problems are common in the wooden structure of traditional houses due to external forces, natural damage or moth erosion: firstly, cracks appear in the wooden columns, which affect their bearing capacity and stability; secondly, the beam structure of some houses' tilts, which seriously affects the safety of houses.

In the case of load-bearing wooden columns, small cracks (width less than 50 mm) on their surfaces are usually filled with wooden strips or special materials; if the cracks are larger (width greater than 50 mm), they are reinforced with steel hoops or bolts through them.

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<sup>[90]</sup> Hu Zhenyu. Exploration and application of fire protection system generation design in the renewal of high-density historical and cultural districts [D]. Southeast University, 2021

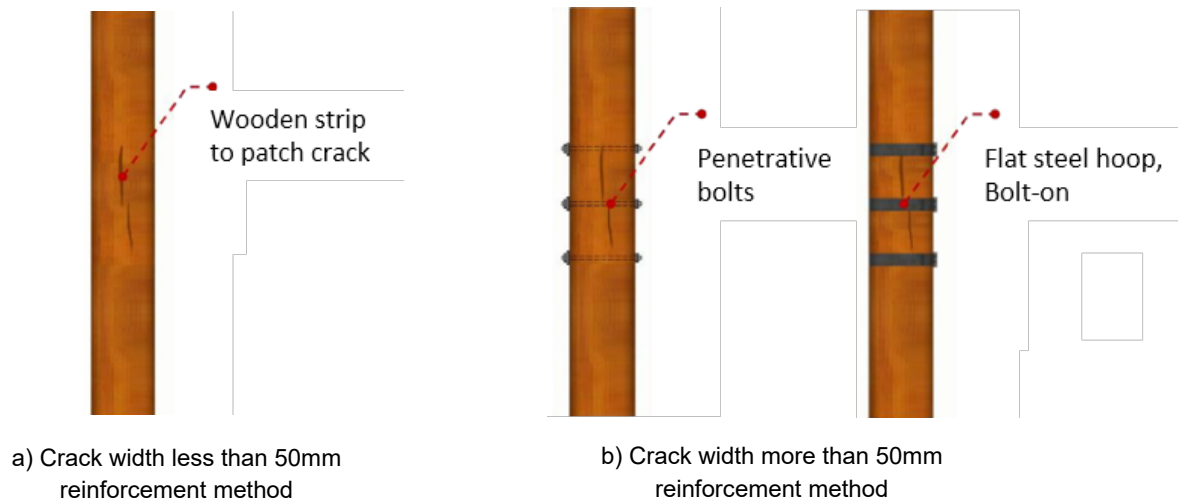


Figure 5-11 Example of wooden pillar structure reinforcement (source: reference [73])

In the case of load-bearing wooden beams, when they are damaged and the load-bearing capacity is insufficient, in addition to the replacement of new materials, they can also be reinforced by means of "attached column reinforcement". In the renovation design of the traditional houses in Xixing, the wooden beams and wood with insufficient bearing capacity are reinforced with additional channels and steel hoops at the bottom or with additional angles and anchor bolts through the corners.

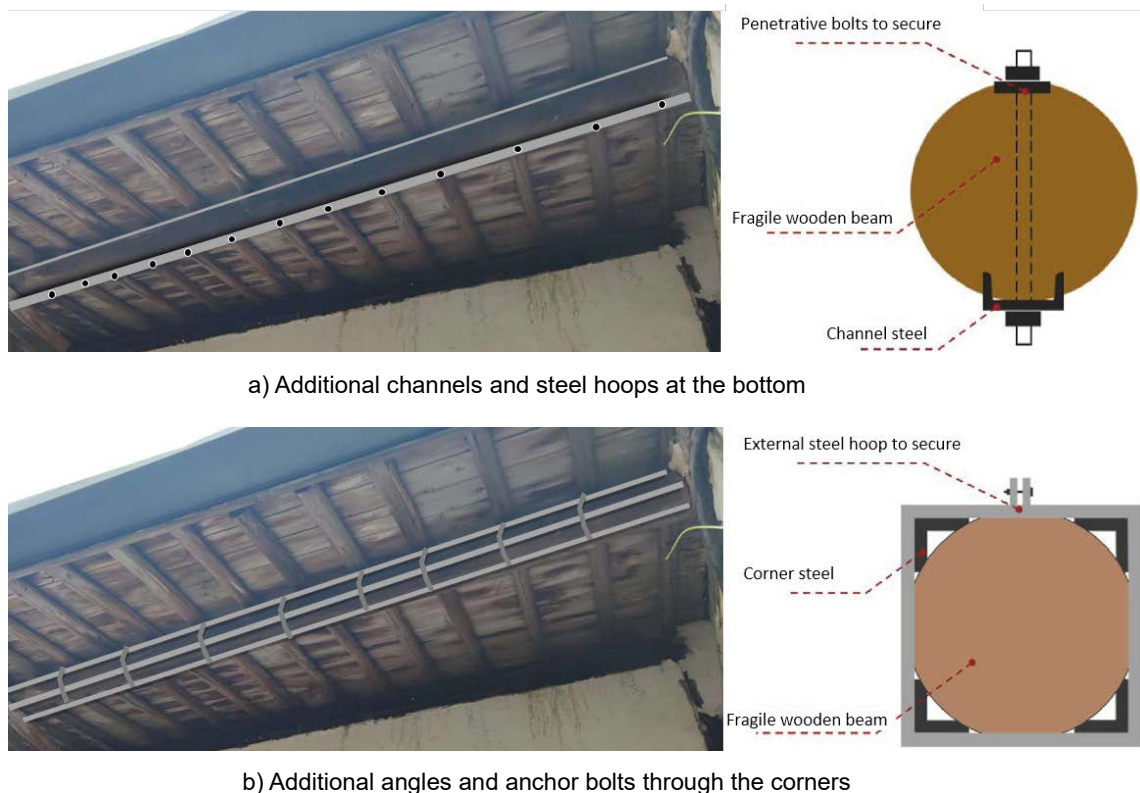


Figure 5-12 Example of wooden beam structure reinforcement (source: reference [1])

## ② Architectural style renovation

The renovation of architectural style is the main reflection of the improvement at the spatial dimension. On the one hand, at present, there is a shortage of land and limited space in the core protection area of Xixing Historic and Cultural Area, the quality of life of the residents and the economic value of the area needs to be improved. On the other hand, the renewal mode of large-scale demolition and construction no longer meets the relevant protection regulations and the requirements of the new era in the Xixing area. Therefore, in this design, the architectural adaptability is improved mainly by building renovation. For example, for the modern buildings that do not conform to the traditional architecture appearance, they can be converted to create a building that meets both modern living needs and traditional style. Meanwhile, for traditional houses with poor lighting, the living quality of residents can be improved by expanding window openings and appropriate greening (figure 5-24).

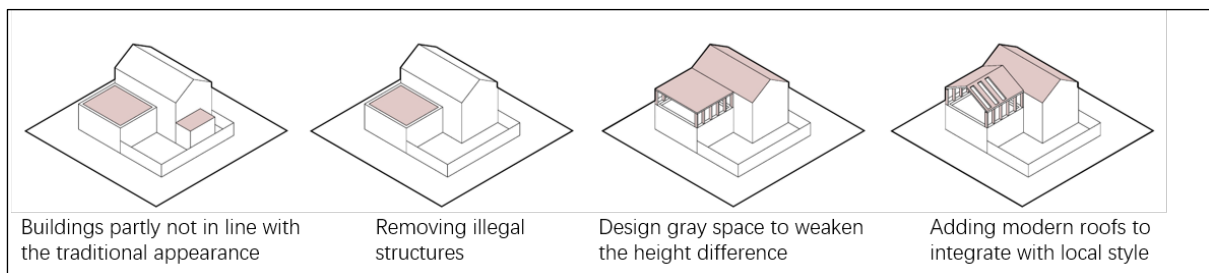


Figure 5-13 Adaptive architectural renewal: Gray space improvement  
(Source: made by the author)

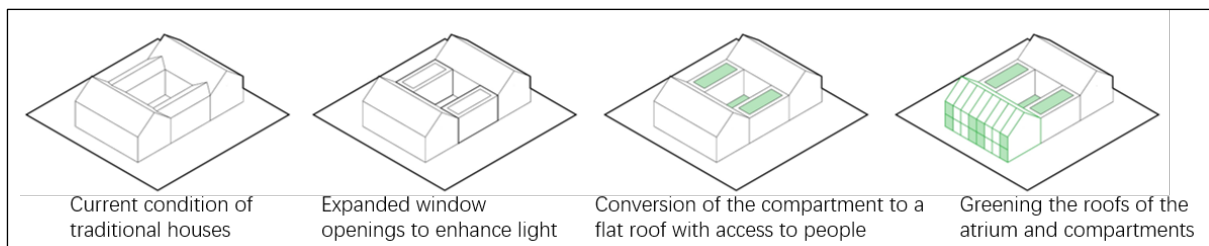


Figure 5-14 Adaptive architectural renewal: Greenery and lighting improvement

## 5.2.2 Connectivity enhancement

The community spatial connectivity enhancement strategy is divided into three dimensions: urban, community and specific spatial design, with the aim of

addressing the lack of connectivity of transportation and open space systems to enhance the corresponding disaster prevention and mitigation capabilities.

### (1) Urban dimension

In terms of municipal road system (figure 5-7), this urban design practice mainly widens Tielingguan Road according to the regulatory detailed planning, so that it intersects with Gutang Road and Chunbo Road as a municipal branch road to improve the accessibility of Xixing historic area; at the same time, this design also builds new static traffic facilities such as parking lots to meet the needs of future tourism development. And in terms of public transportation system (figure 5-8), after determining that the main pedestrian flow comes from two metro stations, Xixing Station and Binkang Station on the south side of the Xixing, this design also adds two bus stops with a radius of 300 meters inside the district to solve the problem of weak accessibility of pedestrians. The above enhancement of municipal road system and public transportation system is aim to improve the connectivity of Xixing Historic and Cultural Area with the surrounding urban transportation system.

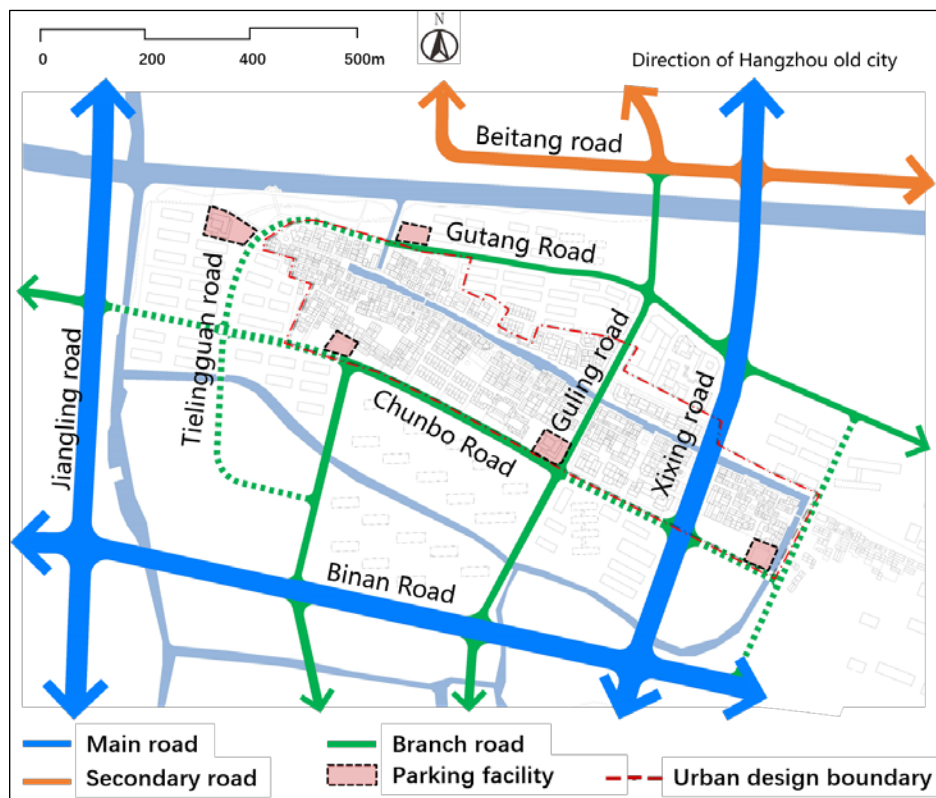


Figure 5-15 Analysis of vehicular traffic system (source: made by the author)

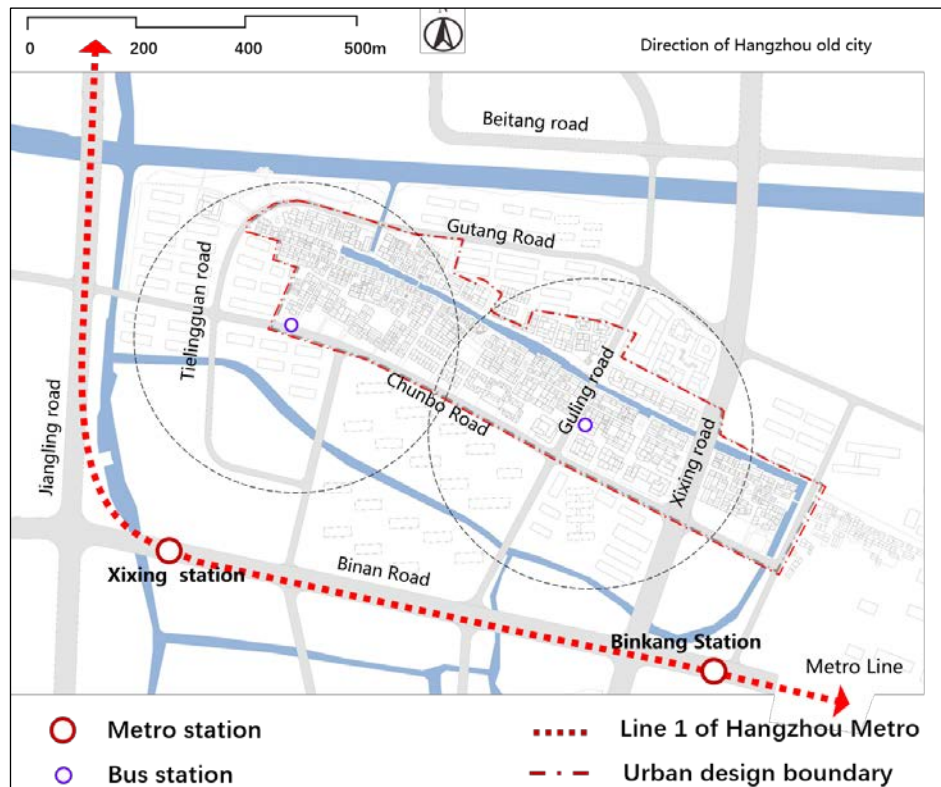


Figure 5-16 Public transportation system analysis (source: made by the author)

## (2) Community dimension

The transformation of traditional streets in Xixing is mainly based on sorting out their original fishbone pattern, opening up some of the broken roads and adding new street paths to strengthen their connection with the open space of the surrounding municipal roads and canal (figure 5-17); in addition, in the improvement of the open space system (figure 5-18), the existing open space system is also sorted out firstly, and adding new open spaces and their connecting paths so that historic sites, tourist gathering squares, corner squares, green parks, community gardens and waterfront trails are interconnected. Through these enhancements to the street system and open space system, the connectivity of the elements within the Xixing Historic and Cultural Area at the community dimension is promoted.



Figure 5-17 Street connectivity analysis in community dimension (source: made by the author)

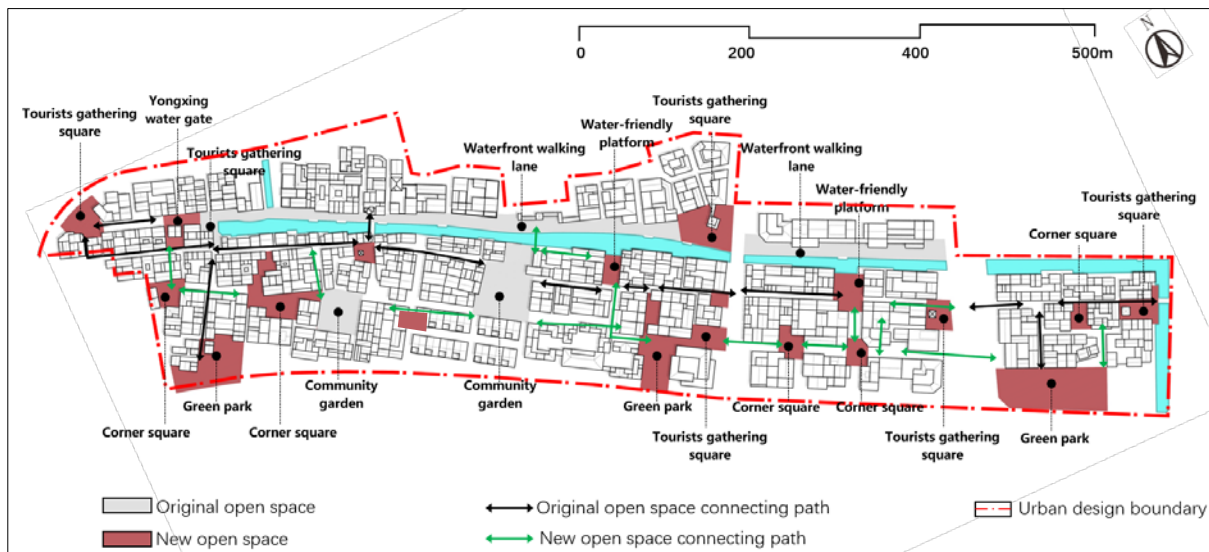


Figure 5-18 Open space connectivity analysis in community dimension (source: made by the author)

### (3) Space design

Taking the area along the west side of Guling Road as an example (figure 5-7), the specific spatial implementation of the connectivity enhancement lies in the following three aspects: firstly, the walking experience of the street space is enhanced, such as the opening of windows on the wall of the gable wall, the addition of canopies and seats and other rest facilities; secondly, based on the removal of some buildings with poor quality and appearance and the opening of the cut-off road, new street paths and open spaces are also added; thirdly, new parking buildings mainly serving tourists and non-motorized parking lots mainly serving residents are built at the entrance of the ancient town, in order to solve the problem of street blockage caused by insufficient parking space, to a certain extent. By the implementation of the above three aspects of specific spatial design, the connectivity of the spatial level will be enhanced.

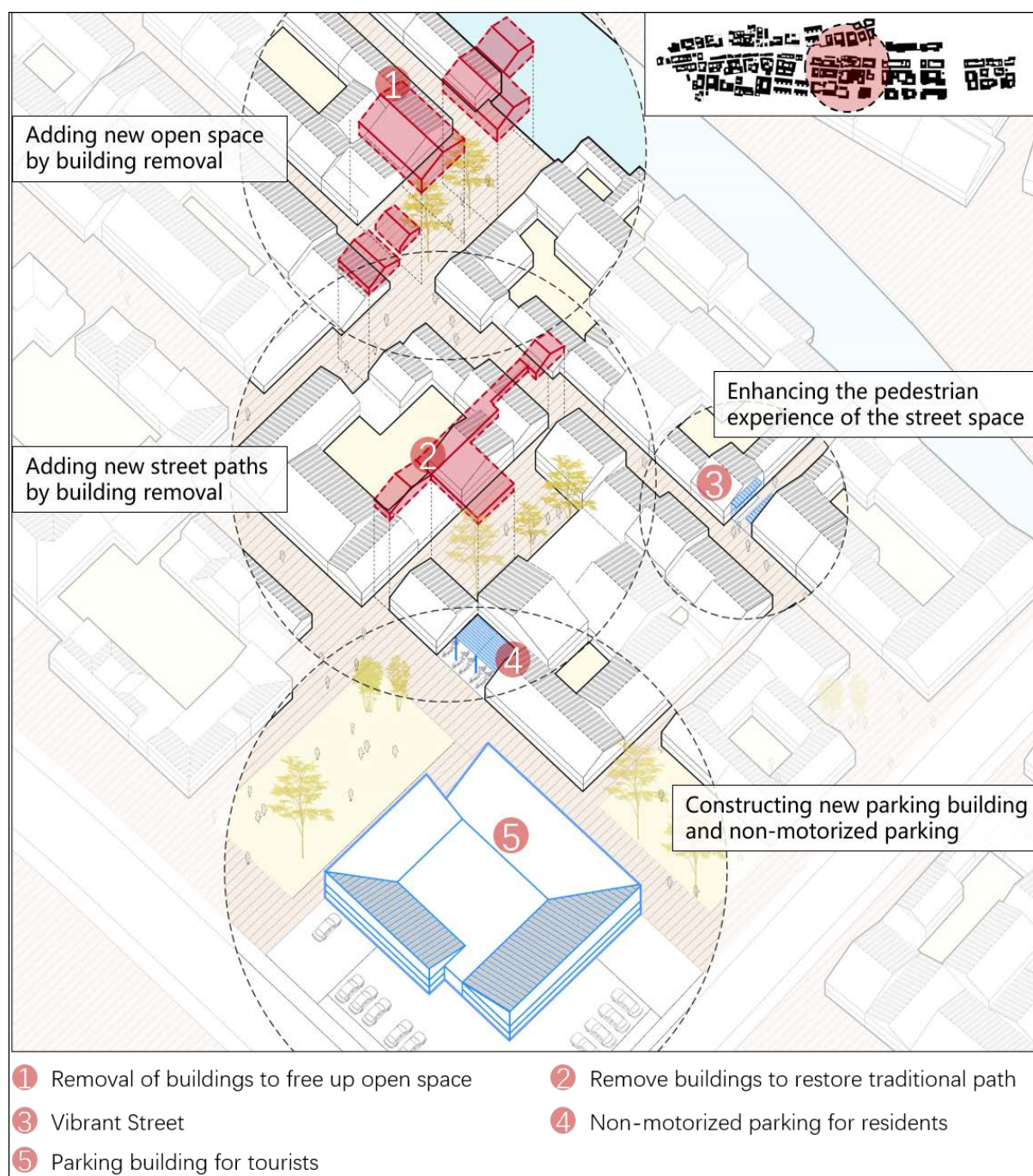


Figure 5-19 Spatial design to enhance connectivity (source: made by the author)

### 5.3 Strategies to enhance social space: strengthening social resilience

The social resilience is designed to enhance the spatial diversity and uniqueness of the Xixing Historic and Cultural Area in order to improve its ability to organize itself and transform itself after the disaster.

### 5.3.1 Diversity enhancement

The spatial diversity of the neighborhood is also improved from the urban to the spatial dimension with the aim of optimizing the age structure of local residents and increasing their income.

#### (1) Urban dimension

The urban level of complexity enhancement is mainly based on the analysis of the current situation and future development of the community, which lays the foundation for the implementation of the community dimension and spatial design dimension. First, the analysis of the current situation of Xixing shows that there are three types of functional groups in the community, namely the heritage group on the west side of the Xixing, the residential groups in the middle and east side, and two commercial groups near Guling Road (figure 5-20); in addition, based on the analysis of the regulatory detailed planning of Xixing unit, it can be seen that there are a large number of green area groups, commercial groups and residential groups planned around Xixing in the future, so the future new functions of the community should be adapted to the future urban function planning of the Xixing based on the consideration of the current group structure (figure 5-21).

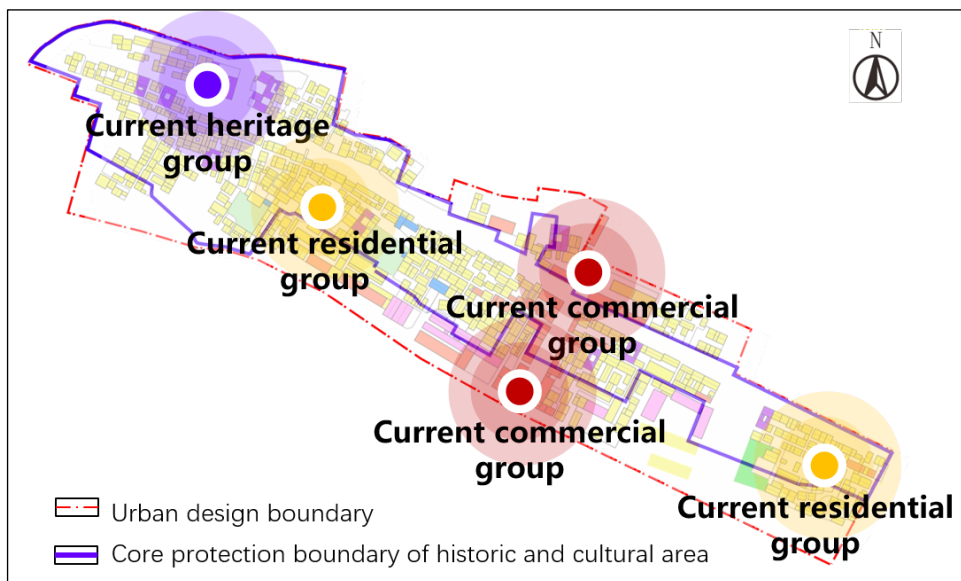


Figure 5-20 Current functional zoning of Xixing  
(Source: made by the author)

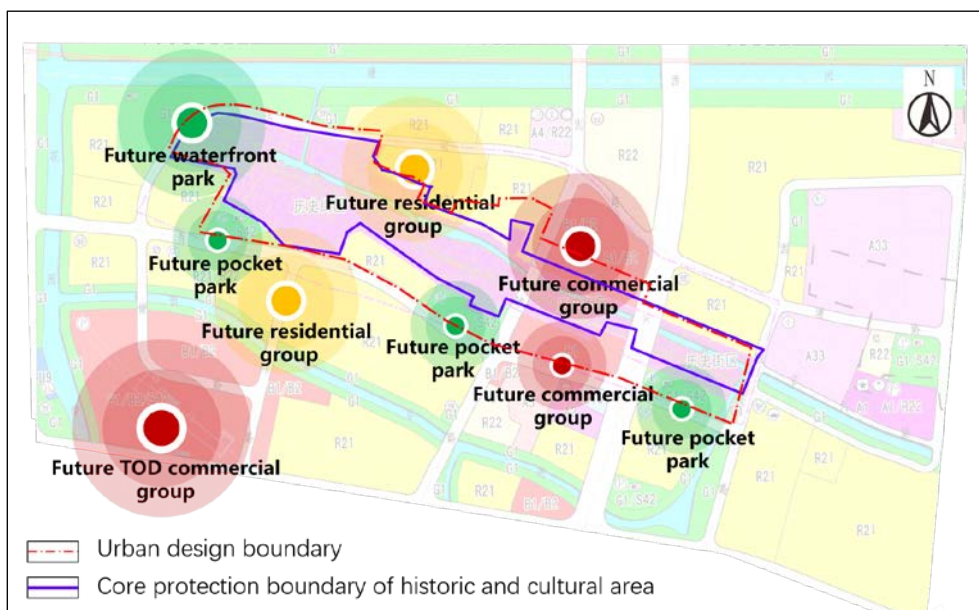


Figure 5-21 Future functional positioning of Xixing according to the regulatory planning  
(Source: made by the author)

## (2) Community dimension

### ① Land use structure

Based on the above-mentioned urban-dimension analysis and the positioning of cultural exhibition, tourism and residence in the upper plan, the community-dimension complexity enhancement introduces complex modern urban functions to Xixing, defining Xixing's future functional structure as "three axes, five zones and multiple nodes" (figure 5-22). The three axes are from east to west, which are the Canal Culture and Tourism Axis connecting cultural functional groups, the Vibrant Commercial Axis based on commercial groups and the Traditional Life Axis based on traditional living experience; the five zones refer to the Canal Culture Exhibition Zone, Traditional Residence Zone, Cultural and Innovative Industry Zone, Traditional Waterfront Commercial Zone and Modern Vibrant Commercial Zone, and the location of each functional zone is based on the current group structure and the future urban planning. In terms of land use planning, through the implantation of cultural and commercial functions, the future Xixing Historic and Cultural Area has changed the traditional land use method that focusing on a single residential function and become a modern area with multiple functions (figure 5-23).

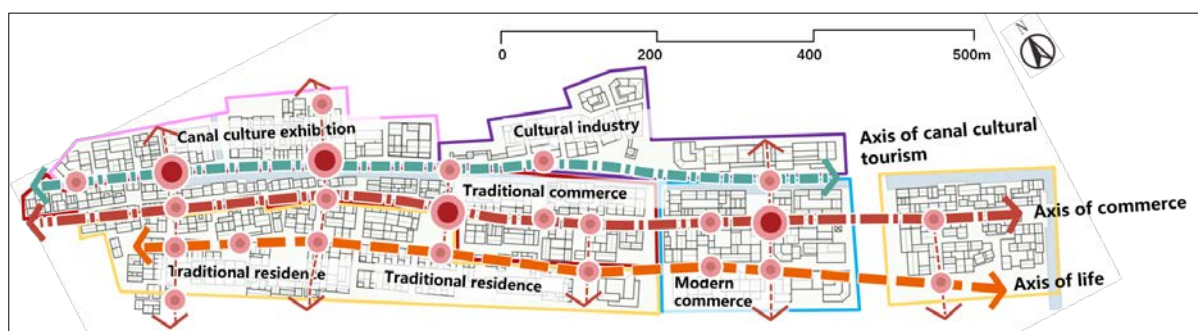


Figure 5-22 Functional structure planning (source: made by the author)

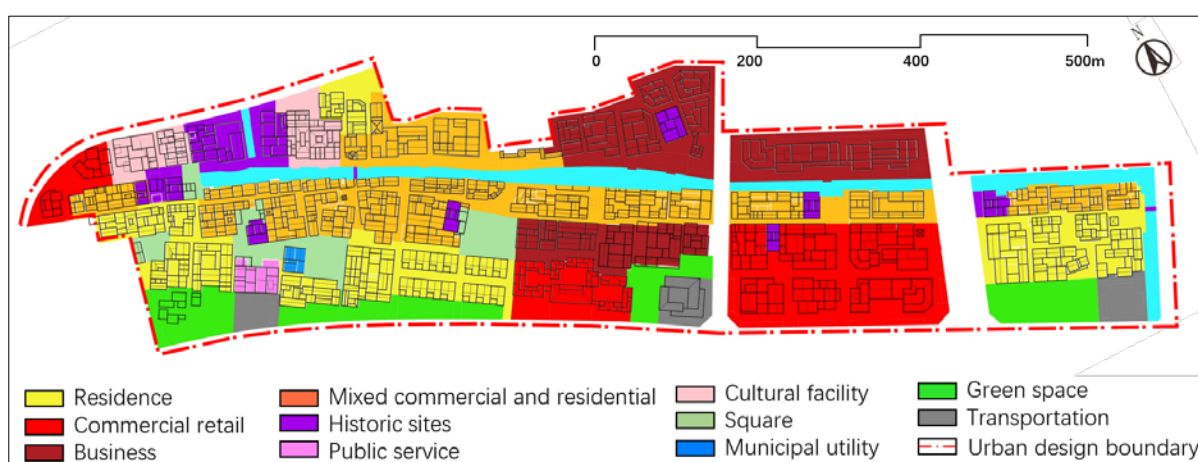


Figure 5-23 Land use planning (source: made by the author)

## ② Living circle

The improvement of spatial diversity at the community dimension is also implemented in the improvement of the Community Living Circle. At present, the living circle facilities in the Xixing Historic and Cultural Area are relatively homogeneous, mainly consisting of municipal facilities such as refuse collection stations and public toilets. It fails to serve different age groups effectively, so it can neither meet the needs of the population aging of the community nor attract the return of young residents. Therefore, this urban design is based on the Five-Minute Living Circle, and on the basis of improving the most basic cultural and commercial services, this design added childcare facilities, aging-friendly facilities and sports facilities that meet the needs of different age groups (figure 5-21 and 5-25).

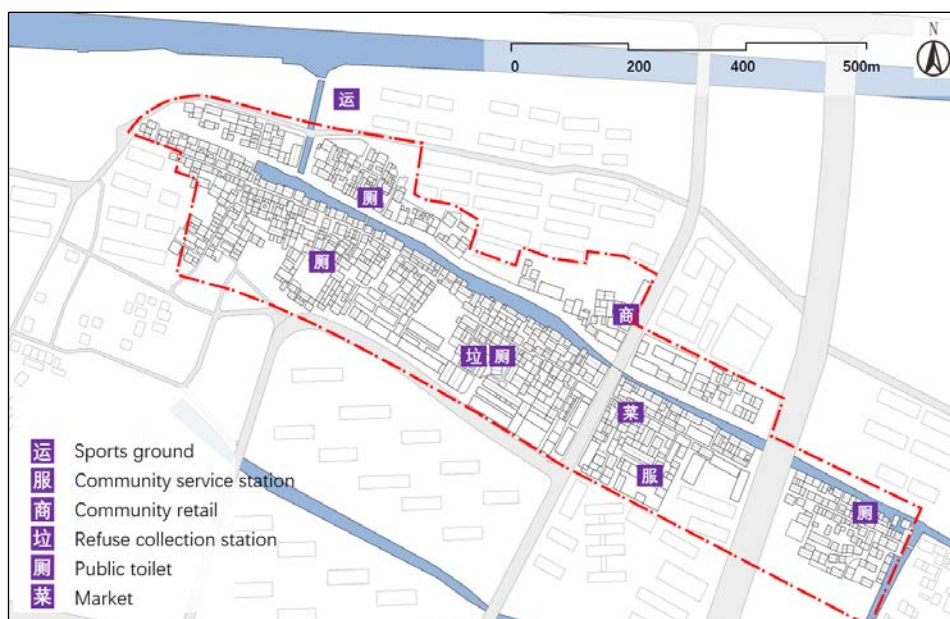


Figure 5-24 Current distribution of living circle facilities  
(Source: made by the author)

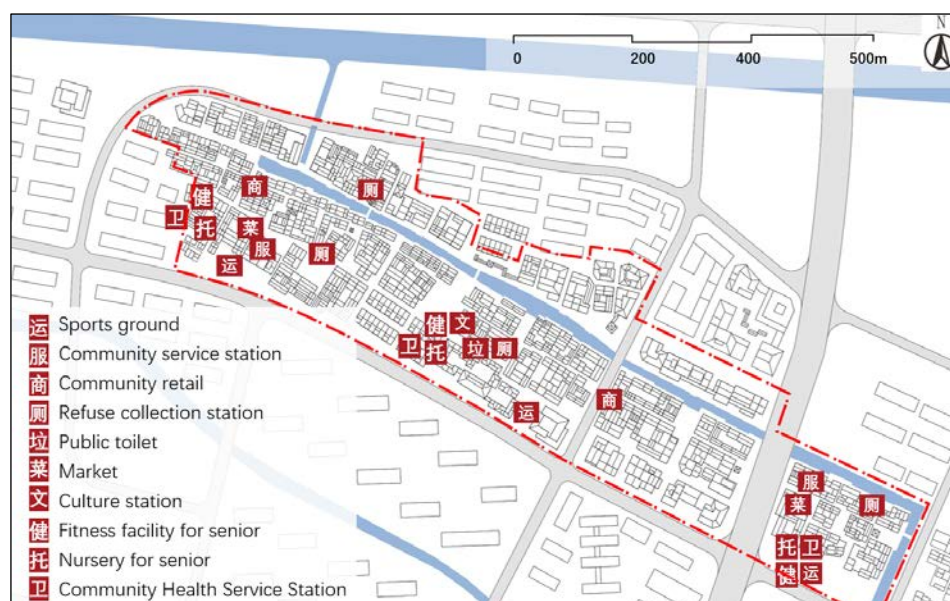


Figure 5-25 Distribution of living circle facilities after design  
(Source: made by the author)

### (3) Space design

#### ① Diverse public service facilities

The specific spatial implementation of the complexity enhancement lies in the introduction and enhancement of commercial and cultural spaces. The design takes the Modern Vibrant Commercial Zone on the east side of Guling Road as an example, and the following approaches are taken for the spatial complexity enhancement of this

functional area: firstly, by referring to the formal characteristics of the traditional architecture of Xixing, a modern commercial block is designed to meet the needs of young people and high-income groups, thereby implanting more high-end business formats; secondly, by combining the heritage protection buildings with the square, implanting small exhibition functions and emphasizing its status as a spatial node; the third is to enhance the commercial interface, such as adding landscape elements to emphasize the entrance space, setting greenery to guide pedestrians to shop, with the aim of solve the problem of commercial interface (figure 5-17); the fourth is to improve the stay-ability of the waterfront space, for example, by adding waterfront gathering places and designing waterfront dining space (figure 5-18).

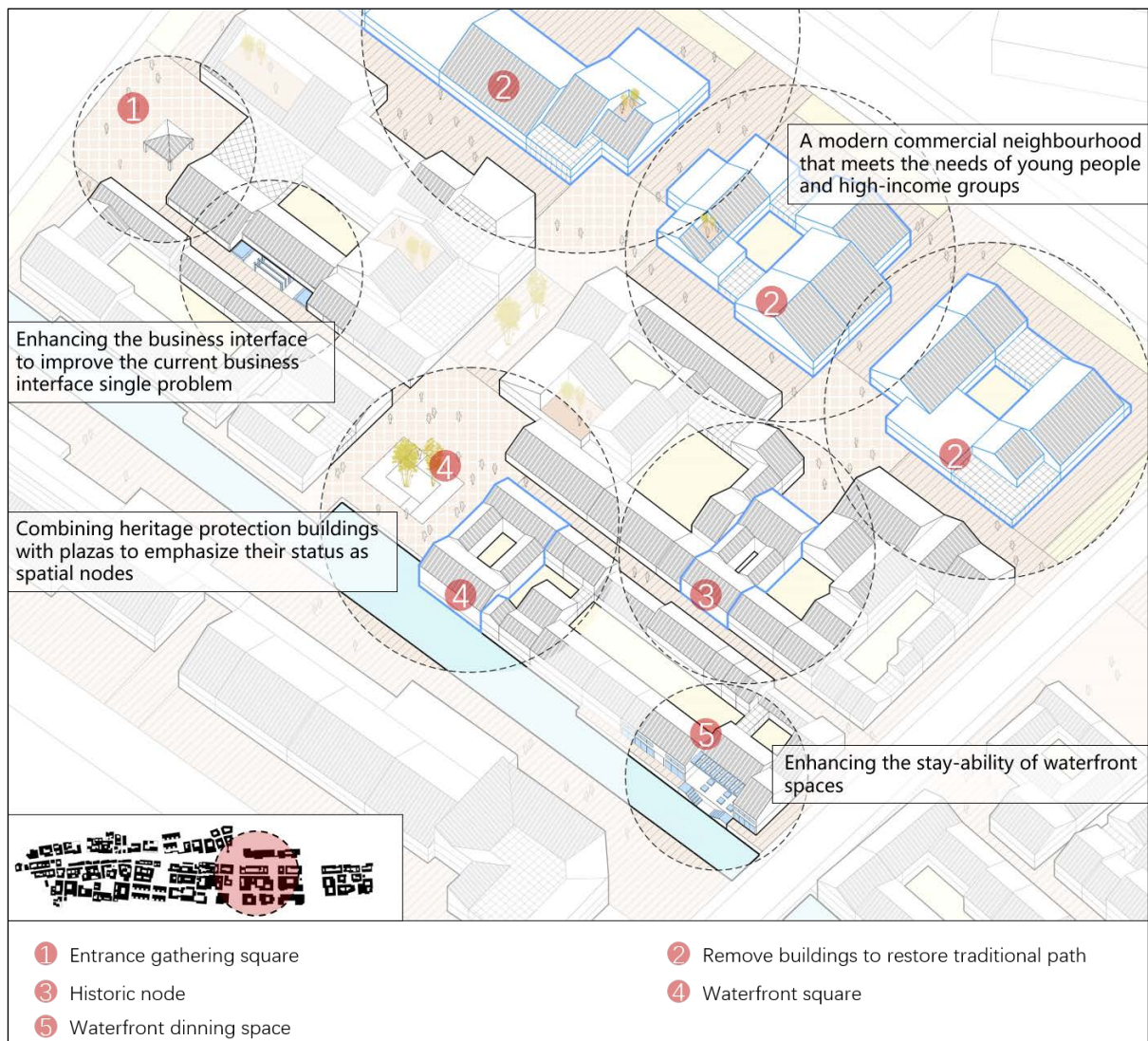


Figure 5-26 Spatial design to enhance complexity (source: made by the author)

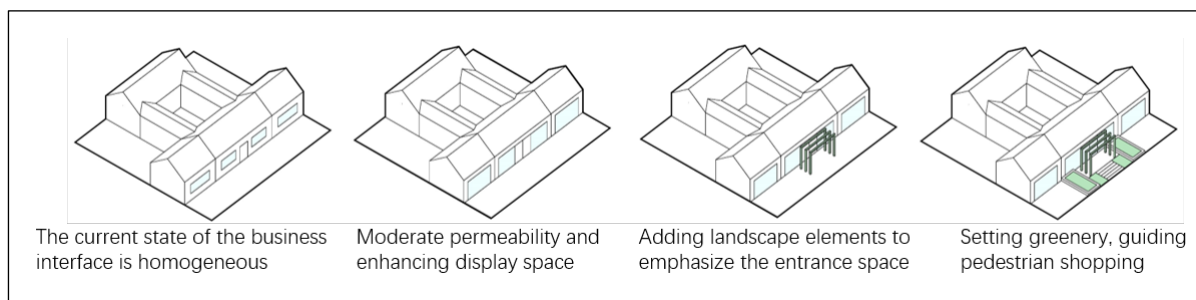


Figure 5-27 Enhancement of business functions (source: made by the author)

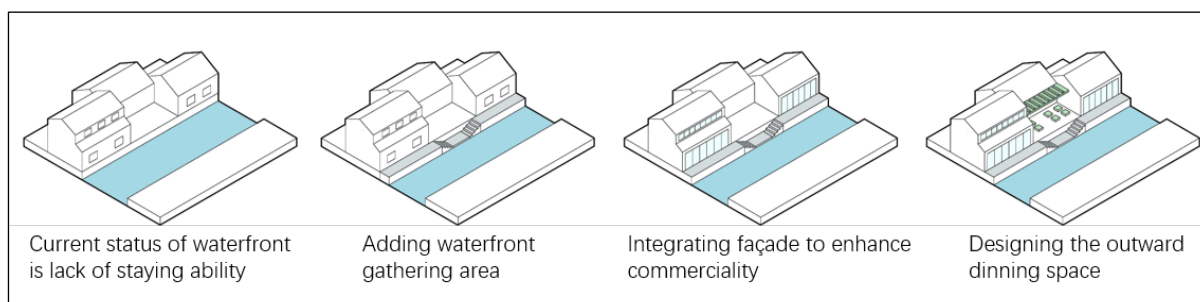


Figure 5-28 Enriching waterfront commercial interface (source: made by the author)

## ② Serving a diverse population

The improvement of spatial diversity is also reflected in the design of public spaces that serving various age groups. Take the area near Chunbo Road as an example, the integrated open space that serving various age groups is set up with different functional zones, including a recreation area for the elderly, a sports area for young people and a playing area for children (figure 5-29). The design of the elderly plaza is based on fitness and leisure facilities, and the corresponding facilities are combined with green space, and the location is planned in the center of the residential area. The youth square is mainly for sports facilities and is located on the outside of the community; the children's playground is combined with the kindergarten and is also arranged in the center of the residential area to achieve the maximum radiation effect.

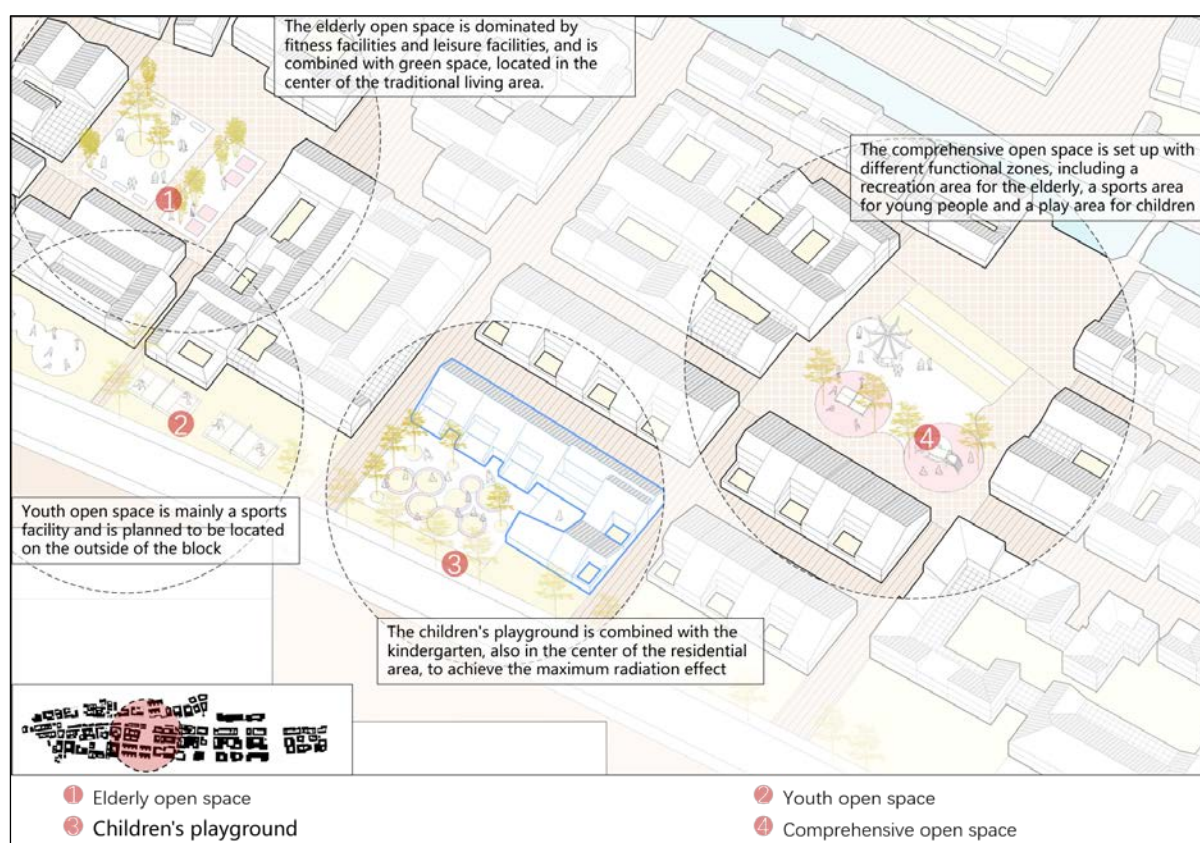


Figure 5-29 Spatial design to enhance diversity (source: made by the author)

### 5.3.2 Uniqueness enhancement

The purpose of the spatial localization of the community is to create a good historical atmosphere in the community, to enhance the residents' sense of identity and belonging to local community, and to strengthen the self-organization ability of the Xixing, and the related practices are carried out from the urban dimension to the spatial design dimension as well.

#### (1) Urban dimension

##### ① Delineating of protection elements

The local enhancement at the city level is mainly implemented by delineating the protected elements in the community to preserve the cultural and historical capital for the future sustainable development of the Xixing area, specifically delineating the protected elements such as heritage buildings, key historical open spaces, and canal area. In addition, on the basis of the core protection boundary of the historic and cultural area delineated by the government, the construction control boundary of the

historic area is added, so that the height, style, color and other characteristics of the buildings can be adapted to the Xixing Historic and Cultural Area and the local tourism style can be improved as a whole.

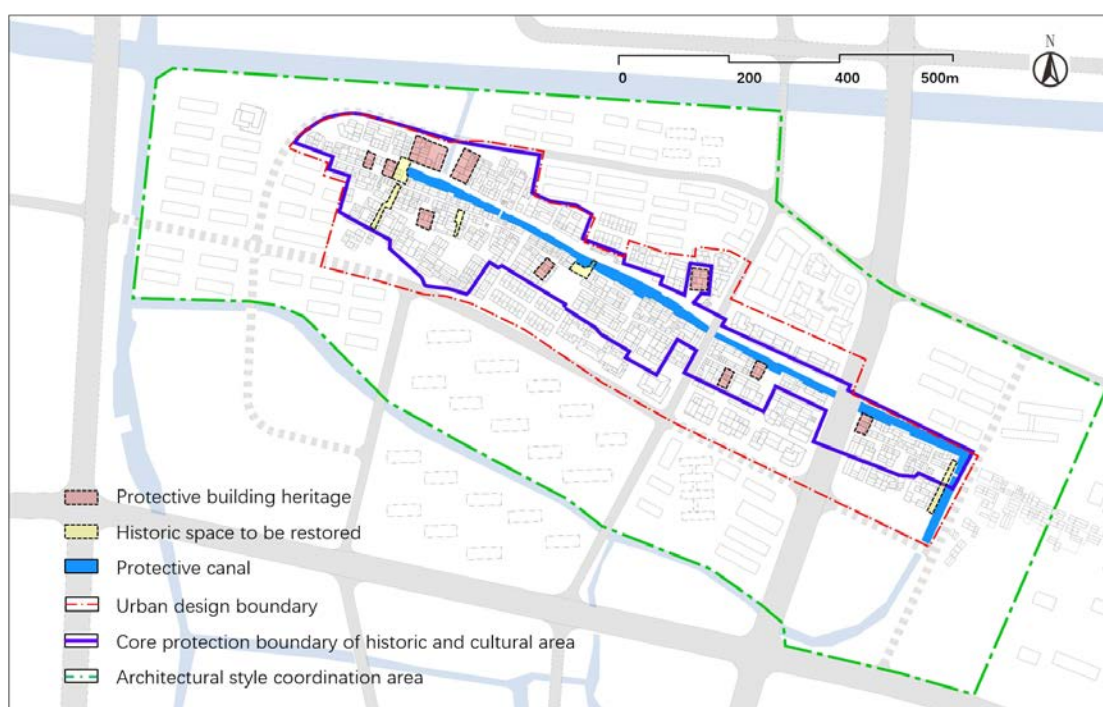


Figure 5-30 Map of protective elements in Xixing (source: made by the author)

## ② Repairing traditional texture

The improvement of uniqueness at the urban dimension also focuses on the weaving of the original architectural fabric. The Xixing Historic and Cultural Area has generally preserved the traditional architectural fabric, which is mainly represented by the old Xixing Street and the buildings along the canal. Therefore, while preserving the sustainable development capital of the original traditional fabric, the design appropriately removes the buildings with poor appearance on the periphery of the district, and gives new functions to the original buildings by construction of new buildings and transformation of traditional buildings (figure 5-31).



Figure 5-31 Adaptive modern fabric implantation  
(Source: made by the author)

## (2) Community dimension

The local enhancement at the community dimension is mainly implemented by delineating the protected elements in the district to preserve the cultural and historical capital for the future sustainable development of the Xixing district, specifically delineating the protected elements such as historical buildings, key historical spaces, and water areas. In addition, on the basis of the core protection scope of the historical and cultural district delineated by the government, the construction control scope of the historical district is added, so that the height, style, color and other characteristics of the buildings around the district can be adapted to the Xixing Historic and Cultural Area and the local tourism style can be improved as a whole.



Figure 5-32 Map of traveling route (source: made by the author)

### (3) Space design

The uniqueness enhancement at the spatial dimension is implemented in the strengthening of the community characteristics. The regional characteristic of the Xixing community is the water culture of canal. Based on this, this design enhances the uniqueness of Xixing mainly in the following four aspects: first, to create water-playing space, for example, to give Xixing unloading stairs the function of recreation, to add water-friendly platform, and to restart the boating function of the canal; second, to create water-approaching space, which is reflected in the arrangement of commercial space on both sides of the canal; third, by removing some waterfront buildings with poor architectural quality and appearance, the historical space nodes of Xixing are restored while enhancing the visual penetration of the canal and forming a water-viewing atmosphere; Fourth, the existing historical buildings are given cultural functions, such as replacing the Guotang Buildings on the north side of Xixing Pier from a single residential function to cultural functions, such as a Historical Exhibition Hall (figure 5-33).

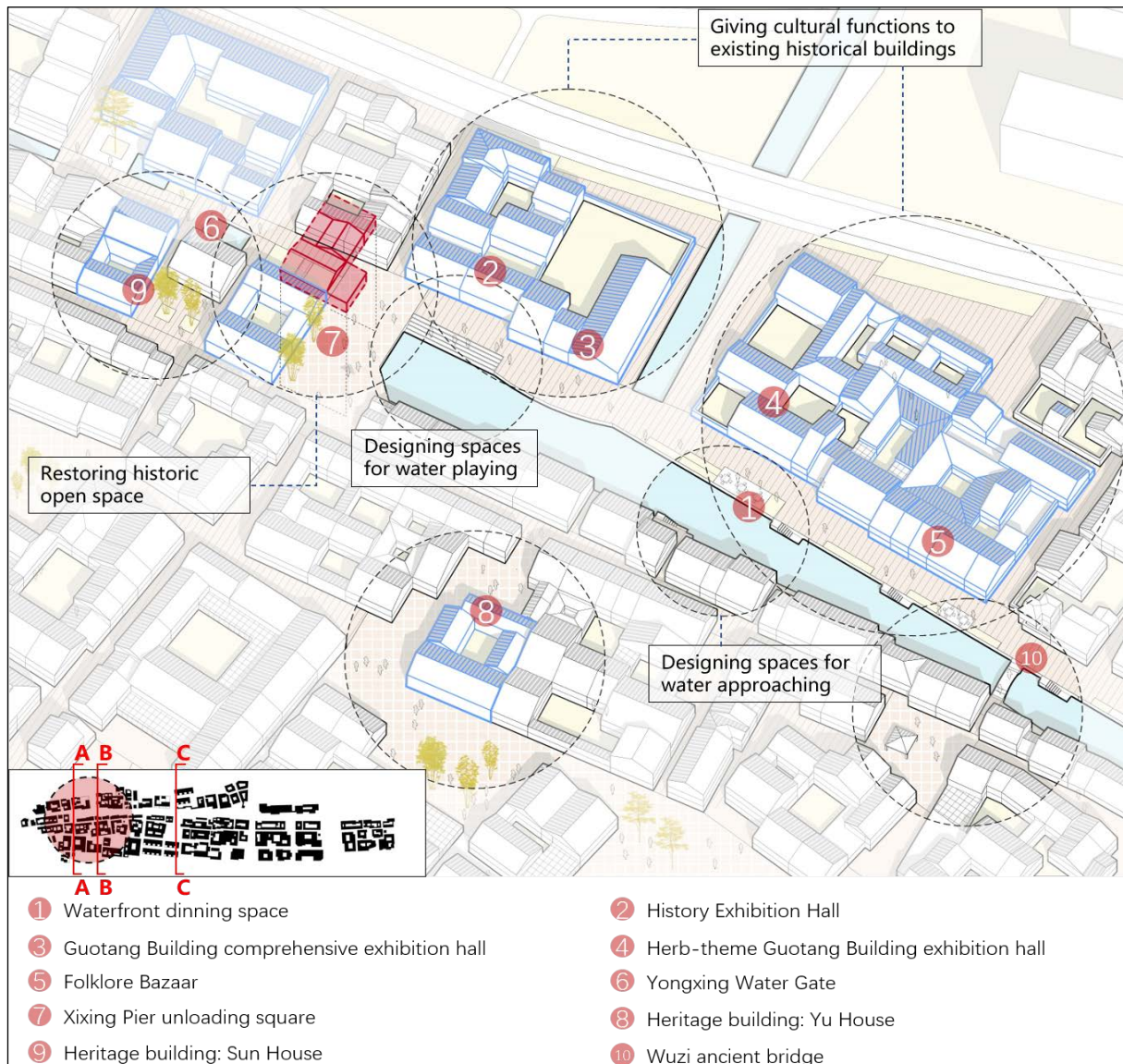


Figure 5-33 Spatial design to enhance uniqueness (source: made by the author)

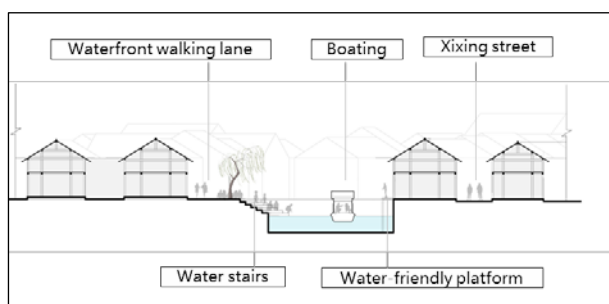


Figure 5-34 Section of water-playing theme (Source: made by the author)

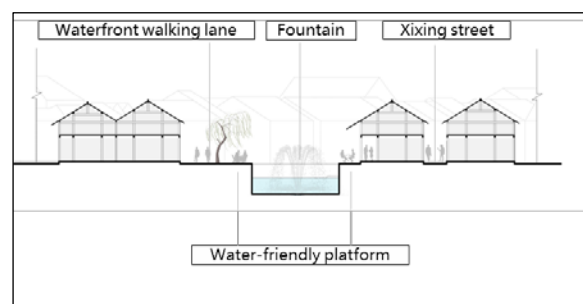


Figure 5-35 Section of water-playing theme (Source: made by the author)

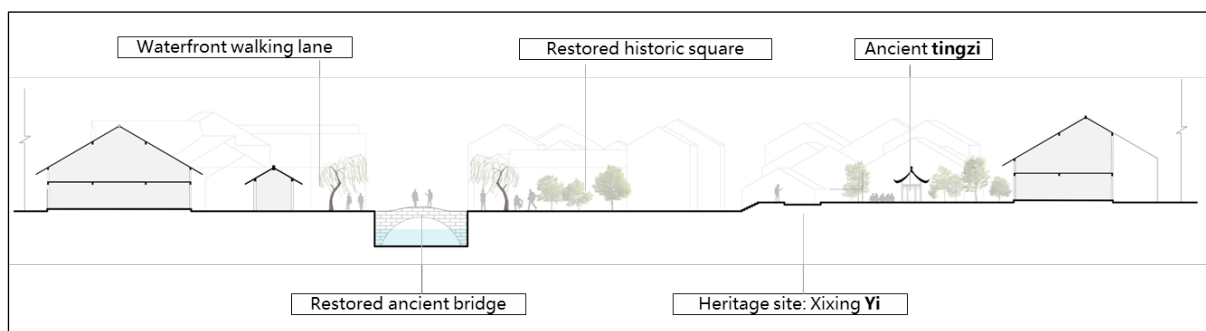


Figure 5-36 Section of water-viewing theme (source: made by the author)

## 5.5 Summary of the chapter

On the basis of the spatial enhancement strategy system constructed in Chapter 4 from the perspective of resilience, this chapter presents the results of the spatial enhancement design of the Xixing Historic and Cultural Area.

Firstly, the first part of this chapter summarize the logical framework of this urban design and clarifies that the orientation of the future development of the Xixing Historic Quarter is being an example of world cultural heritage where history and reality blend, industry and life flourish; And the goals of the spatial enhancement is using urban design methods to develop the Xixing into a historic area that integrating cultural exhibition, tourism, leisure, and traditional living functions, in order to enhance its physical space and social economy resilience, and finally achieve a sustainable. Secondly, the second part of the chapter focuses on the master plan and the aerial view, predicting and presenting the future vision of the Xixing Historic and Cultural Area. Finally, the third part of the chapter is devoted to two parallel sections that explore in detail how robustness, connectivity, diversity and uniqueness are implemented in three dimensions: urban, community and space design.

## **Conclusion and Discussion**

### **6.1 Conclusion**

#### **(1) The development of the Xixing Historic and Cultural Area and the existing problems.**

The development of the Xixing Historic District can be divided into four periods: military town, trade center, urban island and World Heritage Site of the Grand Canal. Historically, the advantageous geographical location gave the Xixing Historic District the function of a water transport transit center, which further promoted the development of the district and led to its basic form. In addition, although the district has undergone a round of environmental improvement work, the current state of development is still relatively general, and the entire historic district has not yet been protected and developed, requiring further spatial improvement work, which faces two core problems: first, the traditional physical space is not adapted to modern life, as reflected in the lack of public service facilities and traffic space blockage; second, the current social space is not adapted to future development, which is reflected in the demographic imbalance, the fragmentation of history and culture, and the lack of traditional businesses.

#### **(2) A strategy system for spatial resilience enhancement of the Xixing Historic and Cultural Area**

Based on the analysis of the elements of the resilience strategy and its mechanism of action, this study constructs the spatial enhancement strategy of the historic district from the aspects of "strengthening the physical space resilience" and "social economy resilience", so as to enhance its resilience to external disturbances, and its resilience after the disturbances (figure 4-2).

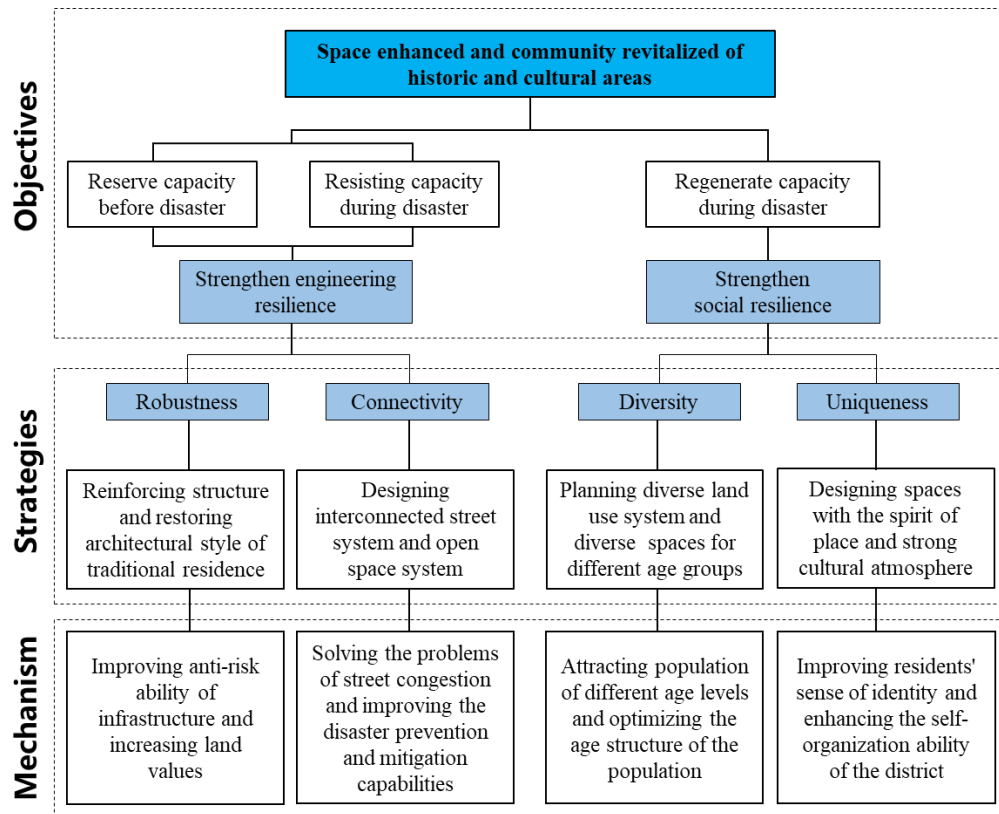


Figure 5-1 Strategy system of space enhancement (source: made by the author)

## 6.2 Discussion

The spaces in the historic and cultural areas are precious because of the richness of their historical and regional culture. At the same time, such spaces are limited and to a certain extent do not meet the needs of residents in the new era. These two aspects mean that the spatial enhancement of historic and cultural districts should be as precise as possible in order to maximize the value of such areas, compared to newly built communities and ordinary old communities.

Therefore, the future spatial enhancement of old communities should not only focus on qualitative considerations, but also on quantitative research. However, the research on the spatial enhancement methods of historic and cultural areas from resilience theory in this dissertation is mainly guided by qualitative aspects to propose strategies and design methods, lacking the quantification of their spatial resilience, which is also the direction of subsequent research in this dissertation.

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## Appendix

### Questionnaire of the previous environmental renovation work

Hello, I am a postgraduate student at xxx University and I would firstly like to thank you very much for helping me to fill in this questionnaire. This questionnaire is anonymous and the information you provide will be used for scientific research only and will be treated in strict confidence. I wish you a happy life.

#### Part 1: BASIC INFORMATION

##### 1.Are you a male or female?

☐. Male ☐. Female

##### 2. What is your age?

☐. Less than 24 ☐. 25-34 ☐. 35-44 ☐. 45-54 ☐. 55-64 ☐. More than 65

##### 3. What is your occupation?

☐. Student ☐. Public institution staff ☐. Private sector staff  
☐. Individual business owner ☐. Ordinary laborer ☐. Service industry worker  
☐. Retiree ☐. Self-employed ☐. Unemployed ☐. Other

##### 4. What is your educational background?

☐. Bachelor's degree and above ☐. Junior college ☐. High school  
☐. Junior high school and below

##### 5.How much do you earn every month?

☐. Over 10000RMB ☐. 5000-10000RMB ☐. 3000-5000RMB ☐. 1000-3000RMB ☐.  
Below 1000RMB

## **Part 2: EXPECTATION BEFORE THE RENOVATION WORK**

### **1. What is your expectation about the improvement of **residential condition**?**

- ☐. Very high expectation ☐. High expectation ☐. Average expectation  
☐. few expectation only ☐. No expectation

### **2. What is your expectation about the improvement of **commercial facility**?**

- ☐. Very high expectation ☐. High expectation ☐. Average expectation  
☐. few expectation only ☐. No expectation

### **3. What is your expectation about the improvement of **educational and cultural facility**?**

- ☐. Very high expectation ☐. High expectation ☐. Average expectation  
☐. few expectation only ☐. No expectation

### **4. What is your expectation about the improvement of **entertainment facility**?**

- ☐. Very high expectation ☐. High expectation ☐. Average expectation  
☐. few expectation only ☐. No expectation

### **5. What is your expectation about the improvement of **medical facility**?**

- ☐. Very high expectation ☐. High expectation ☐. Average expectation  
☐. few expectation only ☐. No expectation

### **6. What is your expectation about the improvement of **transporting facility**?**

- ☐. Very high expectation ☐. High expectation ☐. Average expectation  
☐. few expectation only ☐. No expectation

### **7. What is your expectation about the improvement of **greening**?**

- ☐. Very high expectation ☐. High expectation ☐. Average expectation

☐. few expectation only ☐. No expectation

**8. What is your expectation about the improvement of **income level**?**

☐. Very high expectation ☐. High expectation ☐. Average expectation

☐. few expectation only ☐. No expectation

**9. What is your expectation about the improvement of **community network**?**

☐. Very high expectation ☐. High expectation ☐. Average expectation

☐. few expectation only ☐. No expectation

**10. What is your expectation about the improvement of **cultural atmosphere**?**

☐. Very high expectation ☐. High expectation ☐. Average expectation

☐. few expectation only ☐. No expectation

**11. What is your expectation about the improvement of **public security**?**

☐. Very high expectation ☐. High expectation ☐. Average expectation

☐. few expectation only ☐. No expectation

**12. What is your expectation about the improvement of **community service**?**

☐. Very high expectation ☐. High expectation ☐. Average expectation

☐. few expectation only ☐. No expectation

**Part 3: SATISFACTION AFTER THE RENOVATION WORK**

**1. What is your satisfaction about the improvement of **residential condition**?**

☐. Very high satisfaction ☐. High satisfaction ☐. Average satisfaction

☐. few satisfaction only ☐. No satisfaction

**2. What is your satisfaction about the improvement of **commercial facility**?**

☐. Very high satisfaction ☐. High satisfaction ☐. Average satisfaction

☐. few satisfaction only ☐. No satisfaction

**3. What is your expectation about the improvement of educational and cultural facility?**

☐. Very high satisfaction ☐. High satisfaction ☐. Average satisfaction

☐. few satisfaction only ☐. No satisfaction

**4. What is your expectation about the improvement of entertainment facility?**

☐. Very high satisfaction ☐. High satisfaction ☐. Average satisfaction

☐. few satisfaction only ☐. No satisfaction

**5. What is your expectation about the improvement of medical facility?**

☐. Very high satisfaction ☐. High satisfaction ☐. Average satisfaction

☐. few satisfaction only ☐. No satisfaction

**6. What is your expectation about the improvement of transporting facility?**

☐. Very high satisfaction ☐. High satisfaction ☐. Average satisfaction

☐. few satisfaction only ☐. No satisfaction

**7. What is your expectation about the improvement of greening?**

☐. Very high satisfaction ☐. High satisfaction ☐. Average satisfaction

☐. few satisfaction only ☐. No satisfaction

**8. What is your expectation about the improvement of income level?**

☐. Very high satisfaction ☐. High satisfaction ☐. Average satisfaction

☐. few satisfaction only ☐. No satisfaction

**9. What is your expectation about the improvement of community network?**

- ☐. Very high satisfaction ☐. High satisfaction ☐. Average satisfaction  
☐. few satisfaction only ☐. No satisfaction

**10. What is your expectation about the improvement of **cultural atmosphere**?**

- ☐. Very high satisfaction ☐. High satisfaction ☐. Average satisfaction  
☐. few satisfaction only ☐. No satisfaction

**11. What is your expectation about the improvement of **public security**?**

- ☐. Very high satisfaction ☐. High satisfaction ☐. Average satisfaction  
☐. few satisfaction only ☐. No satisfaction

**12. What is your expectation about the improvement of **community service**?**

- ☐. Very high satisfaction ☐. High satisfaction ☐. Average satisfaction  
☐. few satisfaction only ☐. No satisfaction

**13. What is your **overall expectation** about the renovation work?**

- ☐. Very high satisfaction ☐. High satisfaction ☐. Average satisfaction  
☐. few satisfaction only ☐. No satisfaction

**14. Are you willing to move out of this community when it is available?**

- ☐. Yes ☐. No