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专业学位硕士学位论文

Research on the application of Italian Typomorphological planning technique: A planning proposal for Zhuangyuanfang historic district in Guangzhou

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摘要

意大利形态类型学规划技术（Italian Typo-morphological Planning Technique）是意大利 20 世纪 60 年代以来对于城市总体规划及城市历史中心规划保护与更新的重要方法。1959 年，穆拉托里在其著作《可操作的城市历史》中以威尼斯为例阐述了一种以类型学与形态学为主导的城市分析方法，在此基础上形成了一套成熟的规划技术。这一规划技术以意大利学派类型学理论为基础，涵盖了包括阿尔多·罗西的建筑类型学及穆拉托里的形态类型学等理论和实践方法，同时在 20 世纪 90 年代以后与英德城市形态学融合发展，逐步完善。并在之后的若干年里发展成熟，应用于多个城市总体规划及历史中心规划保护与更新各个环节的实践中。

本文以意大利形态类型学主导的规划技术为研究对象，深入分析该规划技术的形态类型学理论背景，总结归纳其城市分析方法和要素及实践操作手法，并通过实例分析总结该技术具体应用的环节及流程。最终以摸索本土适用性及实践为目的，构建该技术的应用框架，并选取了广州“状元坊”历史街区为例进行规划及城市设计实践研究。

本文共分为六个章节。第一章绪论，首先阐明了研究背景及研究目的，并在理论背景层面对相关研究概念进行界定以及相关研究的综述，最后确定研究方法与研究框架。第二章为基础理论研究，对该技术的理论基础进行介绍，具体分析形态类型学的构成及意大利形态类型学的发展发展脉络，总结形态类型分析方法。第三章为意大利形态类型学主导的规划技术剖析，聚焦于该技术应用的环节及实际操作手段。对整体流程和不同环节的适用性实践进行解析。并以罗马历史中心区规划（2008 版）和巴勒莫历史中心区规划为例，进一步总结该技术的实际应用。第四章为本土化适用性研究，首先对意大利语境下该技术的内在可行性进行研究分析，继而总结该技术的适用范围，最后说明挑选广州“状元坊”历史街区作为实践的依据，并融入本土化研究构建应用框架。第五章及第六章为技术应用的实践部分，第五章应用形态类型学分析方法对状元坊历史街区进行分析，第六章则在此基础上应用意大利形态类型学规划技术进行城市设计导则的制定，并进一步推进总体规划和详细设计。最后在结论部分对整体研究进行总结，并提出研究的不足和展望。

本文希望通过对意大利形态类型学规划技术的应用研究，补充国内对于以意大利学

派为代表的形态类型学研究的不足，同时在该规划技术应用的本土化研究方面提供一定的思路。也为国内旧城规划中的保护与更新提供一定的支持。

关键词：形态类型学，规划技术，历史街区，城市设计

Abstract

The Italian Typo Morphological Planning Technique is an important approach to urban master planning and the conservation and regeneration of historic urban centers in Italy since the 1960's. In 1959, in his book *Studi per una operante storia urbana di Venezia*, Muratori presented a typological and morphological approach to urban analysis, on the basis of which a mature planning technique was developed. This planning technique is based on the typological theory of the Italian school, which covers the theoretical and practical approaches including Aldo Rossi's architectural typology and Muratori's typomorphology, and was gradually improved after the 1990s with the integration and development of the British and German urban morphology. In the following years, it has been developed and matured and applied in various aspects of urban master planning and historic center planning, conservation and regeneration.

This thesis takes the Italian typomorphological planning technique as the research object, analyzes the typomorphology theoretical background of this planning technique, summarizes its urban analysis methods and elements as well as practical operation methods, and summarizes the specific application of this technique and its processes through examples. Finally, with the purpose of exploring the local applicability and practice, the application framework of this technique is constructed, and the historic district of "Zhuangyuanfang" in Guangzhou is selected as an example for planning and urban design practice research.

This thesis is divided into 6 chapters. The first chapter is the introduction, which firstly clarifies the background and purpose of the study, and then defines the relevant research concepts and reviews the related research at the theoretical background level, and finally defines the research method and framework. The second chapter is a basic theoretical study, which introduces the theoretical basis of the technique, specifically analyzes the composition of typomorphology and the development of Italian typomorphology, and summarizes the typomorphological analysis methods. The third

chapter is devoted to the analysis of the planning technique dominated by Italian typomorphology, focusing on the aspects of the application of the technique and the practical means of operation. The overall process and the applicability of different aspects of the practice are analyzed. The master plan of Rome (2008 edition) is used as an example to further summarize the application of this technique at various levels. Chapter 4 is a study of the applicability of localization, firstly, it analyzes the feasibility of the technique in the Italian context, then summarizes the scope of application of the technique, and finally explains the basis for the selection of the "Zhuangyuanfang" historic district of Guangzhou as a practice. Chapter 5 and 6 are the application parts. Based on the above theory, Chapter 5 analyzes the selected district in a typomorphological way and applies the application framework of this technique to the planning and urban design practice of the district's conservation and regeneration in chapter 6. Finally, the thesis summarizes the research process and conclusions, and presents the research gaps and prospects of the study.

This thesis hopes that the research on the application of Italian typomorphological planning technique will complement the domestic research on typomorphology represented by the Italian school and provide some ideas for localized research. It also provides some support for the conservation and regeneration in domestic old city planning.

Keywords：typomorphology, planning technique, historic district, urban design

LIST OF FIGURES

CONTENT

CHAPTER 1: INTRODUCTION

1.1 Research Background

Italy is currently the country with the largest number of existing World Heritage sites and has a correspondingly important position in the field of urban heritage conservation and regeneration. At a time of high global urbanization and urban transformation, many of Italy's historic towns have been able to preserve their unified and harmonious historic landscape and urban tissue, thanks in large part to Italy's traditional philosophy of historic building conservation and to planning techniques that have evolved over time. Among them, the Italian Typo-morphological studies and the Typo-Morphological Planning Techniques have played a very important role.

Typomorphology of the Italian School began in the middle of the 20th century, and its birth and development originated from the Italian School's new perception of the traditional architectural typology theory based on the Neo-rationalism on the one hand, and was influenced by the social context of the massive reconstruction of Italian cities after World War II on the other. In this period, architects represented by Muratori proposed "thinking about architecture on the scale of the city"[1], which elevated the traditional architectural typology to urban form and marked the establishment of Italian Typomorphology.

In 1959, in his book *Studi per una operante storia urbana di Venezia*[2], Muratori presented a typological and morphological approach to urban analysis, using Venice as an example, and translated the results into design solutions. Based on this, it was gradually applied in urban planning, and a mature planning technique was developed. This planning technique was based on the typo-morphological theory of the Italian

[1] Cataldi G, Maffei G L, Vaccaro P. Saverio • Muratori and the Italian school of planning typology[J]. Urban morphology, 2002, 6(1): 3-14.
[2] Muratori S. Studi per una operante storia urbana di Venezia[J]. Palladio, 1959, 1959: 1-113. 22.

school, covering the typomorphology of Muratori-Caniggia and the architectural typology of Aldo Rossi. In the following years it was applied in the practice of several urban master plans and the conservation and regeneration of historic centers. [3]The planning technique is based on the typological and morphological theories of the Italian school, rooted in the traditional Italian concept of cultural heritage conservation, and also reflects the importance that the Italian school places on the historical continuity between heritage conservation and regeneration.

During my double degree at the Politecnico di Torino, I learned about the effectiveness of this technique for urban planning and urban design, especially for the conservation and renewal of historic cities during my course. Therefore, it makes me think whether this approach, which is already quite mature in the West, is applicable to the domestic context, or how this idea of conservation and regeneration can be applied in China.

The domestic research on Italian typo-morphology started late, beginning in the 1980s. Scholars represented by Gu Kai, Chen Jintang, Chen Fei and Tian Yinsheng have made outstanding contributions to the introduction and research of Italian typomorphological theory. However, most of the existing researches explore the significance of Italian typomorphology for Italian historical heritage conservation and related theoretical combing studies, but less about the content and process of planning techniques. Therefore, this thesis aims to take the Italian typomorphology as the leading planning technique, firstly, to review the theoretical basis and development history of this technique, and then to systematically summarize the implementation process of this technique with the analysis of typical cases, and finally, to conduct a practical experiment in the historic district of Guangzhou "Zhuangyuanfang" on the basis of localized research. Finally, based on the localized research, the thesis will try to implement the technique in the historic district of Guangzhou.

[3] Xie S. Learning from Italian typology-and morphology-led planning techniques: A planning framework for Yingping, Xiamen[J]. Sustainability, 2019, 11(7): 1842.

1.2 Research significance and purpose

This thesis is a study based on the above background, which has both theoretical and practical significance.

1.2.1 Theoretical significance

(1) Sorting out the development of Italian typomorphology. The theory and research of Italian typomorphology have been active in the Western architecture and planning circles since the 1960s, and have played an important role in both theory and practice. However, for a long time, its influence has been insufficient outside Italy. This is partly due to the language barrier of Italian[4] and partly due to the extensive exchange and integration of Italian typology with the urban morphology of the Anglo-German Conzen school in its later development, which has not received sufficient attention. This thesis traces the development of Italian typomorphology and helps to construct a clear developmental lineage.

(2) It is beneficial to improve the applied research of typomorphological theory. This thesis summarizes the analysis elements and layers of typomorphology, and systematically presents the existing analysis system and design methods of it.

1.2.2 Practical significance

Through the analysis of real cases, this thesis clarifies

(1) The interventions and conditions of application of Italian typomorphological planning techniques in practical applications.

(2) The specific operation methods and processes for certain scales of land areas.

It also summarizes the characteristics and builds a framework for application in conjunction with localized adaptation studies. This will help to select suitable areas in

[4] Deng Hao, Zhu Peiyi, Han Dongqing. Operative Urban History: Reading Saverio Muratori's Typomorphological theory and design practices [J].The Architect,2016(01):52-61.

China for the application of Italian typomorphological planning techniques.

1.3 Definition of related concepts

The theoretical basis of the Italian typomorphological planning technique is based on the typomorphological research of the Italian school. Typology was originally a discipline used to describe, study and compare the categorical characteristics of structural forms between different objects, so it is often applied in a methodological form in various fields, including archaeology, biology, etc., and its study is mostly of a group or group scale things, rather than individuals.

1.3.1 Typomorphology

The concept of typomorphology in a general sense was introduced in the 1990s by the American scholar Anne Vernez Moudon, who elaborated on the concept of typomorphology in 1994 [5]:

"Typomorphological studies reveal the physical and spatial structure of cities. They describe urban form (morphology) based on detailed classifications of buildings and open spaces by type (typology). It considers all scales of the built landscape from the small room or garden to the large, urbanized area. It characterizes urban form as a dynamic and continuously changing entity immerse in a dialectic relationship with its producers and inhabitants."

Although there is no universally accepted definition of typomorphology in academic circles[6] , it is clear that its theoretical ideas are mainly fused with the urban morphology of the Anglo-German Conzen school and the typology of the Italian school represented by Muratori-Caniggia. The Conzen urban morphology is based on human geography and applies tools such as property maps to study the planar pattern of

[5] Moudon, Anne Vernez. "Getting to Know the Built Landscape: Typomorphology". The Urban Design Reader, (1994) p: 256-281
[6]Chenfei. A new framework: The application of Typomorphology in Chinese context[J]. Architectural Journal,2010(04):85-90.

towns and establishes a systematic research framework that includes several research elements. The Italian typology represented by Muratori-Caniggia takes architecture as the starting point, applies typological maps to interpret the progression of urban tissue, proposes an "operational urban history", and establishes a translation method from urban morphological analysis to design.

The hierarchical approach to urban morphology and the emphasis on the continuity of town morphology provide the premise for the integration of Conzen's urban morphology and Italian typology. At the same time, the fusion of the two schools of thought complemented the inadequacy of urban morphology in guiding design practice with the results of analysis and the inadequacy of the Italian typology. As a result, the exchange between the two schools has become more frequent since the 1980s, and the establishment of the ISUF (International Seminar on Urban Form) in 1994 further promoted the development of typomorphology. [7]

1.3.2 Italian typomorphological studies

The study of Italian typomorphology began with the Italian architect Muratori, who, with his team of students, worked extensively between the 1940s and 1950s on the analysis of historic Italian towns and urban building processes, and applied the analysis to practical design. These early works and projects provide an opportunity to identify the beginnings of typomorphological research in Italy. In 1959, in *Studi per una operante storia urbana di Venezia*, Muratori documented in detail the urban morphological research conducted by his team in Venice and articulated a method of urban analysis that combines morphology and typology. To verify the operability of the method, he participated in an urban design competition for the San Giuliano sandbar in Venice and submitted three proposals applying a structural analysis of the progression of urban morphology.[8]

[7] Moudon A V. Urban morphology as an emerging interdisciplinary field[J]. Urban morphology, 1997, 1(1): 3-10.
[8] Maretto M. Saverio Muratori. A legacy in urban design[J]. 0. PLENARY SESSIONS 25, 2012:

Under the influence of Muratori's research, architects such as Caniggia, Aldo Rossi and Aymonino have been developing the field of Italian typomorphological studies, and in 1966, Carlo Aymonino first defined typomorphological studies[9]：*"Typomorphological studies"-a term coined by Italian architect Aymonino (Aymonino et al.1966) - use building types to describe and explain urban form and the process of shaping the fabric of cities.*

However, in Italian typomorphological studies, there are serious disagreements about the dominant factors of urban morphology and the freedom of creation, so the Italian typomorphological studies have never established a perfect system and framework.

Among them, Caniggia inherited and developed Muratori's theory, interpreting the progression of urban morphology and tissue on the basis of housing typology. He completed works such as *Dalla lettura di Como* (1963) and *Strutture dello spazio antropico* (1976) between the 1960s and 1980s, and carried out different scales of the practice of application at different scales in Rome and Genoa.[10] In a certain sense, it is a continuation of the Italian school of typomorphology.

1.3.3 Typomorphological Planning Technique

In practice, urban analysis methods and planning frameworks that integrate Conzen urban morphology and Italian typology are applied in many European urban planning designs, represented by cities in Italy and France. The planning practice in France, represented by the Menasee region, has attempted to use Form-based Zoning to complete the delineation of site units (POS: Plan d' Occupation des Sols) and their management details. The whole zoning process is based on a systematic

260.

[9] Moudon A V. A catholic approach to organizing what urban designers should know[J]. Journal of Planning Literature, 1992, 6(4): 331-349.

[10] Qi Wenju. From building type to urban form: reading the typomorphology theory of Gianfranco Caniggia[D]. Southeast University,2017.

morphological and typological study.[11] In Italy, the typomorphological planning technique was applied in practice, represented by the new plans of Rome and Bologna.

In a thesis by scholars Xie Shuyi and Giuseppe Bertrando Bonfantini, they defined and elaborated on "Italian typology- and morphology-led planning techniques "[12], and analyze this technique in the context of actual cases of Italian urban planning. The author tries to identify the concepts of typomorphological approach and typomorphological planning techniques.

(1) Typomorphological approach refers to the tools for systematic analysis and planning design of a specific area using morphological urban analysis methods and typological categorization in the context of the theory.

(2) The typomorphological planning technique, on the other hand, contains two layers of meaning. First, the link and level of application of the typomorphological theory and method, i.e., at what point in the planning stage is the intervention. Second, the specific application of the typomorphological method, i.e., how to operate in the planning process.

After the 1980s, with the continuous exchange of urban morphology and typology, the fusion of typomorphology became extremely dynamic and typomorphological planning techniques played an important role in urban planning in Europe. typomorphological planning techniques no longer exist independently based on specific theories, but often adapt specific methods to the actual situation. The Italian typomorphological planning technique discussed here is a planning technique based on an integrated theory and adapted to different operational situations and scales.

[11] Chen Jintang, Yao Sheng, Tian Yinsheng. The theory and localization about Typo-morph ological approach[J] Urban Planning International,2017,32(02):57-64.
[12] Xie S, Bonfantini G B. The evolution and inspiration of Italian typology-and morphology-l ed planning techniques[J]. Urban Planning International 2020.

1.4 Review of relevant studies

1.4.1 Foreign typomorphology studies

Foreign research and application of typomorphological theory can be broadly divided into three categories from the background: the Anglo-German school of urban morphology, the Italian school of typology, and the fused typomorphology.

（1） Anglo-German school of urban morphology

In the 19th century, with the deepening of European urban studies and the intersection of disciplines, scholars with backgrounds in geography and humanities began to introduce morphological theories and geographic tools into urban studies. At the end of the 19th century, the German scholar Otto Schlüter published his famous thesis " *Uber den Grundriss der Stadte* "[13]， which laid the theoretical foundation of the Anglo-German school of urban morphology.[14]

In the 1960s, the German-born geographer Conzen published his book *Alinwick, Northumberland: A study in town-plan analysis*, drawing on the theories of Schlüter and Geisler. In this monograph, Conzen built a relatively complete methodology and research framework for the study of urban form around the town-plan analysis of Alinwick, a town north of Newcastle, England. Conzen further developed the morphogenetic approach based on Schlüter's theory and used property maps as a tool to conduct a study of town-plan progression with independent property plots as the smallest unit of plan analysis. [15]。At the same time, based on the background of human geography, Conzen organized the elements of urban morphology more systematically and made a more accurate and rigorous academic definition of them, mainly including: plan unit, morphological period, morphological region, morphological frame, fringe belt

[13] Schluter O. Uber den Grundriss der Stadte[J]. Zeit-schrift der Ges. f. Erdkunde zu Berli n, 1899, 34: 446-62Schluter44634Zeitschrift.
[14] Yao Sheng. Comparative Study Between Urban Morphology of the Historical Districts in Guangzhou and Birmingham [D]. South China University of Technology,2013.
[15] Zhang Lei. A review on urban morphology studies of the western countries and its enlig htenment [J].Human Geography,2010,25(03):90-95..

and plot redevelopment cycles, etc.[16]

Another key figure in the Anglo-German school of urban morphology is the British scholar J. W. R. Whitehand, who inherited and developed the urban morphological theory of Conzen. The Urban Morphology Research Group (UMRG) at the University of Birmingham, represented by Whitehand, focused on the morphological tissue of medieval towns in the 1970s[17]. At the same time, the academic activities of the UMRG also promoted the exchange between the Anglo-German and Italian schools, and some British scholars, such as Seamus and Karl Kropf, also continued their research and practice of urban morphology under the funding of the UMRG, further promoting the development of typomorphology.

（2） Italian School

The typological research of the Italian school originated from the typology based on the rationalism of the early 19th century. After the philosophical reflections of the Enlightenment, the impact of the great social changes brought about by the Industrial Rprogression and the rise of the Modernist movement, the study and discussion of typology was brought to a climax in the 1960s. In response to the modernist movement's failure to apply typological theory to the traditional city, a series of essays on explaining the continuity of form and structure in the traditional city began to appear.[18] Italian scholars and architects of neo-rationalism began to rethink the research objectives and methods of typology. Their main idea is that the form and structure of a city can be interpreted through the development of different historical periods, and that the type of architecture also exists in the history and culture of the city. They also introduced the concept of "operability", where the analysis of urban form and building type can guide the design of urban form and buildings. Muratori and his student Caniggia, who was a lecturer at the University of Rome in the 1940s, began working

[16] Conzen M R G. Alnwick, Northumberland: a study in town-plan analysis[J]. Transactions and Papers (Institute of British Geographers), 1960 (27): iii-122.
[17] Whitehand J W R. Recent advances in urban morphology[J]. Urban studies, 1992, 29(3-4): 619-636.
[18] Zhang Pan. Type and Typology of Italian School: From Muratori to Aldo Rossi[J].Architecture & Culture,2020(04):168-169.

on the translation and practice of typological approaches to urban analysis. Thus, to some extent the Italian School typology was initially directed toward design.

Under the influence of Muratori, Italian architects such as Aldo Rossi and Aymonino were devoted to the study of typology. Although more academic controversies arose afterwards, it is undeniable that they both advanced the development of the Italian school of typology. Rossi published The Architecture of the City in 1966[19], which delved into the relationship between urban history and urban architecture. In subsequent studies, many Italian scholars have also contributed to the development and application of typology, such as Murat and Managhi at the Politecnico di Torino; Petrucciolli at the Massachusetts Institute of Technology, etc. Among them, Petrucciolli summarized the analysis matrix based on Caniggia's urban analysis method[20], which contains the scale level and complexity level of the module and is able to analyze the urban structure from buildings to regions.

(3) Fused typomorphology

In the 1990s, the American scholar Mouton played a key role in the integration of different schools of typomorphology. In 1987, Mouton began to use the concept of " typomorphology " to explore the possibilities for the integration and development of Anglo-German urban morphology and the Italian school of typology. At the same time, she actively promoted the international dissemination of Italian typology, especially in English-speaking countries, while the British-based Conzen School responded to the exchange with the Italian school and led to the establishment of the ISUF (International Seminar on Urban Form) in 1994. The establishment of ISUF marked a new era in the study of typomorphology, providing a platform for regular exchange between scholars from different countries, and a more diverse range and approach to the study of typomorphology.

[19] Aldo Rossi. The Architecture of the City[D]. MIT press, 1982.
[20] Petruccioli A. Typological process and design theory[J]. 1998.

1.4.2 Domestic typomorphological study

The domestic research on Italian typology theory began in the 1990s, when Wei Chunyu published "Research on Architectural Typology" [21], and Shen Kerning published "Typology in Design"[22] in the same period, which kicked off the research on Italian typology in China. [23] In this period, the research mainly focused on the theory and practice of Aldo Rossi, but the main research direction was still focused on the application of typology in architectural design methods. The Anglo-German school, represented by the Conzen theory, was introduced to China much later. Gu Kai brought Conzen's theory to China for the first time in 2001, and at the same time he cooperated with the British scholar Whitehead to use the urban morphology research framework of Conzen school to analyze the urban morphology of typical historical cities in China, including the ancient city of Pingyao and the historic district of Zhishanmen in Beijing. After this, Tian Yinsheng from South China University of Technology also started his research on urban morphology, and conducted urban morphology studies for several cities such as Guangzhou after 2007.

Among them, Chen Fei published a thesis "*A New Research Framework: Application of Urban Typomorphology in China*" in 2008, which explored the research methods of Western typomorphology and proposed a research framework for its use in Chinese cities. The 16th ISUF held in Guangzhou in 2009 further promoted the research of typomorphology in China, and scholars represented by Yinsheng Tian, Jintang Chen, and Sheng Yao summarized the research theories and methods of western typomorphology and further localized research and practice based on the situation of domestic cities. The 23rd ISUF was held in Nanjing in 2016, continuing the research enthusiasm of typomorphology and demonstrating the significance of typomorphological research for urban planning and conservation in China.

[21] Wei Chunyu. Architectural typology research[J].Huazhong Architecture,1990(02):81-96.
[22] Shen Kening. Typology in design[J].World Architecture,1991(02):65-69.
[23] Yang Bizhu. Research on the Building Type and Evolution of Zhuangyuanfang Area in Guangzhou [D].South China University of Technology,2016.

1.4.3 Practical Research

The typology of the Italian school focused on the translation of urban morphological analysis to design. In 1959, after completing his analysis of the urban morphology of Venice, Muratori validated his analysis through three proposals in an urban design competition for the San Giuliano sandbar in Venice. Caniggia, on the other hand, built on Muratori's theory with more practice and addressed all scales of the city, including the urban renewal of Rome (Piazza Coronari urban tissue restoration) and Florence in the 1960s, the consultancy for the planning of the historic center of Bologna, and the design of the Costa degli Ometti residential area in Genoa in the 1980s. In contrast, the Conzen school was more focused on the framework of urban analysis and therefore lacked the translation of planning and design practice for a long time. However, this set the stage for the subsequent exchange between the two schools and the integration of typomorphology.

Into the 1990s, the integration and development of typomorphology brought vitality to the field of practical urban planning and design. The British scholar Kropf, with the support of UMRG, systematically compared the Conzen school and the Italian school of typology, and on this basis, together with Seamus, explored the use of typomorphology in the field of urban planning, and they devoted themselves to applying typomorphological methods to urban planning and design. Their practical activities were mainly carried out in France, represented by the Menasee region. *The Menasee region has attempted to use Form-based Zoning to delineate the site units (POS: Plan' Occupation des Sols) and their management details, with the expectation that the zoning will be prepared on this basis. The final site units are similar to the "Form-based Zoning", while the management details are graphical to express the morphological control, building layout characteristics and the specific building forms available in the different units.*[24] This is a more mature application of

[24]Zhao Yunfei. The Research on the Renewal Strategy of Ayidun Historic District Based on the Typo-morphological Approach [D].Chongqing University ,2017.

typomorphological techniques at the urban planning level.

In fact, although the concept of typomorphology only gained widespread attention in the 1990s, typomorphological planning techniques have been widely applied in European countries, represented by Italy. Since the 1950s, Italy has been applying the idea of typomorphology in urban planning and architectural interventions. During this period, Italy was faced with large-scale urban redevelopment and the destruction of the historic districts, and the zoning of Siena (1958) and Urbino (1964) was established using a morphological approach in order to better preserve the urban form and architectural tissue. The application of typomorphological planning techniques and processes in the master plan was further refined in the 1990 plan for the historic center of Palermo. In the 21st century, the intersection and development of typomorphology has led to a better use of typomorphological planning techniques in the Rome Master Plan (2008) and the New Plan for Bologna (2009).

1.5 Research Content

(1) The thesis will analyze the background of the application of typomorphological planning techniques in Italy, and provides an in-depth analysis of the theoretical basis of this technique and the factors that have made it highly mature in Italian urban planning.

(2) The thesis will summarize the application framework based on a case study of the practical application of the Italian typomorphological planning techniques through the application process and interventions, specific operation methods and results.

(3) To adapt the application framework to the current situation in China, and finally to try it out in the historic district of "Zhuangyuanfang".

1.6 Research framework

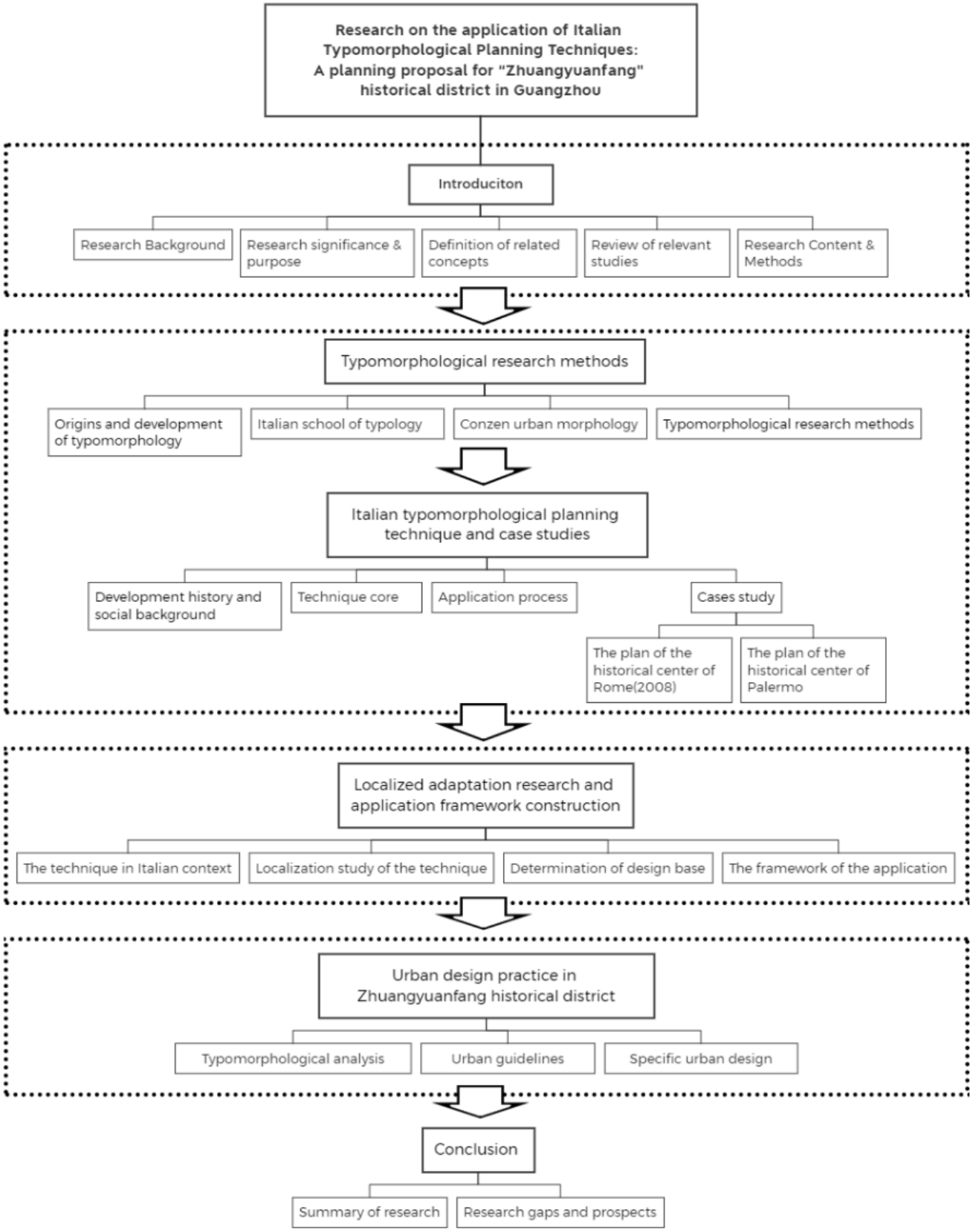


Fig. 1-1 Research framework (Source: by the author)

CHAPTER 2: TYPOMORPHOLOGICAL RESEARCH METHODS

This chapter first analyzes the basic theories and research frameworks of the Italian school of typology and Conzen urban morphology, focusing on showing the research elements and analysis frameworks of both, and comparing them on this basis. Finally, the typomorphological analysis framework is constructed by combining the research summary of domestic and foreign scholars on the typomorphology of integration.

2.1 Origins and development of typomorphology

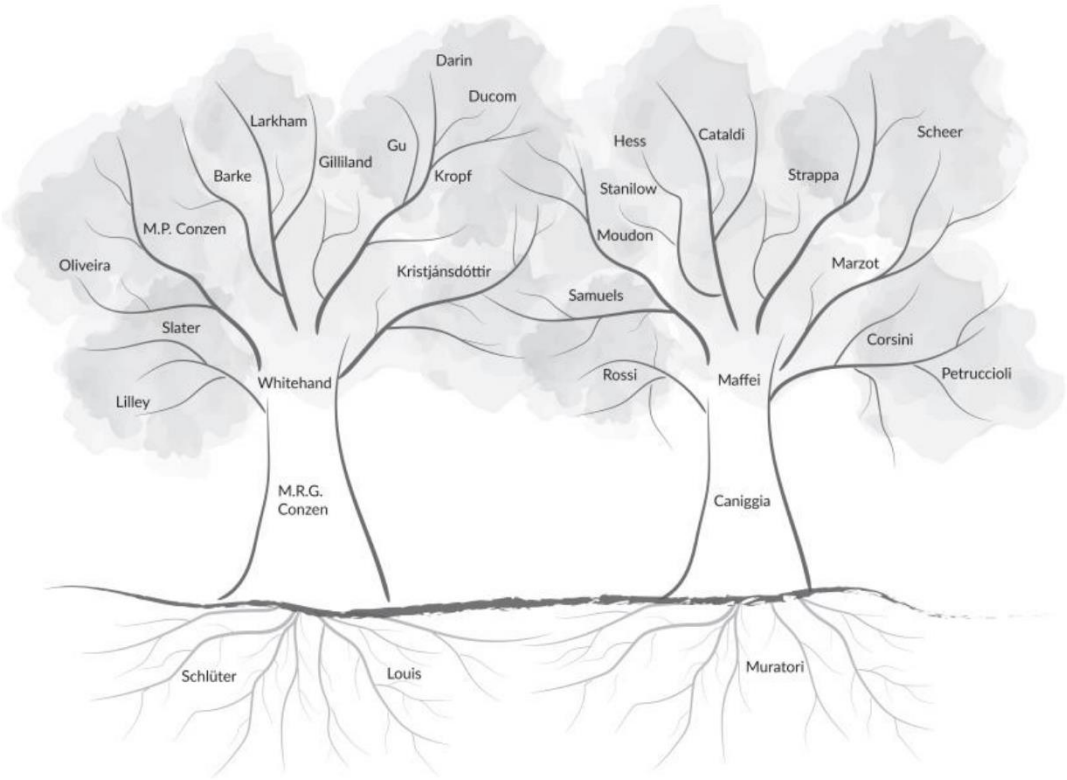


Fig. 2-1 Typomorphology development dendrogram (Source: Yina S., Dian Z., 2009.)

The prototype of the idea of type can be traced back to ancient Greece in the

background of Western culture.[25] The ancient Greek philosophers, represented by Aristotle, revered classical thought, attached importance to rational judgment, and followed the rules in politics and culture. In this cultural background, the ancient Greeks explored the idea of type in poetry, architecture, sculpture and other fields, and with the accumulation of a large number of cultures, a scientific work such as Aristotle's "*Organon*" was finally born, which applied the strict logical method to classify and distinguish the research objects and study them. The earliest transplantation of the idea of type in architecture can be traced back to Vitruvius, in his book "*De Architectura*", he proposed that architecture is "the truth of imitation of nature", [26]and analogized architecture with the human body, and used the three types of temples as the basic framework to construct the typology of architecture.

The study of modern architectural typology has gone through a long history, in 1976, Anthony Vidler organized the historical changes in the concept of architectural typology in Europe and summarized them into the first typology and the second typology. Based on this, Vidler proposed a third typology for architecture itself in the face of the conflict between new architecture and historical cities in the period of urban maturity after the massive urban construction in Italy after World War II. The architects of the Enlightenment attempted to recognize the abstract principles of art forms, or types, by seeking the origins of architecture, i.e., the "Rational order of nature" or "Abstract nature. The first typology, as the prescriptive principle of architecture, existed in the city and the primitive shack, the final materialization of which was the city and architecture of the 19th century, while the modern architectural movement since the actual 19th was called the second typology by Vidler, which originated from a machine capable of mass production outside the material form. In the second half of the 20th century, a group of architects who continued the early Italian concept of architecture and the city reflected on urban form and the act of construction in the service of

[25] Guo Pengyu, Ding Wowo. Towards a synthetic typology: The comparison between the third typology and typomorphology [J]. The Architect,2017(01):36-44.
[26] Vitruvius M P. De architectura libri decem[M]. Teubneri, 1867.

architectural design, one of which is the third typology proposed by Vidler.[27] The third typology attempts to reflect on the relationship between architecture and the traditional city and to guide architectural practice, after walking through an imaginary utopia and an empirical technological progression on the premise of the rupture between modernist architecture and the traditional city. The third typology was influenced by the first typology and tried to fix the operational problems of the second typology. From the 1920s, the third typology was conceived in Italian architecture, and after the 1950s (i.e., after World War II), architects represented by Muratori, Caniggia, and Aldo Rossi developed the Italian school of architectural typology. And in 1989, Moudon proposed the typomorphology and explored the research content of it.

2.2 Italian school of typology

The Italian typology school has mainly selected the research methods and frameworks represented by the Muratori-Caniggia typology and the Petrucciolli typology. Muratori and his student Caniggia achieved great influence in the practice of using typology to study urban morphology in the 1950s, and gradually developed a more systematic approach to urban analysis. Caniggia further developed Muratori's theories and built a typological approach from "reading" to "design". At the end of the 20th century, Petrucciolli used a matrix to analyze the morphology of cities at different levels based on Muratori-Caniggia's theory, and used this method to go beyond the Italian territory to analyze the Mediterranean countries in practice and to give guidelines for urban planning.

2.2.1 From Muratori to Caniggia

Muratori's ideas can be divided into two main parts, the first part is the typological theory's perception of the city and the second part is the operability of urban history.

[27] Vidler A. The third typology[J]. Oppositions Reader. 13-17, 1998.

As the founder of Italian typology under the influence of the Neo- rationalism, Muratori recognized the importance of historical context and focused on the continuity and progression of urban form and structure. Influenced by Gustavo Giovannoni's "organism" (*Vecchie citta ed edilizia nuova*)[28], the originator of the Italian urban planning discipline, Muratori early on developed the idea that "the city is a living organism "and the theory that planning should be based on the analysis of the characteristics of places.[29] The former emphasizes that the city has an integral structure, which consists of elements of different levels, which to some extent are not hierarchically high or low, and at the same time organically influence each other. Secondly, the organism is alive, i.e. evolving and developing, and the urban form is the central expression of this progressionary and developmental process. The latter emphasizes that urban planning should be based on an adequate knowledge of the site, which includes the extraction of site characteristics and the analysis of urban form. The combination of these theories also laid the foundation for the later theory of "operability".

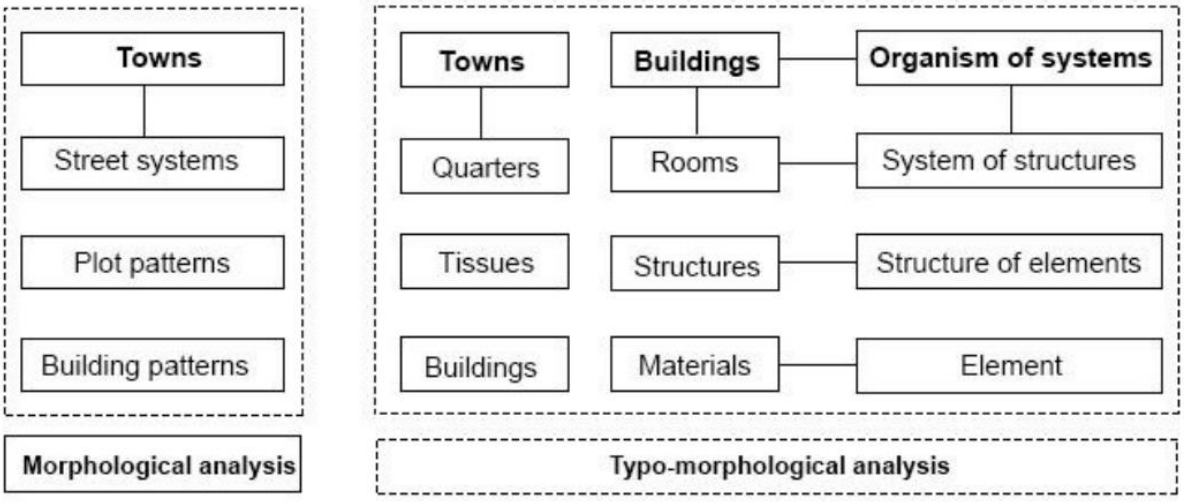


Fig. 2-2 Urban Morphology Studies (Source：Yina S., Dian Z., 2009.)

Muratori's theory of the operability of urban history is complete in the analysis of the urban form of Venice in 1959. He used the analysis of the individual elements of the city and the urban form to interpret the urban history, defined three systems of

[28] Giovannoni G. Vecchie città ed edilizia nuova[J]. VALERIE MAGAR, 1931, 48(995): 57.
[29] Marzot N. The study of urban form in Italy[J]. Urban Morphology, 2002, 6(2): 59-74.

building types generated by the urban tissue, reflecting the characteristics of the urban form and tissue in different historical periods, and finally used the structure of urban analysis for the practice of urban design.[30] The "operability of urban history" is based on readability. The progression of urban morphology has certain patterns, and the analysis based on urban morphology and building types can discover the patterns, and the progression of urban morphology and the dominant building types can provide the basis for urban planning and design. The analysis of urban morphology and building types can be used as a basis for urban planning and design.[31]

穆拉托里		卡尼吉亚	
Theory	理论	Method	方法
Organism	有机体	Structure	结构
Organic	有机	Serial	序列
Architectural organism	建筑有机体	building type	建筑类型
Architecture	建筑	Building	房屋
Territory	区域	Town	城镇

Fig. 2-3 Comparison of terms used by Muratori and Caniggia (Source：Reference [10])

Muratori laid the theoretical foundation for the continuity and operationalization of the Italian school of typological urban history, defining a series of basic typological concepts in parallel with his practical research: urban tissue, urban organism, and architectural organism. However, Muratori's interest in cultural and historical philosophy led him to focus more on theoretical and philosophical aspects, which became evident later in his career[32]. Caniggia, on the other hand, summarized and refined Muratori's theories and methods, focusing his research on the practice of urban planning and renovation with a more organic and generality approach. He further interpreted the relatively broad concept of "organism" and tested and developed the

[30] Maretto M. Saverio Muratori: towards a morphological school of urban design[J]. Urban morphology, 2013, 17(2): 93-106.
[31] Cataldi G. Designing in stages: theory and design in the typological concept of the Italian school of Saverio Muratori[J]. Typological process and design theory, 1998: 35-54.
[32] Cataldi G. From Muratori to Caniggia: the origins and development of the Italian school of design typology[J]. Urban morphology, 2003, 7(1): 19-34.

concepts of type, typology, structure, tissue, series, and continuity. The concepts of type, typology, structure, tissue, series, and seriality were tested and developed. The approach of "processual typology" was established, including the concepts of base types, major types, synchronic variants, ephemeral transformations, and typological products.

The following study focuses on the Caniggia typological research framework and methodology.

2.2.2 The Caniggia typological framework and methodology

In his long-term research and practice, Caniggia has developed a research framework based on the four objects: houses and house types, settlements and settlement tissue, towns and urban morphology, and habitats, which correspond to building, plot, town, and territory, respectively. Through a bottom-up analysis framework, Caniggia achieves a more systematic understanding of urban morphology and derives patterns of urban and architectural progression. At the building scale, the progression of housing types is summarized and extrapolated over time, covering facades, materials, spaces, structures, etc. At the plot scale, we focus on the tissue of districts and houses, understand the laws of tissue generation and progression, and identify and summarize tissue types on this basis. This scale covers building groups and district tissue as well as road boundaries. The town scale focuses on the morphology and tissue of the city in general, and focuses on the development history of the city in different periods. The territory scale, on the other hand, involves the natural environment and the human habitat, and is the most integrated organism, involving a variety of forms including natural elements.

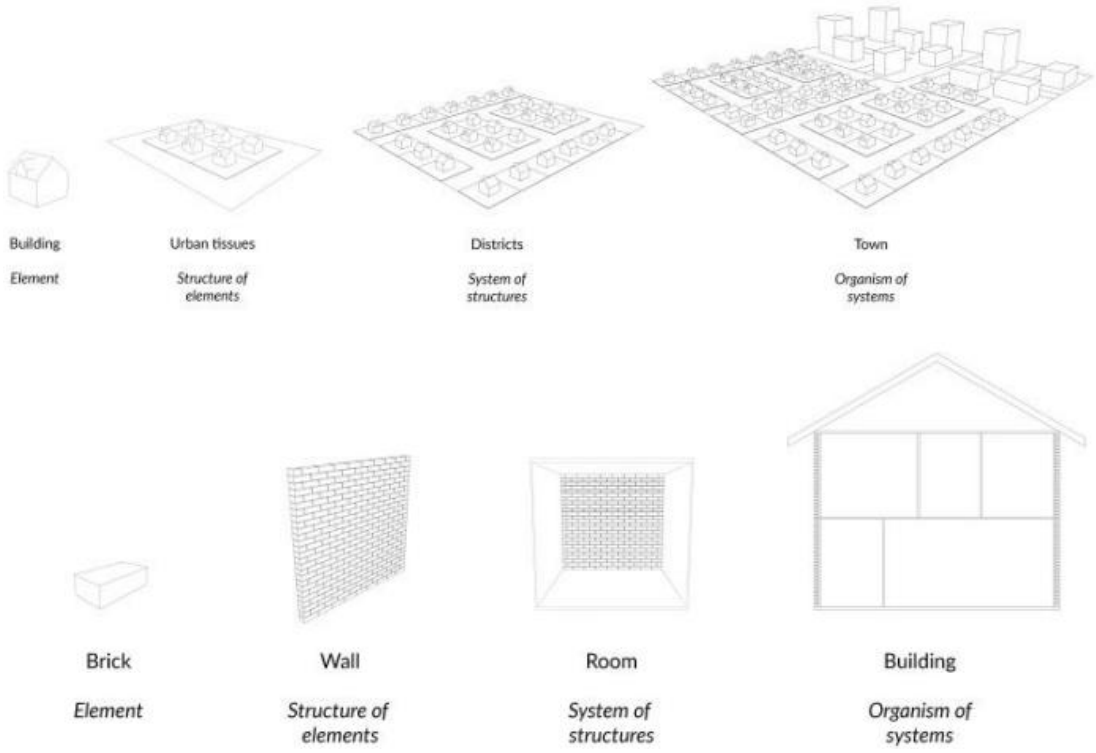


Fig. 2-4 Spatial correlation of a building and a town (Source: Caniggia, 1997)

Processual Typology is the main research method of Caniggia's typology, which refers to the chronological analysis and derivation of the progressionary process since the basic type, within the framework of the four scales of research: building, district, town and territory. The "typological process" is also an important concept of the Italian school of typology, defined by Caniggia as "Examining adaptation of existing building to make it apt to the continuous pursuit between formation and transformation processes of buildings and parallel process changes in needs".[33] It reflects the emphasis of Italian typology on the continuity of urban history.

[33] Caniggia, Gianfranco and Gian Luigi Maffei. Architectural Composition and Building Typology - Interpreting Basic Building, Firenze: Alinea Editrice, 2001.

2.2.3 The Petrucciolli typological framework and methodology

HIERARCHY OF LEVELS OF COMPLEXITY	SCALE HIERARCHY			
	BUILDING	**AGGREGATE**	**TOWN**	**TERRITORY**
ELEMENTS	MATERIALS	BUILDING TYPE	TISSUE TYPE (TYPICAL NUCLEOUS)	URBAN TYPE
STRUCTURE OF ELEMENTS	STRUCTURES	BUILDING TISSUE	URBAN TISSUE	PATTERN OF PROPERTY DIVISION
SYSTEM OF STRUCTURES	LAYOUT SYSTEM	STREET LAYOUT	STREET/ BLOCK PATTERN	TERRITORAL LAYOUT (ROUTES)
ORGANISM	INDIVIDUAL BUILDINGS	INDIVIDUAL TISSUE (NEIGHBORHOOD)	INDIVIDUAL SETTLEMENT (VILLAGE, TOWN)	INDIVIDUAL TERRITORY (VALLEY, REGION)

Fig. 2-5 Chart of the study by Petrucciolli

(Source: Referred by Petrucciolli in 2007 from Maretto (1973))

The Italian architect Petrucciolli is a representative figure of the Italian typology school in the late 20th and early 21st century. He incorporated a new typological perspective based on the theories of Muratori and Caniggia in the context of social development, while his more prominent achievements are in the practice and application of typology. He expanded the typological research framework of Caniggia, more rigorously formulated the analytical matrix according to the scale hierarchy and complexity of the research elements, and applied this research and analytical framework to Mediterranean countries outside Italy, to a certain extent stepping out of the limitations of the Italian school of typology applied to the Italian historical context. His ideas are mainly as follows.

He first inherited the Italian typological school's study of the historical continuity of the city, criticized the destruction of the historical context by urban movements and redevelopment in the 19th century, and defined type as a universal concept that carries

historical processes and social behavior.[34] At the same time, he recognized that the "typological process" of urban form and building type was complex, influenced by multiple influences and prone to multi-layered intersections. He therefore emphasized the need to minimize the complexity of urban forms and building types in research and analysis, and to retrace the most basic types.

Secondly, based on a new interpretation of the concept of typology and a reflection on the complexity of "typological processes", Petrucciolli argues that the first task of typological analysis is to separate the complex elements that build the environment into readable parts and then to search for the roots of these elements, which are themselves part of the typological process. Therefore, he developed an analytical matrix based on the Caniggia research framework incorporating the coordinates of scale hierarchy and hierarchical complexity. Horizontally, based on the scale hierarchy, the building, the aggregate, the town and the territory, and vertically, based on the hierarchical complexity, the elements, the structure of elements, the system of structures and the organism. The element is the smallest component of the urban organism; the structure of element is the association of elements that do not have prominent autonomy in the whole; the system of structure is the effective component and concentration of the hierarchy; and the organism is the whole composed of the element, structure and system.33 This analysis matrix embodies the concept of typomorphology applied at different scales of the city in a hierarchical manner, and also further elaborates the urban organism. That is, at a single scale, such as the building scale, three systems constitute the housing organism, and the analysis of housing can be typologically based on material, structural and plan systems, while the elements at different scales exist in organic relationships and influence each other.

Finally, Petrucciolli also offers his thoughts on typological analysis leading to design. He argues that the new design should include a combination of typological processes and creativity. The Italian school has been greatly divided in the translation

[34] Petrucciolli, Attilio. Bellek Yitiminin Ardından – Akdeniz İslam Kent Dokusunun Öğrettikleri, (çev: Burcu Kütükçüoğlu), YEM Yayın, 2008.

of typological urban analysis to planning and design. Traditional typology, represented by Muratori, emphasizes design as a response to typological processes, and to a large extent perpetuates typological process-led urban design. Many Italian scholars believed that this approach restricts the creative freedom of architects, and architects such as Aldo Rossi and Aymonino openly questioned the relevance of Muratori's typology to design. Caniggia improved to a certain extent, but still designed mainly around the idea of the typological process. Petrucciolli 's new ideas for design focused on two typological concepts: the node and the pole. A node is usually determined by the focal point of a continuous organism, and a pole is the end of a disjoint organism.

2.3 Conzen urban morphology

The Conzen school of urban morphology, with its background in human geography, focuses more on the physical form of urban areas. Unlike the Italian typological studies, which extrapolated from building types to urban morphology from the bottom up, the Conzen school's studies were to some extent top down. His research focused on aspects of the town plan pattern and worked downward, step by step, to individual plan units. Conzen's urban morphology research in Britain was also conducted mainly within the context of urban geography, applying a great deal of geographical terminology in his research, which, combined with its German and English-based background, made it more rigorous than the Italian school. At the same time, the original goal of Conzen urban morphology was based on the analysis of actual towns and the study of methods of urban morphological analysis, and it was not limited by the translation of analytical results into design. Therefore, Conzen urban morphology has built a more systematic research and analysis framework in practice and research, and has received more attention in its subsequent dissemination and development. Its research framework is mainly expressed in Analysis of Town Plan Patterns: A Case Study of Alnwick, Northumberland County (1960).

In the town-plan analysis, Conzen divides urban morphology into town plan, building fabric, and land and building utilization, and the core is to study the three elements of town plan, building fabric, and land utilization in a hierarchical manner, and get the final division of the morphology region. The planar unit includes the street system, plot combination and building base, and also constrains and fixes the building tissue and land utilization in the form of morphology frame; the building fabric includes the building plan, building façade and building profile, and to a certain extent controls and reflects the land utilization. According to the morphological area, the city is composed of three basic spatial units: the central area, the residential area and the fringe belt.

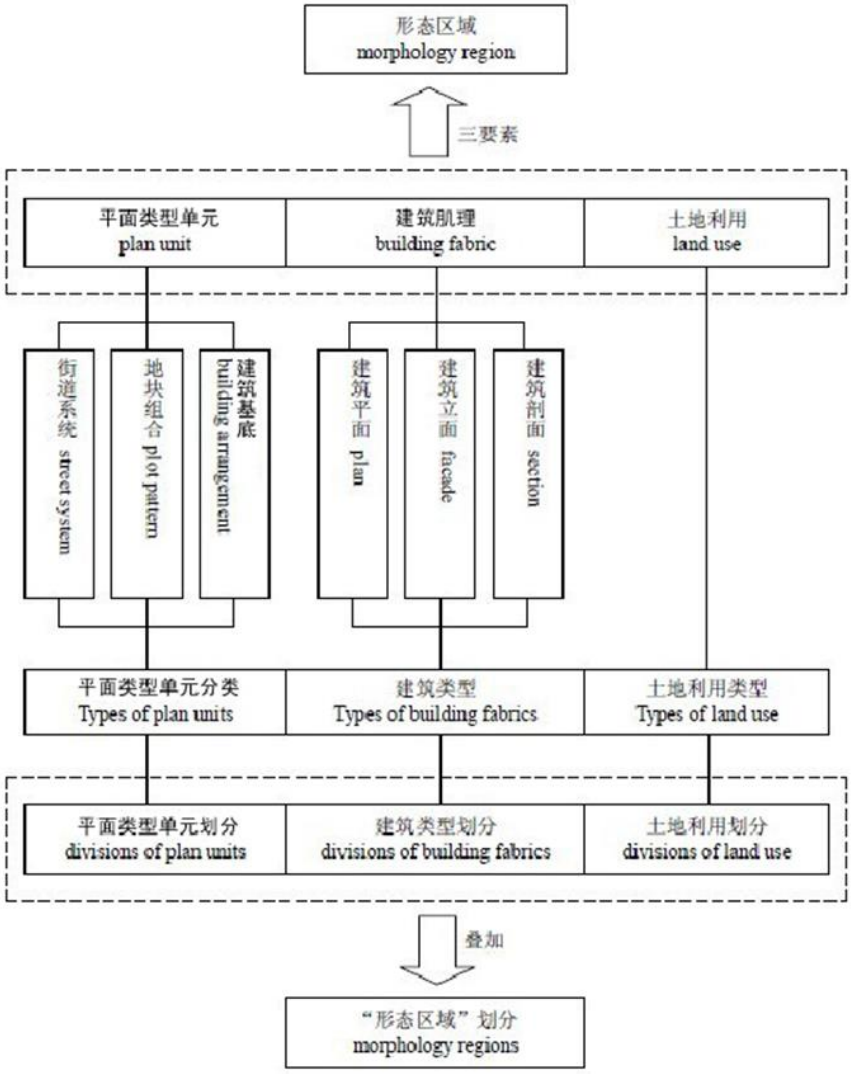


Fig. 2-6 Conzen urban morphology research framework (Source: Reference [15])

2.4 Typomorphological research methods

2.4.1 Comparison of research elements

The extraction and generalization of research elements in the research frameworks of the Italian school of typology and the Conzen school of urban morphology are inextricably linked to their research purposes. Caniggia divides the research elements into building, plot, town, and territory, with the aim of firstly improving Muratori's theory of urban organism, dividing the more general concept of urban organism and forming a systematic and hierarchical research framework. As a result, the elements of Caniggia's study cover an extremely wide range of housing types to territorial types. At the same time, the ultimate goal of Caniggia's typology is to move from "reading" to "design", and because of the complexity and freedom of the design process, Caniggia does not make more detailed divisions under the four scales of research elements. This ensures a certain degree of flexibility in the transformation from analysis to design, but lacks the rigor of a research and analysis framework.

Petrucciolli was aware of this problem in a certain sense and improved on Caniggia's to form his own typological analysis matrix. His matrix first covers four scale levels: building, aggregate, town, and territory, and treats each scale level element as a self-contained organism, under which elements, structures, systems, and organisms are divided according to complexity. Thus, in fact this matrix contains a total of 16 elements under the four elements divided by scale levels. Petrucciolli's delineation of research elements derives in large part from his understanding of the concept of type, which he sees not as a purely morphological analysis or as an ordinary functional classification, but as a universal concept rooted in historical processes and social behavior. How to go about separating the complexity of the constructed environment into readable parts, the primary thing is to carry out the division of elements and traceability. His analytical matrix is therefore more carefully delineated, while also emphasizing the idea that elements at different scales exist independently and are

organically linked. Although Petrucciolli 's research matrix extends the Caniggia's framework and reinforces the idea of the urban organism, the overly detailed division also poses some difficulties for practical application. For example, the elements of the town level have a containment relationship with the elements of the group level, and although the overly detailed division facilitates the understanding of the concept of organism at a single scale level, it inevitably causes overlap and difficulties in defining the research objects during the actual analysis.

Unlike the Italian school, where Caniggia and Petrucciolli use spatial scale as the main basis for the division of research elements and emphasize the organic linkage of scale levels, Conzen's research elements are essentially derived from the concept of "planar unit" in urban geography. He divides the research elements into planar units, building fabric and land use, with planar units including reception systems, plot assemblages and building footprints, and building fabric including building plan, façade and profile. The hierarchical analysis of this research framework is not based on spatial scale as in the Italian school, but rather on importance. The plan element is the highest level, which fixes and influences the building fabric and land use; the building fabric is the middle level, which builds the morphological framework of land use; and the land use is the lowest level, which is controlled and influenced by the plan and building fabric. The Italian typology does not include function in the study, because the original intention of typology is contrary to functionalism. In contrast, the research framework built by Conzen is the application of urban plan pattern analysis, of which land use and function are an important part.

Researchers	Background	Classification of research elements
Caniggia (1963)	Italian school	building, plot, town, territory
Petruciolli (2007)	Italian school, Urbanism	building, aggregate, town, territory
Conzen (1960)	British school	planar units, building fabric, land use

Fig. 2-7 Comparison of research elements (Source: By the author)

In fact, although there are many differences between the Italian school of typology and the Conzen school of urban morphology in terms of research frameworks and starting points, there are many similarities in terms of specific research elements and research tools, which is a necessary condition for the integration and development of typomorphology.[35] With the deepening of the exchange between Italian typology and Conzen school, typomorphology gradually comes into people's view, and typomorphological researchers represented by British scholars Seamus and Kropf and American scholars Moudon began to try to build a research framework of typomorphology on the basis of the research framework of Italian typology and Conzen urban morphology. Among them, Kropf's typomorphological research framework is the earlier and more perfect one, while Chinese scholar Chen Fei proposed a research framework based on the application of typomorphology in Chinese context in 2008, and further developed this research framework in the subsequent exchange and cooperation with foreign scholars, taking a step towards the localization of typomorphological application in China.

2.4.2 Kropf typomorphological research framework

In 1993, Kropf first conducted a systematic comparative study of the Italian school

[35] Kristjánsdóttir S. Roots of urban morphology[J]. ICONARP International Journal of Architecture and Planning, 2019, 7: 15-36.

of typology and the Conzen school of urban morphology with the support of UMRG. In this process he compared the research elements and methods of both, including the definition of relevant concepts, the division of research elements, the structure of the research framework, and so on. On this basis, he summarized and revised the relevant terms and constructed a systematic system of typomorphological terminology[36].

In addition, he proposed a "*generic type*" based on the research elements of the two schools, which includes: building materials, structural elements, rooms, houses, plots, and buildings. buildings, plots, plot series/blocks/streets, tissues/plan units, combinations of plan units, and polycentric urban areas.[37] The generic type as a whole adopts the scale-based hierarchical framework of the Italian typology school, on the one hand refining the relatively ambiguous scope of the Caniggia scale and adding the study elements of plots and blocks between houses and myriads, and on the other hand integrating the elements of plots, roads, and plan units from the Conzen school research framework into the typomorphological research framework.

The concept of *Resolution* is another important concept introduced by Kropf during the typomorphological analysis phase. It is explicitly based on the framework of typomorphological studies of hierarchical analysis, i.e., in order to be able to better separate types at different scales, the resolution needs to be adjusted to achieve sufficient detail at a certain scale or scales. For example, streets and houses belong to the same level of resolution. In practical analysis, the concept of resolution is often realized according to the transformation of specific research tools (maps). A map of the resolution level of streets and houses should show as much detail as possible of the elements studied at that level, while the study of the floor plan and urban areas should be studied operationally on a map of another resolution level.

[36] Kropf K. Aspects of urban form[J]. Urban morphology, 2009, 13(2): 105.
[37] Kropf K S. The definition of built form in urban morphology[D]. University of Birmingham, 1993.

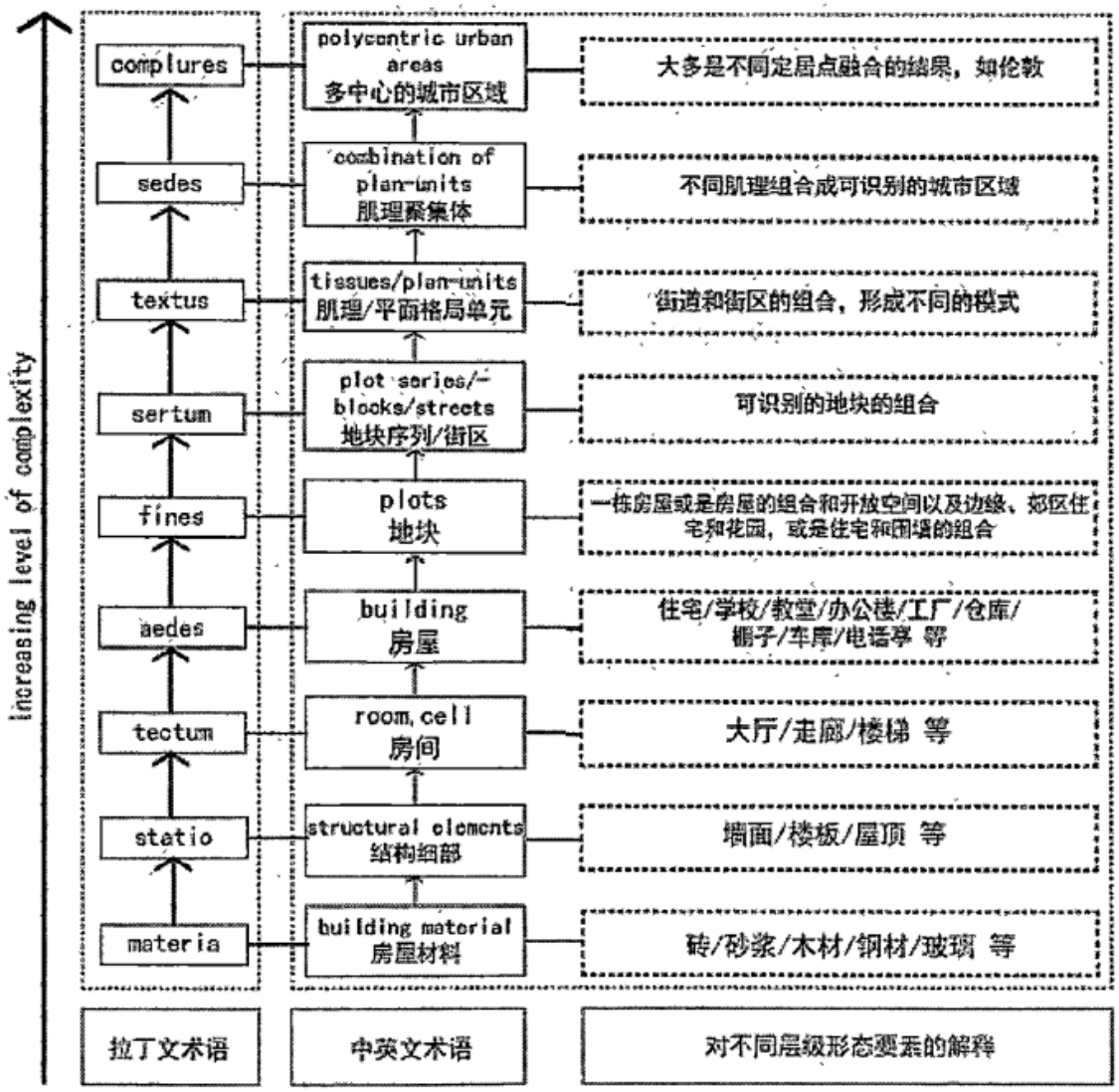


Fig. 2-8 Generic types by Kropf (Source: Reference [38])

Kropf's research is also reflected in the exploration of the application of typomorphology, and he proposes the strategy of "form-based zoning". This strategy is based on the traditional functional zoning, and Kropf analyzes the morphology of each level based on the framework of nine *generic types*, and derives the corresponding characteristics and certain morphological zones. On this basis, design and intervention can be carried out for the study elements by means of guidelines, e.g., housing materials, structures and corresponding spaces in a certain area can be restricted by means of guidelines. The guidelines can also contain different levels of intervention requirements for more flexible control and adjustment of the elements.

2.4.3 Chen Fei Typomorphological Framework - Localization in China

In the 21st century, the research and dissemination of typomorphology by the International Urban Form Forum (ISUF) has attracted the interest of scholars from various countries, and Chinese scholars, represented by Chen Fei from the University of Liverpool, were the first to realize the potential of typomorphology research for existing urban issues and conservation and regeneration in China, and began to experiment with it.

In 2008, Chen Fei, in her thesis "A New Research Framework - Urban Typomorphology in China", gives an overview of the Italian school of typology and the Conzen school of urban morphology, and points out that the ultimate goal of his comprehensive urban morphological research is to guide urban design and to adapt the newly created morphology to the local context.[38] The ultimate goal of their research on integrated urban morphology is to guide urban design and to adapt the newly created forms to local traditions and cultural contexts. She affirms the validity of typomorphological research methods and frameworks in Western contexts, while fully recognizing the potential of typomorphology methods for application in China, but that research frameworks in Chinese contexts necessarily need to be adjusted and adapted to the characteristics of Chinese cities. Therefore, she proposes seven urban morphological elements based on the traditional research framework, namely: urban master plan, skyline, street network and streets, districts, public space, public buildings, and housing. These seven elements of urban morphology are extracted from the traditional typomorphology studies and are also widely found in Chinese cities.

These seven elements of urban form reflect, first of all, the idea of hierarchical analysis, mainly referring to the hierarchy of the Italian School typology divided by urban scale. The general urban plan and skyline belong to the urban scale, the street network and streets and blocks correspond to the urban area; public space

[38] Chen Fei. Typomorphology and the Crisis of Chinese Cities[J]. Urban Morphology, 2008, 2(2): 45-47.

corresponds to the district scale; public buildings and houses belong to the scale of houses. It is easy to see that most of these morphological elements come from Italian typology and Conzen urban morphology. The general urban plan, street network and streets come from Conzen's division of the urban plan grid, and the distinction between public and residential buildings comes from Caniggia's theory (*BUILDING/PSEUDO-TYPE*). In the part of urban morphological analysis, the analysis of urban morphology of Conzen is mainly taken, using map analysis and morphological zoning; in the part of typology of buildings and spaces, the approach of the typological process of the Italian school is mainly taken, and those typologies that have gone through the typological process are continued to be used in the final new design, so that the new design form remains consistent and adapts to the context of the whole area.

The overall research framework is based on seven morphological elements and contains three research processes. The first process is the delineation of morphological zones, taking the master plan as an example, which contains the old city and the new district at the urban scale. Since public space and public buildings do not have morphological zones in the vast majority of cases, they go directly to the next research step. The second step is the typological analysis, in which the types in different morphological regions are analyzed in stages according to different historical periods, and the typological process is extrapolated. In this session, the progressionary process of types within a morphological region is clearly obtained and it is concluded whether the process is continuous and at which stage it is interrupted. Finally, the design guidance is based on the study of the typological process. If the typological process is continuous within a region, then the type of the last stage of the typological process needs to be continued in a new design or intervention, while if there is an interruption of the typological process within a region and it is currently at the interrupted stage, then the type of the interrupted type of the typological process needs to be continued.

Finally, according to the research framework, a series of urban design guidelines

can be derived for different morphological elements and morphological areas, which can effectively realize the transformation from urban morphological analysis to urban design. Chen Fei also mentions in her thesis that her typomorphology research framework covers the scale from housing to city, and the applied framework should be adjusted for different scales of design in practical application.

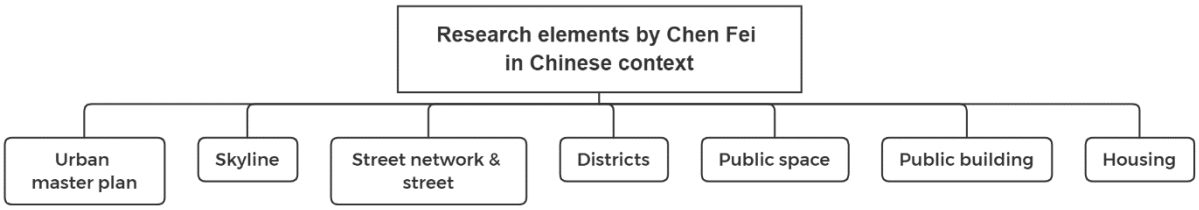


Fig. 2-9 Research elements in Chinese context by Chenfei
(Source: By the author)

表1 在中国城市中(以南京为例)运用形态类型学的研究框架

7大要素	形态区域	类型			类型过程			设计指导
		阶段1	阶段2	阶段3	阶段1	阶段2	阶段3	
总平面	A：城墙内古城；B：新区	类型A	类型 A'	类型 A''	→	→	→	延续类型 A''；其他
天际线	完整天际线；	类型A	类型D	类型F	‖	‖	‖	延续类型C''，关注天际线的视觉质量；
	小尺度天际线	类型B	类型E	类型G	‖	‖	‖	其他
		类型C	类型C'	类型C''	→	→		
街道网络	根据网络类型A，B，C…	类型A；	类型A'；	类型A''；	→	→	→	在A区域延续类型 A''
		类型B；	类型B'；	类型E；	→	→	‖	在C区域延续类型D'；
		类型C；	类型 D；	类型D'	‖	→	→	在B区域响应类型E ；
		…	…	…				其他
街道	同街道网络区域	类型a；	类型a'；	类型a''；	同街道网络类型过程			在A区域延续类型a''；
		类型b；	类型b'；	类型e；				在B区域响应类型e；
		类型c；	类型d	类型d'				在C区域延续类型d'
街区	根据街区类型，A，B，C…	类型A；	类型A'；	类型A''；	→	→	→	在A区域延续类型 A''；
		类型B；	类型B'；	类型E；	→	→	‖	在B区域响应类型E ；
		类型C；	类型D；	类型D'	‖	→	→	在C区域延续类型D'；
		…	…	…				其他
地块	同街区形态区域	类型a；	类型a'；	类型a''；	同街区类型过程			在A区域延续类型a''；
		类型b；	类型b'；	类型e；				在B区域响应类型e；
		类型c；	类型d	类型d'				在C区域延续类型d'；
								其他
公共空间	独立存在，不存在形态区域	类型A	类型C	类型E	‖	‖	‖	延续类型 D；
		类型B	类型D	类型D'		→	→	关注空间质量
		…	…	…				
公共建筑	独立存在，不存在形态区域	类型A	类型A'	类型A''	→	→	→	延续类型A''；
		类型B	类型C	类型D	‖	‖	‖	回应类型 D
		…	…	…				
住宅	根据住宅类型 A，B，C…	类型A；	类型 A'；	类型 A''；	→	→	→	在A区域延续类型 A''；
		类型B；	类型 B'；	类型 E；	→	→	‖	在B区域响应类型E；
		类型C；	类型 D；	类型 F；	‖	‖	‖	在C区域延续类型F；
		…	…	…				其他

注：‖ 表示类型过程中断；→表示类型过程继续

Fig. 2-10 Typomorphological application framework in China by Chenfei
(Source: Reference [38])

2.5 Summary of the chapter

This chapter first introduces the origins and development of typomorphology, then analyzes the basic theories and research frameworks of the Italian school of typology and Conzen urban morphology, focusing on showing the research elements and analysis frameworks of both, and comparing them on this basis. After that, two typical combining Typomorphological research frameworks from foreign and domestic study are introduced, which are helpful to realize the Italian typomorphological planning technique in the following chapters.

CHAPTER 3: ITALIAN TYPOMORPHOLOGICAL PLANNING TECHNIQUE AND CASES STUDY

The ideas of morphology and typology have been studied in the West for more than half a century and have deeply influenced urban planning practice in various countries. With the development of a fused typomorphology, the potential of its practical application in urban planning and conservation is slowly materializing. The UK has applied the zone control guidelines under the framework of Kropf's typomorphology in many township-wide plans,[39] and France has completed the zoning of morphological zones in many areas to complete the division of site units (POS: Plan d' Occupation des Sols:) management and the corresponding management rules. Italy, as one of the birthplaces of fused typomorphology, has applied the ideas of typomorphology to the planning and conservation of historic cities and historic centers, and gradually developed typomorphological planning techniques.

This planning technique, pioneered by Muratori in the late 1950s, is not limited to the restoration of individual monumental buildings, but rather to the urban system as a whole "as a work of art". At the same time, it pursues the idea that the historic center, as the place of a history, depends not only on historical buildings, but also on the history of the city as a whole, whose social, cultural and economic dimensions also deserve careful conservation and development planning. After 1990, fused typomorphology studies contributed to the development and maturation of planning techniques, which were more systematically applied in practical cases. However, due to language barriers and the lack of systematic research, the applied research of typomorphological planning techniques in Italy has been underappreciated.

[39] Kropf K. Stratford-upon-Avon district design guide[J]. Stratford-upon-Avon District Council, Stratford-upon-Avon, 2001.

3.1 Development history and social background

After World War II, Italian cities underwent massive reconstruction, while the economy grew by leaps and bounds. The modernization that was brought about was far removed from the values of preserving tradition and memory, and a large number of traditional urban historic centers were damaged, if not completely destroyed. Under the banner of industrial development and the construction of workers' dormitories (a large number of workers fled the barren south of Italy in the hope of finding a better life in the large industrial cities of the northwest), the historic centers of many cities were turned into " uninhabited region".

Post-war reconstruction and rapid industrialization and urbanization have made the preservation of all types of historical and cultural heritage and its most important historic centers face the double challenge of widespread constructive destruction and a severe lack of socio-economic vitality. Against this background, the 1957 Luca Conference and the subsequent Carta Gubbio 1960 successively clarified that the preservation of historic centers was the responsibility of the state, and that it should also be extended from monuments to historic centers. The preservation of the historic urban tissue in the midst of rapid post-war urban development also became a new challenge for the Italian urban planning sector. Italian architects began to apply the theory of architectural typology and urban form to the "structural interpretation" *(letura strutturale)* of the historic centers of Italian cities, and accordingly many urban planning practices were carried out, which can be divided into three stages according to the objectives and means of planning.[40]

[40] Xie Shuyi. From Historic Center to Historic City: The Typology-and Morphology-Led Italian Contemporary Urban Planning Practices [J].The Architect,2021(02):65-71..

Period of time	Development Stage	Planning goals	Typical practice
1950-1975	**Exploratory stage**	•To respond to the destruction of the historic center by large-scale redevelopment and to preserve and restore the historic center of the city.	•Planning of the historic center of Bologna (1969) •Planning of the historic center of Siena (1958) •Planning of Urbino (1964)
1976-1990	**Advanced stage**	•Preserved the original historic urban landscape and fabric while meeting the needs of contemporary life.	•The Caltagirone Plan (1984) •The Schio Plan (1989) •The plan of historical Centre of Palermo (1990)
1991-Present	**Mature stage**	•To identify the values and roles of different urban tissue and building types, and to formulate corresponding development strategies for the preservation and development of the historic city as a whole.	•The Rome Master Plan (2008) •the Bologna Plan (2009)

Fig. 3-1 Developed stages of Italian Typomorphological Planning Technique
(Source: Information from Xie Shuyi, rewritten by the author)

During the period 1950-1975, the planning goal was to respond to the destruction of the historic center by large-scale redevelopment and to preserve and restore the historic center of the city. During this period, typomorphological planning techniques were still in the exploratory stage, mainly applying typomorphological analysis to the restoration of destroyed buildings and urban tissue. The main planning practices of this period are the planning of the historic center of Bologna (1969), the planning of the historic center of Siena (1958), and the planning of Urbino (1964).

From 1976 to 1990, as typomorphology theory advanced and urban development demanded, typomorphological planning techniques evolved further based on the restoration of the urban tissue, proposing a "redefinition" that preserved the original historic urban landscape and fabric while meeting the needs of contemporary life. The plan demands new architecture and urban tissue, "once the original pattern of the urban form and the type of each building is identified, the design choices are set"[40]. The new design should be consistent with the original, as well as with the historically defined typology and tissue. The main planning practices of this period are the Caltagirone Plan (1984), the Schio Plan (1989) and the plan of historical Centre of Palermo (1990).

From 1991 to the present, the planning objectives are directed towards the

development of the city as a whole, and the typomorphological planning techniques are applied to identify the values and roles of different urban tissue and building types, and to formulate corresponding development strategies for the preservation and development of the historic city as a whole. During this period, the application of typomorphological planning techniques was more complete, and at the same time the objects of operation evolved from historic centers to historic cities. The main planning practices are the Rome Master Plan (2008) and the Bologna Plan (2009).

Here we focus on the third phase of typomorphological planning techniques and practices, i.e. planning techniques and frameworks from 1990 onwards to the present.

3.2 Technique cores

The core of the typomorphological planning technique is reflected in the research elements, hierarchical system and specific measures, which also focus on the core ideas of typomorphology.

（1） Research elements

The research elements are the entry point for urban morphological analysis, and the framework of urban morphological analysis of any school of thought is based on the division of research elements, which also serves as the basis for determining the operational objects in urban planning and design practice. Italian typology and Conzen urban morphology in the framework of typomorphology provide a rich set of research elements for urban analysis. As mentioned above, Caniggia built up a research element divided by four scale levels, and Petrucciolli expanded on it; Conzen's research element consists of planar units, architectural tissue and land use, and is refined under planar units and architectural tissue; Kropf combined urban morphology and typology to propose nine generic types; scholars represented by Chen Fei combined the characteristics of Chinese cities to put forward 7 research elements. The Italian typomorphological planning technique fully absorbs the research elements under the typomorphology framework and adapts them in practice in order to better

respond to the characteristics of different urban forms.

（2） Hierarchical System

Hierarchy is an important concept in typomorphology and the core of planning technology. In morphotype theory, the hierarchy is reflected in the division and study of urban morphological elements based on the scale of space, and the application of the corresponding "resolution" tools (maps) at specific operational levels to show the full details. The different levels constitute a complete urban system, and the upper level contains the lower level, which in turn influences the upper level, thus forming the concept of urban organism in Italian typology. In the planning technique, the hierarchy covers the whole urban scale, which means that the technique can be applied to urban planning and design practices at all levels of the urban organism, from houses, districts, urban areas to cities. The hierarchical system also divides the study elements, which correspond to the corresponding scale levels, and enables the use of different scaled city or building maps for each study element of the hierarchy in practical analysis. In general, the higher the level of the hierarchy, the more stable the morphology is, e.g. the urban scale is more stable than the building scale. The application of hierarchical systems in planning techniques then facilitates the definition of specific study areas and objects, and the use of appropriate research tools for analysis and manipulation.

（3） Specific measures

The most critical aspect of typomorphological planning technique is the transformation of planning and design based on typomorphological analysis, which involves specific measures and results. The measures and results can also be divided into two parts, one of which is concretely expressed in urban morphological zoning and urban guidelines, which embody the control of urban morphological types, and both of which correspond to the hierarchical system accordingly. Urban morphological zoning is based on the division of study elements, and different morphological zones may overlap in space, while study elements are also divided by hierarchy, so the division of urban morphological areas also has a scale. When research is conducted for different

objects and plots, the encompassed layers are adjusted accordingly. The urban design guidelines are the final guiding document, and they involve the control guidelines for urban form and the control guidelines for buildings, which generally include three levels: district, urban area and city, and the building guidelines for housing scale. In the case of the Rome Master Plan, for example, the plan encompasses the whole urban hierarchy, and the final control document includes the *Urban Morphology Restoration Guidelines* and the *Building Intervention Guidelines*, while the former contains three levels in addition to housing.

In addition, another manifestation of the results is the conception of the urban form development, specifically the conception of strategic zones and the strategy of urban form regional development. It differs from the urban design guidelines in that it is more about the possibility of urban form development in the context of real-life problems, and is not mandatory or policy-oriented. The combination of urban design guidelines and related development strategies ensures the continuity of urban form and brings some flexibility to urban planning and design.

3.3 Application method and process

3.3.1 Analysis based on typomorphology

This technique is based on a typomorphological analysis, which analyzes building types and urban tissue separately. The results of the analysis provide the basis for the zoning of the urban tissue and finally for the intervention of buildings in the historic center. The analysis is based on the theories of the Italian typology represented by Muratori and Caniggia, and the tools used include ground floor plans and elevations and sections.

The study of urban tissue is mainly a morphological study that takes the elements that constitute the urban form and tissue in a region as the object of study. The study is based on the value and authenticity of the built and unbuilt elements, further

understanding and describing their various progressionary stages and characteristics, and making certain judgments about the laws of progression, in order to guide the intervention of urban fabric in actual planning. The main tool for this analysis is the historical map of the city in each period.

At this stage of the study, the first step is to identify the research elements according to the scale of the plan and the characteristics of the planning object. Then, the study of each research element is carried out in stages, taking into account the available historical data and the corresponding social context, to obtain the typology and the progression of each research element. The results of the study summarize the progression laws of each research element and provide references for the next step of urban planning and urban guideline development.

3.3.2 Division of building types and morphological zones

According to the analysis of typomorphology, the division of building type and urban fabric is obtained, and they are characterized mostly by the division of building type and urban fabric by morphology with little reference to specific functions, which is also an important feature of Italian typology. The division of building types is often based on the plan form and enclosure of buildings, while the urban fabric is divided by the layout and characteristics of building assemblages in certain historical periods. In the case of Rome's historic center, for example, the building types include the traditional row buildings and point single buildings, while the urban fabric includes the original medieval fabric and the pre-modern sprawl fabric. Different planning practices will adjust the division according to different planning scales and architectural and tissue characteristics, but the general basis is definite.

3.3.3 Control files

The actual planning control is achieved through the development of urban design guidelines based on building type zoning and urban morphological zoning. The direct results of the Italian typomorphological planning technique are divided into two parts, on the one hand the corresponding repair and intervention guidelines based on specific building types. On the other hand, the guidelines are developed for the different urban tissue, covering the control of the elements studied earlier. When planning and designing a specific area, the building intervention guidelines and the urban tissue guidelines should be referred to in order to develop the corresponding conservation and regeneration strategies for the area, with a separate analysis of the specific building interventions. This mechanism ensures flexibility in the operation of specific area units under the control of the overall tissue.

Fig. 3-2 Urban Guideline of Rome (Source: Piano Regolatore Generale di Roma, 2008)

3.3.4 Social objectives of applying the technique

The application of this technique for the conservation of the historic center is aimed at fulfilling the equally important goal of the social dimension behind it, in addition to the restoration of the urban form in the urban tissue and the building types themselves.

(1) Protection of commerce and handicrafts

The urban tissue is closely related to the traditional industries of the city, whose characteristics and modes of operation largely influence the development of the urban form. Before the Industrial Revolution, handicrafts played a crucial role in the Italian economic system in the context of the political and cultural tradition of local autonomy and the economic structure of mainly small and medium-sized enterprises. With the continuous development of industry, the handicraft industry, represented by the south of Italy, gradually declined, while the handicraft workshops and traditional commercial bazaars, located in the urban corners, also declined. The application of typomorphological planning techniques can help to retrace the urban form during the prosperous period of commerce and handicraft, and to ensure the continuity and development of these two traditional industries to a certain extent.

(2) Promotion of cultural industries

Historic centers often bring great economic benefits due to their deep history. The cultural and tourism industries have become pillar industries in many Italian cities, and the application of the technique facilitates the sustainable development of these industries.

(3) Relieving housing pressure

The use of typomorphological planning technique to control the urban tissue is conducive to securing the amount of social housing and relieving housing pressure.

3.4 Cases study

In this section, actual cases of Italian typomorphological planning techniques in urban planning and design are selected for analysis, including the most recent round of planning for the Historical Centre of Rome (2008) and the Historical Centre of Palermo (1990).

These two cases are selected on the basis that (1) they are both urban planning practices from 1990 and onward, which fully reflect the ideas of typomorphology, and at the same time the planning techniques are relatively mature. (2) The study elements were also adjusted in response to the morphological characteristics of different historical cities, which can be used as a comparison.

3.4.1 The plan of the historic center of Rome (2008)

3.4.1.1 Planning context

The city of Rome is located in the west-central part of the Italian peninsula, on seven hills in the plain of the lower Tiber River, and belongs to the Italian region of Lazio. It was inhabited by Romans as early as about 2000 BC. The city was founded in about 753 BC and has a long history of more than 2,700 years. However, it did not become the capital of Italy until more than 100 years ago, when the capital was moved from Florence to Rome in 1871.

The plan of the historic center of Rome is part of the new Rome master plan, following the *Piano Regolatore Generale Comunale* of the Italian legal system for the regulation of building activities in municipal areas, which every municipality in Italy is legally obliged to adopt. It can be drafted by a municipality or by several neighboring municipalities and contains instructions for the possible use or protection of the part of the territory to which it refers.

Historically, the plan for the historic center of Rome was included in the Rome Master Plan, the first version of which dates back to 1883, 13 years after the re-

establishment of Rome as the capital of Italy, and in the following century, three more master plans were developed and adopted: the 1909, 1931 and 1962 editions. The current version was adopted in 2003 and formally implemented in practice in 2008. On the basis of the 1962 master plan, the Italian authorities and researchers have made a detailed study of the problems in the post-World War II industrial era and a more long-term plan. The new plan addresses the more complex social issues of the decades since the previous one, taking into account the realities and future development of large declining areas after the cessation of population growth and the reorganization of industrial production, as well as the need to apply new technologies to balance development with historical, cultural and ecological themes.

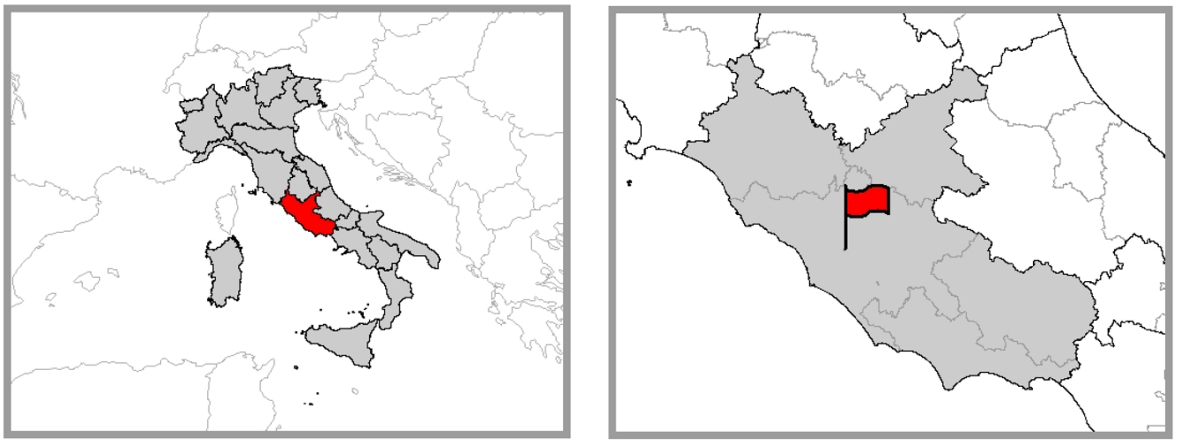


Fig. 3-3 Location of the Historic center of Rome (Source: unesco.org)

In the new plan, typomorphological planning techniques are well established, both as a new way of understanding the city, in order to explore the potential value of urban tissue and building types, and as a way of delineating the zoning of the plan through a typomorphological approach, and ultimately developing an overall control framework. This zoning is not a functional zoning in the traditional sense of the word, and the Roman plan's regulatory documents emphasize that "the new plan replaces the mono-functional zoning inherent in traditional planning, which is not in line with the principle of functional integration, with a systematic and regional zoning. Each type of tissue has its own specific instructions and requirements."[41]

[41] Piano Regolatore Generale di Roma [Z].2008

3.4.1.2 Application process of planning technique

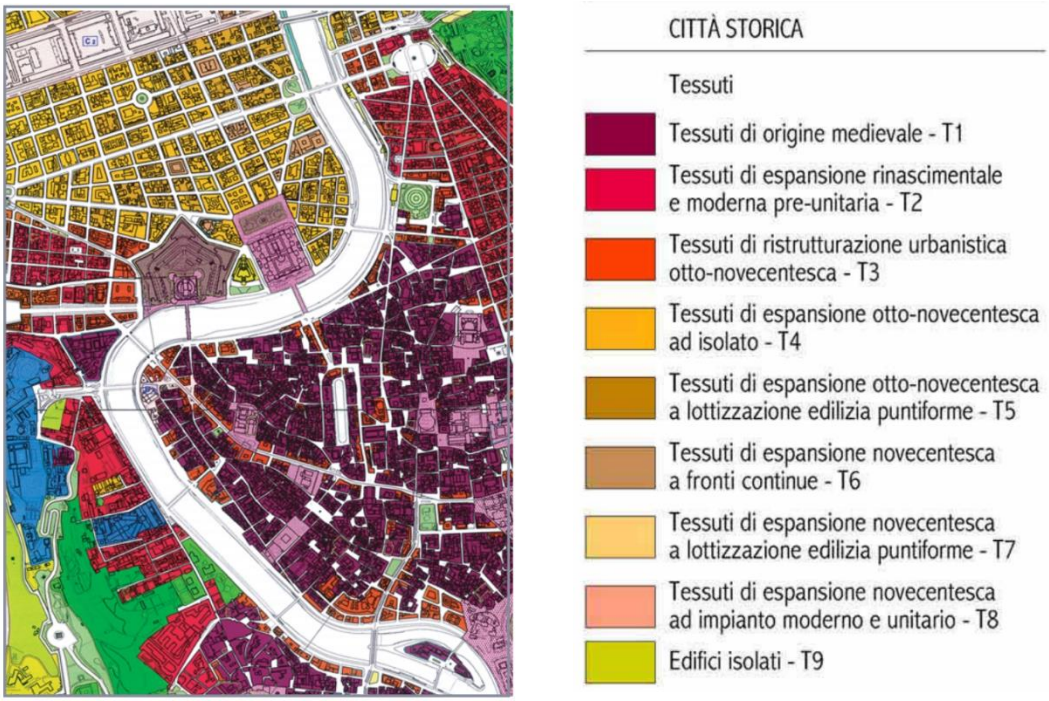


Fig. 3-4 The tissue zoning of the historic center of Rome

(Source: Piano Regolatore Generale di Roma, 2008)

The Historical Centre of Rome plan utilizes a well-developed historical map of Rome as a research tool and previous plans as a reference to study the building types and urban tissue respectively. The building type level involves elements such as structure, material, façade and plan form, while the urban tissue level involves elements such as building group tissue, street interface and public space. The temporal phases of the study are divided into the medieval period, the Renaissance to Italian unification period, the 19th-20th century modern expansion period, and the 20th century onwards, based on the existence of information and important historical points.

The categorization and corresponding characteristics of the existing building types and urban tissue types were obtained through the analysis. The buildings can be divided into five types: public node buildings, independent houses (castles, villas, etc.), serial buildings, etc. The urban tissue can be divided into nine types: medieval original tissue, Renaissance to Italian unification tissue, 19th-20th century reconstruction

tissue, 19th-20th century point building tissue, 20th century continuous façade tissue, etc. (Zone terrioriali omogenee).

According to the five building types and nine urban tissue types, the buildings and urban tissue in the historic center of Rome were divided, and the zoning map of building types and urban tissue was obtained. Then, urban design guidelines were developed for the building types and urban fabric respectively, which control the different research elements and propose specific interventions (Guida per la qualita degli interventi) based on the initial typomorphological study.

Fig. 3-5 Maps of different periods of *Il tridente romano di piazza del Popolo*
(Source: Piano Regolatore Generale di Roma, 2008)

The guidelines can provide the necessary design guidance and corresponding restrictions when operating in specific buildings or urban areas. In the case of the

district of Il tridente romano di piazza del Popolo, for example, the historic district is distributed with a Renaissance and pre-modern expansion tissue, and the renovation and renewal of the district should be carried out in accordance with the urban tissue guidelines that define the parts and specific modalities that can be manipulated, as well as the intervention guidelines for buildings that define the interventions that can be applied to each building.

3.4.1.3 Results of the planning techniques

The results of the technique in the plan of the Rome historical centre are mainly reflected in the Guidelines for the Quality of Interventions, a collection of architectural typological and urban tissue guidelines. The Architectural Intervention Guidelines contain measures and specific requirements for the intervention of different types of buildings, and provide a typological process of the buildings as an example of a typical building, in order to present a complete typological progression of this type of building. The urban tissue guidelines summarize the characteristics of nine types of tissue and provide requirements for specific renovations according to architectural space, building layout, street interface and open space.

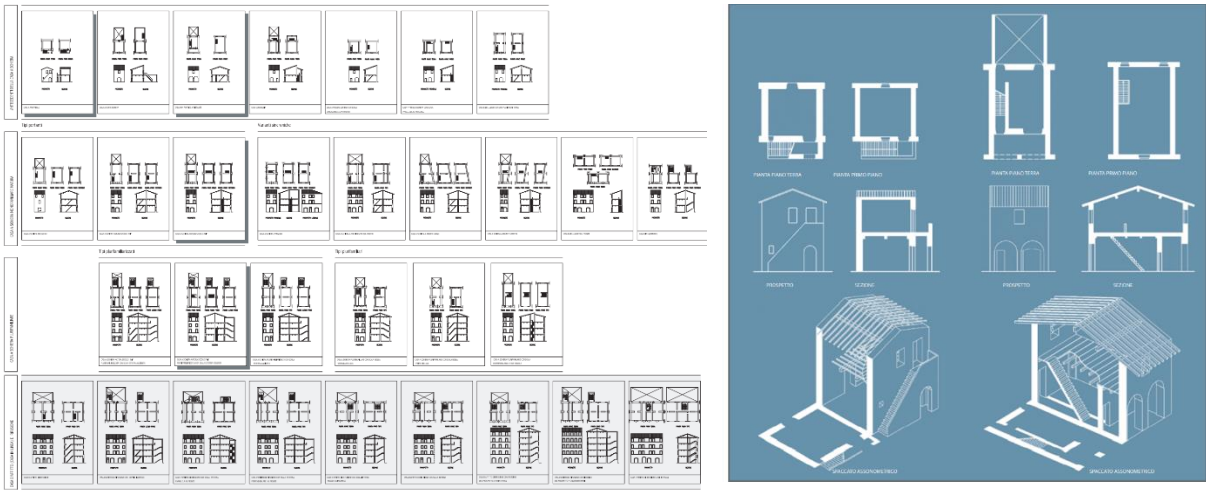


Fig. 3-6 Building intervention guideline (Source: Piano Regolatore Generale di Roma, 2008)

The architectural intervention guidelines and urban tissue guidelines provide an overall framework for urban design, and specific planning and urban design can be

integrated with specific functional needs and development strategies in depth. In conclusion, the typomorphological planning technique primarily ensures the continuity of building types and urban tissue, while providing flexibility for specific planning and design.

Fig. 3-7 Urban tissue guideline (Source: Piano Regolatore Generale di Roma, 2008)

3.4.2 The plan of the historic center of Palermo

3.4.2.1 Planning context

Palermo is a historic city in southern Italy, the capital of Sicily and the center of culture, economy and art since the Middle Ages. The rich historical heritage of the city has been preserved for thousands of years, including more than 200 churches and chapels of all periods, concentrated in a historic center of about 240 hectares, showing the highest level of architecture of all periods. However, after the 20th century, the former glory of the historic center of Palermo rapidly declined, and the destruction of World War II and the shift of the city center to the modern north led to a significant decline in the urban status of the historic center, as well as an extreme deterioration of the architecture and the overall tissue.

The Historic Centre of Palermo Plan, carried out in 1990, firstly identifies the historic value of the Historic Centre and points out that the Historic Centre, as a historic

place, relies not only on historic heritage buildings but also on the history of the city as a whole, with its social, cultural and economic dimensions, and also deserves to be carefully protected and planned for development. The typomorphology planning technique is more mature at this stage and has been applied in many urban planning practices, with the main objective of restoring the overall value of the city through the restoration of building types and urban tissue in the historic center of Palermo. [42]

Fig. 3-8 Aerial photo of the historic center of Palermo (Source: Google earth)

3.4.2.2 Application of the planning technique

The application of this technique in the historic center of Palermo is also based on a typomorphological analysis. The building typology study is based on all the buildings in the area, including monumental and non-monumental buildings, which are grouped together to form a classification of building types. The morphological study takes the entire urban tissue of the historic center as the object of study, including streets, public spaces and other research elements to describe its various stages of progression, changes that have occurred and different dimensions, and thus obtain historical information. For the main operational tools, historical maps dating back as far as 1677

[42] Costantino D. Dal risanamento alla conservazione: piani e politiche per il centro storico di Palermo[J]. 2010.

and 1703 were used to provide valuable historical information to deduce the progression of the fabric. Historical cadastral maps containing the identification and form of all properties in the years 1877, 1930 and 1954 were also applied.

The analysis led to a zoning map of building types and an urban tissue zoning map, where each building in the area is classified as a type and they belong to a specific tissue within the urban context. The application of typomorphological planning techniques in the historic center of Palermo is more prominent in the case of building interventions, with eight types of interventions proposed on the basis of the building type zoning map, including: restoration, reconstruction, demolition without reconstruction, and typology. These include: restoration, reconstruction, demolition without reconstruction, and typological reconstruction, which further classify each building within a typology of intervention, allowing for better conservation and

restoration of the building.

Fig. 3-9 Tissue zoning of the center of Palermo (Source: Reference [45])

Similarly, Palermo has developed guidelines for each building type and urban tissue which are summarized in a Conservation Manual that provides designers with a basis for design and intervention. Once the original pattern of the urban form and the type of each building are identified, the design should be based on the continuation of the original tissue or, in the case of major changes, on a new design that is in dialogue with the style and the surrounding form of the original building.

3.5 Summary of the chapter

Chapter 3 is divided into four parts, starting with an overview of the development history of the technique in the context of Italian society. Three stages of the development of the Italian Typomorphological Planning Technique is presented in this part. Then, the second part analyzes the cores of the technique, which is summarized into 3 points by the author. The third part provides a specific analysis of the application method and process, and finally the analysis is combined with two real cases study.

This chapter provides an in-depth analysis of the technology itself on the basis of theoretical support, focusing on the study of the effectiveness of the application of planning techniques based on a typomorphology basis.

CHAPTER 4: LOCALIZED ADAPTATION RESEARCH AND APPLICATION FRAMEWORK CONSTRUCTION

4.1 The application of typomorphological planning techniques in the Italian context

4.1.1 Application context

The application of typomorphological planning technique in Italian urban planning and regeneration is inextricably linked to its own natural, historical and cultural contexts, and the influence of these contexts is also reflected in the Italian urban morphological characteristics and development concepts and patterns. These application contexts are the first thing to be clarified in the study of the local adaptation of this technique.

(1) Relatively independent historical towns

Italy is 80% mountainous and hilly, with two major mountain ranges standing on the Apennines, the main part of the country. The northern Alps straddle the national border, while the Apennines run almost the entire length of the peninsula, with the two mountain ranges meeting in the northwest and forming the main plain in the northeast, the Plain of the Po. In addition, smaller plains are scattered throughout the long coastline and mountains of the Apennines, which are extremely dispersed. This led to a long period of localization and city-states in Italy, and a system of thousands of small and medium-sized towns that continues to this day. [43]Despite the unification of Italy in 1870 and the establishment of the administrative planning system of administrative districts, provinces and municipalities, the spatial structure of the historical towns remains relatively independent. This feature has facilitated the preparation of plans to a certain extent, such as the ability to define the scope of historic towns more clearly.

[43] Marco Trisciuoglio, Dong Yinan. Towards a Permuting Idea of Architectural Types: The Italian Typo-Morphological Approach and the Chinese City [J].The Architect,2017(06):22-30.

(2) Urban conservation and renewal concept

Italy has a long-standing tradition of conservation and renewal of historic cities and buildings. As early as the 19th century, Italy promulgated a law on the protection of cultural heritage, which clarified the historical value of cultural heritage including urban heritage and architecture, and in the 20th century, especially after World War II, along with the large-scale urban movement and reconstruction, Italy made important contributions to the theoretical research and practice of historic city preservation and renewal. The Italian concept of urban conservation, construction and development as a unity of the historical process of the town is not only reflected in policies and regulations, but is also deeply rooted in people's minds, forming a top-down positive system for the conservation of historic cities.[44]

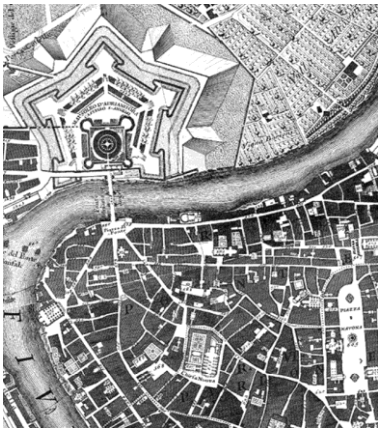
(3) Urban Development Patterns

Italian cities and towns have rarely been developed through major demolition or renovation over a long period of time, partly due to the fact that Italian cities have not had the need for major expansion or renovation for a short period of time in almost all historical periods. It is difficult to find metropolitan areas with an urban population of more than one million in Italy or even in Europe. The extensive city of Rome, with a population of 2.5 million, is already a European megalopolis in terms of population, and even then it has at one time suffered rapid population declines over several historical periods. As a result, Italian towns tend to adopt a model of restoration and renovation and small-scale construction. On the other hand, the concept of conservation of historic buildings makes them rarely adopt demolition and reconstruction, and even when they are renovated, traces of different historical periods are left behind to ensure originality. This pattern of town development allows the urban form and tissue of each historical period to be preserved and provides conditions for the utilization of typomorphological planning techniques.

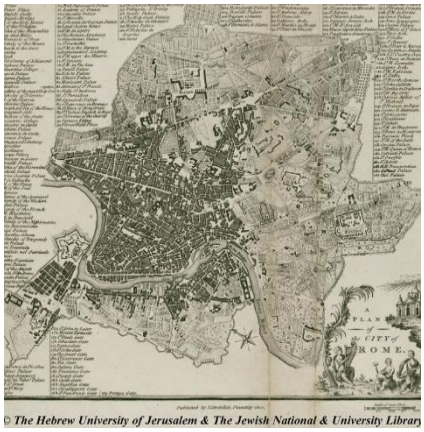
[44] Yao Yifeng, Na Ziye. The Paradigm Shift of Urban Conservation and Renovation for Historic Towns in Italy: Taking Bologna and Genova Historical Center as an Example [J].Urban planning forum,2016(01):99-105.

4.1.2 Application conditions

The relatively accurate historical maps and the historical information covered are the guarantee of the effectiveness of the application of typomorphological planning techniques in Italy. The main research tools of the technique are historical maps and cadastral maps (property distribution maps), and Italy has a tradition of urban mapping. In the case of the new master plan of Rome, for example, the analysis tool contains historical maps of the Roman planning period, dating back as far as the "Plan of New Rome" drawn by Noli for Pope Benedict XIV in 1748, which accurately shows the relationship between buildings and streets at the bottom of the map, and the legend contains a wealth of information about the city. This form of map became known as the "Noli map" and was widely used in urban analysis. The lack of historical maps and their lack of accuracy and information coverage greatly affects the use of typomorphological planning techniques and makes it difficult to ensure their effectiveness.



a) Noli map of Rome in 1748



b) Historical map of Rome (1800)

c) Historical map of Rome (1962)

Fig. 4-1 Historical maps of Rome
(Source: https://geoportale.cittametropolitanaroma.it/)

4.2 Localization study of the technique

4.2.1 Application Potential

The International Forum on Urban Form ISUF was held in China in 2009 and 2016, in which the current problems faced by Chinese cities and the possibility of applying typomorphological methods were also discussed. At present, Chinese cities generally have the problem of saturated development, and relevant policies have proposed that the development model of Chinese urban construction should shift from incremental development to stock regeneration, and numerous topics related to urban regeneration have been proposed one after another. The Italian typomorphological planning technique has been used in Italy's urban regeneration in a mature and systematic way, and has also made outstanding achievements, and its specific experience can provide some reference for Chinese cities in transition.

Fig. 4-2 ISUF Council held in Nanjing, China (2016)
(Source: ISUF, 2016)

At the same time, the phenomenon of homogenization of domestic urban construction has existed for a long time, and in the new period of gradually shifting to stock renewal, the application of renewal concepts and methods will, to a certain extent, determine whether the phenomenon of "one city in a thousand" can be improved. [45]There has never been a shortage of historic cities in China, but there has been a

[45] Tian Y, Gu K, Wei T. Preserving the cultural identity of Chinese cities in urban design through a typomorphological approach[M]//Urban Morphology, Architectural Typology and Cities in Transition. EDP Sciences, 2022: 172-198.

problem of how to carry out specific urban conservation and renewal for historic cities with different geographical and cultural backgrounds. typomorphological planning technique can provide some new ideas for Chinese cities.

4.2.2 Application Difficulties

The difficulties of application can be divided into two main aspects, research tools on the one hand and differences in urban morphological elements on the other. The effectiveness of typomorphological planning techniques requires research tools to ensure them. In the Italian context, a large number of systematic and accurate historical maps exist as research tools in urban planning and renewal, but systematic historical maps are relatively missing in most Chinese cities, and the existing maps lack precision and information. As a result, domestic research and practice is often limited to some cities in the east where historical maps are relatively well preserved. Another point is the difference of urban morphological elements. The research elements in the typomorphological framework can effectively analyze urban morphology in a western context, but the objective differences in urban morphology and cultural background can also affect the localized application of typomorphological planning techniques. Therefore, it is necessary to adapt the research elements for localized adaptive research and practice.

4.2.3 Domestic practice studies

Since the localization of typomorphological planning technique is still relatively insufficient, the author has not found grounded practice. However, the scholar Chen Fei used her typomorphological research framework to study the urban morphology of Nanjing and Suzhou[46] in China, and gave urban design guidelines based on morphological zoning, which to a certain extent reflects the application of the planning

[46] Romice O, Chen F. Preserving the cultural identity of chinese cities in urban design through a typomorphological approach[M]//Urban Morphology, Architectural Typology and Cities in Transition. 2014: 172-197.

technique. The following is a brief analysis of the case of Nanjing City.

Chen Fei selected the city of Nanjing as the target of the domestic urban typomorphological study based on three criteria: first, the city should have a strong traditional urban fabric; second, the case study city should face the great pressure of urbanization, globalization and the serious crisis of loss of cultural identity in order to explore the potential of typomorphology in solving the crisis; third, there should be sufficient and as detailed historical information as possible to support the research.[47]

Fig. 4-3 Historical map of Nanjing City (Source: Reference [48])

Chen divides the study period into three phases, outlining the main periods of

[47] Chen F. The role of typomorphology in sustaining the cultural identity of Chinese cities: the case study of Nanjing, China[J]. 2009.

construction of Nanjing's existing urban form, namely the historical period (-1860s), the modern period (1860-1949), and the contemporary period (1949-). She also investigates the seven morphological elements she proposes for the characteristics of Chinese historical cities: the general urban plan, silhouette (skyline), street network and streets, plots and urban blocks, public spaces, public buildings, and houses. Based on the division of each morphological element, several morphological zones are formed.

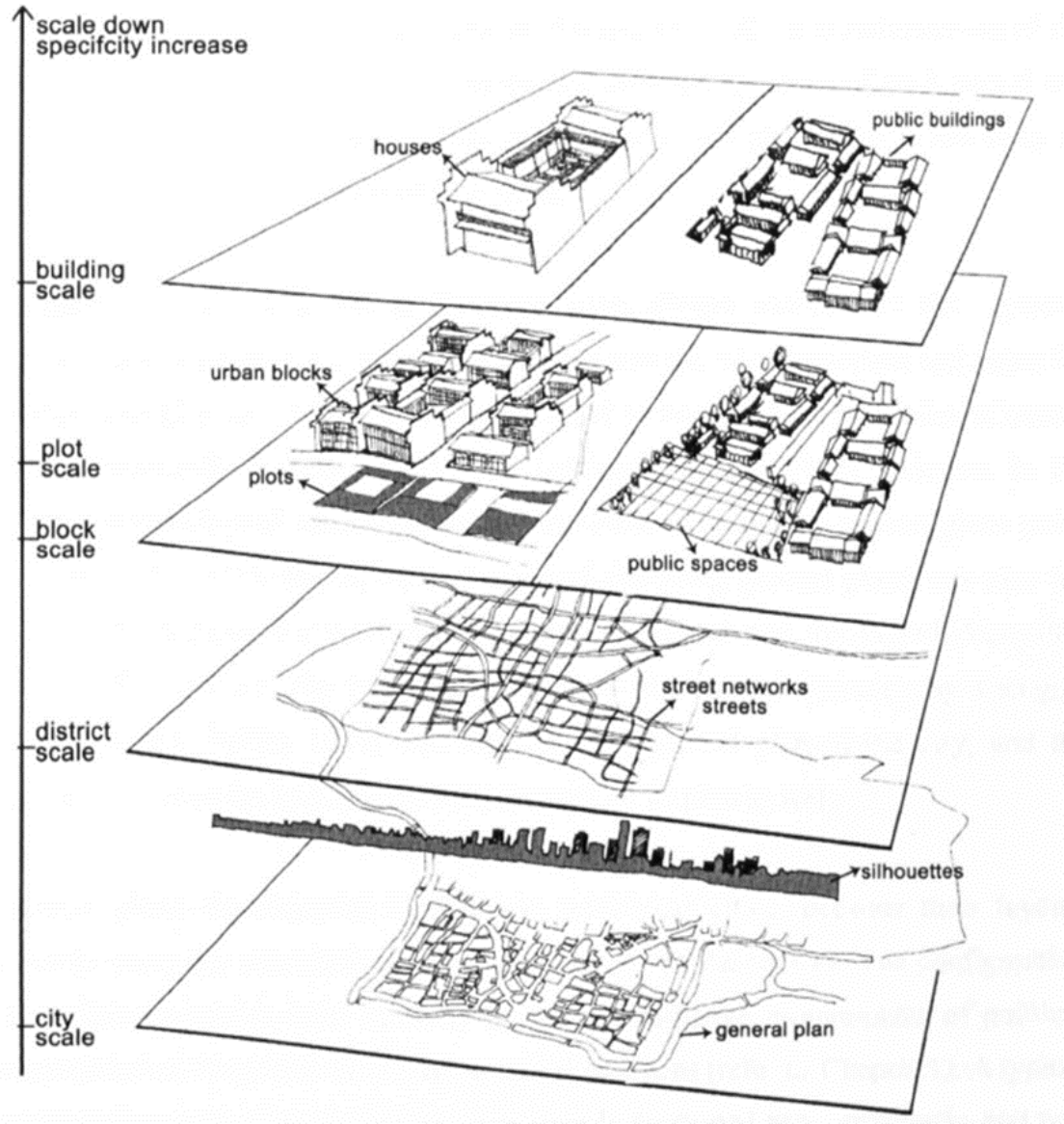


Fig. 4-4 Research elements of Chenfei (Source: Reference [48])

For example, the ground plan is divided into the old city and the new city within the ancient city walls; the silhouette is divided into the traditional small-scale skyline and the skyline with high-rise; the street network and streets are divided into five

morphological zones by street type and combination with the corresponding urban part location, and these zones are to some extent related to each other. Then, Chen analyzes the typological process of each type within the morphological areas separately to determine the progressionary process of the types and to judge whether the process is continuous. And finally, she proposes urban design guidelines for the seven research elements.

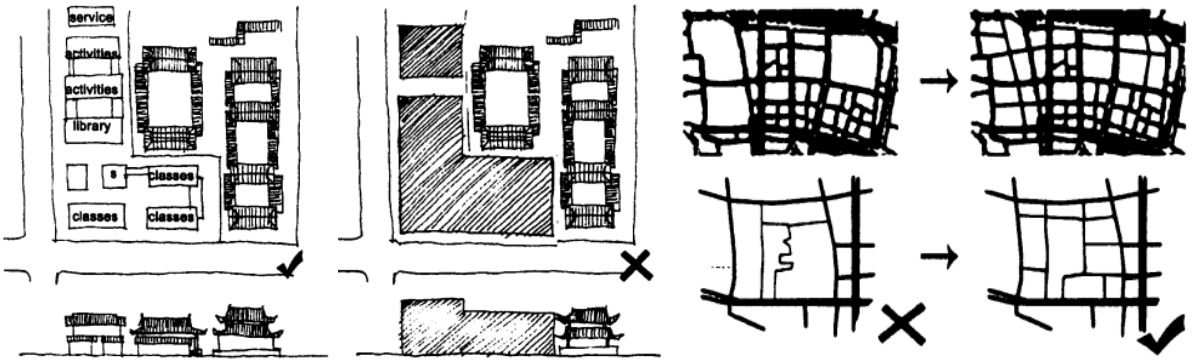


Fig. 4-5 Urban guidelines of the research (Source: Reference [48])

4.3 Determination of design base

4.3.1 Selection criteria

In terms of the selection of design base, four criteria were used as reference for this design.

(1) Scale

The operational scale of the typomorphological planning technique is able to cover four levels from housing to city, and the district scale is appropriate in this study and design to facilitate the research and design work. Therefore, the selection of base was focused on the historic district.

(2) Urban form and type

The target site should have a clear traditional urban morphology and rich characteristics in terms of building type and space. The specific expressions should be: the urban morphology retains traces of different historical periods; the building

types have different types or reflect the transformation or changes of certain historical periods.

(3) Urban problems

The target plots should face some social problems brought by urban development, which may hinder the development of the district or cause inconvenience to citizens and residents. The selection of such plots with relatively prominent conflicts and certain social problems and crises is conducive to the study and exploration of the relevance of typomorphological planning techniques.

(4) Historical information

Relatively adequate historical maps and relatively accurate historical information facilitate the research work, including the identification of research elements. Although the lack of urban historical information is relatively serious in China, some historical maps from different periods are still preserved in the eastern cities represented by Guangzhou in recent times, which also provide a basis for the selection of the base.

4.3.2 Zhuangyuanfang historic district in Guangzhou

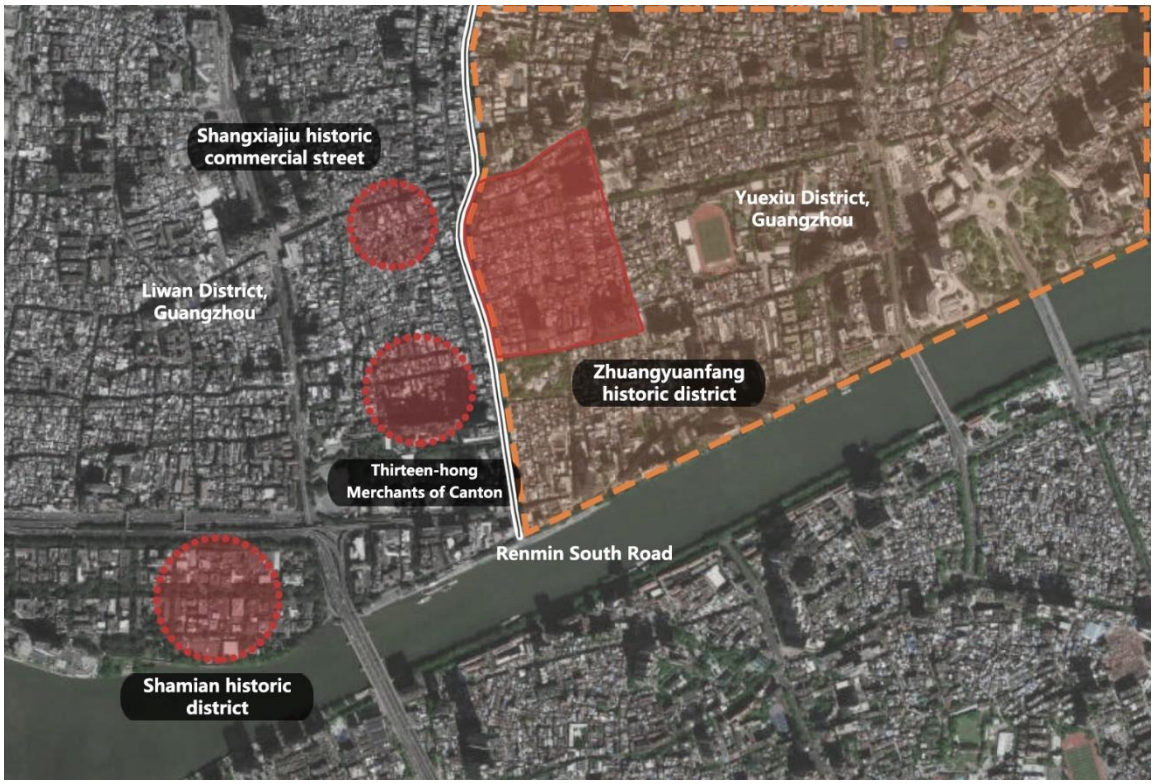


Fig. 4-6 Location of Zhuangyuanfang historic district (Source: by the author)

Zhuangyuanfang historic district belongs to Yuexiu District, Guangzhou City, and is an inner street "Zhuangyuanfang" on Renmin South Road, which has a history of more than 700 years ago. The total length of the street is 260m, with a width of about 5 to 7 meters, and the narrowest part is only 2 meters. With the inner street of Zhuangyuanfang as the center, the area bounded by Dade Road in the north, Yide Road in the south, Renmin South Road in the west and Haizhu South Road in the east, the buildings and historical features of different periods are relatively intact, so this area is accordingly called "Zhuangyuanfang" historic district. The "Zhuangyuanfang" historic district is a typical business district in the old city of Guangzhou, together with the Shangxiajiu business district and the Thirteen-hong Merchants of Canton, which are separated by the South People's Road, as well as the Beijing Road business district, which belongs to the Yuexiu District in the northeast.

Fig. 4-7 Zhuangyuanfang historic district (Source: by the

Since the Kangxi period of the Qing Dynasty, the street has been filled with handicraft workshops processing gold and silver jewelry, opera costumes, pompom

embroidery balls, and was once renowned for selling its handicraft products to the whole country. Since the Qing Dynasty, the street has formed a collection of handicrafts by individual workshops, and gradually developed a relatively complete commercial chain of design, production and sales. 1990 saw the establishment of a handicraft market, which has gradually developed into a street specializing in student supplies and handicraft products, known far and wide. Before 2010, Zhuangyuanfang once became a shopping destination for people, with a huge flow of people. With the shift of the city's commercial center, the traditional districts of the old city, represented by the Shangxiajiu Shopping District and Zhuangyuanfang, gradually lost their popularity and went into rapid decay. At the same time, due to the improvement of online shopping, the handicraft industry in Zhuangyuanfang, which originally lacked irreplaceability, quickly withdrew from competition. In addition, the buildings of Zhuangyuanfang are relatively old and the firefighting problems need to be solved, all these problems have led to its rapid decay in the last decade.

Fig. 4-8 Handicraft industry (Source: by the author)

Fig. 4-9 Comparison between 2000s and 2010s (Source: Baidu.com)

However, the Zhuangyuanfang block, as a traditional old city block with a long history, retains a considerable wealth of architectural types and has a high conservation value. At the same time, it also retains the characteristics of urban form influenced by historical and cultural factors, policies and other factors in different periods, which is extremely important for studying the change of urban form in different periods. At present, in terms of building types, the Zhuangyuanfang block retains a large number of different types of riding buildings, traditional single houses and historically protected buildings. In terms of architectural functions, it is mostly a mixture of commercial and residential buildings.

4.3.3 District characteristics

(1) Historic district

Guangzhou's "Zhuangyuanfang" historic district has a long history, preserving the traces of the development of Guangzhou's old city in different periods of time over more than 700 years of historical changes. According to Muratori's theory, the "Zhuangyuanfang" historic district derives its meaning from its deep background cultural structure and is rooted in the city. The richness of the architectural typology and the different urban morphological tissues reflect "authenticity" and "spontaneity". The deep historical heritage and significance of the historic district of Zhuangyuanfang provide fertile ground for typomorphological planning techniques, which can also better explore and understand its values and guide the construction and historical

regeneration of the city.

(2) Urban morphological continuity

Continuity is the most basic view of architecture and urban form in the Italian school of typology, and the goal of the Neo-rationalism represented by Muratori is to be concerned with the continuity of form and history, and opposes the mechanistic understanding of type. Its main view is that the city is a complete formal structure that can be understood through its continuous historical development process; architecture is neither a mere work of art nor an industrial product, but architecture should be understood as a temporal process of construction from a single dwelling to a whole city. The preservation of relatively complete historical data information of different periods of the historic district of Zhuangyuanfang is conducive to sorting out the changes of urban morphology, and at the same time, it is possible to obtain homogeneous architectural type characteristics and urban morphological characteristics more effectively through typological and morphological methods at the stage of analysis, in order to help the subsequent intervention and design of these two.

(3) Architectural types and tissue

The historic district of Zhuangyuanfang retains rich architectural types and spaces in different periods, and a large number of different types of riding buildings, traditional single houses and historically protected buildings are preserved in terms of architectural types. In terms of architectural functions, it is divided into commercial, residential and mixed commercial and residential. On the one hand, the status quo of relatively mixed types and functions is difficult to define values and formulate measures in a perfect way in the traditional planning mode. For example, traditional planning tends to define and plan the area in terms of themes and functions, and it is extremely difficult to deal with the mixed status quo of the historic district of "Zhuangyuanfang". The typomorphological planning techniques are to a certain extent suitable for this relatively complex situation.

(4) Industrial function

As mentioned above, Zhuangyuanfang has always been mainly handicraft and commerce, and its prosperity and decline in different periods are inextricably linked to the rise and fall of its industries. During the long development, the industrial pattern represented by handicraft workshops is also reflected in the architectural type and urban form. Italian typomorphological planning techniques are largely based on the mixed urban fabric of historic Italian towns and cities, which are based on the industries and functions of the artisanal industry. The use of the planning techniques for the typological study of the historic district of Zhuangyuanfang is conducive to the functional re-integration planning of the historic district and to the regeneration of handicraft industries.

(5) Urban issues

The historic district of Zhuangyuanfang once thrived on traditional trade and cultural industries, but over time, it has rapidly deteriorated and declined in the last decade. Zhuangyuanfang is located in the core area of Guangzhou's ancient city, with an excellent geographical location, but the frequent reorganization of the urban spatial structure and the impact of the surrounding businesses have made its development stuck in a bottleneck, and its traditional urban form tissue and cultural industries have become the shackles limiting its development. With the closure of the last theater costume factory in 2016 due to unfavorable business debts, the traditional cultural industry in the historic district of Zhuangyuanfang faces withering, while the district is currently occupied by the costume workshops of electric businesses. And the urban problems faced by historic districts like Zhuangyuanfang in urban development are of great universality in China.

4.3.4 Research tools

Three main types of data are used as research tools for this study and planning practice: geomancy maps, survey maps and cadastral maps, and relevant historical literature and document references. The geomancy maps mainly come from the dynasties before the Qing Dynasty, and because of the lack of scientific mapping methods in ancient China, the urban geomancy maps reflect the general urban form and the relationship between the natural environment and the location of the city site. Survey maps and cadastral maps first appeared in the late Qing Dynasty and the Republican periods. These historical maps reflect the specific morphological information and property status of the city with relative accuracy, and are updated over a certain period of time, and are the main tools utilized for morphological typological planning techniques. Relevant literature and documents can provide background information on social history, politics, and economy that is not reflected by historical maps in a certain period of time, which is conducive to delineating the research phases, while some official documents such as the Protection Plan for Historical and Cultural Cities can also be used as a reference basis for defining the research scope and formulating urban guidelines. An overview of the research tools for this study and planning and design practice follows.

d) Qing Dynasty c) 1932 b) 1959 a) 1959

Fig. 4-10 Zhuangyuanfang historical maps (Source: by the

（1） Geomancy maps

The area where the historic district of Zhuangyuanfang is located has formed a

prosperous commercial gathering area since the Song Dynasty, but since the Pearl River shoreline has only receded to the present location of Zhuangyuanfang since the early Ming Dynasty, the Geomancy map containing the Zhuangyuanfang area concentrates on the Ming and Qing Dynasties. In the middle of the Ming Dynasty, in 1563, Guangzhou built a new city outside the old city "Yanchicheng" to avoid water damage, and included Zhuangyuanfang, forming the commercial district in the south of the city. And the general layout of Zhuangyuanfang was basically determined in this way. In the Qing Dynasty, the original pattern was basically maintained without much change. Although the city map is not accurate enough, it is useful to trace the root of the progression of the urban form.

（2） Survey maps and cadastral maps

Since the late Qing Dynasty and the Republic of China, survey maps and cadastral maps began to appear, and in 1918, Guangzhou carried out the demolition of the ancient city walls, in which the first phase of the road construction map showed the precise layout of the historic district of Zhuangyuanfang, and also basically determined the street division that continues to this day. The historical information of 1959, 1989, and 2010 is more complete and can be applied to this study.

（3） Relevant historical literature and document references

Relevant historical documents relate to the Guangzhou annal and local annal, such as: Guangzhou Annal (Guangzhou Publishing House 2010), Guangzhou city-fang Annal (Guangdong People's Publishing House 1994), Guangzhou city development history (Jinan University Press 1996), Guangzhou prefectural Annal (Yuexiu Shuyuan, Guangxu 5 years), etc. Documents relate to planning approaches and protection regulations, such as: Guangzhou Historical and Cultural City Protection Regulations (1998), Guangzhou City Master Plan (2011-2020), Guidance on Zoning Planning for the Central Area of Guangzhou Old City, Outline of Guangzhou Old City Renewal Plan (2011.09), etc.

4.3.5 Determination of research history stage

Based on the above historical data and social periods, the study period of the application of typomorphological planning technique will be divided into four stages: the Qing Dynasty and before, the Republic of China period (1912-1949), the founding of New China to reform and open (1949-1978), and after reform and open (1978-). During the Qing Dynasty and before was the formation period of the original urban form of Zhuangyuanfang; during the Republican period, Zhuangyuanfang began the process of modernization and formed the street framework and basic layout that continues to this day; during the reform and open of New China, Zhuangyuanfang produced greater changes, experienced larger-scale reconstruction and certain changes in the urban form; after the reform and open, Zhuangyuanfang first ushered in development under the development of commerce and trade and then experienced the decay, and these changes were also reflected in the change of urban form.

4.4 Identification of research elements

Combining the morphological analysis elements of the Italian typomorphological planning technique and the local adaptation research of Chinese scholars, five elements of morphological research were selected for this applied research and planning design practice. They are house, house and combined tissue, planar land unit, street and street network, and public space. They are the morphological elements extracted from the practical application of typomorphological planning techniques at the block scale and are universal and representative in the historic district of Zhuangyuanfang.

Scale of hierachy	Typomorphological elements	Explanation
Scale of Block/Plot series	Public space	An urban shared space enclosed by the elements in the following layers.
	Streets/Street system	Including the street itself and the morphological network it forms, focusing on material space and two-dimensional forms, respectively.
	Plot	Defined by the streets and contains building groups within it.
	Building layout and tissue	The general plan form of a single unit or a group of buildings, specifically including dimensions and alignment relationships, etc.
Scale of Building	Building	Including the material elements of building plan, façade and three-dimensional space and non-material elements such as function.

Fig. 4-11 Research elements of Zhuangyuanfang historic district (Source: by the author)

(1) Housing

The housing elements include public buildings and civil buildings, and the distribution of houses in the historic district of Zhuangyuanfang is dominated by civil buildings, so the research object is mainly focused on civil buildings. The research elements include: plan form, façade form, floor height and internal function, etc. In this study, we mainly classify the types by combining the construction period and function.

(2) House and combination tissue

This element is the tissue of individual buildings or building combinations that may exist in the property plots, mainly in the general plan, which may include the enclosing relationship, specific shape and size, etc.

(3) Planar land unit

The plan site unit is the smallest urban site divided by streets, mainly in the form of plot outlines.

(4) Streets and Street Network

Street elements focus on the spatial characteristics of the street, and the street network system focuses on the morphology and organization of the plan.

(5) Public Space

Public space refers to the shared space that exists outside the building and is enclosed by the building. They may be formed spontaneously or in the context of planning.

At the same time, the study elements constitute a hierarchical system. Houses and combined tissue, planar land units, streets and street networks and public spaces belong to the block hierarchy in the urban scale system studied by the typomorphology, and houses and their lower elements are in the next hierarchy.

4.5 A framework for the application of typomorphological planning technique in Zhuangyuanfang historic district

The current application framework can be divided into three steps based on the five research elements: typomorphological analysis of the historic district of Zhuangyuanfang, morphological zoning based on morphological type analysis, and specific planning and design practices. The contents are: 1. analysis and typological process deduction for the morphological characteristics of the study elements; 2. drawing morphological zoning and morphological type areas based on the analysis of the study elements; 3. planning structure, urban guideline and urban design.

In the first step, the morphological elements are analyzed separately according to the four historical research stages, and the morphological types of each element are summarized and summarized with the morphological characteristics. After that, the typological process of different morphological types is analyzed to determine the continuity of their morphological progression process, and to provide a basis for the next planning and design guidance.

In the second step, each morphological element is divided into morphological zones, and the morphological type zones are divided by hierarchical boundaries.

In the third step, detailed planning and design are carried out based on the above analysis and zoning. The guidelines are divided into urban tissue restoration guidelines and building intervention guidelines, which correspond to district scale and housing

scale study elements. The specific urban design will be based on the development direction and functional business pattern for the key areas and key spaces.

4.6 Summary of this chapter

This chapter is divided into two parts. The first part analyzes the background and conditions of the application of typomorphological planning technique in the Italian context, and summarizes the potential and difficulties of the application of this technique in China in the light of the existing local adaptation studies. Based on the above analysis, specific criteria for the selection of design base are set, and the historic district of Zhuangyuanfang, Guangzhou is identified as the object of research and planning design practice. After that, an overview of the site is given and the characteristics of why it was selected as the target site are clarified.

The second part is the construction of a framework for the application of typomorphological planning techniques in the Zhuangyuanfang Historic District. Firstly, the specific tools used in the study are described, and the historical stage division of this study is determined by combining the existing historical information and history. After that, five points of research elements are determined according to the actual situation and characteristics of Zhuangyuanfang, covering the block and house scales. Finally, the specific steps from research to planning and design are explained.

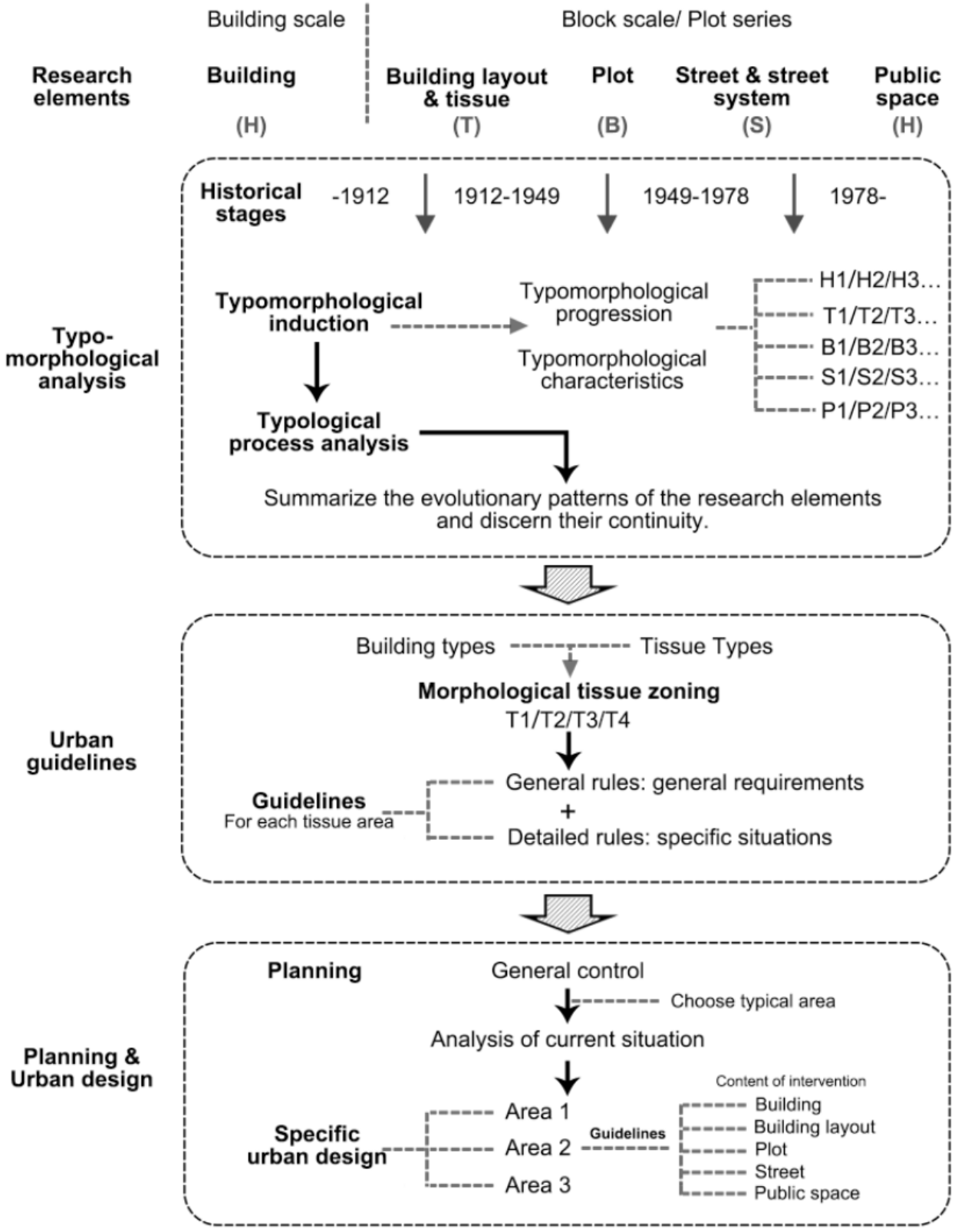


Fig. 4-12 Typomorphological application framework of Zhuangyuanfang historic district (Source: by the author)

CHAPTER 5: TYPOMORPHOLOGICAL ANALYSIS OF THE HISTORICA DISTRICT OF ZHUANGYUANFANG

5.1 Building

Fig. 5-1 Existing buildings of Qing Dynasty (Source: by the author)

Since ancient times, Zhuangyuanfang has been a commercial and residential gathering place, and the houses in the block are mainly residences and stores, with a small number of temples and public buildings. The analysis in this subsection focuses on the specific morphology of the buildings in the block. The categorization of building

types and the derivation of typological processes help to understand the progression of the same type of buildings in different periods and the types and styles of buildings in different periods. It has a direct impact on the delineation of the tissue areas and the specific planning design.

5.1.1 Buildings of the Qing Dynasty

（1）Typomorphological progression

Fig. 5-2 Examples of H1 and H2 in Qing Dynasty

(Source: Yang Bizhu. Research on the Building Type and Evolution of Zhuangyuanfang Area in Guangzhou [D].South China University of Technology,2016..)

During the Qing Dynasty, Zhuangyuanfang had become an important commercial port and the population had increased dramatically. The demand for buildings in that period was mainly divided into two categories, one was to solve the demand for residence and the other was to meet the demand for commerce. This type of building was mainly designed to solve the functional needs of residential buildings, which needed to accommodate as many people as possible in a limited space, so the depth was extremely long while ensuring a certain width. At the same time, in order to improve construction and use efficiency, households are connected to each other, and these houses are commonly known as "Zhutong houses". Some of the traditional row buildings are the same as residential buildings in form, but the ground floor is more

open and functions as ground floor commercial. It is a product of commercial needs and maximum use of building space. There is no difference between these two at the level of building type, the main difference is in the layout and utilization of the first floor plan. In addition to the civil buildings, there are a small number of public buildings including temples within Zhuangyuanfang (Haopan Temple).

（2）Typomorphological characteristics

Two main types of buildings existed during this period: traditional row buildings(H1) and public single building (H2). The traditional row building was manifested in the Qing Dynasty in the form of Zhutong houses, which was a unique product of the combination of social needs and climatic characteristics in the late Qing Dynasty. It was able to solve the demand for a large number of houses within a limited plot of land due to the dramatic increase in population, and at the same time, it was able to achieve light and ventilation by setting up a patio, which to some extent adapted to the natural conditions such as the humid and hot climate of Guangzhou. They generally have few floors, usually 1-3 for row buildings and 2-4 for ground floor stores, with a width of only 3-4 m and a depth of 20 m. The plan is usually in the form of a gate, a hall, a room, a patio, a room and a kitchen, and in the case of multi-story Zhutong houses, a staircase is placed at the location of the plan patio. From the bottom to the top of the façade, there are stone foundations, brick walls and gray tile sloping roofs. The main entrance has a characteristic form of "triple doors", namely "screen door, bar door and main door", and there are no other openings on the façade except for the main door and a window on the door of some houses, which is relatively closed. The main public single building is the Haopan Temple on the north side of Haopan Street, a mosque rebuilt during the Kangxi period of the Qing Dynasty, with a wide face of 5 rooms about 18.8 meters long and a depth of 5 rooms about 19.6 meters long, and a roof with a heavy eave hipped roof.

5.1.2 The republican period (1912-1949)

（1）Typomorphological progression

Fig. 5-3 Existing buildings of the republican period (Source: by the author)

During the Republican period, urban construction was influenced by the Western urban movement and a large-scale urban improvement movement was carried out, which was mainly aimed at urban roads. During this period, the roads were widened and the streets of old residential areas were renovated. In this context, the change of building types in the block of Zhuangyuanfang was mainly focused on two aspects. Firstly, the buildings inside Zhuangyuanfang were partly demolished and rebuilt during the renovation, and their forms basically continued the "Zhutong houses" of the late Qing Dynasty, but with some changes in the specific plan form. In addition, South

Taiping Road (now South Renmin Road) on the west side of Zhuangyuanfang was constructed, and the width of the road reached 32m, which was the highest grade road at that time. In the early Republic of China to the beginning of the war, the street side of Zhuangyuanfang was almost covered with riding buildings. At the same time, the stores inside the Zhuangyuanfang block also shifted to the outer rides.

Fig. 5-4 Examples of H1a and H3 (Source: by the author)

（2）Typomorphological characteristics

During this period, certain changes were made to the traditional row building (H1a), and a new type of Qilou-style building (H3) was created. H1a is a distortion of the traditional Zhutong house, in which the representative plane is the relocation of the staircase to the entrance of the building and the elimination of the patio, so that vertical traffic can be completed without entering the interior, allowing an open house to be offered according to floor to multiple occupants. This progression reflects a shift from the traditional one-room house to a multi-family function, and to a certain extent reflects the gradual disintegration of the traditional family-based living style. At the same time, some of the new row buildings along the street have become more open in their facades and are also rich in decorative styles, with some of the facades being influenced by Western elements. In terms of structure, the buildings also shifted from brick and wood to brick and mixed structure, so the number of stories in the buildings also increased slightly during this period, from 1-3 stories originally to 3-4 stories in

general. Rooftops appeared in the late Qing Dynasty, but were built on a large scale in the early Republic of China in the Zhuangyuanfang. The floor plan is similar to that of a Zhutong house, with stores on the ground floor and residential space on the second floor and above, forming a continuous gable space at the front end to avoid the wind and sun. The riding tower in Zhuangyuanfang is usually 3-4 stories, with the ground floor and the front end of the second story elevated to form a higher space under the porch.

5.1.3 1949-1978

Fig. 5-5 Existing buildings between 1949-1978 (Source: by the author)

（1）Typomorphological progression

At the early stage of the founding of the country, the population grew rapidly in a short period of time, while with the formal implementation of the planned economy in 1953, new requirements for the number and form of dwellings arose. In order to meet the demand for housing in this period, the Zhuangyuanfang district took two approaches, demolition and reconstruction and alteration on some of the old original row buildings, changing the brick and wood structure to brick and mixed in structure and continuing the bamboo house form in plan. In this period, the row building buildings (H1b) were very simple, and under the influence of the policy, the basic principle of construction was practicality, so the design and construction only met the basic needs of life. The quality of construction of these buildings was also a major problem. In addition, the collective nature of the planned economy was also reflected in the construction of housing. During this period, multi-story modern buildings began to appear, initially as factory buildings for employees, providing housing for their families. Its plan form and spatial shape were influenced by the Soviet-style architecture of that period, and were completely different from traditional row buildings.

Fig. 5-6 Examples of H5

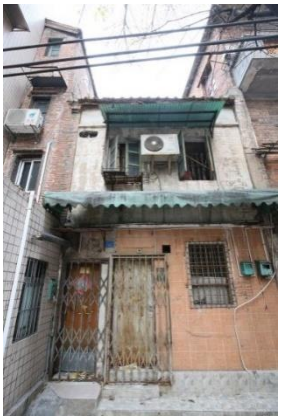


Fig. 5-7 Examples of H1b and H4

(Source: by the author)

（2）Typomorphological characteristics

Two new building types emerged during this period, the slab modern multi-story (H4) and the point modern multi-story (H5). The slab modern multi-story buildings are generally 4-6 stories and function mostly as residential buildings, with a small number of office buildings. There are both internal and external corridors in the floor plan. One

of its characteristics is that the kitchen and toilet are placed separately, usually at the end of the floor, which is also a reflection of its collective character. The point type modern multi-story floor plan organization is different from H4 and is relatively better conditioned. Both of them are relatively distributed within the block and are distanced from the old buildings if conditions allow.

5.1.4 After 1978

Fig. 5-8 Existing buildings between after 1978 (Source: by the author)

（1）Typomorphological progression

After the reform and open, China gradually shifted from a planned economy to a socialist market economy, economic and social development rebounded. However, the

urban landscape of Guangzhou decayed due to stagnant development over a period of time, and the originally prosperous commerce of Zhuangyuanfang was not what it used to be, and the whole was old. Therefore, at the early stage of reform and open, the simple joint-row buildings at the beginning of the founding period were demolished and rebuilt (H1c). And this phase also began to see the emergence of small high-rise buildings on top of the original modern multi-story buildings. Unlike the patterned construction of the row building, the housing forms became abundant and at the same time were able to meet more needs of the residents. After 1990, with the advancement of technology and the further increase of housing demand, high-rise houses with ten floors or more appeared. At the same time, Zhuangyuanfang saw an industrial upgrade and developed into a distribution center for wholesale crafts in a short period of time, and high-rise commercial complexes were built on some of the plots after the old buildings were demolished. Since then the building types in Zhuangyuanfang have not produced any further changes.

(2) Typomorphological characteristics

This period produced changes in H4 and H5, with an increase in the number of floors, producing the evolved types H4a and H5a. A new building type of high-rise commercial complex (H6) was also added. Point and slab modern high-rise buildings are above 10 stories, frame structure, and multi-family with one staircase in the plan. The specific plan form is more variable and also guarantees more privacy for the residents. The facade is relatively plain with little change from the previous ones. High-rise commercial complexes integrate commercial, office and residential buildings and occupy a huge area above 20 stories, often filling up the entire plot. The façade of the early complexes was relatively simple, and after the 21st century the façade represented by the south side Datong commercial building was more open with increased window openings. In general, modern high-rise buildings and high-rise commercial complexes are fewer in number and more scattered in Zhuangyuanfang, the main reason for this is that they occupy a large area and the space in

Zhuangyuanfang is limited. At the same time, in terms of façade style these two are more different from the traditional buildings.

Fig. 5-9 Examples of H1c and H4a (Source: by the author)

Fig. 5-10 Examples of H5a and H6 (Source: by the author)

5.2 Building layout and tissue

Building layout and tissue is the morphological expression of buildings and building groups on the fifth elevation, and the way the buildings are arranged on the plot. This section will analyze the buildings and assemblages in relation to their morphology on the general plan and in relation to the roads, and classify the types according to different periods.

5.2.1 Qing Dynasty

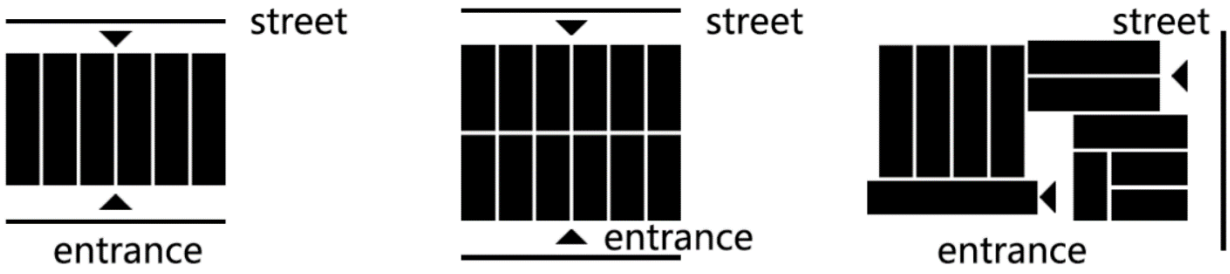


Fig. 5-11 Traditional building layout (Source: by the author)

（1）Typomorphological progression

The main buildings in Qing Dynasty are Zhutong houses, which are usually between 3-5m x 15-25m in plan, with a narrow width and extremely long depth, with the long sides stuck together and the short sides lined up facing the street. To further save space, some plots contain two groups of these Zhutong houses, with their short sides facing the street, forming large traditional plots with extremely high building density. In addition, in some special plots with large areas and irregular forms, the Zhutong houses inside the plots that are not along the street are linked by lanes.

（2）Typomorphological characteristics

Since the morphological types of this period are all divided by the relationship between the traditional Zhutong house and the street, they can be collectively referred to as the traditional row building layout and tissue (T1). They can be further divided into two categories based on the openness of the ground floor: the traditional row-

buildings tissue with a private ground floor (T1a), and the traditional row-buildings t with an open ground floor (T1b).

5.2.2 The republican period (1912-1949)

（1）Typomorphological progression

As part of the traditional Zhutong houses of the Qing Dynasty were demolished during this period, the reconstruction process tends to produce certain gaps with the original buildings, so some small courtyards can be found in this kind of tissue. In addition, the large number of Qilou-streets on both sides of the main city roads constitutes T2.

（2）Typomorphological characteristics

The buildings of the Republican period continues the characteristics of the late Qing Dynasty, and the building layout and tissue also maintain the characteristics of the late Qing Dynasty.

5.2.3 1949-1978

（1）Typomorphological progression

From the early period of the founding of the country to the period of reform and open, new building types have brought changes to the layout and tissue of buildings. The construction of modern buildings is often built on the demolition of old buildings, while they occupy a much larger area than traditional buildings, so they can be considered as modern expansion tissue (T3).

（2）Typomorphological characteristics

This period is divided into two main categories. The traditional building layout and tissue did not change much, although some of the old buildings were demolished during this period, but the reconstruction continued the traditional form from building type to layout. The modern expansion tissue, on the other hand, differs greatly from the traditional tissue, characterized by relative independence and a clearer relationship

between the building itself and the street generated by the reason that the volume of modern buildings has become larger and the road structure is more clearly defined. However, the invasion of traditional tissue by modern tissue also destroys the original order.

5.2.4 After 1978

（1）Typomorphological progression

After the reform and open(1978), some more old buildings were demolished, and the area of traditional types was significantly reduced in terms of the overall building layout and distribution of tissue at the block scale, but the morphology inside the plots was still maintained. around 1990, the construction of high-rise residential and commercial complexes was a development of the modernization of building layout in the previous period, and the main change was a larger footprint and a richer shape.

（2）Typomorphological characteristics

The traditional building layout and tissue is maintained, and some plots have produced large commercial complexes after demolition of the original buildings, which can be considered as reconstruction tissue (T4).The intrusion of the reconstruction tissue into the traditional tissue is irreversible, because it is established after the overall removal of the traditional tissue.

5.3 Planar unit/Plot

Fig. 5-12 Graph of the evolution of the plots in Zhuangyuanfang (Source: by the author)

Plots are the morphological elements that articulate houses and blocks and are often used to divide management units, they are usually divided by streets. In this section, the progressionary study and typology will be carried out from the point of view of planform combined with function and accessibility.

5.3.1 Qing Dynasty

（1）Typomorphological progression

During the Qing Dynasty, the main street network consisting of the main street and secondary road within the Zhuangyuanfang district had already divided the entire block into regular plots. The two east-west streets and longitudinal lanes of Daxing Street and Zhuangyuanfang defined the core plots including Zhengshi Street and Shengping Street.

（2）Typomorphological characteristics

In this period, the morphology of the plots can be divided into two categories according to the way they are defined: traditional plots (B1) and special plots (B2). Traditional plots are bounded by streets and have a relatively regular form, with an area of about 5,000 ㎡. These plots are mostly distributed in the core area of Zhuangyuanfang and are in a long shape. Special plots are influenced by other elements outside the streets, and their morphology is related to the water system and the city wall. Take the plot enclosed by Daxing Street and Haopan Street as an example, it has an L-shaped morphology and is curved on that side due to the influence of the city wall on the northwest side. The morphology of such plots is irregular and the area is large, able to reach 20,000 ㎡.

5.3.2 The republican period (1912-1949)

（1）Typomorphological progression

The city and road construction during the Republican period widened the scope of the Zhuangyuanfang district. The demolition of the city wall on the north side and the widening of Dade Street added two plots to the north of Zhuangyuanfang, which were bounded on the south side by Yudaihao Street and had a long and narrow form, thus dividing them into special plots. The demolition of the city wall on the south side led to the creation of two new plots between Yan Gong Street, Xinqiaoshi Street and

the city road Yide Road, which are also regular in shape and bounded by streets, and are therefore classified as traditional plots.

（2）Typomorphological characteristics

The division of the original plots did not change during this period, and many lanes were added inside the plots with the demolition and construction of certain buildings, which improved the internal accessibility of the plots, but it did not affect the division of the plots because the scale of the lanes was small and they were not connected. The morphological type is preserved for both plots.

5.3.3 1949-1978

（1）Typomorphological progression

The division and shape of the plots in the Zhuangyuanfang district have changed a lot in this period. On the one hand, the improvement of the road system at the beginning of the founding period further clarified the division of the plots, and the horizontal Daxin Road, the vertical Tiancheng Road and Haizhu South Road, as urban roads, completely divided the district into four large blocks, while the internal part of the plots was refined due to the formation of lanes connecting the lanes. The northwest area is the location of the former Haopan Street and Yudaihao Street, containing 4 plots; the southwest area is the core area of Zhuangyuanfang, containing 10 plots; the northeast area contains 6 plots; the southeast area contains 4 plots. On the other hand, due to the construction of some modern residences, new roads within the plots were created, which had a certain tendency to cut large plots, although they did not directly affect the division of plots during this period.

（2）Typomorphological characteristics

The period contains three plot types, B1a and B2a. B1a evolved from traditional plots, where the subdivision of plots produced smaller plots that were relatively small in size and not entirely regular in form, but were still essentially defined by the street, and thus an progression of the traditional street. B2a is similar, subdivided from special

plots.

5.3.4 After 1978

（1）Typomorphological progression

Between 1978 and 1990, the division of plots did not change much, with residential construction occurring within the plots. The trend of dividing larger plots became increasingly evident as new row buildings and small high-rise residences were built on larger scale plots. After 1990, the Zhuangyuanfang district saw an industrial transformation and became a gathering place for stationery supplies and small goods wholesale, with a number of old buildings demolished and high-rise residential and commercial complexes built. Among them, a large special plot on the southwest side of the block was reorganized and divided into 3 plots. The plot on the northeast side was integrated into 1 block due to the overall demolition and reconstruction of the original two plots.

（2）Typomorphological characteristics

Traditional plots were not much affected during this period and their morphological characteristics remained stable, while special plots were further subdivided, smaller in size and more regular in form. The new plot type B3 emerged, which is characterized by the way it is defined with public spaces like squares in addition to streets. The reason for its emergence is that the new type of building is constructed on the vacant land after the demolition of the old type of row buildings, but the new building has a lower building density and there is often a certain area of plaza. Therefore, the interior of B3 plots is different from traditional and special plots in that the building density is lower, while the area per unit building is larger, and there are often only 1-2 buildings within a plot.

5.4 Street and street system

Fig. 5-13 Graph of the evolution of the street system in Zhuangyuanfang

(Source: by the author)

This section focuses on summarizing the morphological progression and characteristics of street system and streets through various stages of analysis, and

carrying out a typological process. The studies for the street network system focus on the overall morphology and structure, while the streets focus on the scale hierarchy and spatial characteristics. In terms of categorization of morphological types, since the current structure of streets is based on the establishment of the Republican period, the study of streets and street networks in the Qing Dynasty and before is only used as a reference for the progression of morphological types and is not counted in the categorization.

5.4.1 Qing dynasty

（1）Typomorphological progression

In the middle of the Ming Dynasty, Guangzhou built an outer city to encompass the district where the Zhuangyuanfang was located. Since the water level of the Pearl River in the Ming Dynasty was located just outside of Zhuangyuanfang, the commercial district in the south of the city was formed with the Haopan Street as the center, which was the most prosperous place in Guangzhou at that time, and the basic structure of Haopan Street was continued. According to the "Map of Guangdong Eastern Province", [48]the street network of Zhuangyuanfang district was further defined in the Qing Dynasty. It was bounded by the east-west Dade Street (now Dade Road) to the north, the AnLan Gate and Youlan Gate of the new city to the south, the Taiping Gate to the east, and the Banxiang Street (Haizhu South Road) to the west, close to the old city wall. Therefore, the formation of the early street network of the Zhuangyuanfang district in the Qing Dynasty and before was inseparably related to the construction of the water system and the city wall.

（2）Typomorphological characteristics

The street network of early Zhuangyuanfang has a distinct hierarchy, with the main traffic streets mostly oriented east-west and a regular overall form. The streets can be mainly divided into internal roads and external roads. Internal roads, such as

[48]

Zhuangyuanfang, are used to connect the inner part of the district to improve accessibility and are characterized by a small scale, often between 2-5m, and the buildings on both sides are also mostly 1-2 stories. The external roads are represented by Haopan Street and Dade Street, whose alignment is related to the water system and the city wall, while functionally linking the outside with the district while defining the scope of the district. They tend to be larger in scale, at 5-10m.

5.4.2 The republican period (1912-1949)

（1）Typomorphological progression\

In 1918, the Guangzhou Municipal Office was established and started to demolish the ancient city walls and build modern roads on a large scale. Over a decade from 1921, more than one hundred roads were built in batches. The demolition of the walls and the construction of the roads changed the external pattern of the Zhuangyuanfang district since the Ming Dynasty. The demolition of the walls on the west and south sides of the city made these two sides of the district no longer closed, and the demolition of the walls on the north side further widened Dade Street. Together with the construction of Yide Road (former Anlan Street) and Taiping Road (former Taiping Gate Wall) city roads, the modern pattern of the Zhuangyuanfang district was formalized. At the same time, this period for the original streets and alleys also carried out some transformation, to Tianping Street, Pancake Lane as the representative of the main streets within the district was widened, in addition, in the city road along the side of the street with the rise of the Qilou-style buildings, the emergence of a new form of Qilou street.

（2）Typomorphological characteristics

During this period, with the improvement of the road construction, the hierarchical structure of the street network became more clearly defined, and at the same time, more branches were created in terms of morphology, which were not so regular. According to the scale level and morphology it can be divided into 4 main categories, which are: city road (S1), internal main street (S2), internal alley (S3), and lane (S4).

City roads are vehicular roads that connect the district with the outside, with widths between 15m-25m, with one city road on the south, north and west sides at this stage. The internal main street is represented by Zhuangyuanfang, Haopan Street and Yangong Street, which are the original main streets inside the district. Since historically such streets were mostly made along the water, the main street of the district is mostly running east-west through the district in the Zhuangyuanfang district, with a width between 5-10m. The internal alleys are attached to the internal main street and are mostly short streets of about 100m in length, with a certain degree of connectivity and a width between 2-5m. Lane does not have connectivity, it is usually a short alley serving a few households, and has an irregular dendritic shape with a width of 2m or less.

5.4.3 1949-1978

（1）Typomorphological progression

During the period from the founding of the country to the reform and open, the construction of city roads was further carried out, and the east side of the Banxiang Street, the Tianping Street, which is in the center of the site vertically, and the Daxin Street, which is horizontally located between Haopan Street and Zhuangyuanfang, were converted into urban road, thus dividing the Zhuangyuanfang district into four parts by city roads. The internal streets were transformed into more lanes by the construction of houses and buildings in the early years of the founding of the country.

（3） Typomorphological characteristics

The urban road structure was fixed during this period, and the street network within the district, consisting of main streets, alleyways and lanes, remained stable. However, the number of lanes and alleys decreased somewhat during this period, due to the demolition of a certain number of buildings. The rest of the types did not change significantly.


Fig. 5-14 Examples of S1 and S2

Fig. 5-15 Examples of S3 and S4

(Source: by the author)

5.4.4 After 1978

（1）Typomorphological progression

After the reform and open (1978), Guangzhou accelerated its urban construction, mainly in housing construction. Before the reform and open, the construction of housing was stagnant for a long time, However, after that the government made a big construction. The Zhuangyuanfang district underwent small-scale demolition for the construction of row buildings and small high-rise residential buildings at the beginning of the reform and open period, and a larger-scale demolition of some plots for the construction of high-rise commercial buildings after the 1990s. In this process, some internal alleys and lanes were demolished, and the interface along the main street was also regularized.

（2）Typomorphological characteristics

The structure of the street system, with the main street and alleyways as the core, has not changed much. The internal main street has been changed in two ways during this phase, one is the regularization of the interface, and to some extent the width has been increased, and the middle of the main street represented by Haopan Street has been divided into two-way streets through intervals and greenery.

5.5 Public space

In this section, the typomorphological study of public space will be conducted in conjunction with specific morphology, relationship with buildings and other factors, and the development trend of public space in the Zhuangyuanfang district will be extrapolated and studied to better guide the next specific planning and design. Due to the lack of information on public spaces in the Qing Dynasty and before, this section is divided into three research phases.

5.5.1 The republican period (1912-1949)

（1）Typomorphological progression

Since the Ming Dynasty, the Zhuangyuanfang district has been a gathering place for the population, with high building density and mostly traditional row buildings. Under such objective conditions, it was difficult to generate public space on a large scale, and there was no planning for public space in the Republican period, so public space in this period was spontaneously generated among streets, buildings and natural elements. Although there was no specific planning, the widening of some streets and the construction of new houses reinforced some of the spontaneous public spaces to a certain extent. However, the overall amount and distribution of public space is still relatively small.

（2）Typomorphological characteristics

The public spaces in this period can be divided into two types, namely street enlarged space (P1) and district open space (P2). Due to the lack of planning of early buildings and streets, the interface is often uneven, and the streets locally produce large open spaces, which over time become shared spaces for neighbors, and some leisure and recreational activities occur in such spaces. Despite their small scale, they are the most extensive and active public spaces in traditional districts. District open spaces are larger scale district shared spaces, which are usually formed by iconic

landscapes, and the setbacks of major buildings. They are often located at the edges of plot units and within the boundaries of key landscapes (e.g., old trees). Open spaces are more public in nature and cover a wider area than street enlarged spaces, but they are more scattered and less numerous in the Zhuangyuanfang. Both types possess spontaneity.

5.5.2 1949-1978

（1）Typomorphological progression

In the early period of the founding of the country, urban and road construction was further promoted, and the internal street improvement of Zhuangyuanfang coupled with the demolition of old buildings for new construction, some street enlargement space was expanded. At the same time, the ground floor of some new residential forms were set back and deformed on the basis of the original street enlarged space, forming P1a. During this period, the open space of the district was also strengthened, and the construction of roads was accompanied by the paving of traditional spontaneously formed public spaces, and such spaces gradually evolved into small district parks under certain planning P2b. In addition, the construction of new-style residential buildings brought new public space type, namely the square (P3). As mentioned in the sub-section on streets and plots, the new-style residential buildings are more independent and have a certain setback from the streets, which then give rise to the squares.

（2）Typomorphological characteristics

During this period, street enlarged spaces generally became larger in scale, while the emergence of new forms increased the richness and liveliness of the spaces, and residents were more willing to gather in the first floor setbacks for rest and recreational activities. The character of the open spaces in the districts changed little, but the planned paving made them fixed and became the main shared space inside in the form of district parks. Squares were still fewer in number during this period, and all were

small in scale and less shared. Overall, from the early days of the founding of the country to the eve of reform and opening up, public space was still dominated by street enlarged spaces and district parks, with some development in the form of street enlarged spaces, but the overall number remained small.

5.5.3 After 1978

（1）Typomorphological progression

After the reform and open, the traditional public space form did not change much between 1978 and 1990, while the acceleration of housing construction brought more small square-type public spaces to the Zhuangyuanfang district. After 1990, Guangzhou started a large-scale renovation to address the problem of dilapidated urban landscape, and some of the main streets in the district were separated and greened, and developed into district parks with some leisure facilities. The new high-rise complexes have given up more distance to the streets and formed larger squares.

（2）Typomorphological characteristics

There is little change in the spatial characteristics of street enlargement and some decrease in the number. A part of the widened streets is transformed into local parks, thus increasing in number, but the overall form remains stable. The number of squares became more numerous and larger in scale.

Fig. 5-16 Examples of P1 and P2 (Source: (Source: by the author))

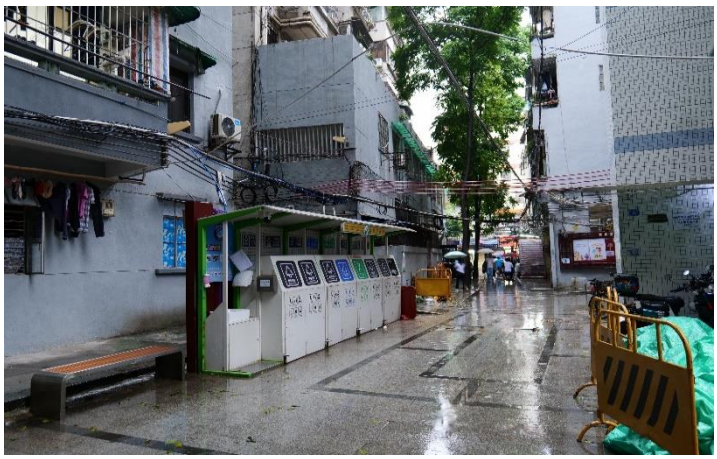


Fig. 5-17 Examples of P3 (Source: by the author))

5.6 Generalization of research elements and progression pattern

This subsection focuses on summarizing the research elements and further summarizing the progression patterns, which have gained knowledge of the cyclical characteristics of the formation and evolution of the district physical space. At the same time, the specific elements content can be judged to have continuity according to the progression pattern in order to determine the next step of intervention.

(1) Building types

There are 6 types of surviving buildings in Zhuangyuanfang, of which H1 (row building), H2 (traditional public single building) and H3 (Qilou-style building) are the original building types. The most extant row buildings have undergone the most complete succession, producing subtypes with continuity from the Qing Dynasty to the early reform and opening-up period. Up to the last subtype (H1c), traces of the original features were retained in the overall three-dimensional form and façade. Traditional public single buildings are typical of ancient architecture, appearing only in the Qing Dynasty. H4 (slab modern building), H5 (point modern building) and H6 (modern large complex) are modern building types. The first two have not produced any obvious changes in plan and façade form during their evolution, but they have been increasing in height.

(2) Tissue types

There are 4 types of tissue in the district, T1 (traditional row-buildings tissue) and T2 (Qilou tissue) belong to traditional tissue. T1 has emerged since the Qing Dynasty and has been divided into two subtypes based on the openness of the ground floor. T2 is distributed along the main urban road of the city and initially formed a continuous interface, but was destroyed in later development. T3 (modern expansion tissue) and T4 (reconstruction tissue) belong to modern tissue. T3 mainly appeared after the founding of the country and originated from the reconstruction after the demolition of the traditional tissue, which has a relatively close connection with the traditional tissue and has a certain reversibility for it. T4 mainly emerged after 1978, which originated from the large-scale demolition of traditional tissue, and is relatively independent and irreversible.

(3) Plot types

Plot types can be divided into three main categories: B1 (traditional plots), B2 (special plots) and B3 (unit plots). Currently, the district is dominated by traditional plots, with a small number of special plots and unit plots. In the long-term development, it is a common trend that the original special plots are continuously split up and transformed into traditional plots.

(4) Street types

Four categories of streets exist within the district, S1 (Urban roads), S2 (district main streets), S3 (internal alleys) and S4 (lanes). These types of streets maintain a stable character overall during the development process and do not change particularly much, and have a certain characteristic scale and form. The overall street system is well layered, and the lanes have some potential to be upgraded to improve the connectivity of the internal roads in the district.

(5) Public space types

Three main types of public spaces exist in the district: P1 (street enlarged space), P2 (open space) and P3 (square). The street enlarged space and the open space are

spontaneous, but both were consciously planned and developed after the founding of the country (1949). The square emerged after 1978 along with the planning of large open spaces next to modern buildings

5.7 Summary of the chapter

This chapter begins with a phased typomorphological analysis of the Zhuangyuanfang Historic District within the framework of the study in the previous chapter, and a morphological evolutionary derivation and summary of the characteristics of the research elements. Finally, the elements are summarized and categorized in the form of a table, and the laws of their morphological evolution are summarized to better guide the next specific interventions.

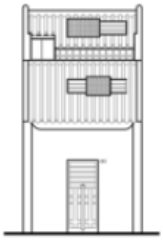
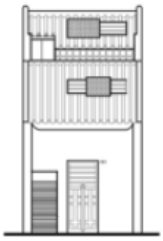
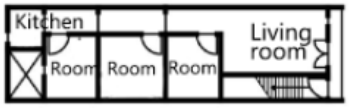
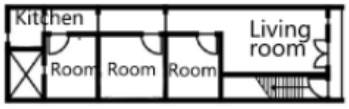
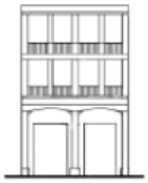
Types of building		Example	Period of time				
			-1912	1912-1949	1949-1978	1978-1990	1990-
H1 Row building	H1	Original ground plan/facade  		→			
	H1a	Typical ground plan/facade  			→		
	H1b	Typical ground plan/facade  			→		
	H1c	Typical ground plan/facade  				→	
H2 Public single building		Temple (Haopan temple) 		→			
H3 Qilou-style building		Typical ground plan/facade  			→		

Fig. 5-18 Building types induction (Source: by the author)

Types of building		Example	Period of time				
			-1912	1912-1949	1949-1978	1978-1990	1990-
H4 Slab modern building	H4	 Slab modern multi-story			→	→	|
	H4a	 Slab modern high-rise				→	→
H5 Point modern building	H5	 Point modern muti-story			→	→	|
	H5a	 Point modern high-rise				→	→
H6 Large high-rise complex building							→

Fig. 5-18 Building types induction (Source: the author)

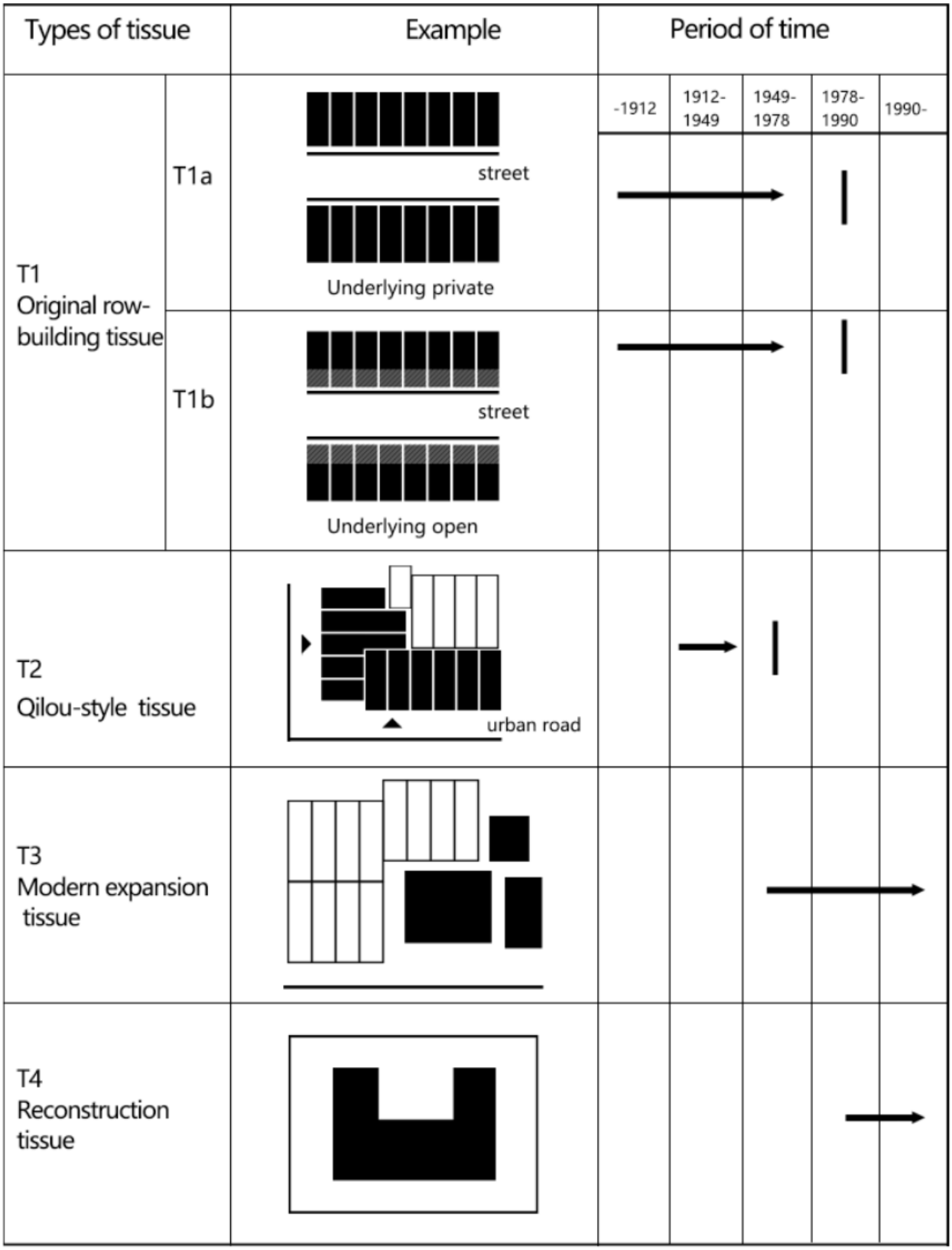


Fig. 5-19 Tissue types induction (Source: the author)

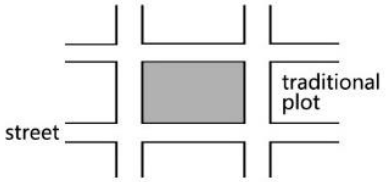
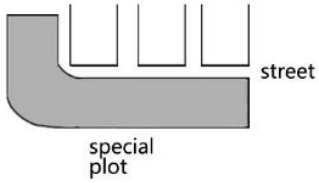
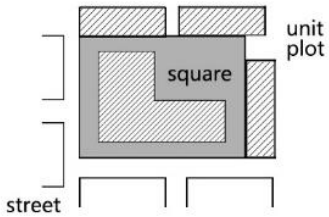
地块类型 Types of plot	图例 Example	特征 Explanation
B1 传统地块 Traditional plot		1.由传统街道来界定 2. 尺度相对较小，形状较为规整 3. 最为稳定，不会产生较大的改动 4. 状元坊内的传统地块面积一般在5000m²左右
B2 特殊地块 Special plot		1.界定受到街道外其它要素的影响，如：原城墙和水系 2. 尺度较大，形状不规整 3. 容易产生改变，通常在新的街道的界定下变成B1地块 4. 状元坊内特殊地块集中在街区边缘，面积能达到20000平方米
B3 单位地块 Unit plot		1. 界定方式包括街道和公共空间 2. 往往在公共建筑和大型现代建筑的周边范围形成 3. 面积较大

Fig. 5-20 Plot types induction (Source: the author)

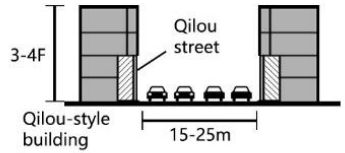
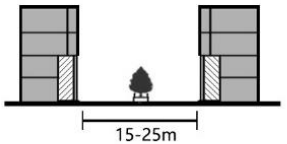
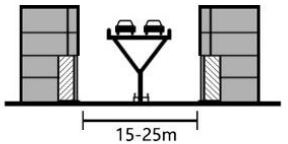
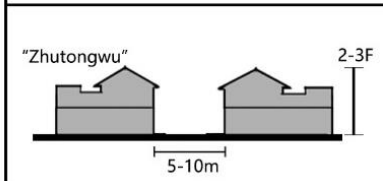
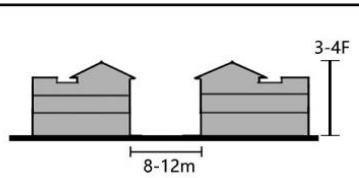
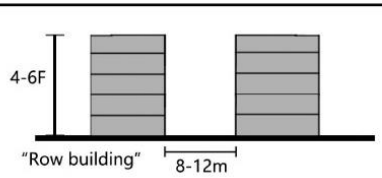
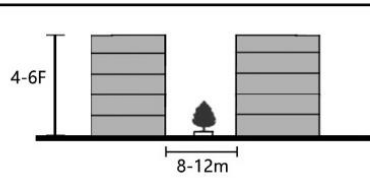
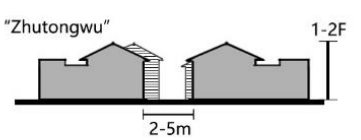
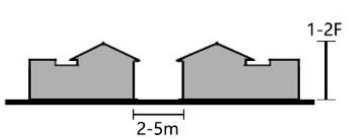
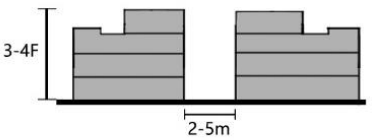
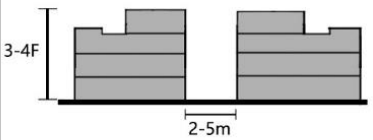
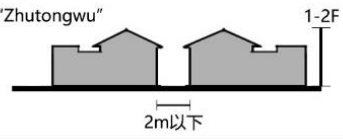
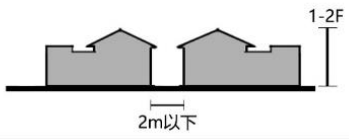
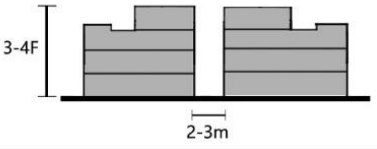
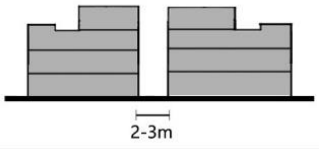
街道类型 Types of street	清代 Qing dynasty	民国时期 （1912-1949）	1949-1978	1978-2010
S1 城市道路 Urban road	清代还没有出现现在意义的城市车行道路	1.宽度在15-25m之间 2. 城市道路旁的建筑类型往往是骑楼，同时形成骑楼街 3. 两侧建筑层数在3-4层，1<D/H<1.75	1.部分城市道路中间增加绿化分隔 2. 其余特征延续上一时期	1.北侧和西侧道路修建了高架桥 2. 其余特征延续上一时期
	—			
S2 街区主路 Main road in the block	1.宽度在5-10m之间 2. 主路旁建筑底层多为商铺，层高较高 3.层数多为2-3层，D/H：0.5-1.2	1.宽度普遍拓宽，在8-12m之间 2. 建筑层数也有所增加 3.D/H：0.75-1	1.宽度在8-12m之间 2. 建筑类型出现多层住宅 3.D/H: 0.5-1	1.部分主街中间产生绿化分隔，并形成街区开放空间 2. 其余特征延续上一时期
				
S3 内部巷道 Main road in the block	1.宽度在2-5m之间 2. 道路两侧建筑多为1-2层竹筒楼 3.D/H: 0.5-1.5	1.这一时期随着道路规划，建筑的界面也得到了调整 2. 其余特征延续上一时期	1.建筑层数增加，普遍在3-4层 2.D/H: 0.2-0.6	1.街区内部建筑层数变动不大 2. 特征基本延续上一时期
				
S4 里巷 Lane	1.宽度在2m以下 2. 平面形态曲折	基本延续上一时期特征	1.部分里巷小幅加宽 2. 建筑层数普遍在4层左右	基本延续上一时期特征
				

Fig. 5-21 Street types induction (Source: the author)

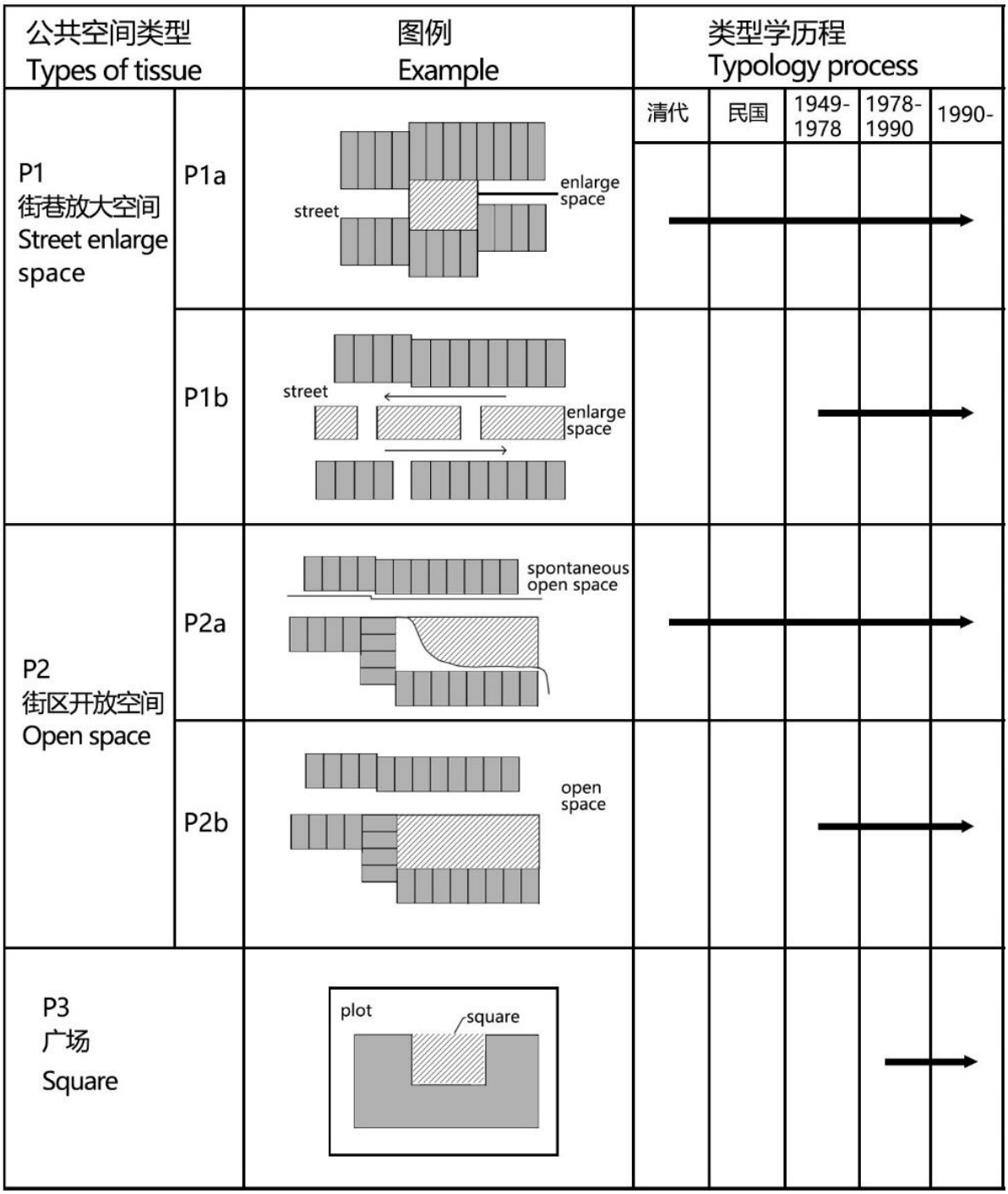


Fig. 5-22 Public space types induction (Source: the author)

Chapter 6: URBAN DESIGN PRACTICE BASED ON TYPOMORPHOLOGICAL PLANNING TECHNIQUE

6.1 Urban guidelines based on tissue zoning

The typomorphological analysis of the five research elements in the district of Zhuangyuanfang in the previous chapter allows to obtain specific morphological divisions and then to study the characteristics and the succession process. On this basis, the Italian typomorphological planning technique is combined with the characteristics of the current state of the site in terms of morphological zoning, and specific urban design guidelines are developed for each of them. The guidelines control the research elements and propose corresponding control and intervention tools to effectively guide the specific planning and urban design.

The specific guideline control will be divided into two parts, one is the general rule, which provides a general definition of the element type or a general requirement based on the research results. The other part is the detailed rules, which address specific situations or typical problems that exist within the site, and which will be combined with existing practical conditions as examples.

Fig. 6-1 Existing building types (Source: the author)

Fig. 6-2 Tissue zoning in Zhuangyuanfang historic district (Source: the author)

6.2.1 Urban guidelines for T1(Traditional row-building tissue)

Fig. 6-3 T1 zoning (Source: the author)

This area is a concentrated embodiment of the traditional tissue of Zhuangyuanfang district, and the protection of the original tissue should be fully considered in the specific design and intervention.

(a) General rules of intervention:

Before intervening with buildings and other elements, it is important to analyze the specific architecture and tissue of the site. The main interventions can be divided into five categories: protective restoration, façade renovation, total renovation, rebuild and demolition. After analyzing the overall tissue and specific buildings, the intervention methods should be carefully determined. Take T1 area as an example, there are large areas of traditional buildings represented by Zhutong houses in this area.

For the Zhutong houses of the Qing Dynasty and the Republic of China, the main intervention method should be to protect and repair them, and direct demolition is not appropriate. The methods of intervention for the buildings in the area should take full account of their historical value.

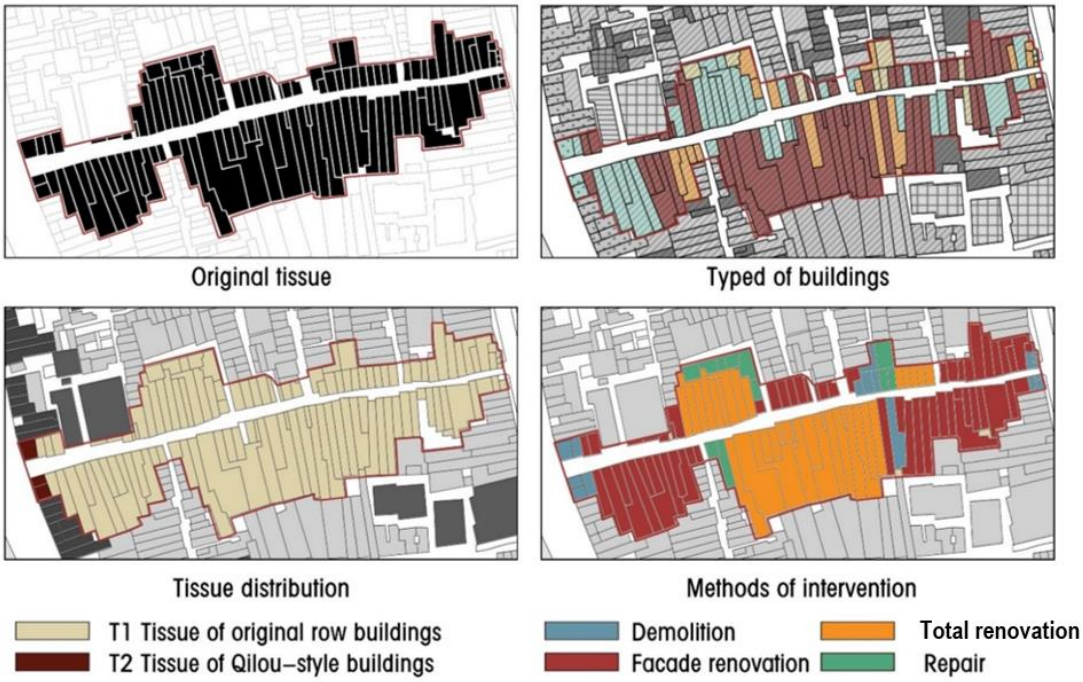


Fig. 6-4 Example of building intervention analysis (Source: the author)

(b) Building

General rules:

1. The façade of the renovated and reconstructed buildings should be consistent in color and form with the adjacent traditional buildings in the same street. (Fig. 6-7)

2. The building height should be controlled below 12m in T1a and 18m in T1b to conform to the overall building height of the area. (Fig. 6-5)

3. The plan and internal space can be adjusted to some extent, but the main structure

of the original building should not be damaged.

4. The building function is appropriate to set the ground floor as commercial and recreational space and encourage the transformation of commercial characteristic space. At the same time, it is appropriate to restore the function of the original first floor warehouse to residential and commercial functions.

Fig. 6-5 T1 Façade general control guidelines (Source: the author)

Detailed rules:

1. In some areas, redevelopment of buildings destroys the continuous interface during the development process, so special façade interventions should be adopted for this kind of phenomenon. For example, a separation is made by material or decoration at 3.5-4m of the façade, so that the ground floor interface is continued. (Fig. 6-6)

2. If new buildings are constructed in this area, there should be a clear vertical separation on the façade as well as reference to typical specific colors, materials and façade elements. (Fig. 6-6)

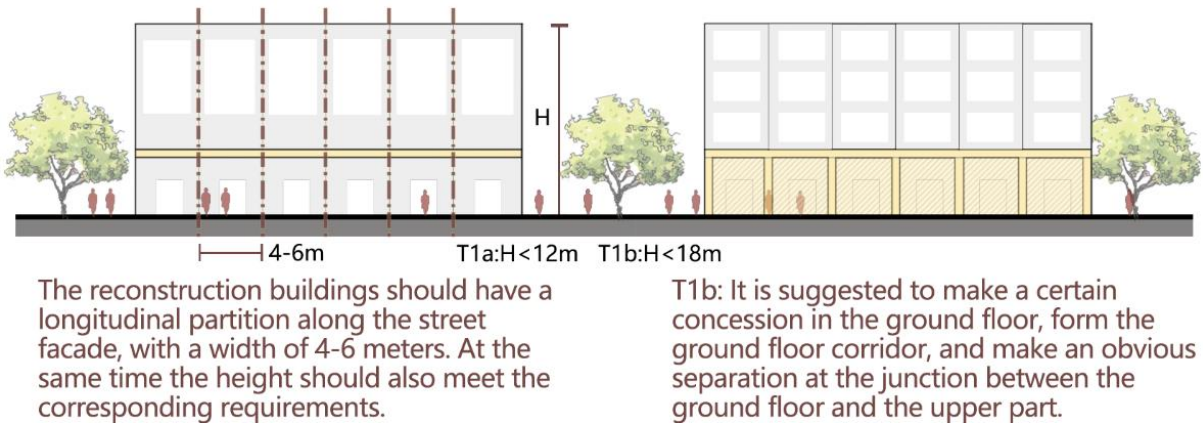


Fig. 6-6 T1 Façade detailed control guidelines (Source: the author)

Fig. 6-7 Typical Buildings in T1 area (Source: the author)

These facade elements are prevalent in the T1 tissue, providing a reference for colour and material respectively.

Facade elements	Color	Material
Rooftop		
Splitter line		
Wall		
Window		
Cornice		
Door		
Skirting		

Fig. 6-8 T1 Reference of the facade (Source: the author)

（c）Building layout and tissue

General rules:

1. The renovation and new construction of the building should fully maintain the tissue of the original building group, the scale of the single unit should not be too large, the fifth façade should continue the traditional long strip tissue.

2. The building entrance and exit should fully consider the relationship between the original building and the street, and the entrance and exit should be set on the short side.

Detailed rules:

1. The reconstruction building should meet the recommended width of 4-8m, the depth of 15-25m, the specific size can be adjusted according to the group and adjacent buildings. (Fig. 6-9)

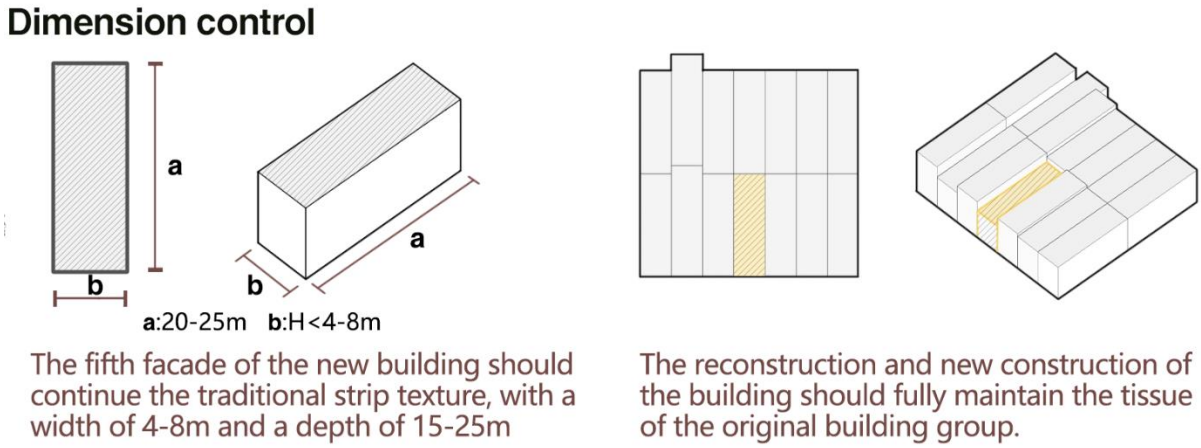


Fig.6-9 T1 Building layout guideline (Source: the author)

（d）Street

General rules:

1. the street system should be dredged on the basis of the original structure, and some of the lanes can be opened to improve the connectivity of the area, and also to reduce the potential fire hazards. (Fig. 6-10)

2. It is advisable to adjust some of the uneven street interfaces, but it should not be too flat, and the traditional concave and convex overall form should be retained. (Fig. 6-11)

Fig.6-10 Street system adjustment

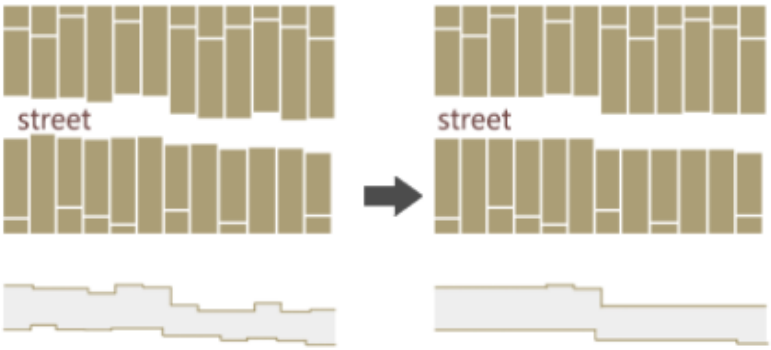


Fig.6-11 Street interface control

(Source: by the author)

Detailed rules:

1. The width of the main street should be increased moderately, and the main street (Zhuangyuanfang Street) should be 8-12m, while greening can be separated. Internal alleys and lanes should be implanted with greenery.

2. The underlying corridor can be set up if there is a demand for the bottom open corridor, the width of which is about 3 meters.

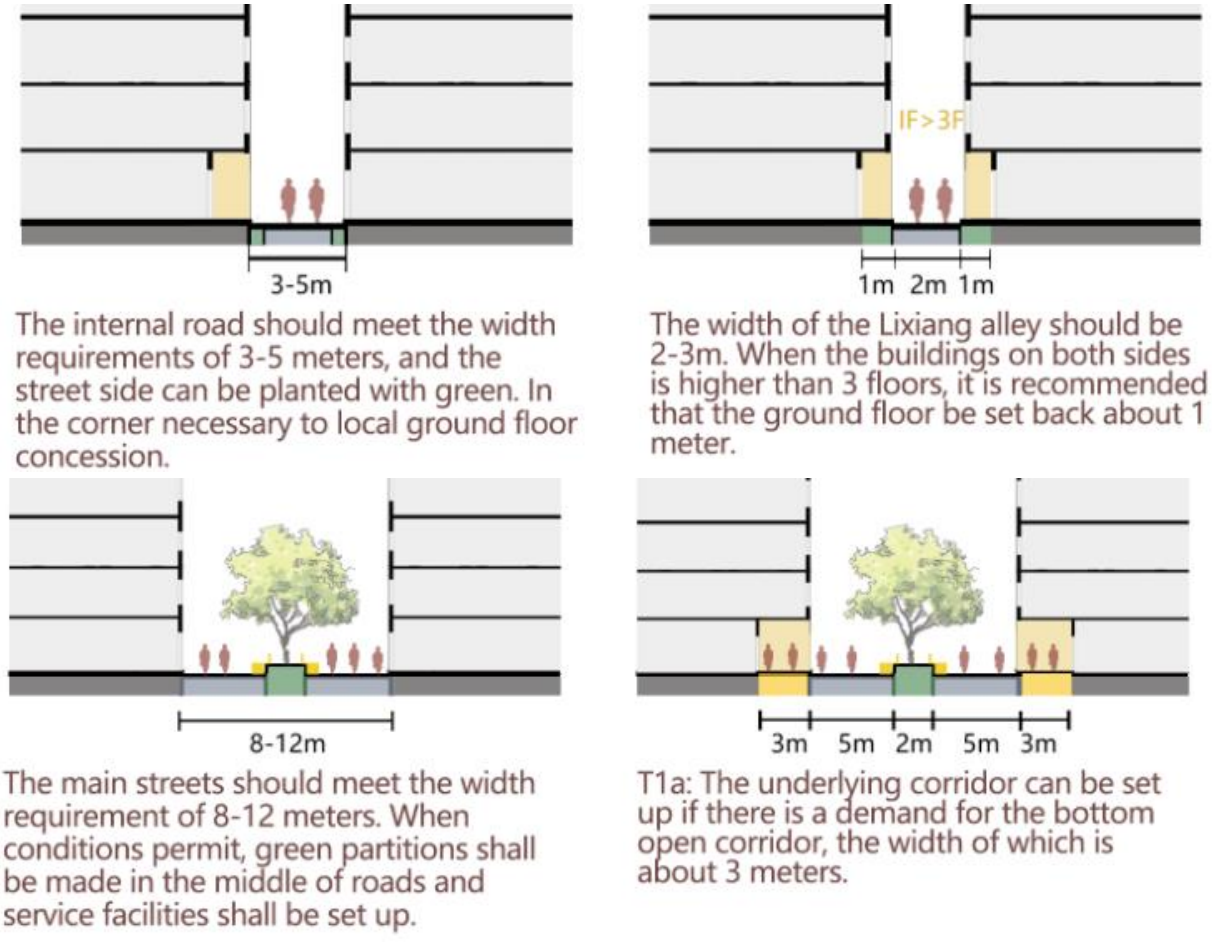


Fig.6-12 T1 Detailed rules for T1 area street control (Source: the author)

（e）Plot

General rules:

Special plots with large areas and irregular forms should be further divided, and can be operated for lanes where such a trend exists. The treatment of plot regularization is conducive to the convenience of transportation in the district and also makes it easier to divide management units.

Plots division before adjustment　　Plots division after adjustment

Fig.6-13 T1 Plots adjustment (Source: the author)

（f）Public space

General rules:

1. There is an overall lack of public space within the Zhuangyuanfang district, and the existing street enlarged space and public space can be landscaped to improve the quantity and quality of public space.

2. There is a lack of recognizable landmark spaces in the district, and it is appropriate to combine landmarks (such as pagodas) and iconic landscapes (such as ancient trees) for the design of entrance spaces and major parks.

Detailed rules:

1. Street public spaces are widely present in the T1 area, among which are street enlarged spaces and main street public spaces. Street enlarged spaces are the most

widely distributed, the smallest in scale, yet the most active. This type of space tends to occur at street corners and where buildings create setbacks. Some main streets have evolved to spontaneously generate active public spaces, but there are still some main streets to be optimized, which can be used as a reference in the following figure treatment. (Fig. 6-15)

Fig.6-14 Typical public spaces in T1 area (Source: by the author)

2. There are also a number of iconic spaces and large shared spaces to be developed within the T1 area. Iconic spaces are centered on landmark plants and structures, such as old banyan trees and old pagodas. Large shared spaces are represented by community parks that have formed spontaneously or have been planned. (Fig. 6-14) The specific design approach can be found in the figure below. (Fig. 6-15)

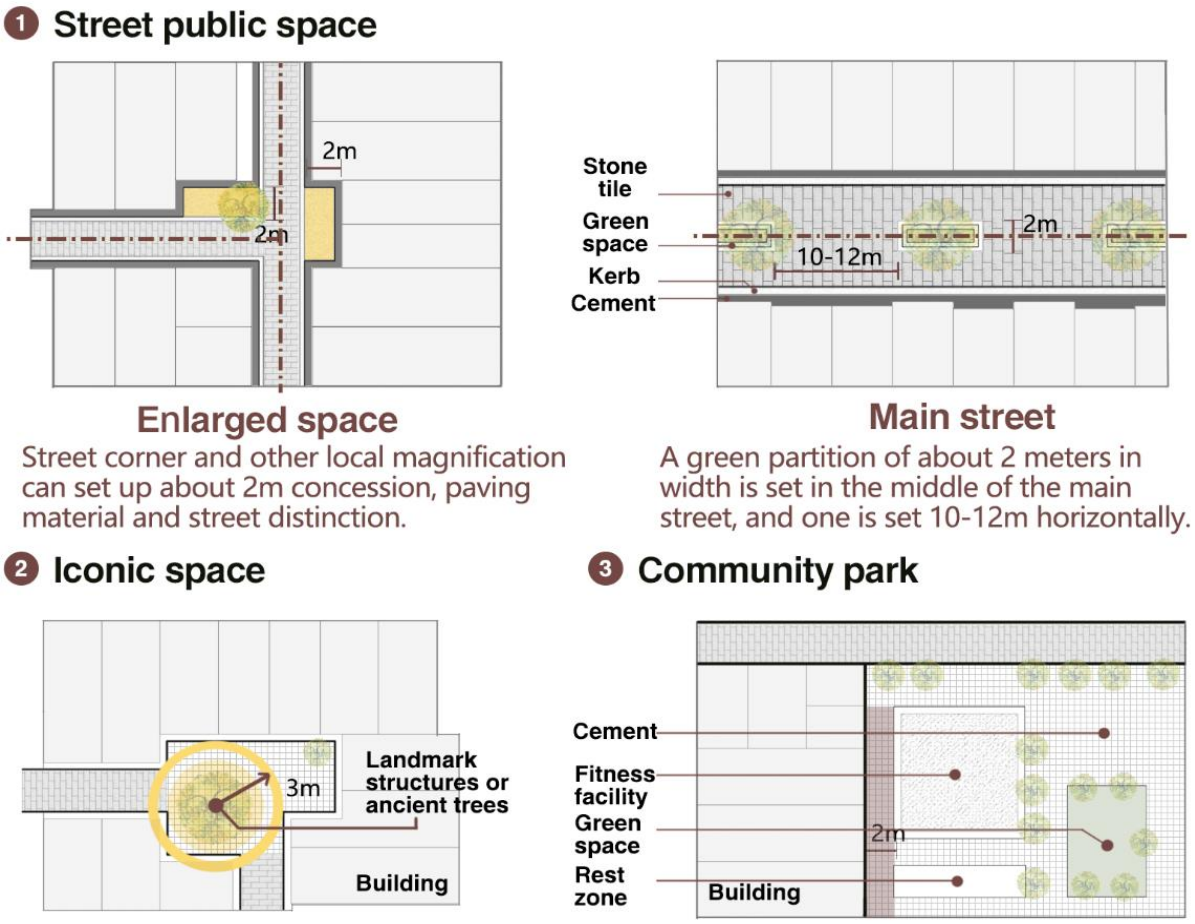


Fig. 6-15 Plots division before adjustment (Source: by the author)

6.2.2 Urban guidelines for T2 (Qilou-style building tissue)

Fig. 6-16 T2 zoning (Source: the author)

The area of Qilou-style building tissue is the key protection area of Zhuangyuanfang district, and its typical building type has great historical value. In the specific design and intervention, the existing tissue should be protected while restoring the Qiou-style building interface at the edge of the original urban road.

（a）General rules of intervention:

To the existing Republic of China period Qilou-style building should be taken to protect the intervention of repair, shall not be demolished. It is desirable to renovate the interface of the existing discontinuous Riding House, which can be demolished and rebuilt for some of the poorer quality and lower value of the joint-row buildings along the street.

（b）Buildings

General rules:

1. The renovation and reconstruction of the building facade should be consistent in color and form with the adjacent traditional buildings in the same street. At the same time, there is a diversity of styles in the façade of the Qilou-style houses, and it should not be mandatory to adopt a uniform style. (Fig. 6-19)

2. The building height should be controlled below 12m according to the relevant regulations of heritage building protection.

3. The plan layout can be adjusted according to the function, but should not destroy the main structure of the original building. The space under the corridor should be kept continuous, and the reconstructed building should be kept uniform in height.

4. The building function maintains the ground floor commercial and encourages the transformation of commercial characteristic space.

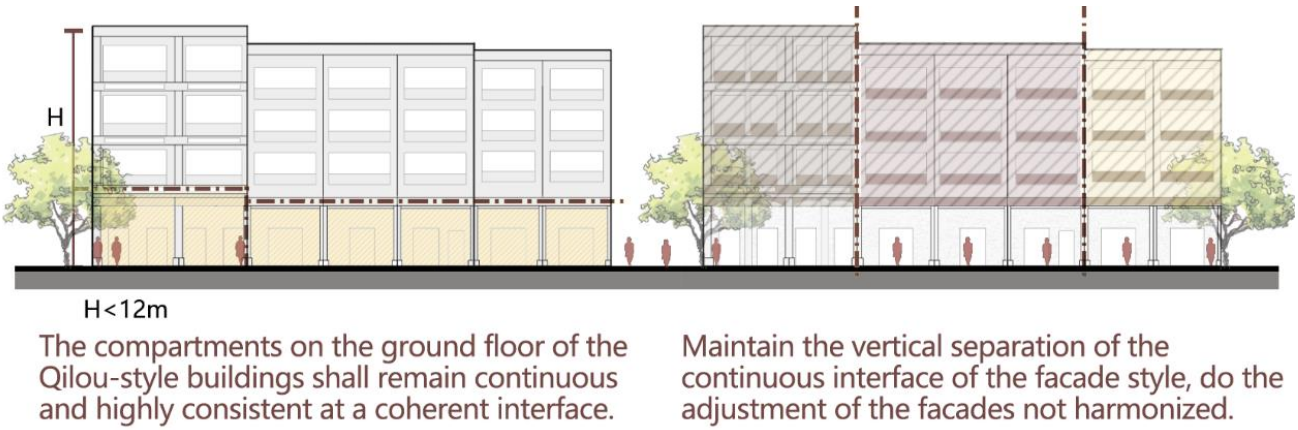


Fig. 6-17 T1 Façade general control guidelines
(Source: By the author)

Fig. 6-18 Typical Buildings in T2 area (Source: the author)

These facade elements are prevalent in the T2 tissue, providing a reference for colour and material respectively.

Facade elements	Color	Material
Rooftop		
Splitter line		
Window		
Handrail		
Wall		
Door		
Column		

Fig. 6-19 T2 Reference of the facade (Source: the author)

Detailed rules:

1. Distributed on the side of the urban main roads, the Qilou-style building is the most representative urban interface; they were originally continuous, but were destroyed during the development process. T2 tissue interface should maintain continuity, and the discontinuous façade should be intervened and repaired.

2. When intervening, the ground floor corridor should be set up, with the height consistent with the surrounding Qilou-style buildings and an obvious horizontal division. Below the second floor, the façade window should be in line with the adjacent side.

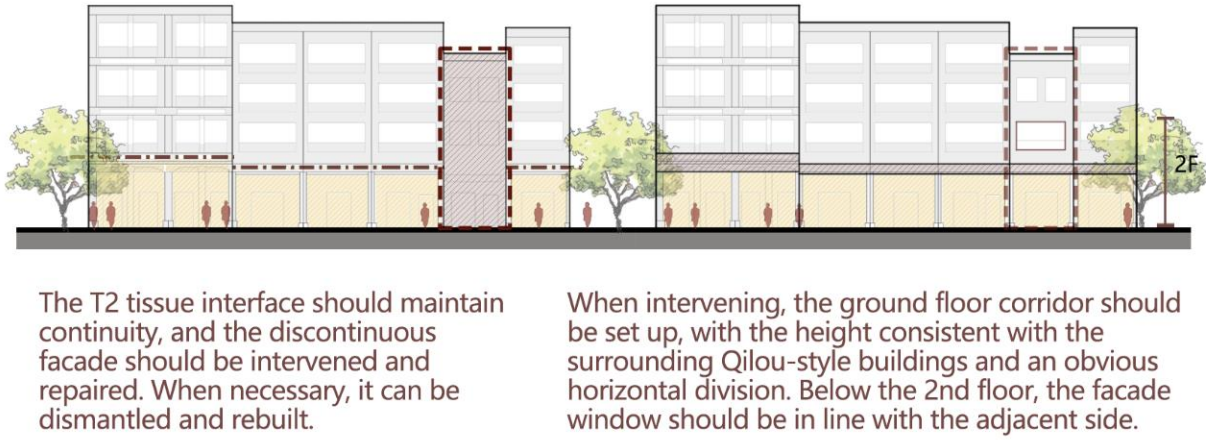


Fig. 6-20 T1 Façade detailed control guidelines (Source: the author)

（c）Building layout and tissue

General rules:

The relatively continuous interface of the riding tower should be maintained in the building renovation and renewal (the section of South Renmin Road on the west side and the section of South Haizhu Road on the east side), and the discontinuous interface should be repaired.

（d）Street

General rules:

The main street type in this area is a ground floor corridor street, which is suitable for revitalization in combination with commercial functions. The net width of the new building under the corridor should not be less than 3m, and the net height should be consistent with the adjacent buildings.

Detailed rules:

1.Along part of the minor arterial pedestrian passage depends on the space under the Qilou-style buildings, with a width of about 2.-3 meters and a width of about 8 meters for vehicles.

2. Part of the minor arterial is provided with a 1.5 meters wide sidewalk outside the Qilou-style buildings, and trees are planted if conditions permit.

3. The Qilou-style buildings beside the arterial of the city need to be equipped with a sidewalk and green belt about 4 meters wide.

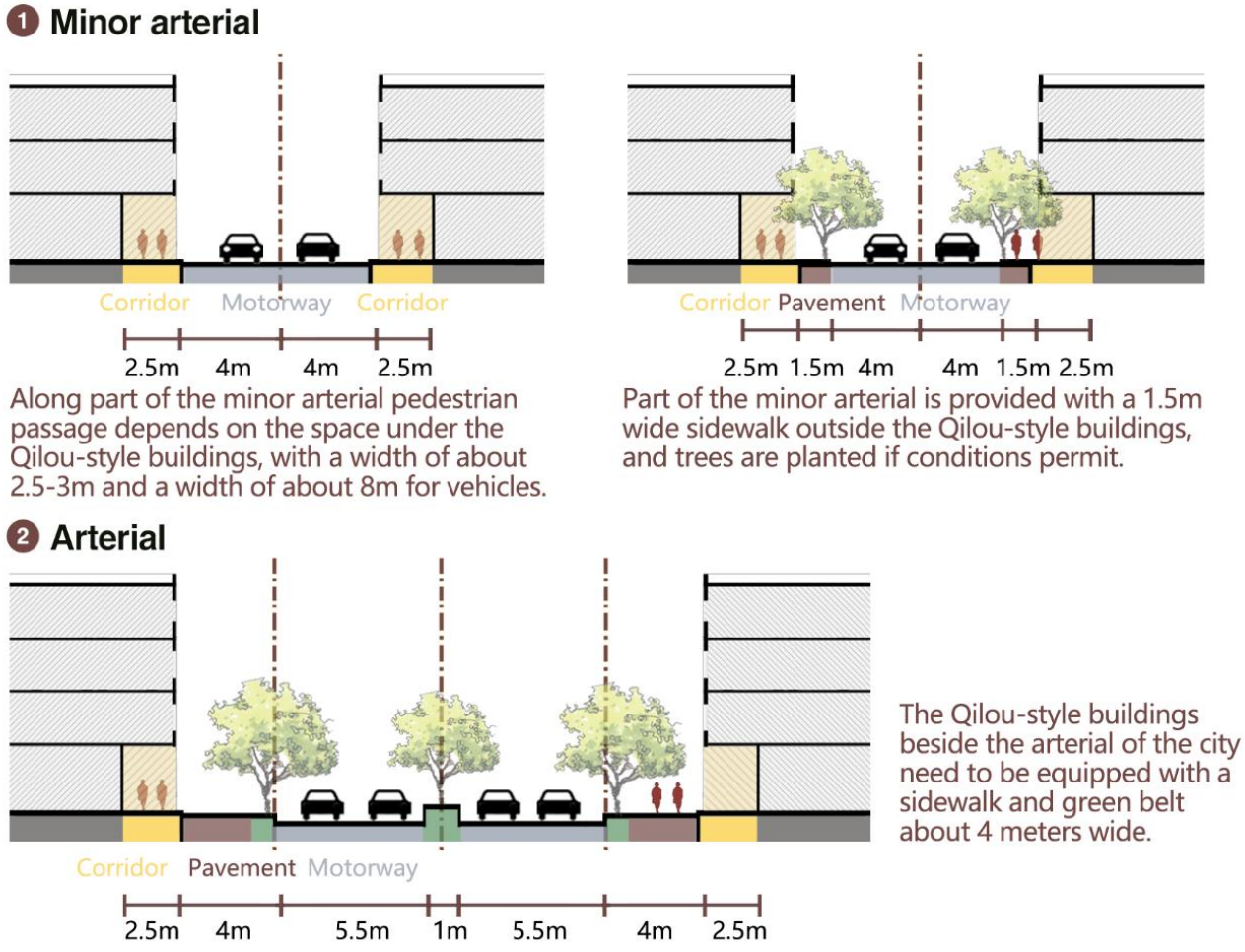


Fig.6-21 T2 Street guideline (Source: the author)

6.2.3 Urban guidelines for T3 (Modern expansion tissue)

Fig.6-22 T3/T4 zoning (Source: the author)

The area of modern expansion tissue is mainly a modern building reconstruction after the demolition of the original building after the founding of the country (1949), and it is close to the original building, which is an invasion of the modern large volume tissue to the traditional tissue. However, it has certain reversibility, so in this area, it

mainly adopts the way of transformation to repair the original tissue.

（a）General rules of intervention:

The low-quality multi-storey buildings from the early period of the founding of the country to the reform and opening-up period (1949-1978) will be demolished and rebuilt, and the small high-rise buildings after the reform and opening-up period (1978-) will mainly be renovated, and some of the severely damaged ones can be demolished and rebuilt.

（b）Building

General rules:

1. The façade of the renovated and reconstructed building should be consistent in color with the traditional buildings in the same street.

2. The building function is mainly residential, and some demolition buildings are appropriate to be designed in combination with community public service functions.

Detailed rules:

1. The modern expansion tissue interspersed between traditional buildings often produces large differences in volume and façade forms from the traditional, and façade adjustments should be made in the intervention process. Among them, two buildings are used as examples to illustrate the two proposed interventions respectively. (Fig. 6-23)

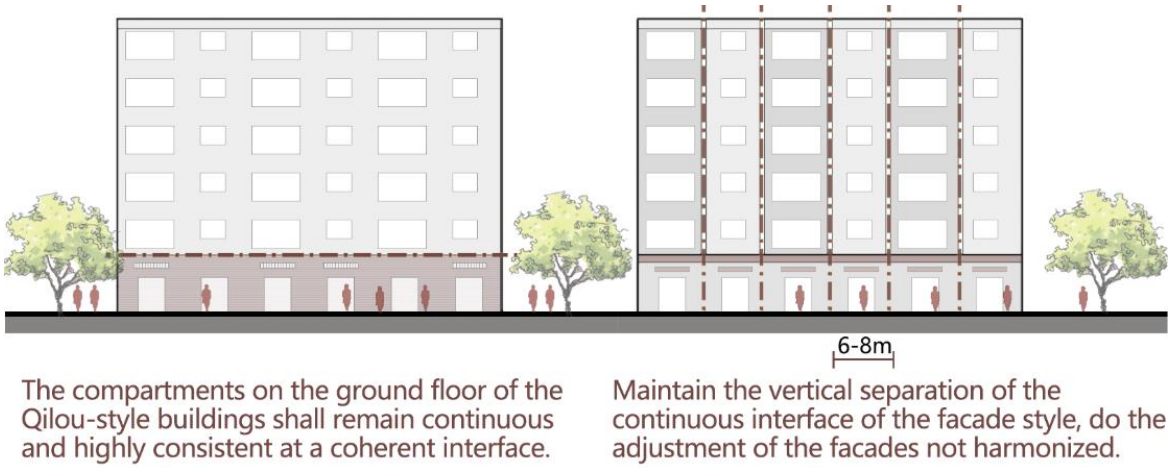


Fig.6-23 Detailed intervention for T3#1 (Source: the author)

2. Some of the modern buildings in the middle of the traditional tissue are large in volume, creating a sense of spatial confinement. Some buildings in the T3 tissue are also responsible for the public function of community service, so it is recommended to make appropriate ground floor elevation for this type of buildings. (Fig. 6-25)

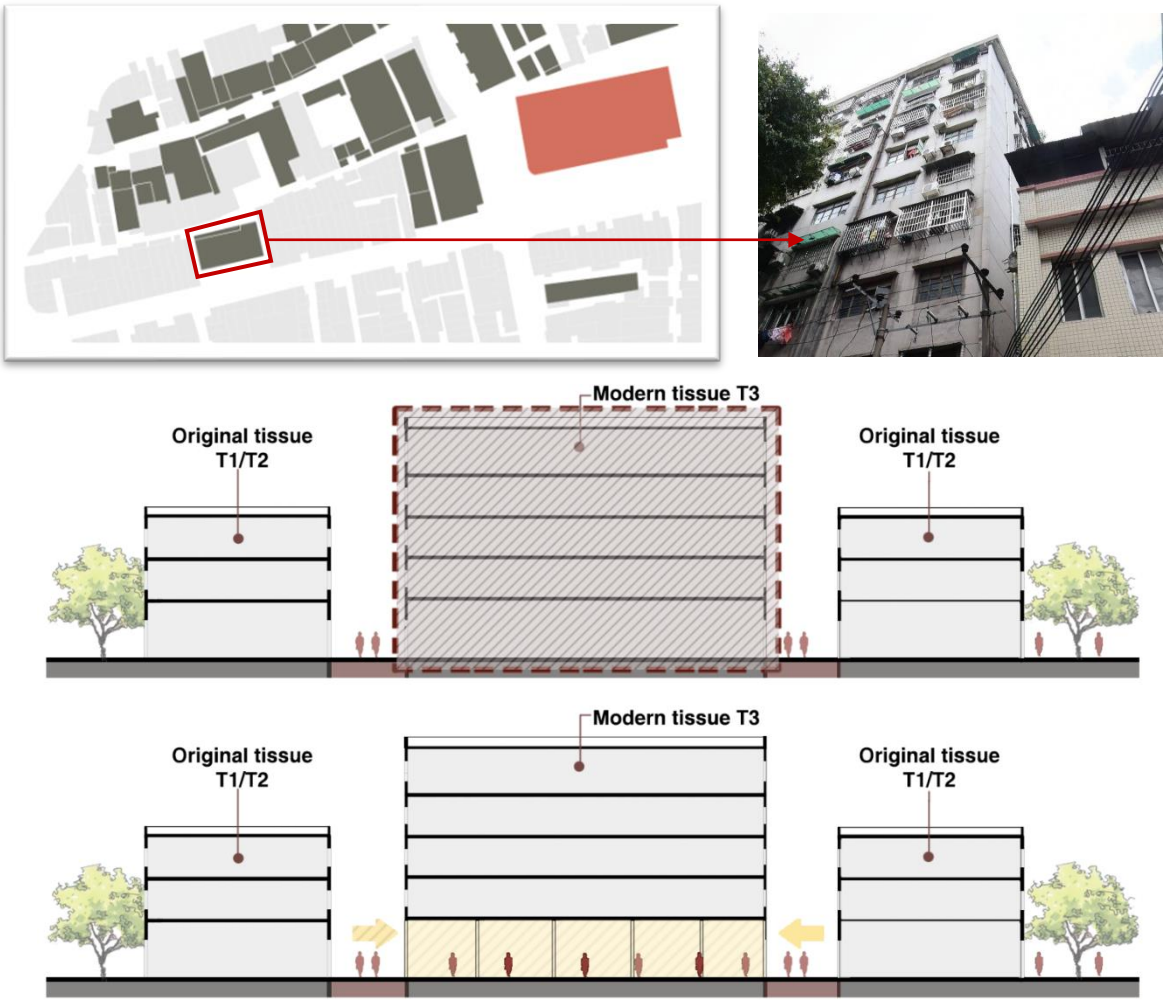


Fig.6-24 Detailed intervention for T3#2 (Source: the author)

（c）Building layout and tissue

General rules:

1. The consistency with the architectural tissue of the plot to which it belongs should be fully considered, and a long strip layout tissue is appropriate.

2. The renovation of the original building should be cut in the general plan, and the large volume of the building is recommended to have a recognizable plan division design.

3. New buildings should not be too large, and it is recommended to use strip building to form a group and combine with courtyard design.

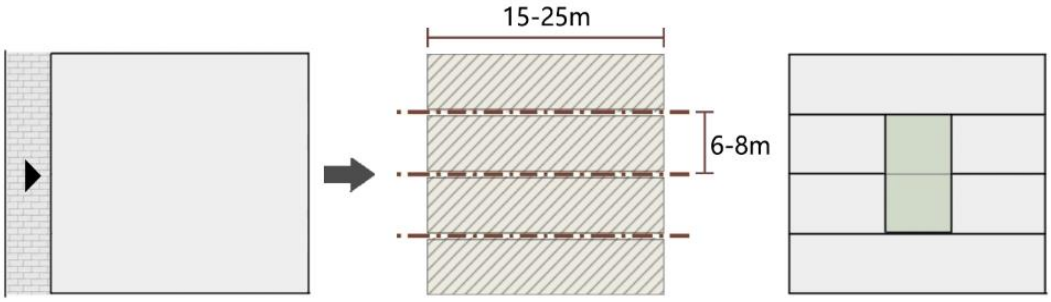


Fig.6-25 General rules of building tissue for T3 (Source: the author)

（d）Street

The road around the new building should not be too wide, preferably around 5m, with D/H kept between 0.5 and 1.

（e）Public space

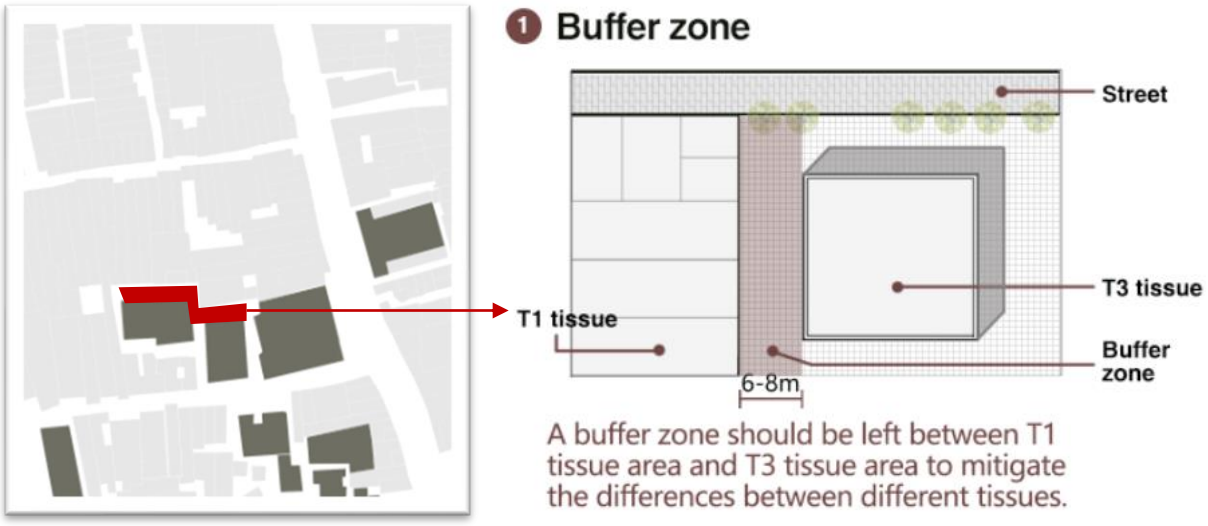


Fig.6-26 Detailed rules of public space for T3#1 (Source: the author)

1. It is appropriate to leave a buffer zone of about 10m between modern architectural tissue and traditional tissue in the process of building renovation, and landscape design should be carried out in the buffer area. (Fig. 6-26)

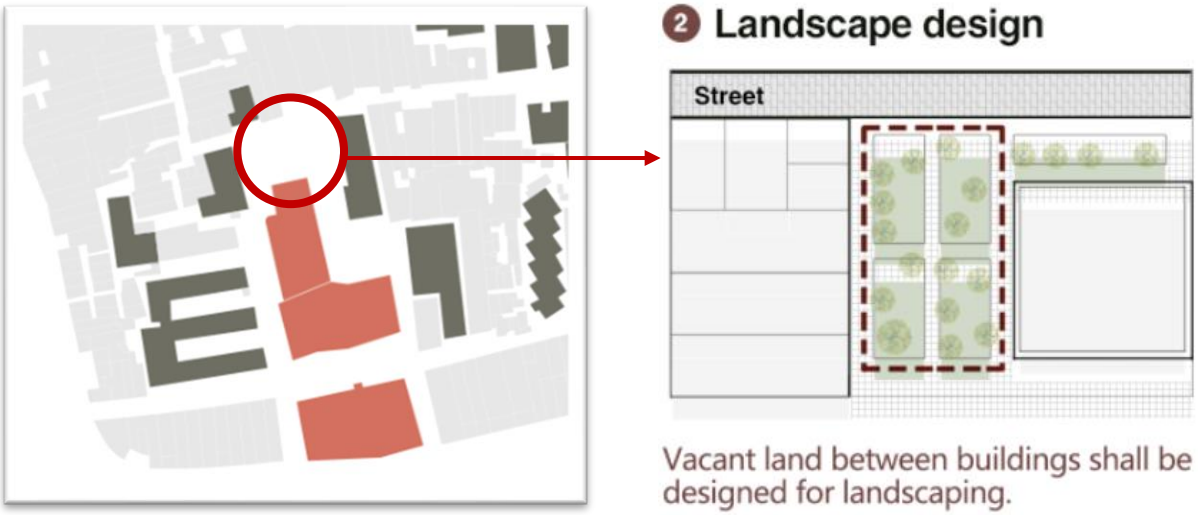


Fig.6-27 Detailed rules of public space for T3#2 (Source: the author)

2. A certain amount of square space should be left in front of the public service buildings. (Fig. 6-27)

6.2.4 Urban guidelines for T4 (Reconstruction tissue)

The reconstruction tissue area is a high-rise modern building rebuilt after the overall demolition of the traditional buildings within the site, with the function of a commercial complex. Since the traditional buildings in the site have been completely demolished, the destruction of its traditional tissue is irreversible, and only partial transformation can be used in this area to achieve harmony with the traditional tissue to a certain extent.

（a）General rules of intervention:

The buildings in this area are modern high-rise buildings after 1990, and there is not much room for changes in the internal space and specific forms, and the main transformation is concentrated on the façade. At the same time, this guideline also puts forward certain control requirements for the new high-rise buildings that may exist in the future Zhuangyuanfang.

（b）Building

General rules:

1. the transformation of the building façade should be in harmony with the traditional architecture in terms of color, the podium and the human eye visible range should make a certain vertical separation in the façade.

2. The ground floor can be appropriately elevated, and the spatial interface of the corridor on the ground floor of the continuation of the Qilou should be in the form of a colonnade.

3. The building function is to maintain the commercial office complex, and the ground floor can be combined with commercial and cultural display functions.

Detailed rules:

1.In T4 area, the height range of façade intervention control is determined by the effective visible angle. The key areas in the range of 8-12m height were identified. (Fig. 6-28)

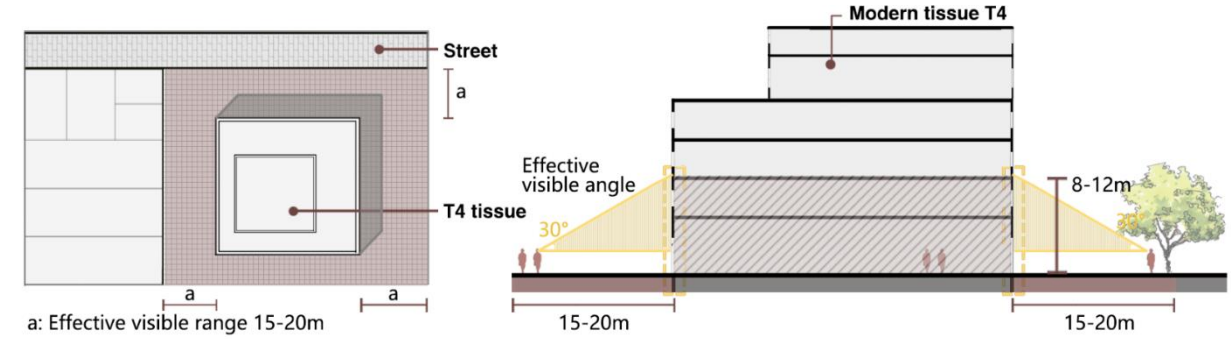
2. Materials similar to traditional buildings can be used within the visual range of the façade and divided longitudinally. Part of the façade can also retreat to the ground floor to create a corridor. (Fig. 6-29)

（c）Public space

General rules:

1. it is advisable to design the square of the area with corresponding landscape design, divide the large area of open space and implant greenery.

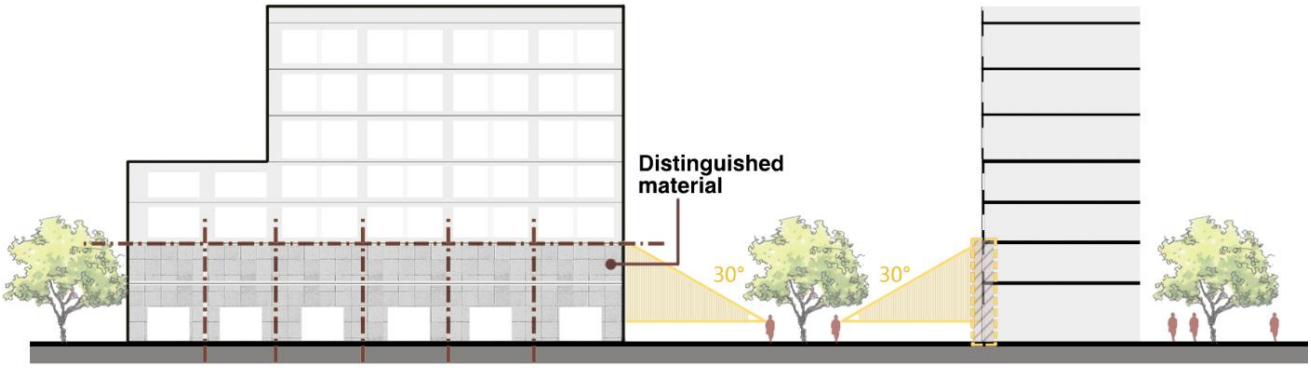
2. Combine the square space with the traditional neighborhood park in order to expand the service scope to the neighborhood of Zhuangyuanfang, increase the shared space of the neighborhood and improve the quality of service facilities.



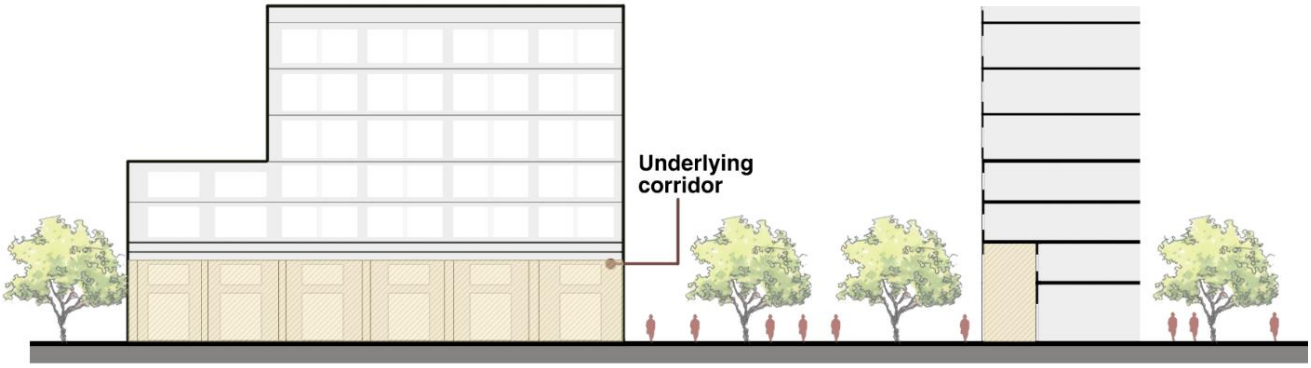
The effective visible range of T4 area is 15-20m, and the key part of facade intervention is determined by the visual distance.

The height range of facade intervention control is determined by the effective visible angle. The key areas in the range of 8-12 m height were identified.

Fig. 6-28 Effective visual range (Source: the author)



Materials similar to traditional buildings can be used within the visual range of the facade and divided longitudinally.



Part of the street facade can also retreat to the ground floor to create a corridor.

Fig. 6-29 Detailed rules of building intervention for T4 (Source: the author)

6.2 General control

Through the above typomorphological analysis and the development of the morphological zoning guidelines, specific planning and urban design can be carried out for the historic district of Zhuangyuanfang. In this section, the general control of the

site will be carried out through the adjustment of roads, the division of plots, the planning of functional structure and the planning of open space system, followed by the selection of different morphological area units for specific urban design.

6.2.1 Road system adjustment

Fig.6-30 Road system adjustment (Source: by the author)

The overall road system continues the original pattern, with the city roads and the main roads of the neighborhood remaining unchanged. The local lanes are opened up and upgraded to internal roads in the neighborhood for better accessibility, and the

original larger plots are further divided.

6.2.2 Road level planning

Fig.6-31 Road level planning (Source: by the author)

Based on the adjusted road system, the road grades are divided and some of the streets are upgraded to better suit the needs of residents and visitors. At the

same time, certain requirements for the width of the different classes of roads are proposed, and the width requirements should be met as much as possible in the next design.

6.2.3 The division of plots

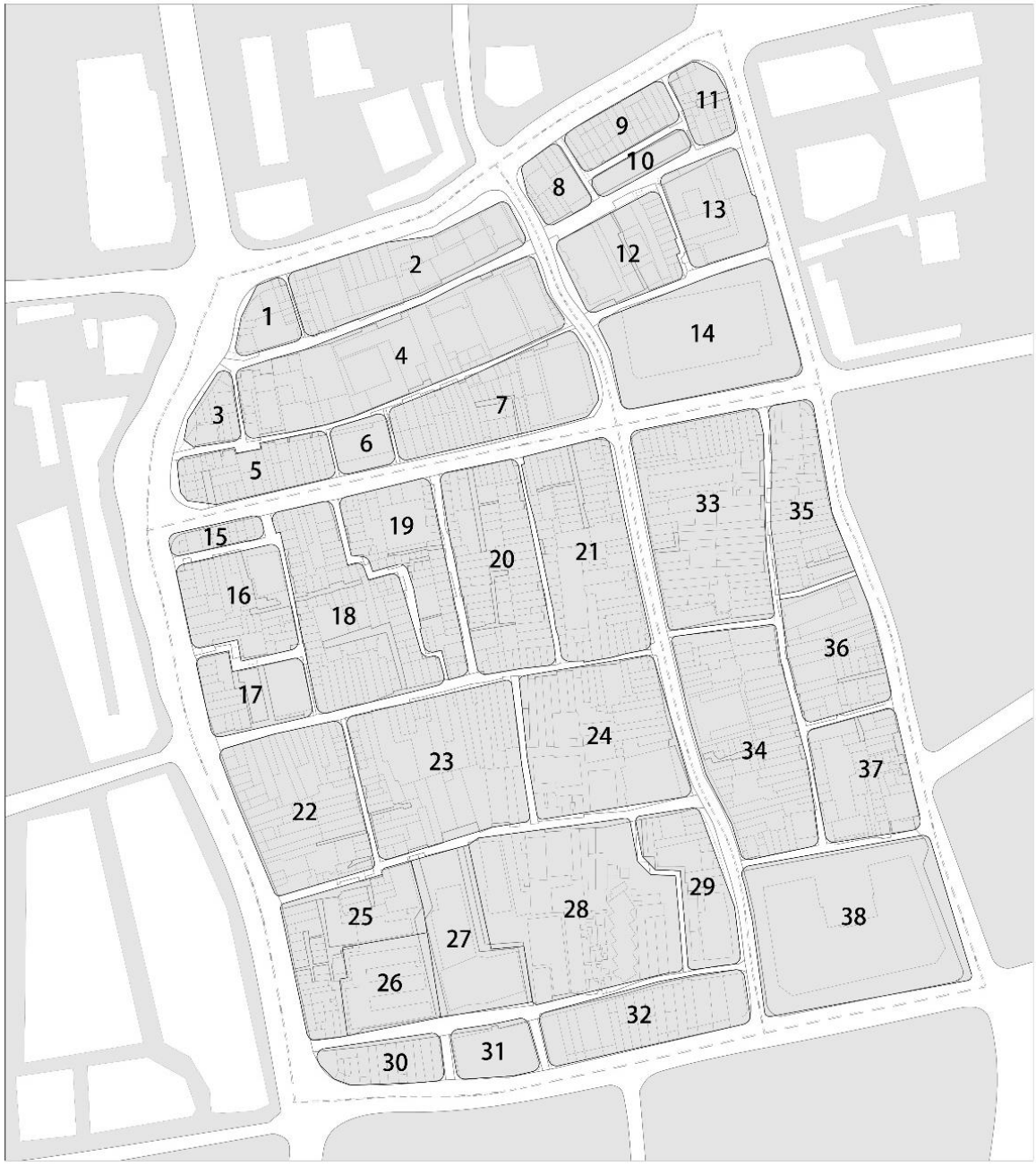


Fig.6-32 The division of plots (Source: by the author)

The division of plots has also been adjusted along with the roads, with the main change being the division of larger and irregularly shaped plots into traditional plots of

moderate size and regular shape, an adjustment that continues the overall trend of plot evolution. The adjustment of the plots facilitates the refinement of the actual management, and at the same time provides a clearer picture of the urban tissue.

6.2.4 Functional structure

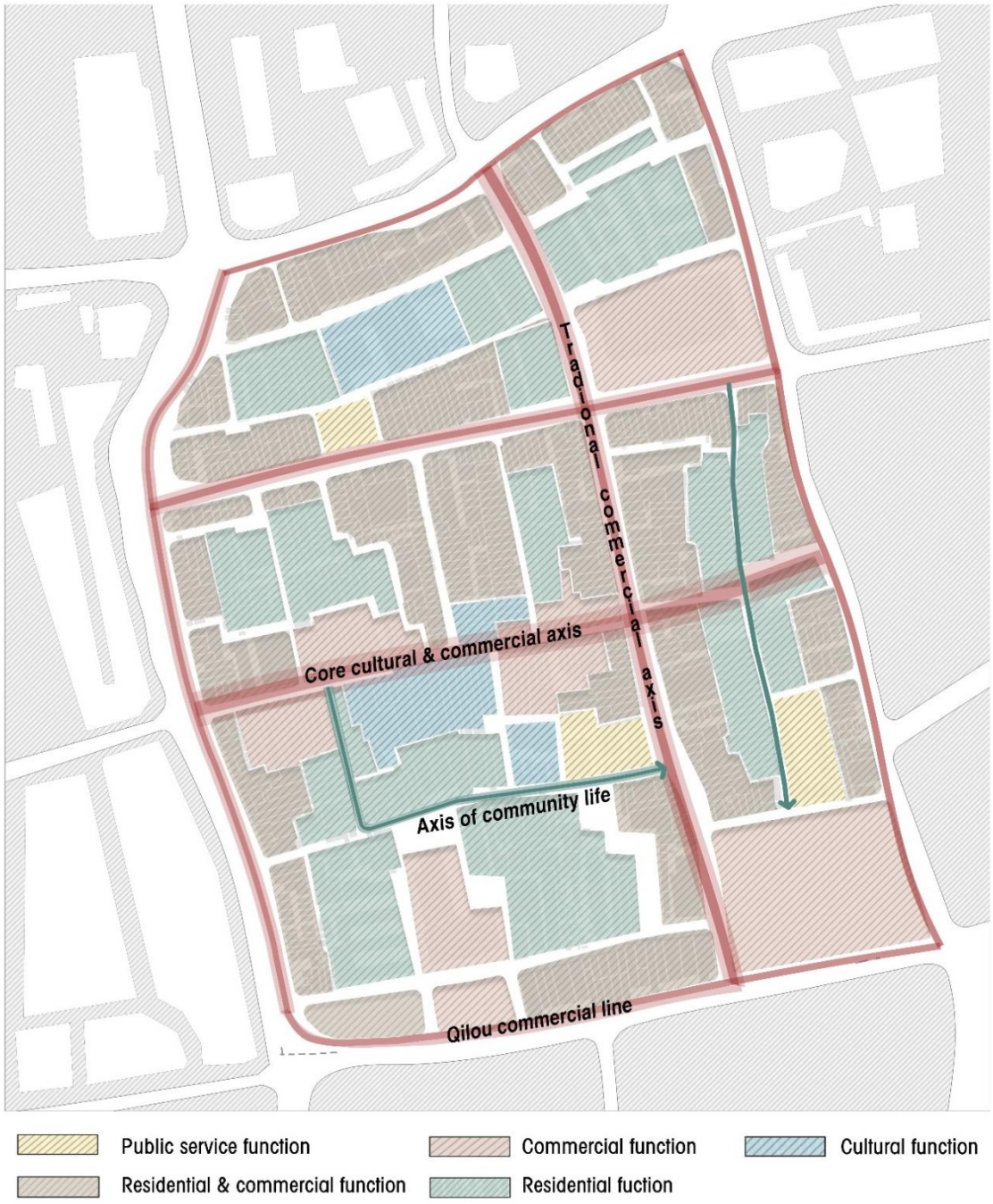


Fig.6-33 Functional structure (Source: by the author)

Two types of axes are planned according to the original functional business, which

are commercial and cultural axes and community living axes. The commercial culture axis includes the cavalry commercial street axis along the main city road, the commercial culture spine of Zhuangyuanfang and the ground floor commercial axis on both sides of the general city road. The community life axis is the main internal roads of the neighborhood that link the residential units. This divides the functional business of Zhuangyuanfang into five categories: public service function, commercial function, cultural function, residential function and mixed commercial and residential function.

6.3 Specific urban design

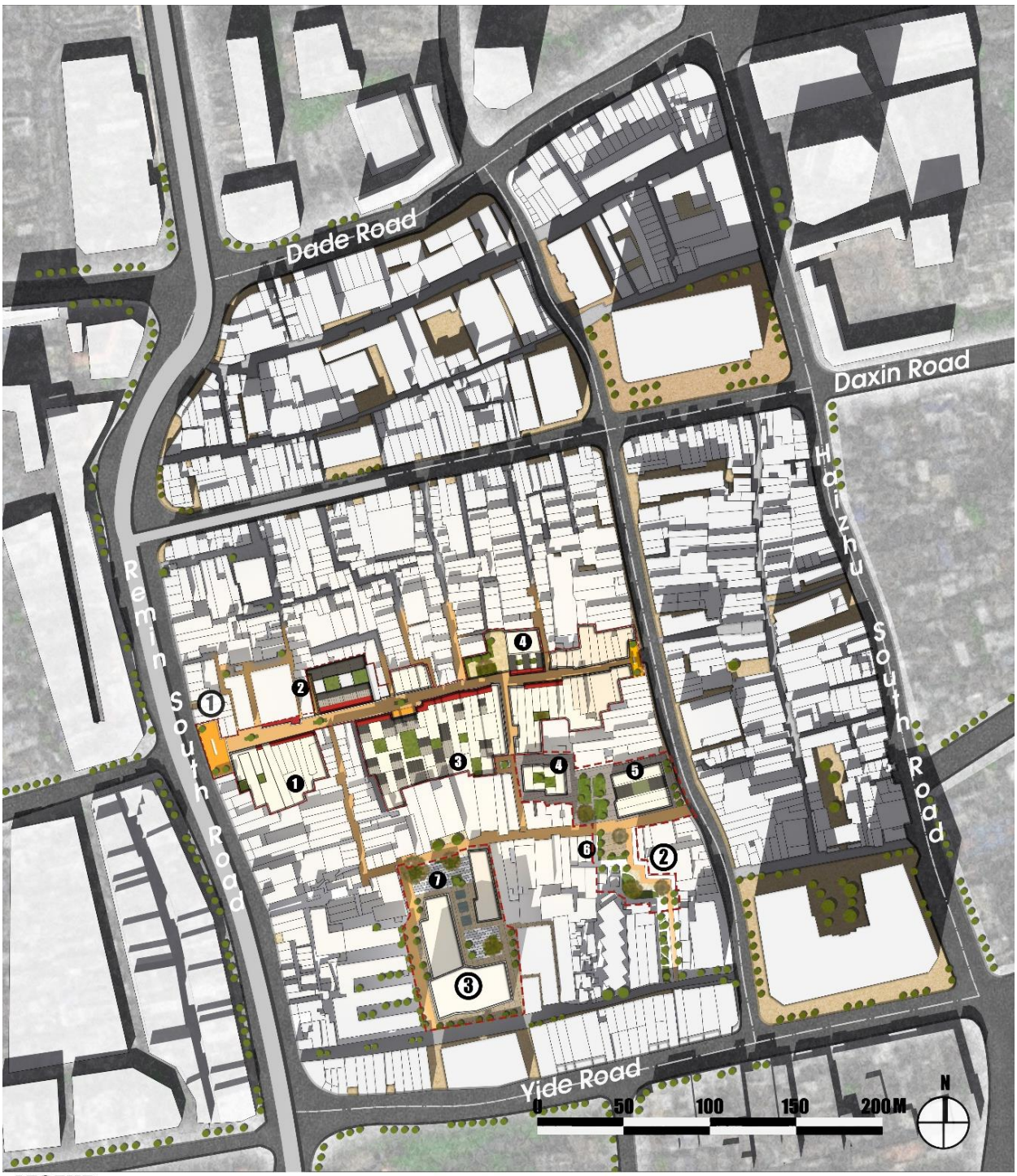


Fig.6-34 Master plan (Source: by the author)

This section provides a detailed design of three selected areas based on urban design guidelines and master plan control, which include the traditional joint texture, modern expansion texture and reconstruction texture respectively. The program intervenes in different study elements and designs specific spaces, placing the functions of the master control into the corresponding buildings, in order to achieve the restoration of the overall value of Zhuangyuanfang on the basis of urban fabric protection, and also to meet the needs of residents and tourists.

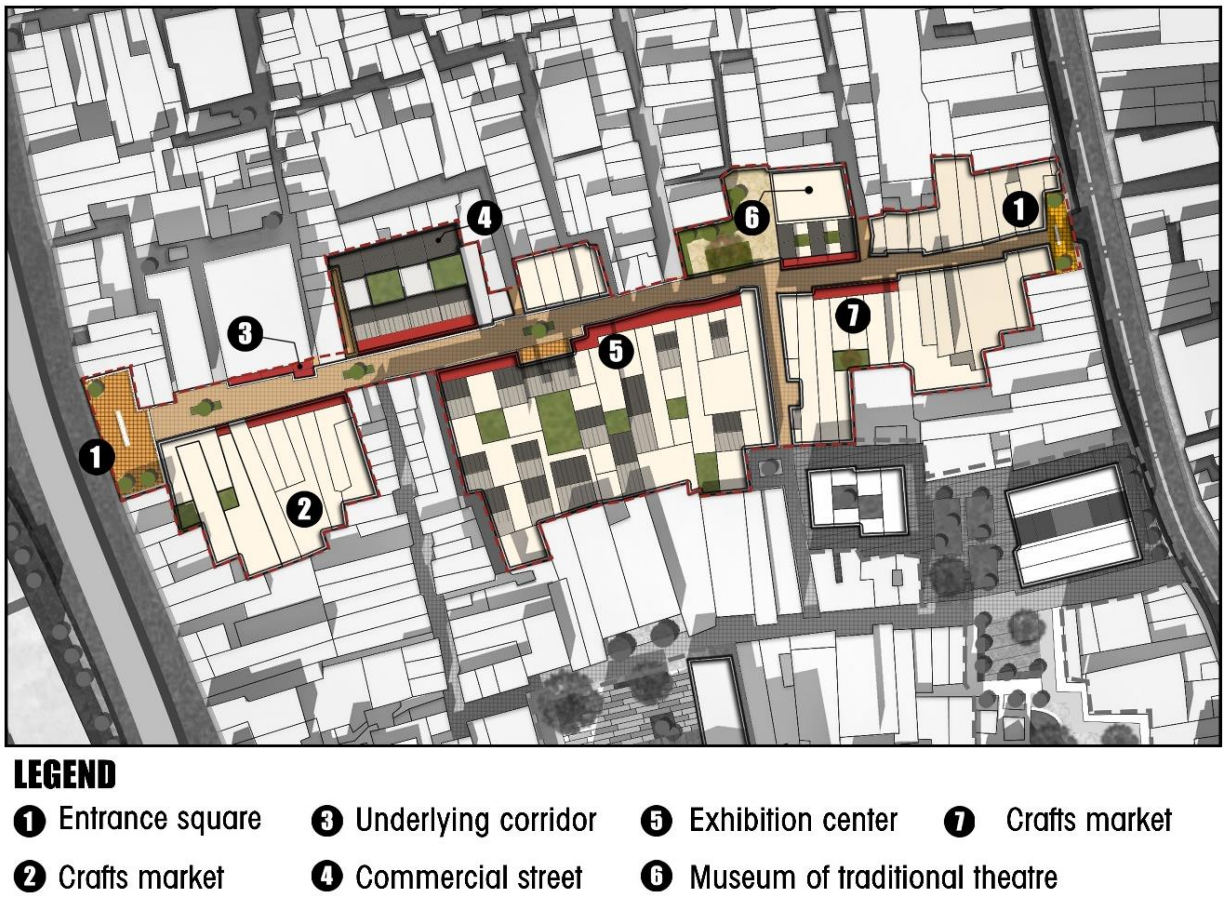
6.3.1 Area 1

Fig.6-35 Typical situation of Area 1 (Source: by the author)

Fig.6-36 Location of the Zhuangyuangfang main street (Source: by the author)

Area 1 is the main street of Zhuangyuanfang and some of the buildings along the street. The main street area of Zhuangyuanfang has been a prosperous commercial area since ancient times, and goods were first transported from the Pearl River on the south side to the main street for trading through the longitudinal water alley, forming a commercial gathering of mainly traditional handicrafts in later development. At present, with the decline of Zhuangyuanfang street, the traditional handicraft industry is gradually disappearing, replaced by small workshops mainly in the modern garment industry.

According to the master plan control, the main street of Zhuangyuanfang will be made into the main axis of commerce and traditional culture, and the renovated functions will include handicraft market, exhibition center and traditional drama



museum.

Fig.6-37 Plan of area 1 (Source: by the author)

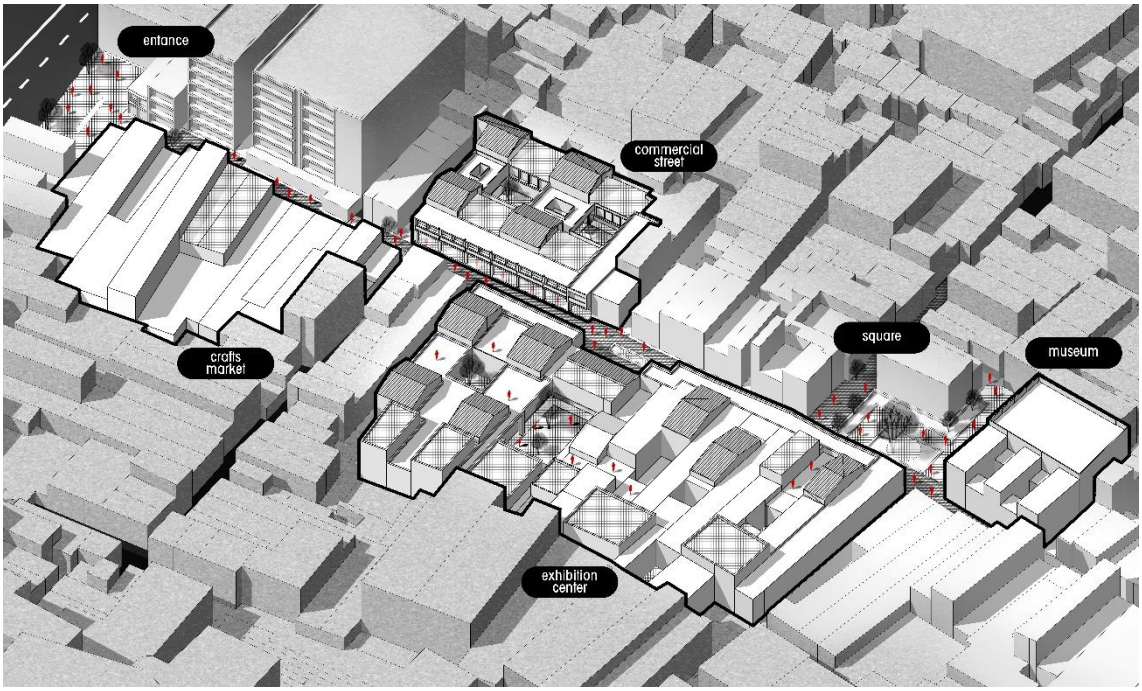


Fig.6-38 Axonometric of Area 1 after intervention (Source: by the author)

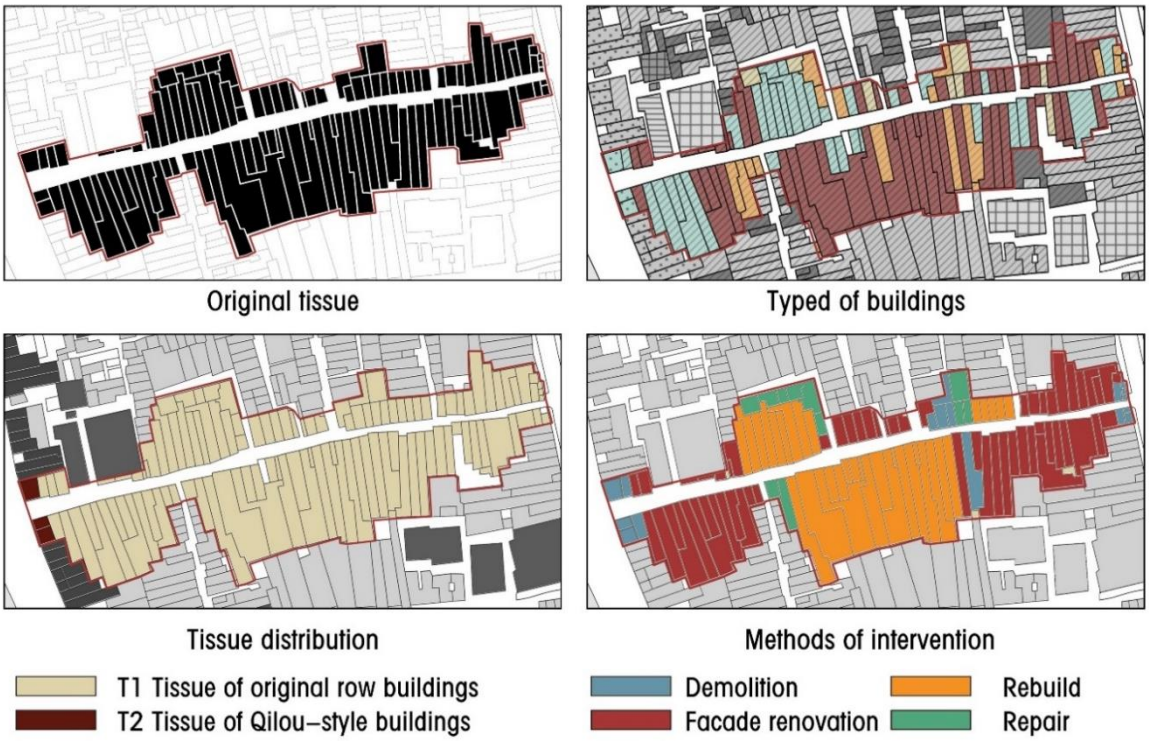


Fig.6-39 Tissue analysis of area 1 (Source: by the author)

The main street of Zhuyuanfang as a whole belongs to the traditional townhouse texture, but the quality of the distributed buildings is mixed, and a large portion of simple townhouse buildings from the early founding period exist. The building types

and texture of the area were analyzed, and four specific means of intervention were identified for each building, including demolition, reconstruction, façade renovation and restoration.

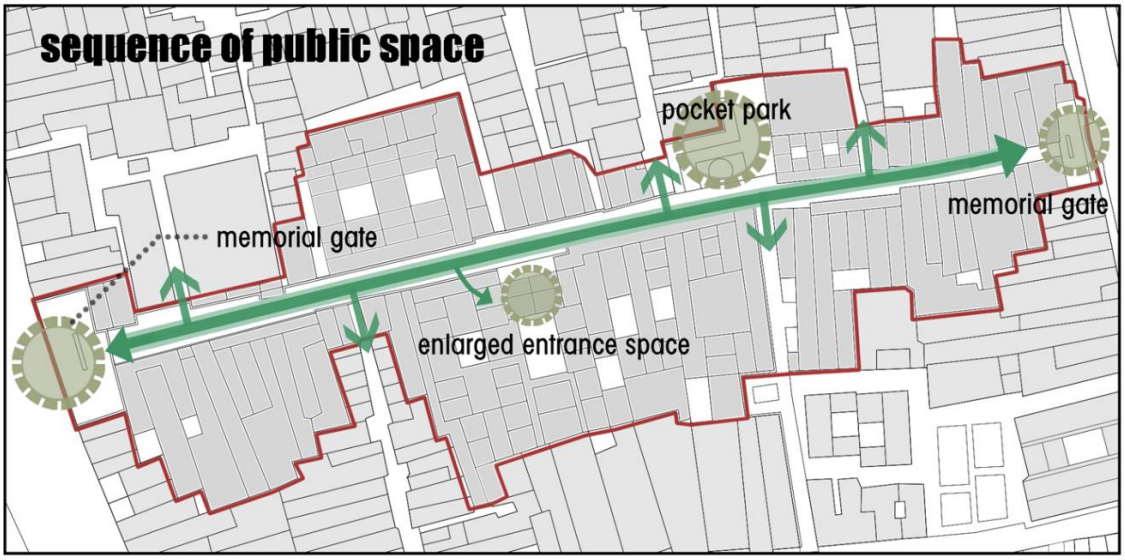


Fig.6-40 Sequence of public space (Source: by the author)

Fig.6-41 Functional axis (Source: by the author)

The transformed public space forms a certain order. Firstly, the entrance plaza is designed in combination with the pagodas at the end of the east and west sides of the main street to form a larger recognizable space. The entrance of the new building is set back from the street, forming a node space for street enlargement. In the middle of the street, with the demolition of some buildings, a larger open space is formed, which functions as the front square of the traditional drama museum and a pocket park.

Fig.6-42 Façade intervention (Source: by the author)

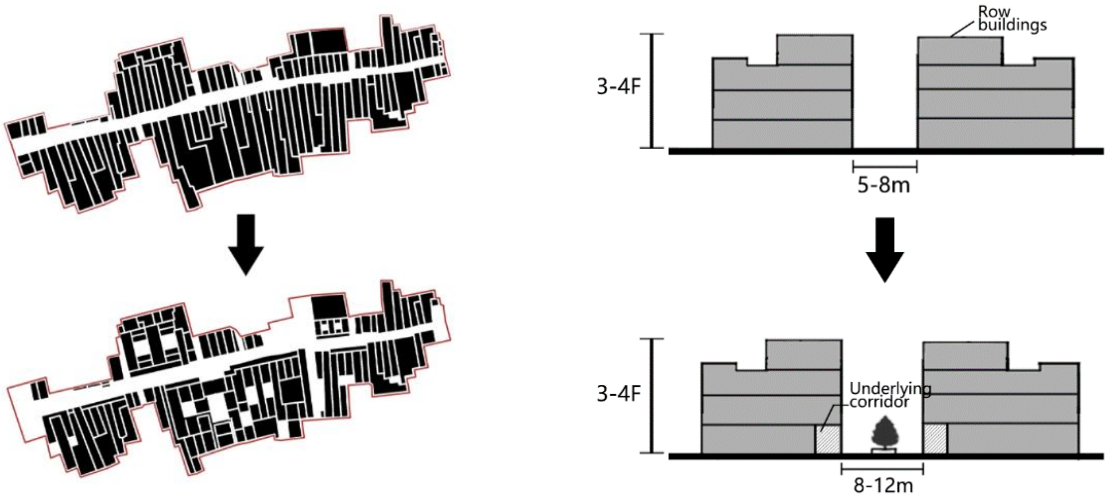


Fig.6-43 Street intervention (Source: by the author)

The street system is not changed much, with the main street of Zhuangyuanfang connecting the internal roads of the longitudinal block, and one building removed to add an internal road to relieve the overcrowded building layout on the south side. The width of the street is partially widened by the renovation of the building façade, reaching the main street size of 8-12m, while greenery is implanted in the middle of the street. The ground floor elevation on both sides of the street forms a corridor to improve the comfort of residents and visitors, while echoing with the external cavalry streets. The overall height is controlled at 3-4F, 12m below.

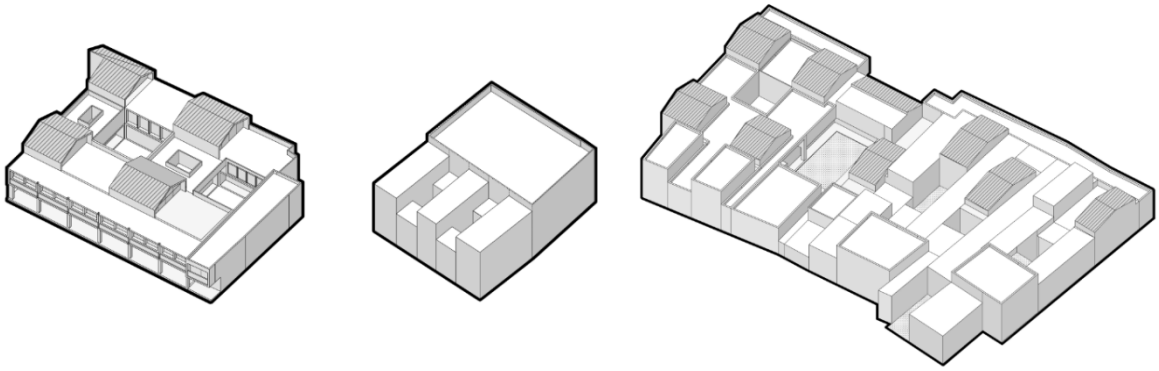


Fig.6-44 The references of rebuild buildings (Source: by the author)

The design of the building level refers to the requirements of the urban design guidelines for façade separation, building height and architectural style, while the plan form is based on the reference of the original plan characteristics of the townhouse,

combined with the actual function to form a combination of longitudinal traffic-oriented hall and courtyard design.

6.3.2 Area 2

Fig. 6-45 Current situation of Area 2 (Source: by the author)

Fig. 6-46 Location of Area 2 (Source: by the author)

Area 2 is on the southeast side of the main street of Zhuangyuanfang, which is a typical T3. The buildings therein are typical point modern buildings after 1978, ranging from 4 to 8 stories in height. The construction of these buildings is based on the demolition of the original traditional buildings and the destruction of the original architectural layout and tissue. Therefore, the first priority is to analyze their specific architecture and identify specific means of intervention. At the same time, the

renovation is carried out on the basis of urban design guidelines, taking into account the specific functions.

Fig. 6-47 Plan of Area 2 (Source: by the author)

The site has always carried the function of public services, and the large open space makes it a place for people to gather and relax, while the current function of the surrounding buildings also includes community services. Therefore, this renovation also aims to turn the site into a public space that integrates cultural and community service functions.

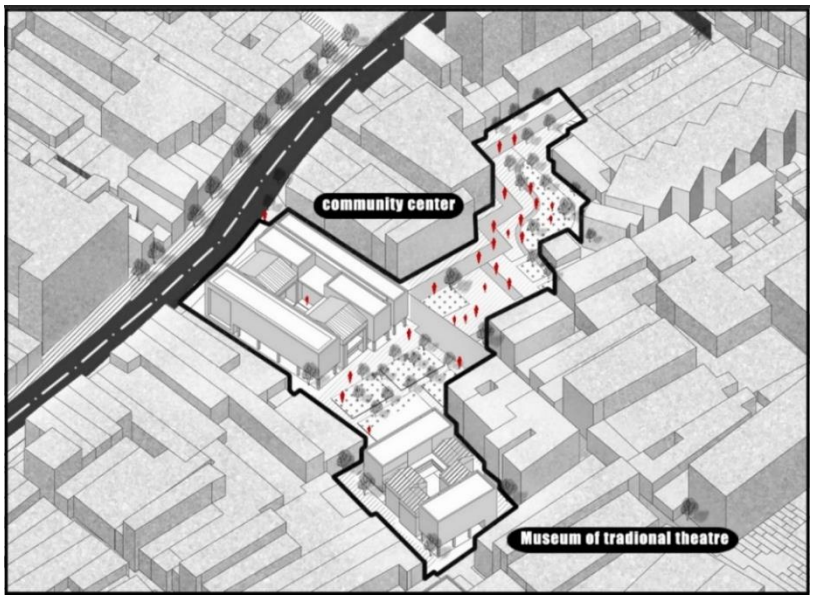


Fig. 6-48 Axonometric of Area 2 after intervention (Source: by the author)

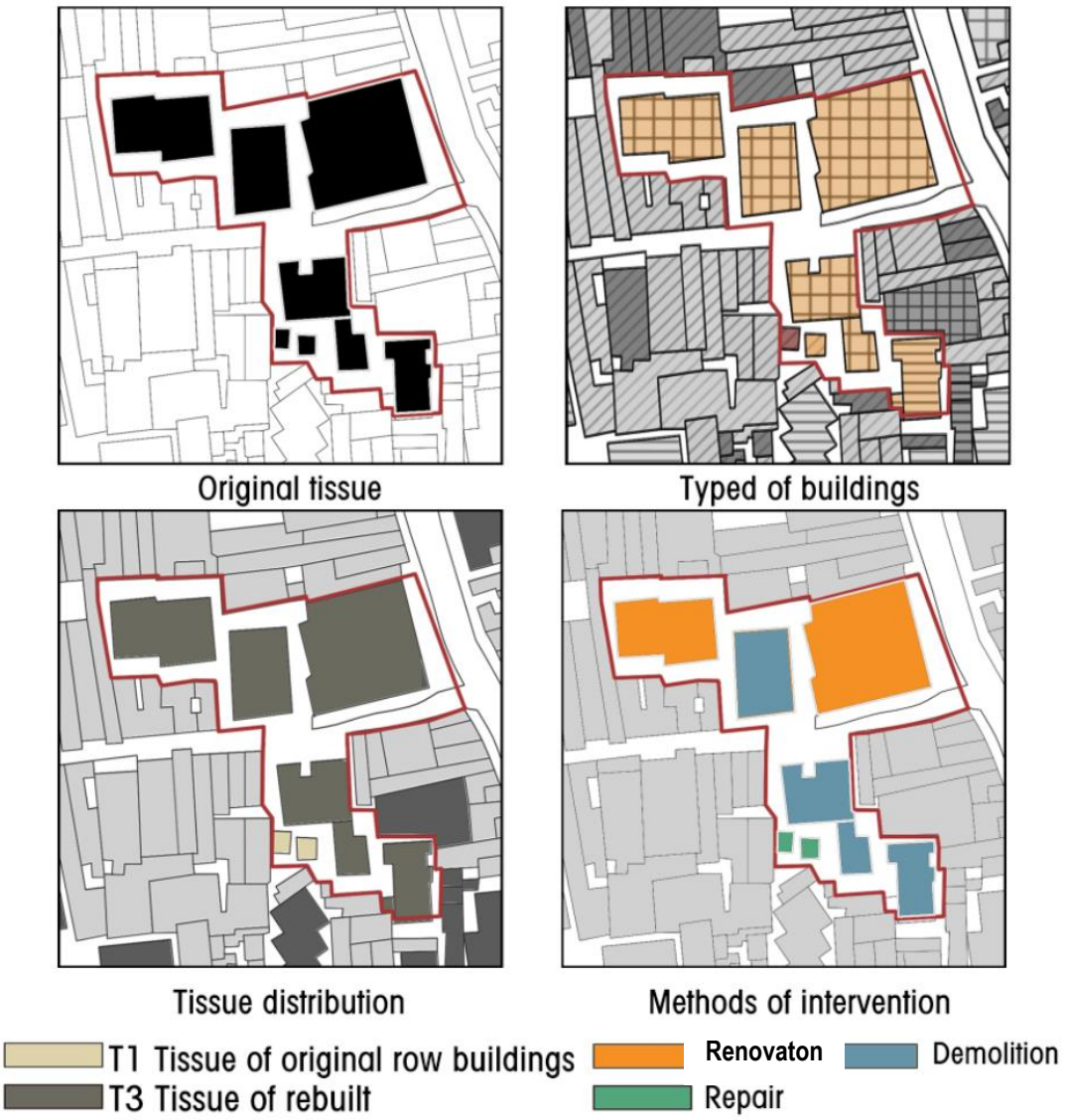


Fig. 6-49 Tissue analysis of area 2 (Source: by the author)

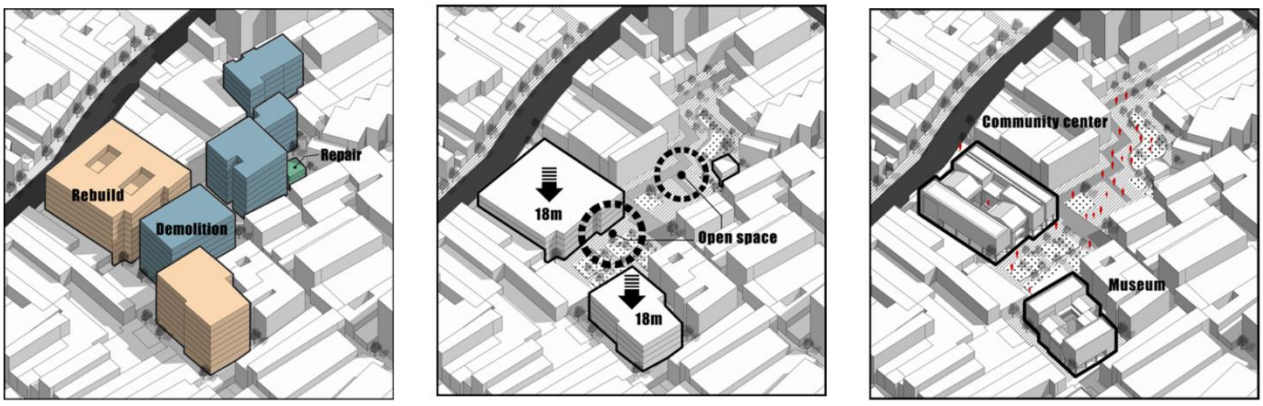


Fig. 6-50 Building intervention of area 2 (Source: by the author)

6.3.3 Area 3

Fig. 6-51 Current situation of Area 3 (Source: by the author)

Fig. 6-52 Location of Area 3 (Source: by the author)

Area 3 is located on the south side of the historic district of Zhuangyuanfang, which is a typical T4. The site mainly contains a large modern commercial complex and slab-type modern buildings. The two buildings form a rare large-scale public space on the site around two ancient trees, but currently, due to negligent design, this area has become a space for unloading and stacking goods.

In the specific renovation, a texture analysis was first conducted to determine the intervention of the two buildings. Then the public space and the building and façade

forms were designed according to the urban design guidelines of T4 area respectively. Based on the morphological type control, the problem is solved and the needs of residents and travelers are met.

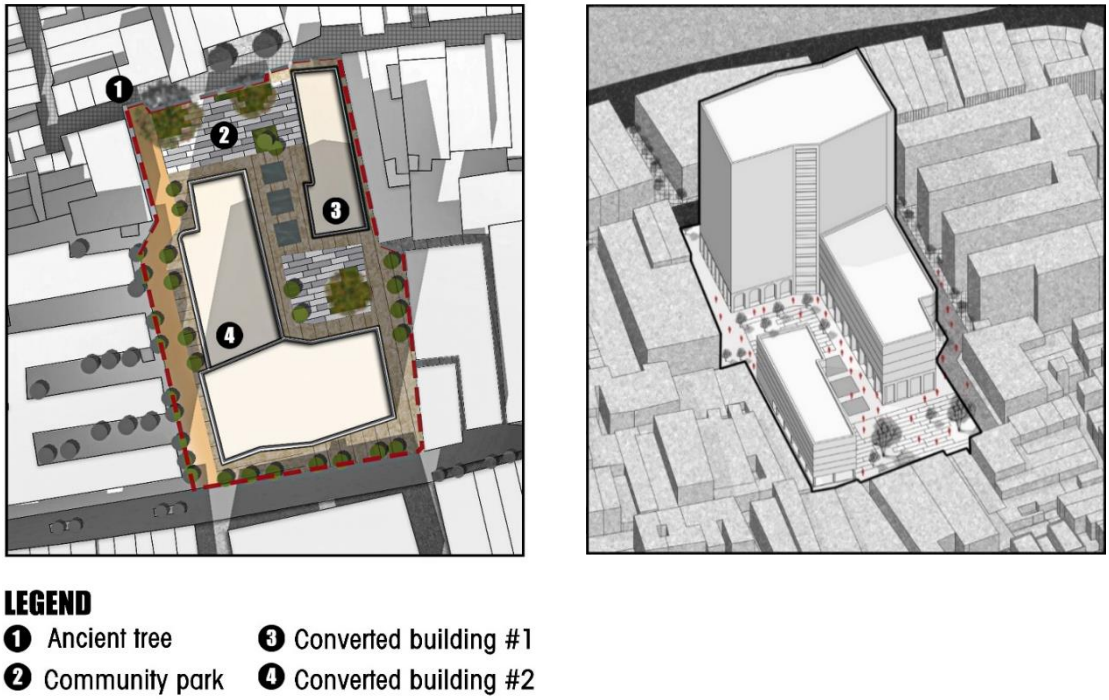


Fig. 6-53 Plan of area 3 (Source: by the author)

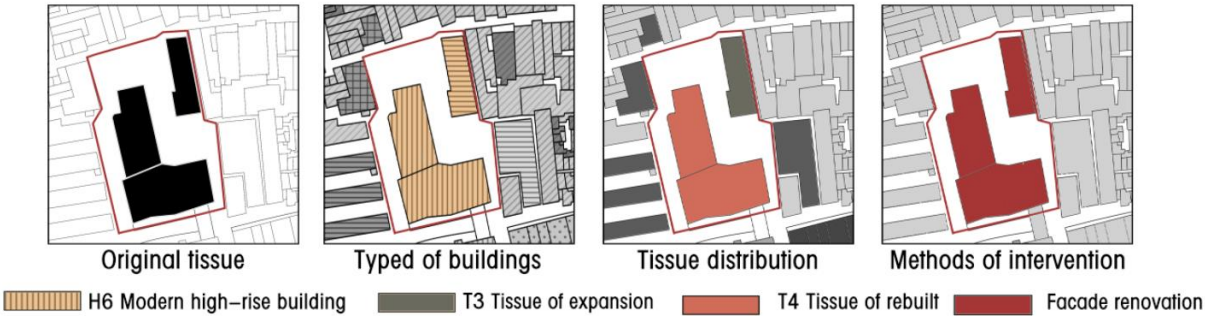


Fig. 6-54 Tissue analysis of area 3 (Source: by the author)

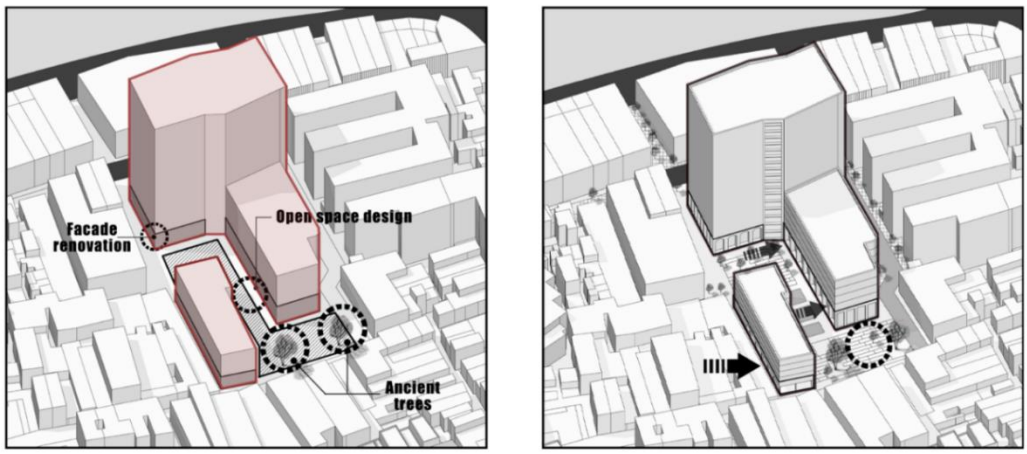


Fig. 6-55 Building intervention of area 3 (Source: by the author)

6.4 Summary of the chapter

This chapter carries out the practice of urban design for the historical district of Zhuangyuanfang on the basis of typomorphological analysis.

First, based on the results of the analysis in the last chapter, the current building types and morphological tissue are zoned, and urban design guidelines are developed for different tissue zones. The goal is to put aside the functions and control the neighborhood morphology purely through the evolutionary laws and characteristics of morphological elements to ensure the characteristics and continuity. Then, the overall control of the Zhuangyuanfang district is carried out in terms of streets, plots and functions. Finally, three representative sites were selected for specific renovation design, which contain traditional tissue (T1/T2) ,modern expansion tissue (T3) and reconstruction tissue (T4).

CONCLUSIONS AND PROSPECTS

7.1 Summary of research

Through the study of typomorphological theory and Italian typomorphological planning technique, this thesis summarizes a complete set of technical application process from site analysis to design based on the existing case application. Next, the background and conditions of the application of the technique are further analyzed, and after combining with the local adaptation study, the historic district of Zhuangyuanfang in Guangzhou is selected as a specific application object. Finally, using Zhuangyuanfang as the research and design object, the planning technique is fully applied and advanced in layers. The main conclusions can be summarized as follows.

(1) Feasibility of the application of Italian typomorphological planning technique in China

Although it is recognized in the preliminary analysis that the application of this technique needs to be based on a certain cultural and social background and requires certain historical data of the area, the application of this technique in China is feasible from the overall point of view. First, China has paid more attention to the preservation of old cities in recent years, and has become more aware of the potential historical value, and has consciously absorbed advanced foreign ideas in the system to deal with complex urban problems. Second, although the application of this technique in China is largely limited by the lack of historical data, relatively complete data are still kept in some eastern cities for reference. At the same time, the analysis of the sites and the information stored in the database can also help to build up a database of urban forms in China, which can be useful for future planning practice.

(2) Significance of Typomorphological planning techniques in China

Typomorphological planning technique can help to cope with the transition from

incremental development to stock regeneration in China, while bringing changes to the existing planning techniques. In the past, urban planning in China was characterized by large-scale development, which was often accompanied by large-scale demolition and construction, while the overall urban planning and design thinking should be changed in the period of stock regeneration. The starting point of typomorphological planning technique is the respect for urban morphological types, the exploration and guidance of urban morphological evolution laws based on continuity, and the intervention of specific planning and design based on operability.

(3) Significance of the practical study of the historic district of Zhuangyuanfang

The application of Italian typomorphological planning technique to the urban design of Zhuangyuanfang historic district is an important attempt to put typomorphology theory into practice. In previous studies, scholars have realized the significance of typomorphology theory and foreign applications for urban regeneration in China, but the practical aspects are less studied. In this thesis, the Italian planning technique, which is a mature application of typomorphology, is studied, and a practical attempt is made to deepen the localization of typomorphological planning technique by consciously combining it with the Chinese context.

7.2 Research gaps and prospects

The deficiencies of this study can be generally divided into two parts, which are the deficiencies of the research on the technique and the deficiencies of the application practice of the Zhuangyuanfang historic district.

First, due to the language barrier and the lack of first-hand information, the research on the overall application process of Italian typomorphological planning technique is insufficient. At the same time, many western countries represented by Italy have established mature urban conservation and regeneration systems, and the typomorphological planning technique relies heavily on existing ordinances and rules, so this study mainly focuses on the more specific technical implementation and results,

and there is a certain lack of depth and breadth.

Secondly, the shortcomings of the application practice of Zhuangyuanfang can be summarized as follows.

(1) Insufficient quantitative analysis of the morphological types of the historic district of Zhuangyuanfang. Due to the lack of historical data and the limitation of energy, the research on the research elements is mostly focused on the qualitative research, and the research on the basis of the definition of the type is not deep enough, which also causes a certain error in the analysis results.

(2) There is a shortage of research scale. In practical application, although the design object is a district, the analysis process often starts from the upper level for a more comprehensive morphological type recognition. However, in this study, this part is lacking due to the objective conditions.

(3) The specific analysis of the relevant research elements needs to be deepened. In the Italian context, for example, the analysis of building types is often based on the typological map of the whole area (i.e., the ground floor plan), but in practice this is difficult to achieve, and the lack of information also leads to a lack of depth in the analysis of building types.

In conclusion, the purpose of this study is to promote the practical research of typomorphological planning technique and to promote the development of typomorphology concepts to better intervene in the conservation and regeneration of Chinese cities. In this study, the author also realized that urban renewal, especially the conservation and renewal of historic districts, is a complex and holistic issue. In order to solve this problem well, conceptual, institutional and technical synergies and continuous experimentation are needed. Although the technique cannot solve all the problems of urban renewal, it can serve as a breakthrough point to convey the importance of the historical value of urban morphology in concept, to perpetuate the urban morphological tissue in practical application, and to improve the content of related institutions.

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