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Research on Spatial Integration in Old Urban Areas Based on Linkage Coupling Thoughts: An example in Chuanghua Historic District, Guangzhou

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Research on Spatial Integration in Old Urban Areas Based on Linkage Coupling Thoughts: An example in Changhua Historic District, Guangzhou.

A Dissertation Submitted for the Degree of Master

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摘要

自20世纪80年代以来，中国的城市化与城市建设发展规模与速度空前，快速的现代化发展打破了城市原有的空间结构和肌理，导致了现代城市空间与传统空间的不可融合，造成新旧要素彼此之间没有关联协调，从而成为无序的组合和混乱的拼凑。许多具有历史价值的旧城空间环境在这种不平衡的发展过程中不断碎片化、离散化、被孤立在城市之中，丧失活力。由于城市多元化与复杂化的趋势，继续忽视城市新建部分与旧城空间联系的建立，不但会降低整个城市的运作效率，同时会加剧城市形态整体性和特色的丧失，历史文脉更加不能得到延续。

基于上述背景，本研究以关联耦合思想作为理论指导，选择广州昌华历史街区作为应用对象，尝试从物质和非物质两个层面，对旧城空间中多元与复杂的要素进行关联与整合，重塑城市的空间结构与秩序，从而改善旧城环境分布离散、缺乏衔接、内部混乱等问题，最终实现对旧城历史文化的保护与更新，激活旧城的空间活力。

本论文的主要内容分为四个部分。第一部分是理论研究部分，介绍了关联耦合思想的发展过程以及相关的重要理论成果，例如连接理论。并结合相关理论研究与案例，概括了关联耦合思想从联系单纯物质形态到考虑行为、交通和复杂系统，再到纳入心理、人文因素的逐渐完善过程。第二部分是案例研究部分，分别从城市尺度和街区尺度选取了各两个旧城案例进行联系要素和关联耦合方式的分析，旧城类型包括工业遗址、传统居住区、历史文化街区等多种类型，试图从具有背景差异的案例中寻找出关联耦合的共同规律，使其能适用于各种尺度与类型的旧城空间整合实践中。第三部分为策略总结部分，基于理论和案例的学习研究，这一部分从联系原则、联系要素、联系线索和整合方法上全面地阐述了旧城空间的整合策略。在方法探索上，又从空间、形态等物质层面和文化、功能等非物质层面详细讨论了具体的关联策略和耦合策略。第四部分是实践应用部分，通过实地调研，梳理场地以及周边区域的相关要素，分析场地现状和主要问题，再将策略与广州昌华历史街区的历史环境相结合，实现街区内部环境和它与城市周边的整合，从而激活区域的活力，使街区的历史价值和文化资源被感知。

本文希望通过对关联耦合思想的研究，引导规划者关注城市空间、文脉与功能等方面的连接问题，为旧城空间整合提供一定的思路。

关键词：关联耦合思想；整合；旧城空间；联系

ABSTRACT

Since the 1980s, urbanization and urban construction in China have developed at an unprecedented scale and pace. Rapid modernization has disrupted the original spatial structure and fabric of the city. As a result, the modern urban space is incompatible with the traditional space, which makes the old and new elements unrelated and uncoordinated, becoming a disorderly combination and chaotic patchwork. Many spatial environments of old cities with historical value are constantly fragmented, discrete, isolated in the city and lose their vitality in this unbalanced development process. Due to the trend of diversification and complexity of cities, continued neglect of making spatial connections between new parts of the city and the old urban areas will not only affect the functioning of the city as a whole, but will also exacerbate the loss of integrity and character of the urban form and the non-continuation of the historic heritage.

Based on the above background, this research takes linkage coupling thoughts as the theoretical guide and selects Changhua Historic District of Guangzhou as the application object, trying to correlate and integrate the multiple and complex elements in the old urban spaces at both tangible and intangible levels, and reshape the spatial structure and order of the city, so as to improve the problems of discrete distribution, lack of articulation and internal chaos of the old city environment, and finally realize the protection and renewal of the history and culture of the old urban areas and activate the spatial vitality of them.

The main contents of this thesis are divided into four parts. The first part is the theoretical research, in which the development process of linkage coupling thoughts and the related important theoretical achievements, such as linkage theory, are presented. In addition, relevant theoretical researches and case studies are combined to outline the gradual improvement process of linkage coupling thoughts from linking simple material forms to considering behavior, traffic, and complex systems, and then to incorporating psychological and human factors. The second part is case study, in which two cases of old urban areas are selected from urban scale and neighborhood scale respectively to analyze the connecting elements and connecting methods. The third part is the summary of the strategies. Based on the theoretical research and the case studies, this part comprehensively elaborates the integration strategies of old urban space in terms of the connecting principles, connecting elements, connecting

clues and integration methods. Specific linkage strategies and coupling strategies on the tangible level, such as space and form, and intangible level, such as culture and function, are discussed in detail in the methodological part. The fourth part is the practical application part, in which the relevant elements of the site and the environment are elaborated through field research, the current situation and the main problems of the site are analyzed, and then the strategies are combined with the historical environment of Guangzhou Changhua Historical District to realize the integration of the internal environment of the district and it with the urban environment, so as to activate the vitality of the area and perceive the historical value and cultural resources of the district.

This thesis hopes to guide planners to pay attention to the connection between urban space, history and culture and function through the study of linkage coupling thoughts, and to provide certain ideas for the spatial integration of the old urban areas.

Keywords: Linkage coupling thoughts; Integration; Old urban area; Connection

CONTENTS

CHAPTER 1: INTRODUCTION

1.1 Research Background

1.1.1 Significance of old urban areas in the process of urban development

In the modernization of today's cities, the construction of regional characteristics was neglected due to the rapid construction activity, which resulted in the gradual disappearance of many places housing people's memories, leaving few substrates for urban memory. The lack of people's cultural identity in the city has also caused the city to lose the direction of its own development and have a disturbing modern homogeneity[1], while the old urban areas full of urban atmosphere are the symbol of the city's characteristics. However, in the rapid construction of the city, the government and developers are chasing profits and economies of scale, and the new areas in the empty city are hot, while the difficult old urban areas are deleted from the urban development plan and become "urban scars". This approach has led to a variety of fractures, sudden advances, and contradictions and imbalances in development. The result is an all-too-obvious collage of urban spaces and a failure to connect urban elements in space and time. When the importance of the old city in the city is ignored, the urban system comes apart at the seams, and this lack of integration leads to the loss of urban form, urban integrity, and urban character.

1.1.2 Dilemma and opportunity of the fragmented old urban areas

In the development process of any city, there are inevitably various imbalances, whether cultural, economic or technological, which lead to some fragments of urban space. For various reasons, the old urban space remains in the modern city, but its distribution is characterized by fragmentation[2]. These "urban fragments" create various difficulties for the city as a whole. On the one hand, these discrete fragments of the old city are not enough to form a complete historical landscape area, so their significance is difficult to be explored. In the wave of urban renewal, they are either isolated and obscured, or they are compromised by the power of developers and eventually give up their land in favor of urban construction and development. If these deprived urban spaces continue to be subjected to the market and are not protected and regenerated, the fragmented old city will gradually disappear. On the other hand, if urban development focuses on the regeneration of the old urban areas, there are

many problems in the concrete implementation of the works. One of them is that there is no mature paradigm for exploring the model from "large-scale" to "gradual". Second, there are economic issues such as the lack of government funding, the lack of profitability for contractors, and the stagnation of preservation and renewal work.

However, there are values and opportunities worth exploring in these seemingly "low value" urban spaces[3]. Because the historic district is often located in the heart of the city, these areas are strategically located. Good conservation and use will restore the organization of the old urban areas, continue the cultural lineage, and reactivate the old urban areas, along with the economic value of the urban land. There are many "perceptible" historical resources in the old urban areas, which can be called a historical museum in the development of any city, recording the intellectual civilization and social public life of several generations and being the soul of a city. As people strive for a higher and higher spiritual level, they gradually realize the importance of urban culture. In recent years, the old urban areas have gained great attention and importance, and this is one of the opportunities for the old urban areas to move forward in urban development.

1.1.3 Trend of urban diversity and complexity

Since the reform and opening up, China has made great achievements in urbanization and urban construction at an unprecedented scale and pace. According to the seventh census, about 900 million people live in China's cities, more than half of the total population. The massive influx of people into cities and the increasing development of urban systems have led to a rich and complex evolution of the Chinese urban form. Early functionalism no longer meets the needs of modern urban development, and pluralism and complexity have become the prominent features of contemporary cities. However, some order must be found behind the diversity of cities, and how to achieve a dynamic and pluralistic balance of all elements in cities has become a new challenge. According to Kisho Kurokawa, "The era when cities were constructed by unifying a single order is over. Hundreds of inner cities, or parts of cities will be interconnected while maintaining their own self-regulation."[4]

Diversity hides the features of fragmentation, but fragmentation is only a superficial phenomenon behind which a new order emerges. "If we do not gain clues from these seemingly fragmented phenomena and thus form a general view, we will return to the view that contemporary history is entirely composed of heterogeneous components, is

an arbitrary difference, and is a juxtaposition of completely different forces whose effectiveness cannot be determined."[5] City managers must integrate and reshape the diverse and complex forces of the city, strengthen the interconnectedness of its parts, and bring them into a new order so that the city always has a clear structure and becomes a continuously well-functioning mega-system that adapts to the times.

1.2 Research purpose and significance

1.2.1 Research purpose

In urban planning and design, the role of coupling is to regulate the interrelationship between the components of urban space, to define the axes of urban space and to play the role of each element of urban space. The thesis tries to reasonably divide the various elements of urban space, find the clues and coupling points between the elements of old urban space with linkage coupling thoughts, and thus obtain strategies and methods for the integration of old urban space that is progressive, respects cultural lineage, adapts to the development of the times and is sustainable to promote the modern development of old urban space. By summarizing the theories and methods and linking them to real sites, practical, concrete and multi-level solutions for the design of spatial integration of old cities are summarized, and the basic directions for relevant designs for old city renewal are shown.

1.2.2 Research significance

The thesis extends the application of the linkage coupling thoughts to the old urban areas and applies the summarized strategies to the actual design practice of the old urban areas in order to verify its functionality and rationality. From the perspective of urban morphology, this study hopes to improve the spatial structure of a large number of fragmented old urban areas in China by integrating elements, strengthen their systemic and holistic character, adapt the old urban areas to modern development patterns, and achieve its sustainability. From an intangible point of view, this study hopes to preserve the regional characteristics and historical traditions of the old urban areas by improving the connection between the old city and the modern environment, and restore the vitality and value of the old urban areas while meeting the quality of life and spiritual needs of citizens.

1.3 Explanation of related concepts

1.3.1 Linkage coupling thoughts

Linkage coupling thoughts means following the relationship and law of interaction between elements, a way to deal with the problem of association and systematics between complex elements. It is the organic nature that is indispensable to this systemic nature, which helps to control the design as a whole, promote the interconnection between elements, and finally integrate them into a complete system and organic whole. Designers should consider not only the elements themselves but also the relationships between them when designing. The most basic feature of linkage coupling thoughts is to integrate different elements together and make them coupled and coordinated into a new design. After years of intensive research and development, linkage coupling thoughts have become an important way of thinking and design technique for organizing space, which is widely used in many fields such as urban design and has a certain universal applicability[6].

1.3.2 Integration

Integration is the combination of fragmented elements in a certain way to achieve organic coordination of the various parts and finally form a whole with high efficiency[7].

Integration is the demand of modern urban spatial development. Urban modernization continues to damage the integrity of urban form, resulting in fragmentation and mutation of new urban space and old urban space, and urban form becomes a combination of fragments with weak correlation. The thesis investigates the way of connecting and coupling different urban elements in the old urban space. The thesis accomplishes the integration within the old urban space and the integration of the old urban space with the surrounding urban environment. This integration is conducive to the optimization and development of the entire urban spatial structure, and can better preserve the historical culture and place memory in the old city environment, and integrate the old urban living patterns with the comfortable modern urban space.

1.3.3 Urban renewal

The term "old town" refers to certain economically declining, old and dilapidated houses, backward municipal facilities, areas with poor public environment and quality of life in the built-up areas of cities. In order to rejuvenate them and fulfill their role, it is necessary to adjust the original structural pattern, compensate for material

deficiencies and adjust population distribution to improve the environment, revitalize the economy and improve the quality of life, which is commonly referred to as urban renewal. Regeneration refers to the necessary adaptation and modification of buildings, space and environment according to the requirements of urban development and the needs of urban residents, and is a comprehensive work to selectively preserve, protect and improve the quality of the environment through various means. It is neither a large-scale demolition nor a mere protection, but a timely "guidance" for urban development[8].

In general, urban renewal includes the following elements: protection, preservation, restoration, rehabilitation, replication, renovation, reconstruction, and insertion. For example, in the preservation of historic buildings, the interior is renovated to adapt to modern life; new buildings are built in harmony with the original buildings; illegal buildings and structures are cleared; reasonable traffic organization is carried out; the environmental quality of public space is improved; and infrastructure is improved. In short, urban renewal mainly includes the following three aspects[9].

(1) Renovation, remodeling, or redevelopment. It refers to the relatively complete removal of certain aspects of the existing environment with the aim of creating space and adding new elements to improve the quality of the environment.

(2) Rehabilitation. It refers to the reasonable regulation of the use of the existing environment, generally only a local adjustment or small changes.

(3) Protection. It refers to the preservation of the status quo with the conservation value to maintain, basically not to change.

1.4 Research contents and methods

1.4.1 Research contents

The content of the research can be divided into three main parts

(1) Theoretical discussion: by understanding the basic composition and development of the idea of correlation and coupling, as well as the relevant research theories of Maki Fumihiko, Roger Trancik and Edmund N. Bacon, the thesis corresponds to the connotation of this thought with urban space, and explores the meaning and guiding value of linkage coupling thoughts for urban design. The theory of integration of *urban architecture* and external space in the special context of old urban spaces is systematically analyzed and summarized to provide theoretical support for the future

development of urban public space.

(2) Case study: by collecting and analyzing cases of various scales and types of urban regeneration, analyzing how they apply linkage coupling thoughts in actual design, exploring the design principles and methods, and concluding a relatively complete set of integration strategies for old urban spaces, which will serve as a certain inspiration for future development in old urban spaces.

(3) Design practice: combine the linkage coupling with the design in practice, apply the resulting strategy in the actual old urban space, and use the actual design scheme to integrate the old urban areas to verify the interpretation of the linkage coupling thoughts in the old urban space.

1.4.2 Research methods

The research of this thesis is based on a large amount of literature and data reading, case collection and analysis and field research, then through summarizing and analyzing, combining with existing theoretical ideas to solve practical problems, and finally arrived at the results of this research topic.

(1) Literature review method

After determining the target of the thesis, the researcher will consult relevant books, academic journals and Internet resources to understand the existing achievements in the field of urban renewal, integration of spatial elements in the old city and application of linkage coupling thoughts at home and abroad, as well as master the knowledge of related disciplines such as urban planning, sociology and environmental psychology.

(2) Case analysis method

We collect a large number of domestic and foreign design cases in which linkage coupling thoughts is applied, and select some representative cases for systematic analysis to summarize the design logic, element organization, linkage system and integration method, which serve as case support and innovative basis for subsequent design practice, and better support the ideas of this research.

(3) Field research method

Typical old urban areas in China and the surrounding environment are selected for field research, combined with site-based textual information and on-site observations to discover the main problems of the old urban areas and to summarize and analyze the current situation and advantages of the sites. Individual interviews with site

residents are also an important part of the survey. Through interviews and inquiries, people's behavioral characteristics and demands are summarized to understand the history and culture, living habits and living conditions of the site. Comprehensive exploration of the specific strategies of associative coupling ideas to integrate spatial elements in the old urabn areas.

(4) Systematic research method

The systematic research method advocates analyzing the research object in terms of the whole and the hierarchical structure. The whole can be subdivided into independent and interconnected subsystems. The city is a huge system, so it is better to decompose the city as a whole into various elements and then make connections to find out how they relate to the city. Specifically in architecture, the holistic view of systems theory can be summarized as follows: 1) independence of the whole; 2) relative hierarchy; 3) organic correlation.

1.5 Research framework

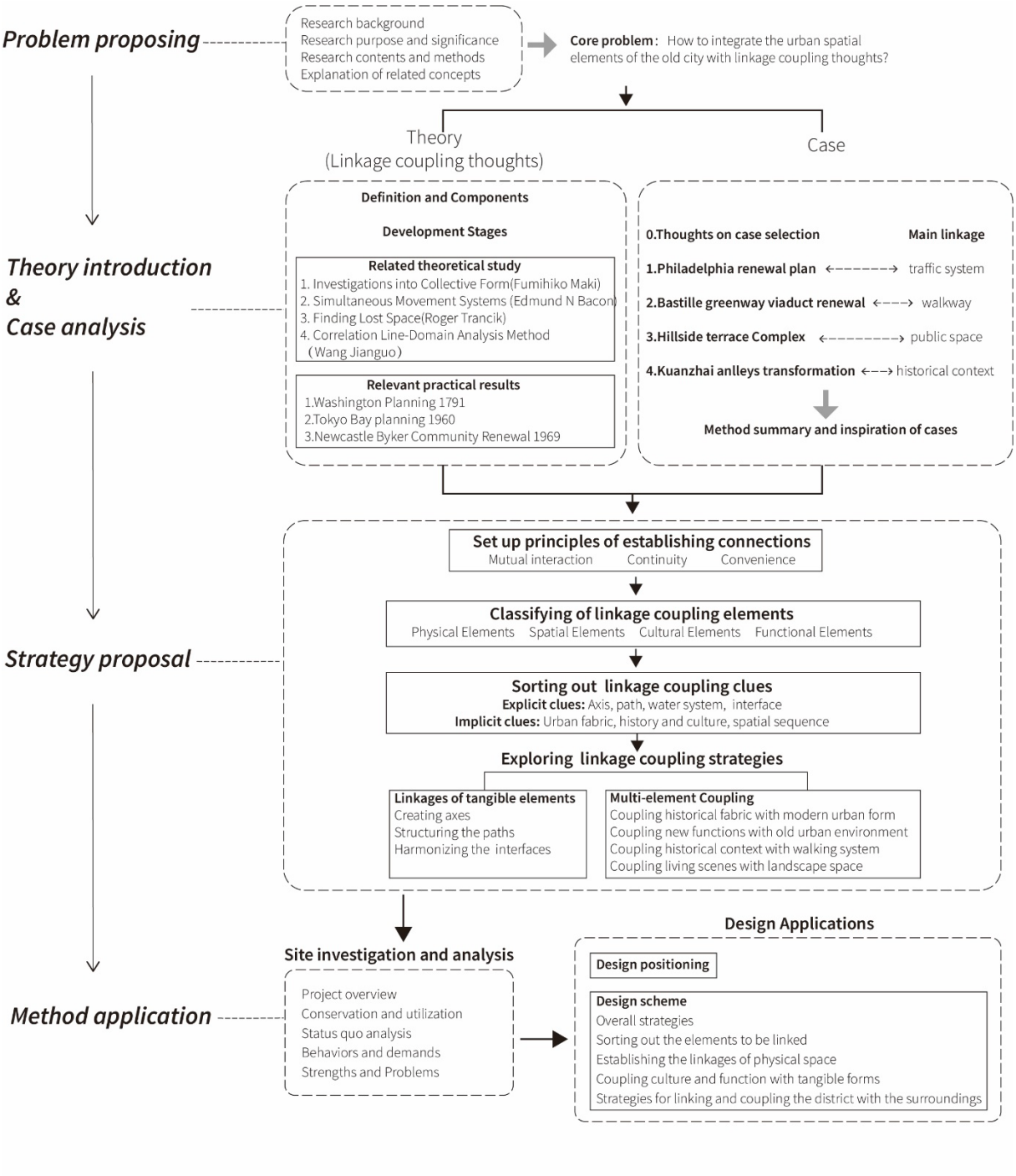


Fig. 1-1 Research Framework
(Source:by author)

CHAPTER 2: Development of Linkage Coupling Thoughts

2.1 Definition and basic components of linkage coupling thoughts

2.1.1 Definition of Linkage Coupling Thoughts

2.1.1.1 Linkage

"Linkage" refers to interlocking, expresses the connection between related elements and constituents, emphasizes systematicity and connectedness[10]. It emphasizes explicit connection, the physical form of linkage.

2.1.1.2 Coupling

The term "coupling" emphasizes the implicit connection, the non-material form of connection. The concept of "coupling" originated in physics and expresses the mutual promotion or inhibition between two or more systems, motions, or objects through a medium. "Coupling" refers to a concept of the existence of an apparent interaction or mutual influence between objects and emphasizes the complexity of the law and the results of synthesis. "Coupling" emphasizes implicit connection, the intangible form of connection[10].

2.1.1.3 Linkage Coupling Thoughts

Linking and coupling is an existential feature of the complex relationship of objective things, and its application in urban design is an important thought about the integration of all parts of urban space. The most important means is the purposeful creation of links between urban elements, the connection of all parts of the city and buildings with the external spatial environment through the organization of "lines" in urban space and the creation of an orderly and continuous system of linkages. In this way, the new urban system will generate an overall control and the necessary elementary constraints to achieve coordination and cooperation between the elements.

Linkage coupling thoughts was first manifested in the field of urban design as early as the Roman urban design in the 16th century Baroque period. It emerged in the 1960s, and a group of famous architects and planners researched and practice on this theory. One of the first architects to explore the linkage coupling thoughts was the famous Japanese architect Kenzo Tange, whose designs for the new American community MIT

and the Tokyo Bay Plan both explicitly introduced the concept of the "urban axis" and emphasized the important role of the urban axes in organizing the spatial order of the city[11]. In 1961, Aleris Josic, George Candilis, and Shadraeh Woods transformed linkage coupling thoughts into the design concept of "stem" and applied it for the first time in a real project (Toulouse-Le-Mira, France). Through continuous development and refinement by Fumihiko Maki, Edmund Bacon, Roger Trancik and others, the idea of correlation and coupling has become one of the important methods to guide urban design today, emphasizing the study of the linear relationship between the constituent elements of the urban form environment.

2.1.2 Basic components of linkage coupling thoughts

The basic components of linkage coupling thoughts are mainly coupling elements, coupling clues and coupling methods.

2.1.2.1 Coupling elements

Elements are the building blocks of things, the basic units that make up a system[12]. F. Gibberd defines "everything that can be seen in the city is an element"[13]. In this study, the coupling elements correspond mainly to the various elements in the urban space that need to be linked and coupled, such as the elements of architectural units, public space, landscape space and historical heritage.

2.1.2.2 Coupling clues

Coupling clues are the vein base that links the elements, i.e., the connecting factors between coupled elements. Coupling clues are divided into explicit clues and implicit clues. Usually, the clues that reflect the connection between the elements are explicit clues, such as the road connecting two buildings, the entrance area connecting the road and the building, etc. The clues that reflect the coupling between elements are implicit clues, such as the spatial sequence between the buildings of the Forbidden City in Beijing, the relationship between the opposing views, etc. The clues do not necessarily have to have a linear shape, but they must have the character of a line and play the role of linkage between elements.

2.1.2.3 Coupling methods

In short, coupling mode refers to the way of interaction between coupled elements. Urban spatial elements exist in the city in a variety of complex states, and the relationship between elements is also mixed. After sorting out the urban spatial elements and finding the linking and coupling clues among them, we should use the coupling method to connect the elements together and create a complete and orderly public space.

2.2 Development stages of linkage coupling thoughts

The stages of development of linkage coupling thoughts are summarized as the following four: embryonic stage, initial application stage, the prevailing stage, theoretical stage. By summarizing the modern urban design, the author concludes the chapter with the contemporary development and future development of linkage coupling thoughts.

2.2.1 Embryonic stage

Before the 14th century, there was no clear theory of urban design, but due to natural growth and some external factors, the urban spatial form began to reflect a certain line of control over other elements of the city. The construction of cities at this time clearly reflected the human characteristic of "avoiding harm" in order to live. In order to avoid fires, the early Chinese concept of village construction reflected the use of the water system as an important "line" for spatial connection and the connection of life. Abroad, Marcus Vitruvius Pollio in *The 10 Books On Architecture* mentions the ideal octagonal urban scheme with easy access to the outside world through roads or rivers and an urban grid in the form of a radial ring system when considering the relationship between roads and public buildings.

After the Renaissance movement, the development of art and culture contributed to the advancement of urban design theory, and in the 15th century, L.B. Alberti, in his book *De Architectura* after Vitruvius, proposed the "Lineamenta" of architecture in the city: "In the body of architecture one sees a system of lines that is neither material nor dependent on it[14]." The "Lineamenta" became the first theory of urban design that included linkage coupling thoughts.

2.2.2 Initial application stage

After the fifteenth century, people consciously controlled the spatial form of the city by organizing public buildings and using spaces such as city squares to link other parts of the city. For example, in the Forbidden City in China, the entire palace complex unfolds along the central axis, and the palace buildings are connected by the space of squares between them to form an orderly whole. After the European Renaissance, Pope Sixtus V rebuilt Rome, linking the scattered religious buildings and city squares by street axes to create an urban structure connected to the paths of pedestrian flows. During the transformation of Paris, Louis XIV built several enclosed squares that linked the Louvre southward to form a far-reaching central axis. Under Napoleon, the Arc de Triomphe was built, continuing the axis of central Paris. Later on, Haussmann's plans for the reconstruction of the street network, green spaces, parks and squares, and infrastructure of downtown Paris essentially completed the spatial pattern of the Grand Cross of Paris.

In this period, the "axis" was already deeply reflected in the urban form in China and abroad, and public space was used as a system to organize the city in tandem. At this stage, linkage coupling thoughts are reflected only in the urban structure created by visual axes and pathway planning, which is simply a connection of material forms.

2.2.3 The prevailing stage

In the 1960s, linkage coupling thoughts gained great attention. The second industrial revolution brought the development of construction technologies and changes in transportation. Cars and railroads brought convenient travel options, changing the original urban structure characterized by pedestrian scale. Technological innovation also influenced the application of the idea of correlation and coupling in urban design, and designers paid more attention to the dynamic nature of urban form and the correlation between elements.

In the 1950s, Edmund N. Bacon's Philadelphia development program attempted to restore spatial coherence to the city through urban-scale connections. This was an important exercise in creating urban spatial connections on a large scale. The original network of square streets served as the basic framework, with two major streets

forming an axis in east-west and north-south directions that intersected at City Hall and downtown, leading to a radial boulevard. Bacon also led the design of the renewal of the local building clusters based on the connection of the entire urban structure, i.e., the reorganization of sight lines and pedestrian flow within the neighborhood to connect the urban building units with the spatial void. The idea of linkage and coupling is reflected in the overall structure of the city.

In the second half of the 20th century, more and more theories of urban planning drew on the concepts of movement systems and spatial flows to create more experimental linking systems. The Tokyo Bay Plan (1960), designed by Kenzo Tange after World War II, used a sea-level high-speed transportation system as a connecting skeleton to laterally couple other urban elements. Another typical example is Peter Cook's idea of the Plug-in City (1964), in which different communities can be connected as easily as plugs can be connected to electrical outlets, and in which transportation, production, and social life can be organized in this way. It contains a system of connections that encompasses multiple dimensions such as time, space, vertical and horizontal to realize the modernist concepts of collective living and transport integration.

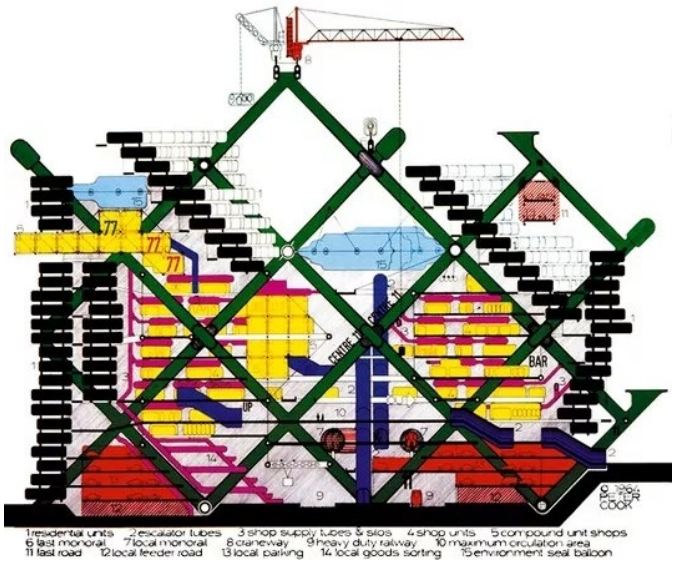


Fig. 2-1 Typical Section of Plug-in City (Source: marcocitta.wordpress.com)

In the design for Toulouse-Le Mirail (1961), the architects proposed a system called "from stem to cluster," which used the street system as a "framework for change"[15] to connect residents' lifestyles and complex community forms.

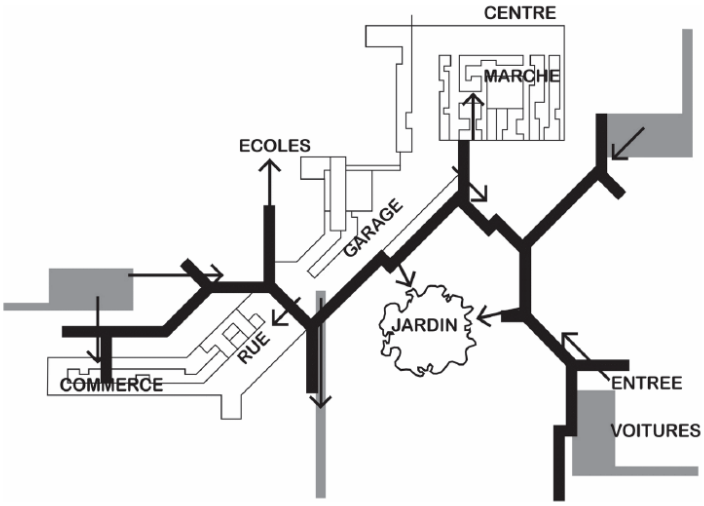


Fig. 2-2 Candilis-Josic-Woods. Toulouse-Le Mirail, 1962. Diagram with platform of pedestrian routes on the ground floor.

(Source: redesigned by the author based on Candilis et al. (1962).)

In this stage, the practice of linkage coupling thoughts in urban design breaks the limitations of traditional geographical conditions, and the urban vision is futuristic and experimental. This stage of development is characterized by the emphasis on the relationship between multiple systems at the material and invisible levels, and the design of urban form fully takes into account the transformation between the real and the virtual, the organization of flows of people, housing and activities, modes of transportation and other multidimensional connections, and the diversification and complexity of design practices reflect the gradual improvement and maturity of linkage coupling thoughts.

2.2.4 Theoretical stage

In 1964, Fumihiko Maki, a famous Japanese architect, firstly elaborated linkage coupling thoughts in a more systematic way, believing that coupling is the most important characteristic of external space. In Investigations into Collective Form, he summarized urban space into three types of forms: Compositional Form, Megaform, and Group Form. He provides an "urban design benchmark" for the composition of urban public space through the association and coupling of forms, and uses the control of form composition to cluster and connect all kinds of spatial forms into a clear, hierarchical, compact, coordinated, open and interrelated system network.

Subsequently, researchers have understood the linkage coupling thoughts more objectively and rationally. An example of this is Bill Hillier's 1974 research on spatial syntax, which combines topology and graph theory to evaluate spatial configurations and attempts a more quantitative analysis of linkage relations.

In the second half of the 20th century, the architects represented by Team 10 began to respond to humanism in their designs. C. Norberg Schu proposed the concept of place and context in "Genius Loci", and Jan Gehl's "Life between Buildings", Jane Jacobs' "The Death and Life of Great American Cities American Cities" studies of public space and behavior, all taking a human perspective and implicitly incorporating the immaterial dimension into the idea of correlation and coupling, compensate for the neglect of the spiritual dimension of urban culture by the simple large-scale urban spatial structure.

In 1986, Roger Trancik theoretically defined linkage coupling thoughts in *Finding Lost Space* based on the study of modern spatial evolution and the analysis of historical examples, and formally proposed the "linkage theory", pointing out the emphasis on the connection and dynamics of the city easily leads to ignoring the spatial definition, and a design strategy of superimposition and integration with figure -ground theory, linkage theory and place theory is proposed that emphasizes the connection between cities and the virtual and internal relationship of urban material space from multiple dimensions. In the thoughts of linkage and coupling, the three theories are respectively embodied in the coupling of virtual and real space, linear connection of units, and coupling of material and spiritual culture. Therefore, " linkage theory" can be understood as an important theoretical achievement of linkage coupling thoughts, or the embodiment of linkage coupling thoughts in a narrow sense.

After 1980, researchers studied the connections of urban elements more systematically and theoretically from various perspectives, and summarized some theoretical results represented by Linkage Theory. The scope of research on linkage coupling thoughts is also no longer limited to the physical spatial elements of the city, but human, social, cultural and other intangible elements, as well as ecological elements are gradually being considered.

2.2.5 Contemporary developments and future rends

After 1980s, Wang Jianguo, a researcher in China, expanded the "behavioral line" and the "psychological line" based on the "spatial line" in the Linkage Theory in the "Modern Urban Design Theory" and analyzed more aspects of urban culture, people's life and behavioral psychology, so that the linkage coupling thoughts are more applicable to human-centered urban design.

Against the backdrop of changing times and changing needs of urban development, the "lines" between urban spatial elements are gradually updated. Against the background of growing population, the development of urban space shows a trend of three-dimensionality. The development of underground space, the construction of high-rise buildings and super high-rise buildings, and the widespread use of the TOD model show that the new way of urban linkage and coupling must also include the connection of the vertical direction of the city. Based on the demand for the complexity of urban functions and the disappearance of urban spatial boundaries, the function of "connecting line" is transformed into the bridging line of different functional spaces in the city, such as the interpenetration and integration of architecture and transportation and the mutual opening of architectural space and urban space. The redevelopment of the waterfront and the exploration of landscape cities in modern urban design also leads designers to further explore the integration of artificial and natural systems, which is another important dimension for the future development of the idea of linkage and coupling in the field of urban design.

Table 2-1 Table- the Summary of development of Linkage Coupling Thought

Representative persons	Key achievements	Time	Related contributions to linkage coupling thoughts
Sixtus V	Urban Design of Rome city	16th century	Nodal benchmarks are set in the urban space to establish urban movement routes, so that the urban movement flows are unified with the urban spatial structure.

Le Enfant	Washington Planning	1791	The linear connection between the city's political and monumental public buildings, based on an urban network, gives Washington a distinct urban skeleton and fabric.
Eugene Haussman	Renovation of old urban areas of Paris	19th century	The city's spatial structure is integrated through the construction of a network of radioactive roads that form an urban view corridor, with the important square buildings in each area of Paris as the center.
Frederick Gibberd	*Town Design*	1953	Emphasis on the union of different objects is key to urban design, arguing that designers need to consider both the objects themselves and the relationship between one object and others.
Kenzo Tange	Tokyo Bay Planning	1960	The connection of the physical space of the city is redefined by means of transport, and the concept of 'urban axis' is clearly formulated, emphasizing the important role of urban axis in organizing the spatial order of the city.
Aleris Josic George Candilis Shadraen Woods	Toulouse - Le Mira planning scheme	1961	By incorporating linkage coupling thoughts into the design concept of the “stem”[16], the scheme couples the main traffic routes and living places of the citizens with the main artery of the urban extension. It embodies the planning and design concept of 'cluster flow, growth and change'.
Peter Cook	*Plug-in City*	1964	By linking infrastructure, service pipelines and functional units on top of each other, the coupling results in a unitary model of renewable communities.
Fumihiko Maki	*Investigations into Collective Form*	1964	Emphasis is placed on linkages as the cohesive force of the city and coupling is proposed as the ruling law that integrates the various activities and material form levels in the city. Three types of collective forms are summarized: compositional form, megaform and cluster form.

Edmund N Bacon	*Design of Cities*	1967	Argues that important urban nodal architecture facilitates the opening up of distinct urban patterns, emphasizing the coupling of urban nodal connections.
	Downtown Philadelphia Redevelopment Plan	1976	Points out that the city's movement system links the city's buildings and spaces and plays an important role in shaping the urban form and integrating regional functions.
Jan Gahl	*Life Between Buildings*	1971	His study of the associative integration of urban elements from a human behavioral perspective was the prototype of linkage theory.
Bill Hillier	the concept of "spatial syntax"	1974	His pioneering work on the social logic of spatial structures and the spatial laws that underpin them has clarified the importance of spatial factors in sociological research. A more objective and rational understanding and analysis of 'linkage'.
Roger Trancik	*Finding Lost Space*	1986	He summarized the three major theories of modern urban design: Figure-ground theory, Linkage Theory and Place Theory, and proposed for the first time three linked and coupled threads: urban materials, behavior and mind[17].
Wang Jianguo	*Modern urban design theory and methods*	2001	Extends the 'spatial line' and 'psychological line' of linkage theory to analyse more aspects of urban culture, people's lives and behavioral psychology, making linkage theory more applicable to people-oriented urban design.

(Source:by author)

2.3 Related theoretical researches of linkage coupling thoughts

2.3.1 Investigations into Collective Form by Fumihiko Maki (1964)

"Investigations into Collective Form" was the first complete exposition of linkage coupling thoughts. Based on the experience of a settlement trip, Fumihiko Maki, a famous Japanese architect, gradually developed his theory of group form and published " Investigations into Collective Form " in 1964. In it, Maki discussed in detail the networked organization of external space and the elements of spatial composition. He argued that "connectivity is the cohesive force of the city, which organizes the city's various activities and creates the city's spatial form.....".[18] On this basis, he summarized urban space into three types: Compositional Form, Megaform, and Cluster Form.

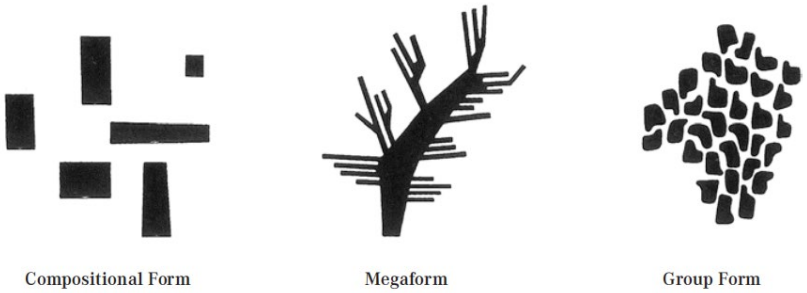


Fig. 2-3 Three collective forms of Maki Fumihiko
(Source: 《JA》1994.04)

In compositional form, individual buildings have a strong independence, and their functional and spatial relationships can be established in a relatively simple two-dimensional plane. The coupling is implicit and static; the tension between them is a product of the independent forms of the buildings and their relative positions, which is common in many modernist urban patterns, such as the government center of Chandigarh and the new city center of Brasilia, where the buildings themselves are more important than the perimeter of the open space.

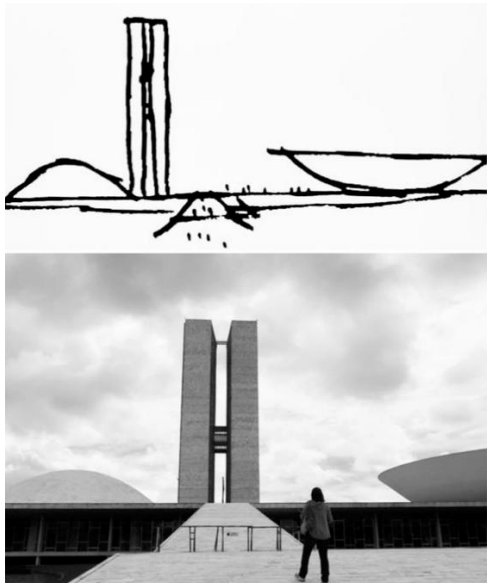


Fig. 2-3 The National Congress of Brasilia
（Source：blogvambora.com.br）

Megaform is a giant framework that combines and concentrates various functions of public facilities. It emphasizes hierarchical, networked, and other holistic systems in which urban elements are categorized and collected and then connected through explicit material links to form a complete urban space. Influenced by recent technological developments and international architectural thinking, this form chooses a new spatial construct to overlay the original city[19]. This highly structured approach is an articulation of the complex life of the city. Individual elements are clustered and combined into a hierarchical, open and interconnected network of systems, with coupling enforced by material means. For example, a high-speed road network or the technology to build large spaces. The Tokyo Bay Plan and Boston Bay Plan by Kenzo Tange are both megaforms.

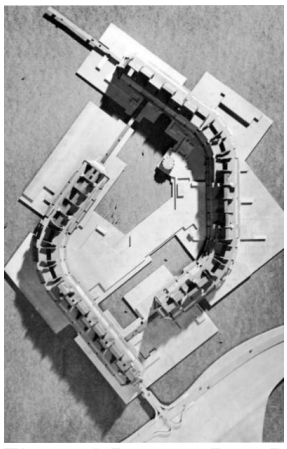


Fig. 2-4 Boston Bay Plan
（Source: https://www.pinterest.com/pin/86412886569735847/）

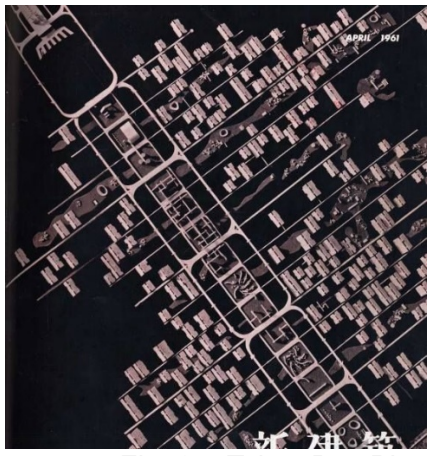


Fig. 2-5 Tokyo Bay Plan
（Source: https://www.pinterest.com/pin/16325617386299745/）

Cluster form is the result of the progressive development of spatial elements along a linear hub. This is very common in many historical town forms (especially in small towns). Here, relatedness is neither implied nor imposed, but naturally evolves as an integral part of the organism. Group morphology critiques statics and advocates a dynamic model for the rich, changing city. This morphology is often a bottom-up developmental model and has evolved over a long period of time, such as the linear village in Japan.

Fig. 2-6 Japanese linear villages
(Source: *Investigations in Collective Form*)

Among the three paradigms proposed by *Investigations in Collective Form*, both compositional form and megaform are architects of spatial order, while cluster form expresses the mechanism of generating spatial order. Later, Shintaro co-wrote the section on the linkage of cluster form with Jerrydian-Goldberg, a graduate student at the Washington University. The linkages here go in two directions: First, cluster forms can be created by linkages, and second, cluster shapes can be understood and recognized by analyzing the way they are linked. The linkages mentioned in the text are not limited to linkages between individual elements, such as linkages between architectural monoliths, but also include linkages of behavior, linkages of three-dimensional space, linkages of temporal dimensions, and linkages of sociality. He summarizes the specific operations of linkage in the following five categories.

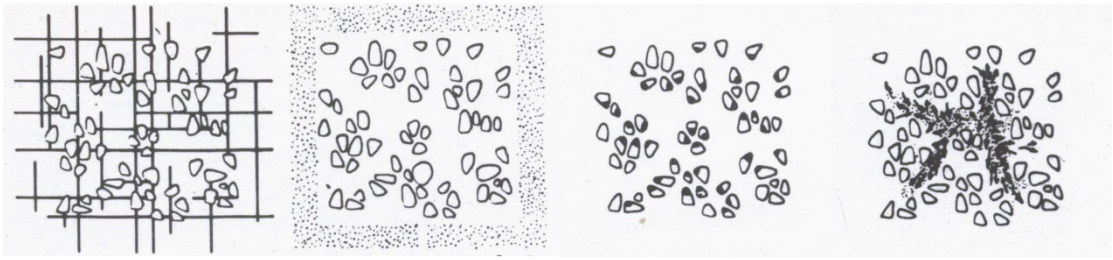


Fig. 2-7 Four basic linking acts
(Source：Linkage In Collective Form)

（1）To mediate

Connection with intermediate elements or implicit connection with any medium (including composite free space).

（2）To define

Enclose disparate structures with a meaningful barrier. Create unity within the barrier and separate from what is outside.

（3）To repeat

Give each element a common characteristic so that it can be identified as part of the same order.

（4）To make a sequential path

Place activities that are performed in sequence in a recognisable spatial relationship to each other.

（5）To select

Create unity through site selection before design. Select a site with character can directly influence the design and create a unified visual force when the project is completed.

The linking operation here can be considered as a "loose framework". The specific operations vary depending on the specific project. According to Maki, specific operations can be divided into two types: physical linkages, i.e., tangible linkages such as bridges and corridors, and implicit linkages, i.e., intangible linkages that achieve the purpose of connection through the implication of space and landscape.

2.3.2 “Simultaneous Movement Systems” by Edmund N Bacon (1967)

The reform of transportation profoundly affected the construction of urban structures, making the consideration of movement systems a turning point in the transition from a purely material level to a multisystemic and multidimensional notion of linkage and coupling. Edmund N Bacon, an American urban planner, focused on the relationship between the pulse of the city and the formation of the city as a whole, saying, "To be able to influence urban development, designers must have a clear idea of the basic design structure that drives the whole process of building the city." The basic design structure referred to here is the "simultaneous movement systems[20]."

With the development of contemporary urban functional technology, the movement of people in space has made extensive use of mechanical power. This development has disrupted the ancient unified perceptual system and produced a variety of urban modes of traffic, each with its own unique perceptual system and speed of movement. For this reason, Bacon proposed "simultaneous movement systems" in his book *Design of Cities*. In his concept "Simultaneous Movement Systems", he considered that the structure of the city is the skeleton (urban pulse) that forms the function and image of the city from the movement system, and that various urban nodes are organically connected to the city, and their changes and growth are all related to the development of the whole city. In the process of maturing the urban structure, the new structure is combined with the movement system, and the basic structure is formed from the natural features and regional topography, which are combined by people's perception sequence to form a basic sense of order[21].

He applied this theory to the Philadelphia Renewal Plan. Bacon believed that the continuity of the movement system is important to the spatial experience, especially the harmonious transitions between pedestrian and vehicular traffic. This movement system is not about speed, but about order and convenience. The current mixture of intermittent and direct traffic makes all streets equally ineffective. By this time, Bacon had a complete idea of the system of organizing space and movement. He said, "What I had in mind to do with this site was to not think in terms of buildings at all, but think in terms of the way people moved around the area. " " I intuited absolutely clearly at that point that my function would be to get burrowed in the ground in the mud to establish the roots connecting utilities and underground transportation and produce a force which would rise up like a top of a tree reaching into the light. At that point I would let

go, handing the whole thing over to an architect who would, as it grows up into the sunlight, make it into beautiful architecture[20]. "

Fig. 2-8 GM's vision of the future presented in its Futurama exhibit in the 1939 World's Fair.
（Source：Vision and Blindness: Edmund Bacon's 1963 Plan for Center Philadelphia）

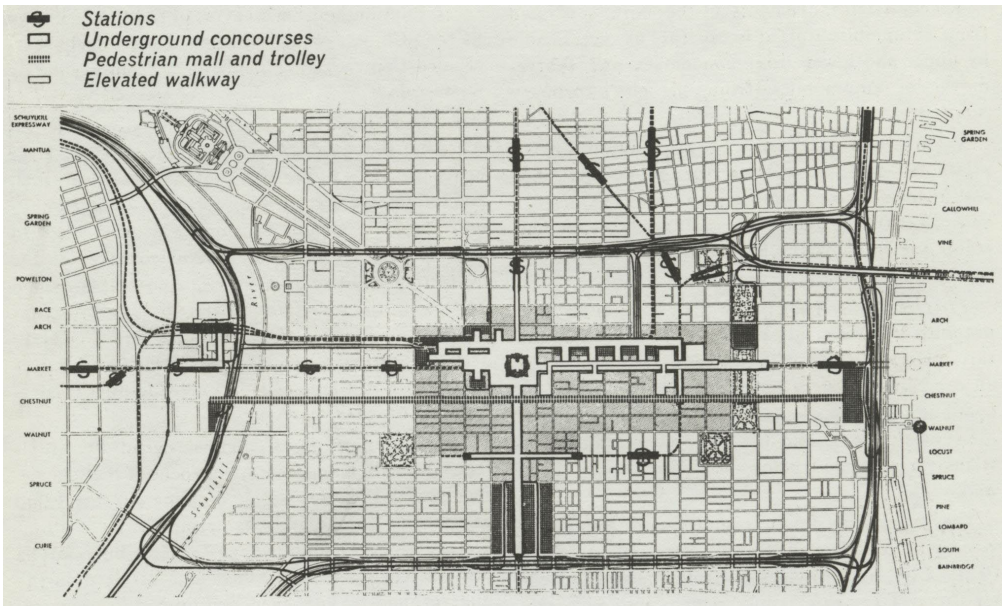


Fig. 2-9 plan of pedestrian system
（Source：THE PLANNING OF PHILADELPHIA CENTER CITY 1952-1962 Eleanor Smith Morris）

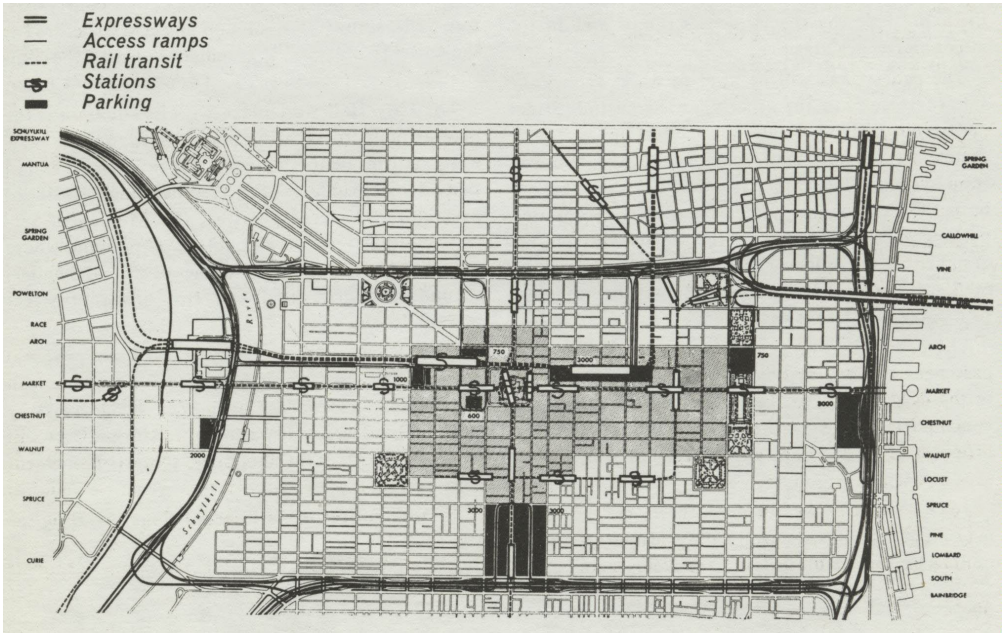


Fig. 2-10 plan of traffic system
（source：THE PLANNING OF PHILADELPHIA CENTER CITY 1952-1962 Eleanor Smith Morris）

2.3.3 Linkage Theory by Roger Trancik (1986)

Linkage theory is an important theoretical achievement of the concept of linkage and coupling, and it is also the most direct urban space design theory that can put linkage coupling thoughts into practice. Although the focus of linkage theory is still on the physical spatial form, the combination of linkage theory and place theory can more fully reflect the basic connotation of the idea of coupling. Three theories of urban spatial design are proposed, namely figure-ground theory, linkage theory and place theory. The main point of the linkage theory is to connect buildings with the external spatial environment through the organization of "lines" in urban space, including property boundaries, traffic flow lines, axes, etc. The purpose is to organize a system of connections or a network to create an orderly urban spatial structure. According to Roger Trancik, the object of analysis of connection theory is the "line" of interconnection between the various elements of the city. This "line" is a spatial datum that connects buildings to space, which can be "a strip of base, a directional flow of movement, an organized axis, or even the edge of a building[22]."

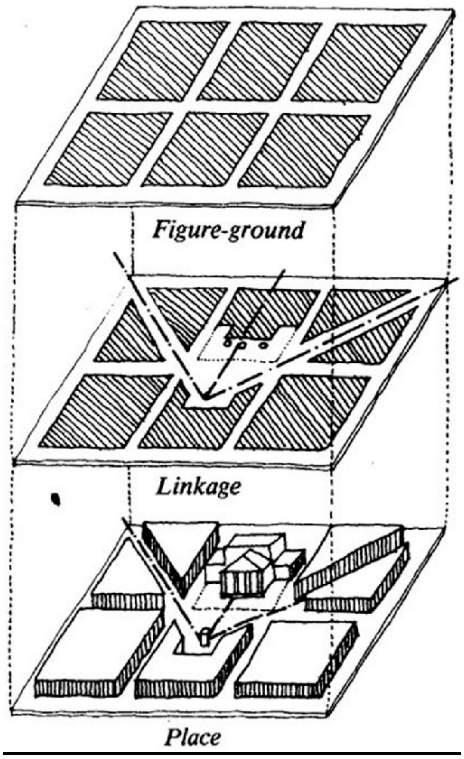


Fig. 2-11 Three design theories proposed by Roger Trancik
（Source：*Finding Lost Space*）

Roger Trancik vividly compares the baseline system in the city to a musical score, where the baseline in the city serves as a constant reference standard in the same way as a pentatonic score. “The organization of lines that connect the parts of the city and the design of a spatial datum from these lines relate buildings to spaces. The concept of datum in spatial design is analogous to the staff in music, upon which notes are composed in an infinite number of ways. The musical staff is a constant datum, providing the composer with continuous line of reference[22].”

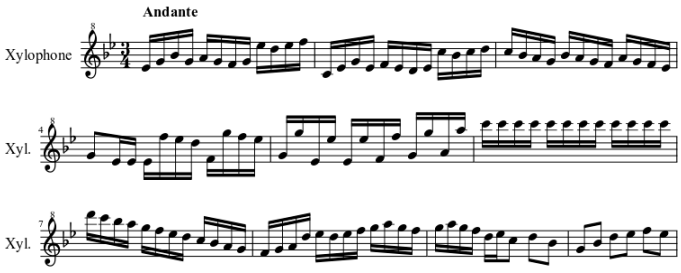


Fig. 2-12 Music score（Source：musescore.com）

In his book, Roger Trancik analyzes the problems of unclear urban structures or weak connections between areas such as the Shawmut Peninsula in Boston, Washington, D.C., and Gothenburg, Sweden. This leads to four key points of connectivity theory:

①The ideal street must form a completely enclosed unit to avoid the impression of being a thoroughfare and provide a better setting for architecture;
②Emphasis is placed on circulation diagram rather than the spatial diagram of the figure-ground theory;
③Movement systems and the efficiency of infrastructure take precedence over patterns of defined outdoor space;
④All about streets, pedestrian ways, linear open spaces and elements connected to each other[22].

2.3.4 Correlation Line-Domain Analysis Method by Wang Jianguo (2001)

The development of association and coupling thoughts in China began in the 1980s. Wang Jianguo of Southeast University proposed the method of "association and coupling analysis" in his famous urban design theory book "Modern Urban Design Theory and Methods", and gave a clear explanation of "association and coupling theory" and "linkage and coupling". He believes that the object of linkage and coupling analysis is the dominant force lines in the base, which are the reference points of spatial places, and using these lines of force and reference points as the basis of design can clarify the impulse and mechanism of urban operation.

In order to call for a more integrated and holistic analysis method, Wang takes the "line" in urban spatial structure as the basic analysis variable, and forms an analysis from the "line" to the "domain surface" logic. In the book, the author divides "lines" in the city into four categories, namely "material lines", "psychological lines", "behavioral lines" and "man-made lines". "Material lines" are generally identifiable lines that exist in the city, such as engineering lines, street lines, building lines, etc. "Psychological line" is based on human perception and cannot exist without people. This "force line", which is formed by psychological perception, includes the spatial influence line of landscape and tall buildings. The "behavioral line" consists of the periodic movements of people and the relatively stable urban space they occupy. It usually occurs in open spaces such as urban streets and squares. The "man-made line" refers to the red line of planning and design, spatial control line, etc., generated by man-made planning in modern urban design. Based on the previous theories, the author extends the "behavioral lines" and the "psychological lines" to include other aspects of the analysis of urban culture, place culture and behavioral psychology[23].

In the Correlation Line-Domain Analysis Method, the physical and psychological aspects of the urban area under study are first analyzed. Then, the above "lines" are

superimposed or composed between classes to form various networks of the city, and then the network is comprehensively analyzed and studied so that the designer can finally understand the various qualities and connotations of the given urban analysis area and finally form a "line-to-domain" analysis idea to form a complete urban structure.

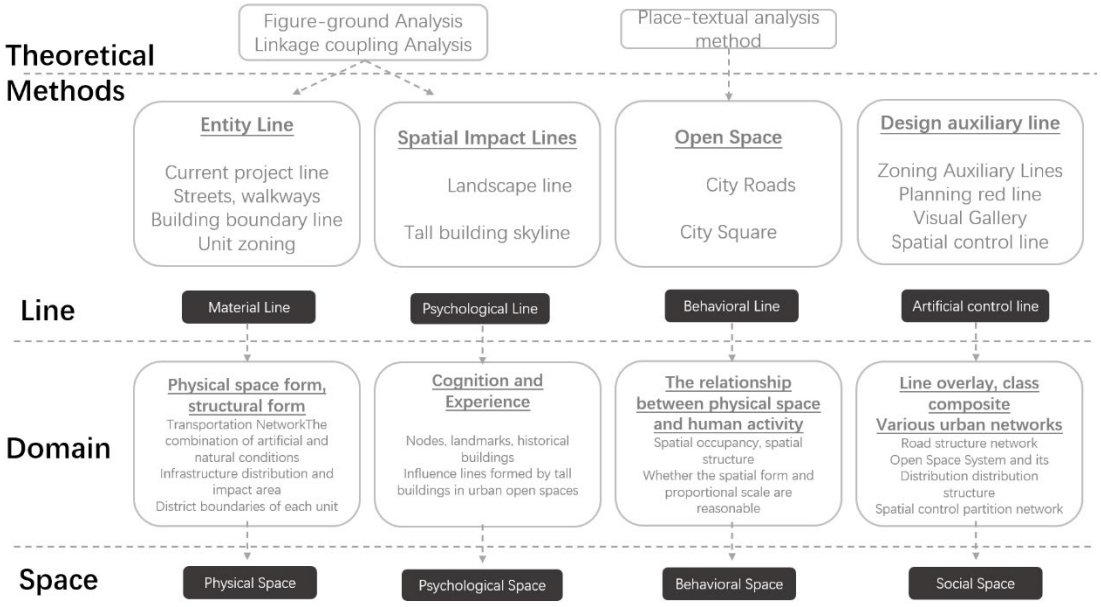


Fig. 2-13 Correlation Line-Domain Analysis Method
（Source：self-drawing）

2.4 Related stage practice of linkage coupling thoughts

2.4.1 Washington Planning by Le Enfant (1791)

Before linkage coupling thoughts gained much attention in the field of urban design, its application was mainly reflected in guiding the spatial form of the city by connecting material aspects such as well-structured axes, visual corridors, and layered fabrics. The planning and design of Washington by Pierre L' Enfant is a typical application of linkage coupling thoughts before it was mature. In this plan, Congress, the principal legislative body of the three branches of government, was placed on a knoll 30 m from the river, now Capitol Hill. At the west end of the east-west axis is the Lincoln Memorial and at the north-south end of the short axis is the Jefferson Memorial and the White House, with the Washington Monument at the intersection of the two axes. Starting from the two axes and incorporating Capitol Hill and the river, the plan promotes an interactive relationship between nature and the city, while the overlay of diagonal

streets and the orthogonal grid attempts to link municipal functions with the residential and commercial life of citizens[24].

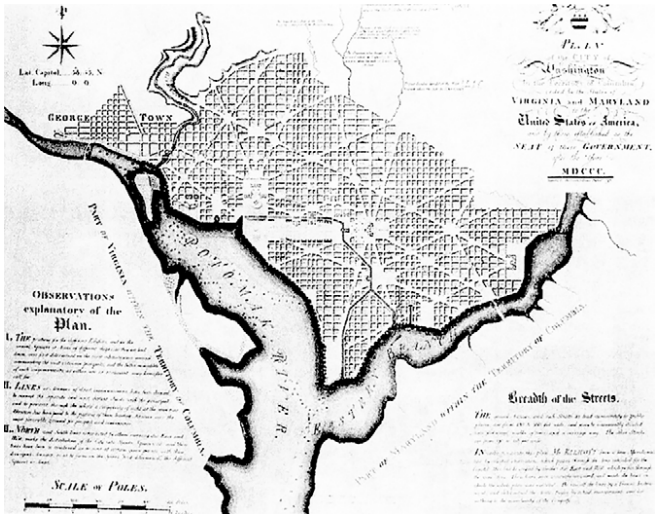


Fig. 2-14 Plan of Washington by Le Enfant (1791)
(Source：*Finding Lost Space*)

The diagonal roadway is an important linkage in Washington's plan, but a lack of clarity in defining the boundaries along the road led to the destruction of this structure in the early stages of the planning scheme. In addition, the triangular parcels that were carved out of the orthogonal grid by the idealized diagonal streets became lost spaces due to a lack of design guidelines.

In Pierre L'Enfant's plan for Washington, the application of linkage theory was no longer limited to the purpose of symbolizing and commemorating rituals, traditions, and regimes, nor was it limited to the communication and connection between the city squares and public buildings, but began to pursue connections between nature and the man-made environment, and between government and citizens. Later, the McMillan Plan of 1901 and many other plans intended to reconstruct the original design of L'Enfant served as a guide to define and extend the urban axes, strengthen the continuity and connection of public life, and ultimately improve the monumental urban spatial structure of Washington.

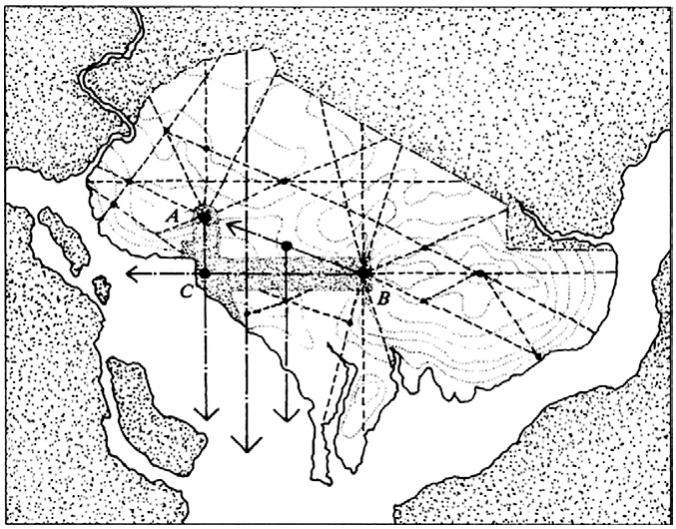
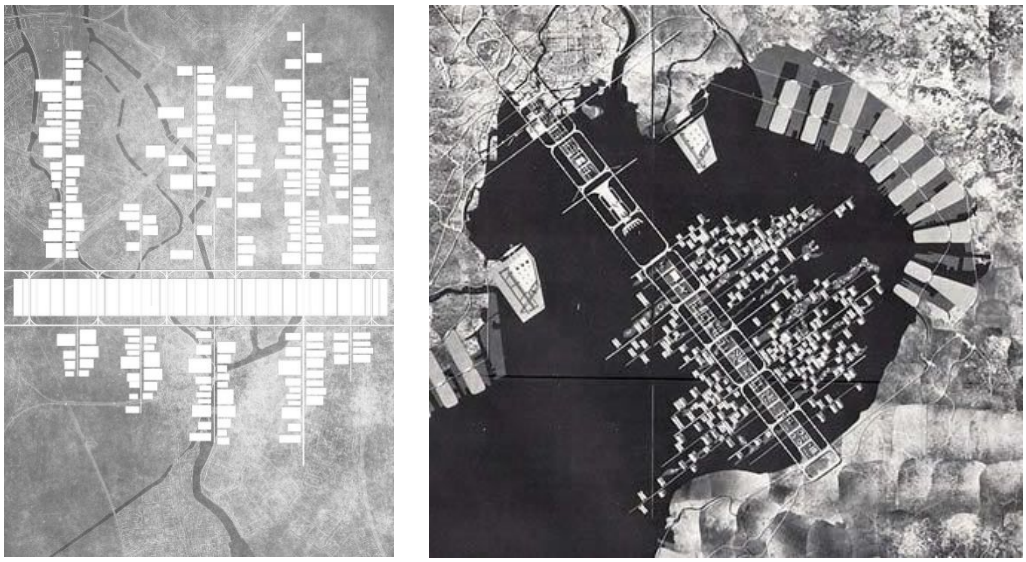


Fig. 2-15 Washington Planning Plan Analysis （Source：*Finding Lost Space*）

2.4.2 Tokyo Bay Planning by Kenzo Tange (1960)

The 1960 Tokyo Bay Plan is a classic example of the emergence of linkage coupling thoughts in the 1960s and a typical case of Fumihiko Maki among the three collective forms mentioned above. It follows the concept of "axis" in early linkage coupling thoughts, but pays attention to the growth of urban elements and incorporates an efficient urban traffic system into the main structure. In the context of the rapid economic growth of Tokyo after World War II and the shortage of land for urban development, Kenzo Tange proposed the Tokyo Bay planning concept, in which two high-speed roads overhanging the sea form the backbone of the city, extending from central Tokyo across Tokyo Bay to Chiba. Commercial offices and public cultural buildings will be located between the highway loops, and the loops will be extended by land reclamation, with residential units growing on both sides.



a）the structure of Tokyo Bay plan　　b）Tokyo Bay plan

Fig. 2-16 the structure of Tokyo Bay plan and Tokyo Bay plan
(Source: presidentsmedals.com / historiasztuki.com.pl)

The plan can be understood as a linear urban renewal model that grows like a backbone, with a linear "urban axis" as the main structure and a locked transportation system, called Cycle Transportation System, as the backbone for efficient transportation[25]. The linear and locked traffic system is the core of the city's connectivity. The rest of the city is closely linked to the transportation structure, such as the inner "urban axis" interspersed with buildings such as offices and restaurants, intersections with system service cores containing vertical transportation and urban facilities, and numerous large residential buildings on branch roads. It also contains urban elements such as schools, squares, tramways, prefabricated houses, etc., which become independent urban environments. Due to scientific and technological limitations, this concept was not really put into practice that year.

2.4.3 Newcastle Byker Community Renewal by Ralph Erskine(1969)

Around the 1970s, urban design theory began to address the internal structure of urban society and culture, and linkage coupling thoughts began to influence the spatial form of the city, taking full account of historical and cultural, humanistic and spiritual dimensions, and began to focus on the implicit level of association. The renewal of the Byker community in Newcastle, England, illustrates this shift.

In 1969, architect Ralph Erskine undertook the renewal of the Byker community. The Byker community before the renewal was built in the late 19th century. It was built as

social housing by the government to solve the housing problem of shipyard and machine workers. The housing in the settlement was in the form of townhouses with a square grid spatial layout. With the construction of the city and socio-economic development, the Byker neighborhood gradually declined into an overcrowded slum with extremely inadequate infrastructure. Therefore, in 1967, the city council decided to renew the Byker community.

Erskine's design for the renewal of the Byker community respects the wishes of the users and uses a phased, rolling development approach to ensure that the aspirations of the original residents are met[26]. Erskine is committed to building a "Byker City for the Bykers" for residents. In revitalizing the Byker community, the architects placed great emphasis on respecting historic sites, preserving the original community structure as much as possible, and creating public open spaces with a strong sense of place to maintain good neighborly relations as the community revitalizes, as well as preserving original trees and original buildings such as churches, schools, factories, and bathhouses[27]. Byker community renewal will also preserve the original trees, churches, schools, factories, and bathhouses. Erskine's people-oriented design philosophy, respect for the natural and social environment, emphasis on public participation, and use of a rolling development model in the Byker community renewal have all contributed to the preservation of spatial places, social relationships, and neighborhood interactions.

Fig. 2-17 the plan of the Byker community before regeneration
(Source： https://maps.nls.uk/view/10109937)

Fig. 2-18 the graphic plan of the Byker community
(Source: John Pendlebury，Tim Guy Townshend，Rose Gilroy. Social housing as heritage: The case of Byker, Newcastle upon Tyne[J])

2.5 Summary of the chapter

This chapter mainly analyzes and explores the linkage coupling thoughts. First, it explains and summarizes the linkage coupling thoughts and elaborates on its basic components (coupling elements, coupling clues, coupling methods) corresponding to urban space are treated individually. Then, the development history of linkage coupling thoughts from the 16th century to the present is sorted out and summarized into four stages: embryonic stage, initial application stage, the prevailing stage, theoretical stage, and the current development and future trends are discussed.

In the process of development, *Investigations in Collective Form* by Fumihiko Maki and linkage theory of Roger Trancik are systematic summaries and important theoretical achievements of various researchers. In this paper, the author conducts a deeper discussion on these related theoretical studies and explains their relationship with linkage coupling thoughts.

Finally, according to the law of development of the linkage coupling thoughts - from the simple visual and physical connection of the axes to a multisystemic and dynamic connection in the urban form and then to the connection with the humanistic spirit. In order to correspond, the author selects three typical practical cases: Washington Planning and Design, Tokyo Bay Plan, and Newcastle Byker Community Renewal in England, to fully reflect the gradual completeness and maturity of linkage coupling thoughts.

CHAPTER 3: Case Studies of Linkage Coupling Thoughts

In the process of urban modernization, the originally complete spatial system of the old urban areas was broken down into isolated and decaying historical fragments. Beginning in the 1960s, urban planners gradually recognized the importance of structure and wholeness to the city and employed linkage coupling thoughts to integrate urban space.

3.1 Thoughts on case selection

In terms of time, the four practice cases selected in this chapter are representative of renewal practices in each period from the second half of the twentieth century to the early twentieth century after the emergence of linkage coupling thoughts. In terms of scale, the four cases range from large to small, with the Philadelphia renewal program and the renewal of the Bastille-greenway viaduct being city-level renovation projects, while the hillside terrace and the Kuanzhai Alleys transformation project are urban renewal cases at the neighborhood level. They also differ in the way they are linked and coupled, integrating urban space through traffic systems, landscaped trails and public spaces, and historic heritage as connecting threads.

The author's reflections on the case selection include mainly two aspects: on the one hand, because the old urban areas are complex and diverse, including industrial areas, traditional residential areas, historic and cultural districts and other types. The author would like to derive certain rules from the numerous cases of old urban areas and find the common points of linking and coupling among their differences, which can be applied to the complicated old urban areas in modern cities. On the other hand, the theoretical application part of this thesis refers to Changhua Historic District, which is both about improving the connection between the district with the Xiguan area and integrating the inner space of the area. Thus, we aim to learn from the analysis of cases at different scale levels and summarize the linkage coupling strategies that can be applied at the urban scale and the district scale.

3.2 Traffic system as the linkage: Philadelphia Renewal P Program

3.2.1 Project Overview

Edmund Bacon's Philadelphia Renewal Plan in 1950 was an important application of linkage coupling thoughts at the city level. Throughout the program, Bacon focused on transportation issues and the preservation of traditional patterns in the process of

modernization, addressing the relationship between new and old, heritage and development. Bacon seeks to restore coherence to the city by organizing the urban movement system and directing the development of new urban areas and methods to urban development. The movement system in this case is the main thread of connection.

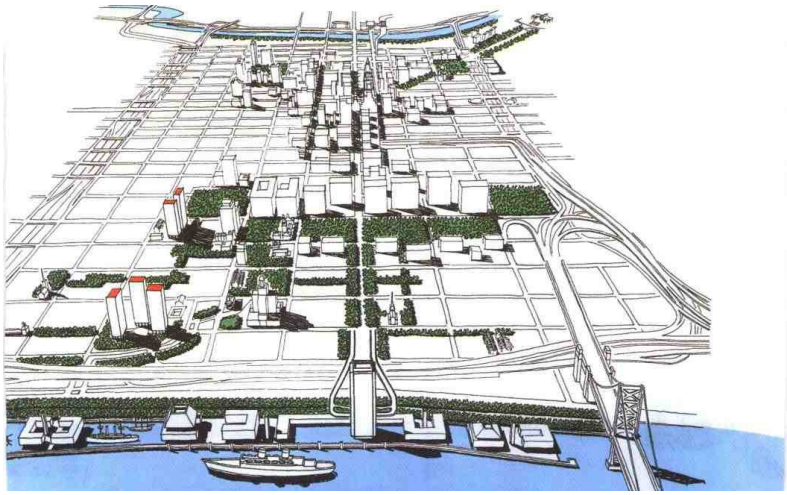


Fig. 3-1 An aerial view of the Philadelphia renewal photo
(Source: *Design of Cities*)

3.2.2 Sorting out the elements

The spatial elements of the early city of Philadelphia are mainly reflected in its simple and rectilinear urban layout. According to Payne and Holm's 1683 plan, the streets in the center of Philadelphia were laid out in a grid-like pattern, with four intersecting wide arterial streets on the east, west, south, and north, dividing the city into four districts. Each area has a park or plaza, and the central arterial intersection has a central plaza and major public buildings. The two great rivers that serve as the east-west boundary, the two main axes, the unified street grid, the one open space in each of the four districts, and the central plaza were the most important spatial elements of Philadelphia at this time. The physical elements are mainly the large public buildings near the center of the city. The overall urban pattern of four streets and five squares, along with the historic buildings and neighborhoods, form the cultural element. Since this is an urban-scale renewal, the functional element includes all basic urban functions.

Fig. 3-1 Penn and Holm's urban planning of Philadelphia
(Source: The formation and development of Philadelphia's open system)

Due to the irreplaceable role of the Delaware River and its harbor in the industrial and commercial development of early Philadelphia, early development of Philadelphia has been developing north-south along the banks of the Delaware River at the eastern end of the city, while proceeding relatively slowly to the west. As a result, the historic center of the city, including Independence Hall, Congress Hall, the banks, halls of commerce, and other public buildings of the capital, is concentrated mainly to the east, and the communities with historical and cultural characteristics, Old City and Society Hill are also located here. With the construction of City Hall, the city gradually developed westward, commercial buildings and other buildings moved closer to City Hall, the financial center moved away from the east, the status of the old city declined, and the upper-class people who used to live there moved to new neighborhoods. Thus, as the city changed, the cultural elements of Philadelphia remained in the east, but the physical elements and major functional elements of the city gradually expanded westward along the east-west axis.

3.2.3 Linking the material spaces:

3.2.3.1 Strengthening the axis

Before the renovation, Philadelphia's urban network was well organized, but lacked connectivity. The four areas of the city, southeast and northwest were each assigned a public space, which seemed to meet the needs of each area, but to some extent weakened the centripetal force of the city and left each area relatively fragmented. After the decline of the historic district, this fragmentation has become even more pronounced. To restore the vitality and commercial prosperity of the historic district,

Bacon reorganized the entire urban structure. This involved leaving the original grid almost unchanged as a skeleton, but by improving the pedestrian system, creating a greenway system and connected urban open spaces with a continuation of the east-west axis and a rail connection to the original strip park east of City Hall. A new axis is formed by a diagonal boulevard leading out from the City Hall as the central point. These measures will strengthen the horizontal and diagonal axis and create a new urban structure for Philadelphia.

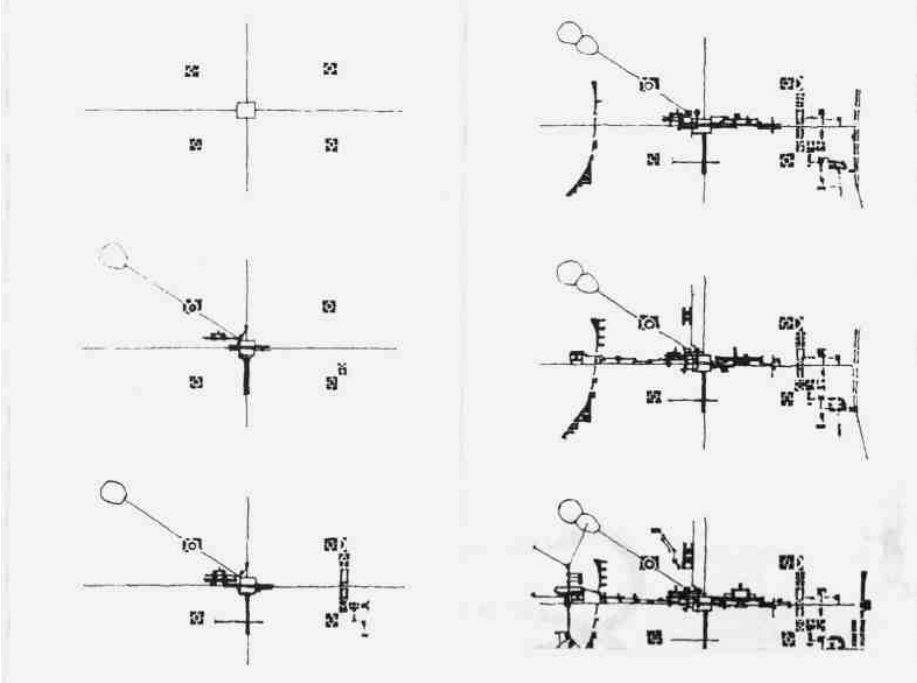


Fig. 3-3 Development of the Walking System in central Philadelphia
(Source: *Design of Cities*)

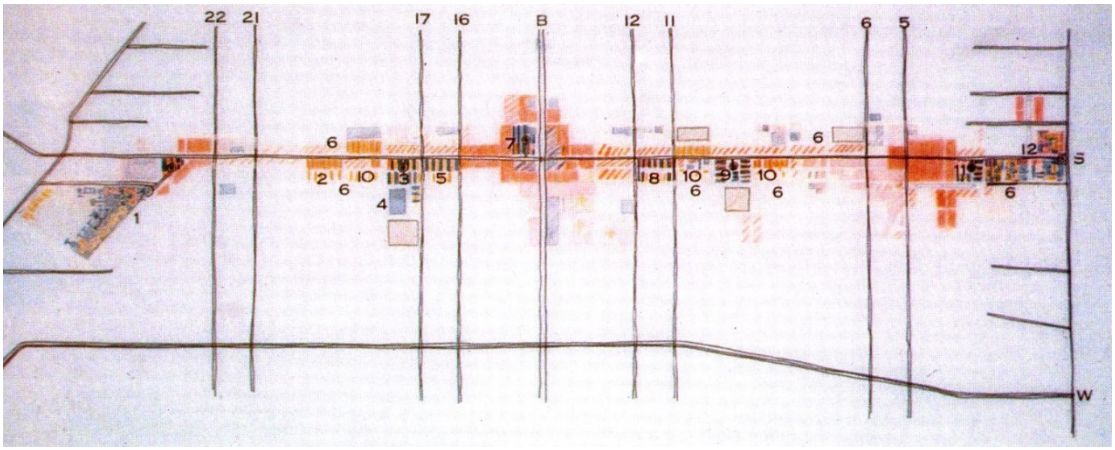


Fig. 3-4 South street activities map
(Source: http://hiddenarchitecture.net/the-philadelphia-crosstown-community/)

3.2.3.2 Organizing the transportation system

The transportation plan for Center City calls for three different types of interconnected movement systems: Cars connected to parking lots via the freeway system; commuters and passengers via the subway, rail, and bus systems; and pedestrians via separate sidewalks on lower or upper floors[28]. The organic integration of the three different transportation systems and their ability to efficiently serve the city is the culmination of Bacon's design for the Philadelphia renewal project[29]. To meet the daily recreational, work, and shopping needs of downtown citizens, Bacon created a continuous and complete system of secondary movement beneath the streets that allowed people to move from block to block and building to building, and to glimpse the sky from the ground. In 1953, for example, Robert Dewling followed Bacon's idea of a pedestrian level below ground as a continuous whole connected to the subway, bus stops, and underground parking garages, with roofs added to the entire space. The glass curtain wall brought street views and sunlight were introduced into the building, also visually connecting the subterranean and ground levels, as shown in Fig 3-5.

Fig. 3-5 Municipal service building with the introduction of urban landscape
(Source: *Design of Cities*)

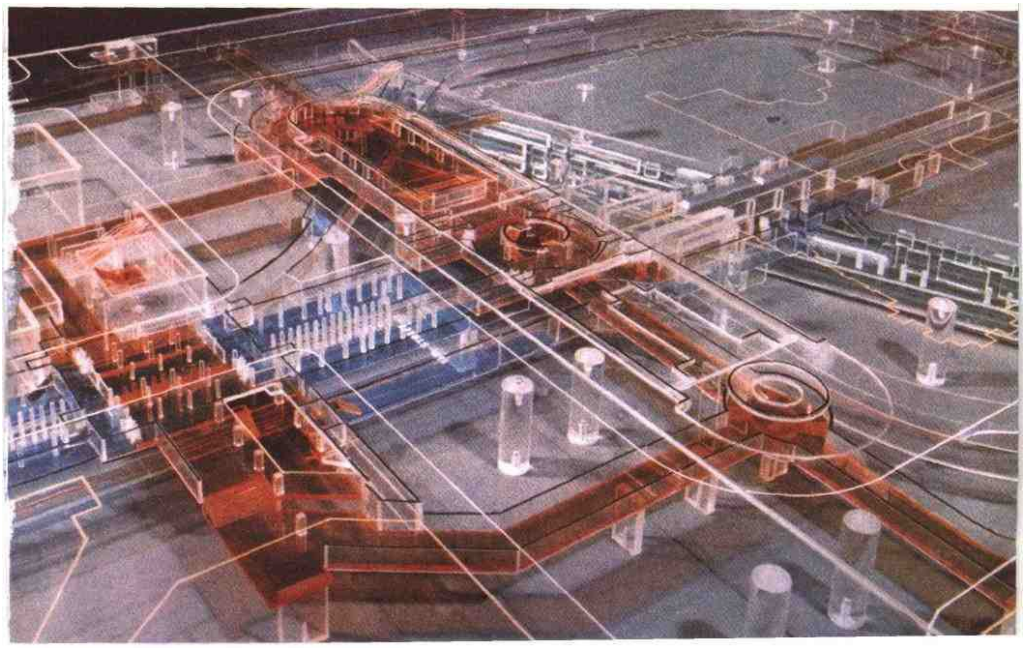


Fig. 3-6 Interweaving of transportation systems (brown for pedestrian system, blue for subway system) (Source: *Design of Cities*)

East Market Street is a typical integrated area where above-ground and below-ground spaces are linked and coupled. The initial scheme was connected directly to the subway station under the street through a sunken plaza on the street side, but that did not fit with the way people enter the stores directly from the street. The final scheme sets up a continuous semi-basement internal pedestrian street in the middle of several plots, with the first floor as the dominant pedestrian level, connecting the bus terminal, garage and the railroad passenger station on the north side. It connects the subway and stores to the south, playing the role of a node that maintains the continuity of the pedestrian streetscape while preserving the original spatial structure of the block at ground level and the mobile transportation mode, and more conveniently connecting the subway lines on both sides of the block. This design utilizes the entire site area in an integrated manner, preserving the original urban spatial structure to the maximum extent. The overall effect of the continuous semi-subterranean street brings vitality to the area, and the convenient connection with the two subway lines leads to a large concentration of people, which greatly promotes commercial development. The urban space is efficient and abundant thanks to the semi-subterranean streets.

Fig. 3-7 Original urban design for East Market Street, Philadelphia, USA
(Source: *Design of Cities*)

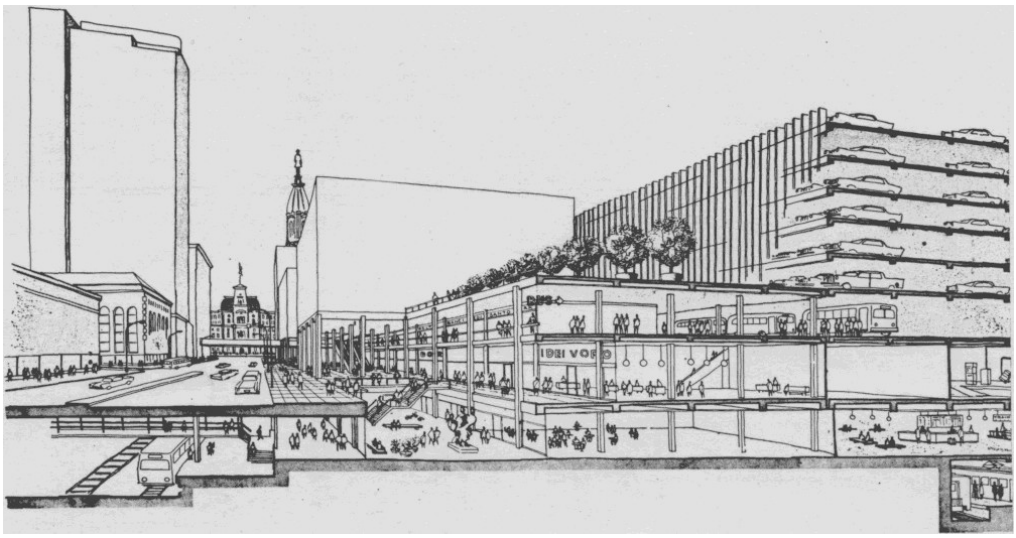


Fig. 3-8 Final urban design section of East Street, Philadelphia
(Source: *Design of Cities*)
(Notes: Subway on the left and underground commuter trains on the right. The center has three levels of retail shopping areas, the bottom on the subway floor, connecting the subway and commuter train system)

3.2.3.3 Connecting the new and the old

As the city developed at a rapid pace and historic areas withered, planners and architects faced the difficult problem of reconciling high-rise and slab type apartment buildings with eighteenth-century architecture-a problem that was particularly evident in the vast area east of Washington Square to the river. In the case of the Bay Tower in Philadelphia, for example, architect Preston Andrade originally planned six

residential towers, three on the waterfront and three on Washington Square. To reinforce the connection between the nearby colonial houses and the towers, I.M. Pei replaced the original slab type apartment buildings with three-story residential buildings. This transitional architecture mitigates the disruption of the interface caused by the passage of time and restores a dialog between the new and the old.

Fig. 3-9 The Design Scheme of Preston Andrade in 1958.
(Source: *Design of Cities*)

Fig. 3-10 Design scheme of I.M. Pei in 1960
(Source: *Design of Cities*)

3.2.4 Coupling multiple elements

The east-west pedestrian system reinforces the declining routes of the retail district and activates the downtown by linking commercial activities, recreational activities, and essential work life. A high degree of functional integration plays an essential role in this process, and this pattern of functional integration is now used extensively in urban design around the world. In terms of the natural landscape, Bacon believed that "greenways allow people to walk in the center of a neighborhood and connect different things[30]," creating a system of greenways and sunken gardens at the pedestrian entrances to the mall that creates a holistic urban and natural environment both horizontally and vertically. Particularly in the eastern portion of Washington Square, which extends to the banks of the Delaware River, large green spaces, garden paths, and "pocket parks" weave throughout the area, providing an "organic growing capacity." At the historic level, the significant buildings of the Society Hill neighborhood, also in the area, are connected by a system of greenways, with restored colonial-era homes, new townhouses, and apartment buildings creating a new order. Society Hill has been transformed from a "forgotten" and "once glorious neighborhood" into the historically appealing, street-level residential and tourist destination that Philadelphia is known for today. The Philadelphia Renewal Plan preserves and perpetuates the urban pattern of downtown Philadelphia from the city's 17th century beginnings and achieves appropriate coupling of time dimensions by continuing the urban fabric and preserving the overall pattern.

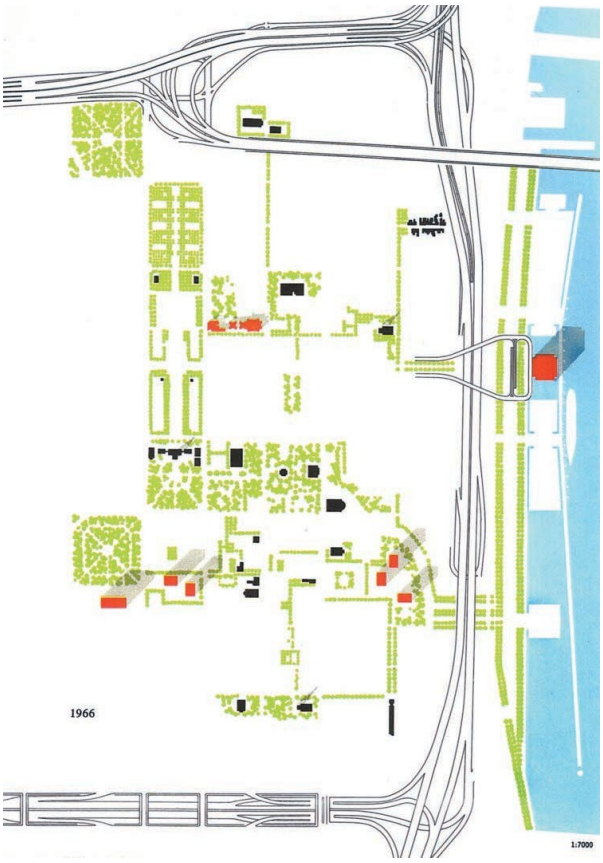


Fig. 3-11 Social Mountain Area (Source: *Design of Cities*)

(Notes: Greenway system-Green shows garden trails connecting important historic buildings, black shows through the old city and social Mountain, not along the street, but through the center of the block)

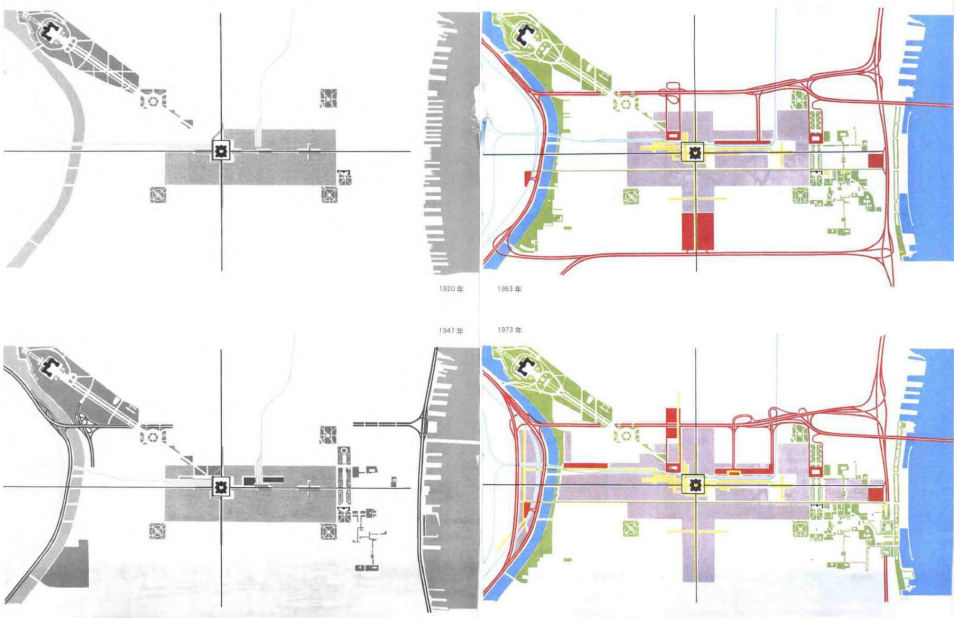


Fig. 3-12. Urban pattern of Philadelphia, 1920-1973.
(Source: *Design of Cities*)

3.3 Walkway as the linkage: Renewal of the Bastille-Greenway Viaduct in Paris

3.3.1 Project Overview

The French Bastille Greenway Viaduct was the inspiration for New York's High Line Park and is a classic example of linking abandoned infrastructure to the city. The Bastille Viaduct, a rail line running through the 12th arrondissement of Paris from the Bastille to Vincennes, became obsolete, fell into disuse and decay after the completion of the PER (A) line in 1969, and was scheduled for demolition. However, the viaduct's fate was revived in the 1980s as part of a bold urban renewal plan by the city of Paris. Sociologist Richard Sennett points out that "the essential feature of the urban experience is movement from one neighborhood to another, from one scene to another."[31] The renewal of the Bastille-Greenway viaduct has created a unique urban experience for Paris, bringing innovation to life in these neglected neighborhoods.

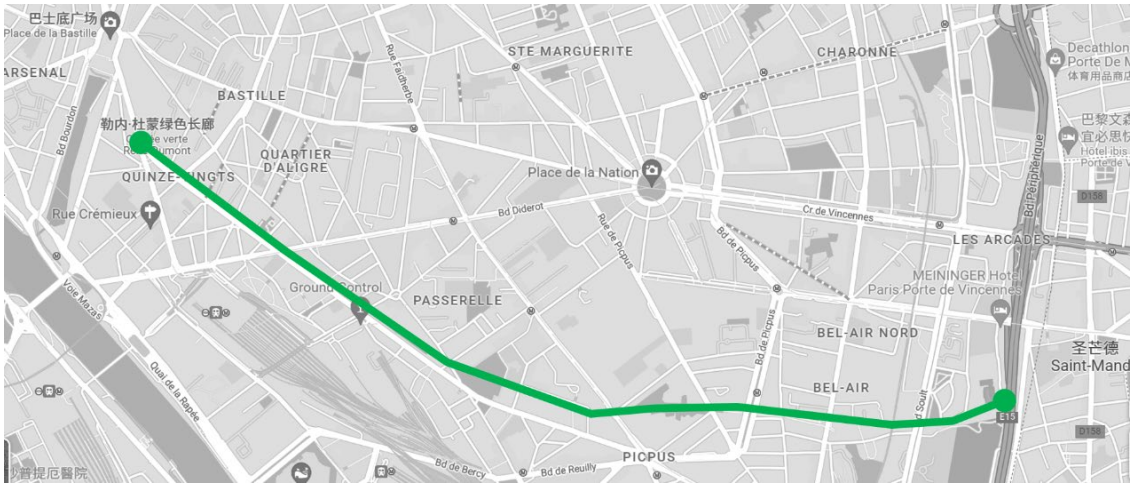


Fig. 3-13 Bastille Viaduct roadmap
(Source: Self-drawn from Google Maps)

3.3.2 Sorting out the elements

The most important physical element related to the coupling of this project is the preserved viaduct. The spaces above and below the bridge, as well as the nodal spaces through which the railway line passes, are the main spatial elements. In addition to the railroad facilities themselves as industrial relics, traditional businesses and old crafts that are representative of Paris are actively integrated into the renewal project as cultural elements. After the renovation, commercial, recreational and cultural functional elements are fully integrated into the project.

3.3.3 Linking the material spaces

3.3.3.1 Creating an organic axis

Unlike the diagonal straight axis of Paris or Washington, D.C., the Bastille Greenway Viaduct as a whole is more of an organic axis in the city, and its greatest effect is to facilitate the connection between the north and south, which were previously separated by it. Its northern side was originally the most prosperous traditional artisan district in Paris before it degenerated into a civilian neighborhood. The southern side, near the river and the train station, became a vibrant new neighborhood. Due to the lack of attention and poverty of the north side, the Paris government, after careful consideration, decided to preserve the elevated railway line as a "cover", but not in the spirit of heritage preservation and ecological restoration. The elevated railway line originally physically separated two very different areas through spatial fragmentation and visual obstruction, and deepened the social divide between the north and the south.

Fig. 3-14 Bastille Greenway Viaduct
(Source: https: / / kknews.cc/zh-hk/travel/nqqjky2.html)

On the 4.50 km track where trains used to run, architects Jacques Vergely and Philippe Mathieux designed the Promenade Plantée, a continuous, elevated, linear park. Thousands of trees, shrubs and flowers transform it into a green space that offers the experience of a green walk over the city while attracting people from all walks of life. The entire linear park is connected to the urban open space system, which links a series of pocket parks, open urban green spaces, and other public nodes into a continuous and complete spatial sequence. A viewing platform is constructed at each

intersection with the city street, allowing pedestrians to further approach the edge of the viaduct and perceive the different urban landscape between north and south, connecting the north-south divide through the human visual axis. Steps connecting the ground level with the elevated green corridor are evenly distributed throughout the greenway system. Thus, people can easily cross the greenway and walk to either the north or south side, realizing the urban connection of the north-south area in terms of physical space.

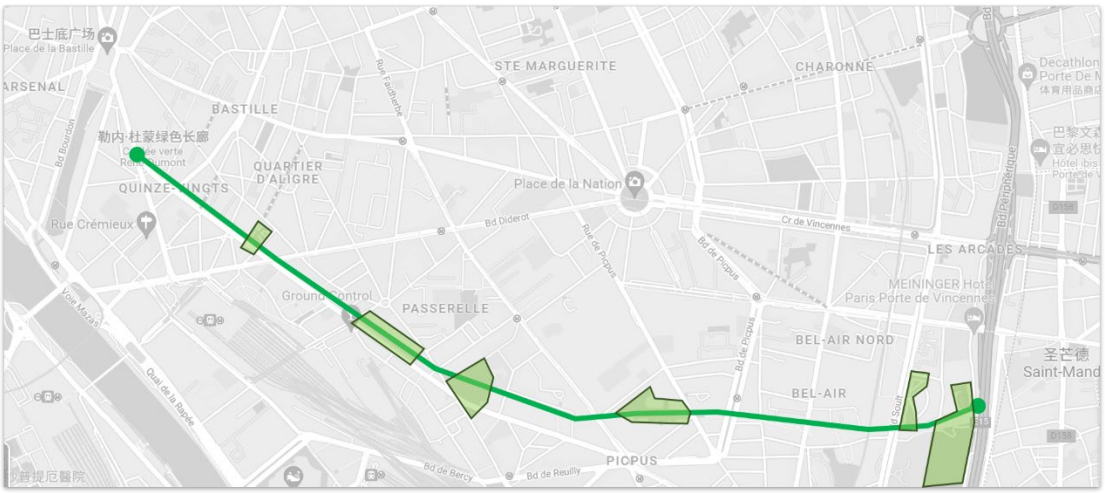


Fig. 3-15 Public space node map in series of the bastille greenway
(Source: Self-drawing)

Fig. 3-16 Connection between the Bastille Greenway and the Ground
(Source: http://www.patelmonica.com/viaduc-des-arts-case-study)

3.3.3.2 Unifying the external elements

In 1988, the team of architects transformed the 64 arcades under the viaduct into business premises. In terms of exterior form, all building components were executed

in traditional Parisian craftsmanship, with the traditional form of shutters from historic Parisian stores and arcaded streets transferred to the exterior of the stores to emphasize the historical significance of North Street and echo the Baroque façade across the street. The restored viaduct still follows the form of the warm red brick façade, which strongly echoes the adjacent older buildings, as seen in Figure3-17.

Fig. 3-17 Echoing the facade of the Bastille Viaduct and the surrounding buildings (Source: https://parisplusplus.com/paris/the-viaduc-des-arts-artisans-precinct-elevated-linear-garden-oasis/)

3.3.4 Coupling multiple elements

The Bastille-Greenway viaduct combines the richness of functions and the diversity of cultures carried by the various neighborhoods in two main ways: the integration of ecological and natural systems with the pedestrian system and the integration of commerce with cultural and industrial sites. Today, the Promenade Plantée, also known as the Coulée Verte, is a green pedestrian walkway loved by nature-loving Parisians and successfully regenerates the landscape in the city's historic industrial district. And the vault below has been transformed into a multifunctional commercial space for the city. The renovated art galleries, workshops and retail space are used by artisans such as glassblowers, jewelry designers, textile designers, furniture makers and restorers, tapestry makers and restorers, metalworkers and leatherworkers, some of whom practice rapidly disappearing local arts such as paper restoration and handmade flutes. They even set up their workbenches right in front of the windows so that any passerby can see the old crafts in action. "I do not think any of us own our craft," says one artisan, "we are just temporary keepers of our skills, and our job is to pass them on and act as a bridge to the next generation of artisans." Traditional artisans are increasingly being pushed out of the city due to high rents. Repurposing

downstairs spaces provides them with new studios, while the projects create new spaces for cultural exchange, responding to the city's growth while appropriately preserving local cultural traditions.

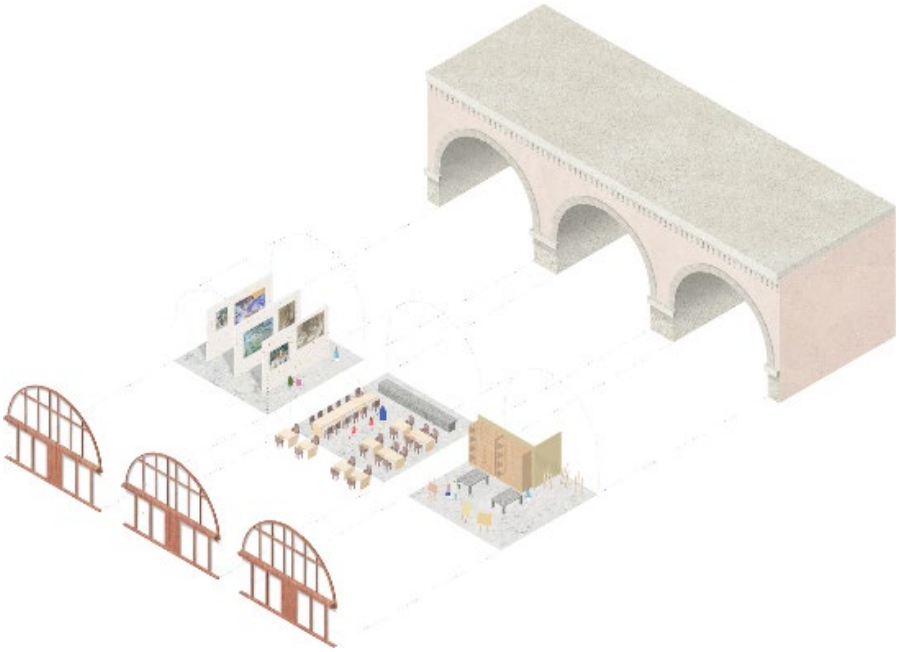


Fig. 3-18 Axonometric drawing of art arcade
(Source : http://www.patelmonica.com/viaduc-des-arts-case-study)

Fig. 3-19 Philippe Atienza's Shoe Studio in Viaduc des Arts
(Source: https: / / www.parisinsidersguide.com/viaduc-des-arts.html)

3.4 Public space as the linkage: Hillside Terrace Complex in Tokyo

Fig. 3-20 Aerial view of Hillside Terrace Complex
(Source: Archiposition)

3.4.1 Project Overview

The Hillside Terrace Complex is a masterpiece of Fumihiko Maki's cluster form theory, and the project integrates office, commercial and residential functions. The entire design cycle spanned 25 years[32], from 1967 to 1992, and Koolhaas considers it an example of "slow-growth urbanism." In this project, Fumihiko Maki faced the challenge: "How do the buildings and neighborhoods survive simple or complex changes in urban functions as phases of design? In fact, the design intent of the different phases consists of many elements, each of which has a different phase value, but which maintain a sense of continuity in the development axis of the neighborhood and the city of Tokyo as a whole[33]." Despite the long cycle, the designers have achieved a spatial and temporal continuity of the entire complex with the city at all levels through clever arrangements and small-scale designs.

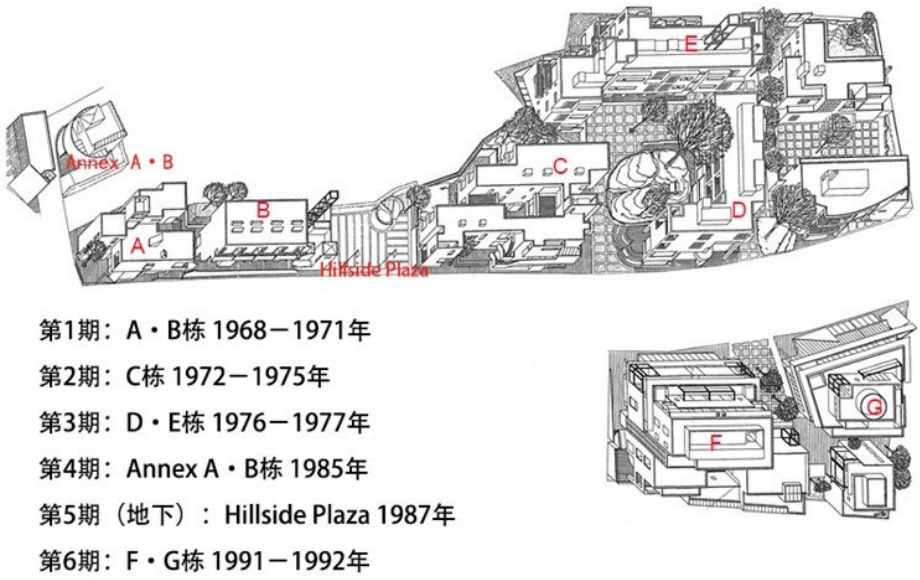


Fig. 3-21 Phase1-6 of Hillside Terrace Complex
(Source: Comprehensive Planning Research Institute of Maki)

3.4.2 Sorting out the elements

Unlike the previous cases, the project as a whole is characterized by the accumulation of various elements over time until 1992, when it was finally shaped into a complete neighborhood form. The physical elements are the residential buildings A-G, while the spatial elements are the public spaces and the circular paths they traverse. The core of the project is the reasonable embedding of open space elements to form a coherent overall neighborhood. The most typical spatial elements are the small squares, courtyards and public spaces between buildings. Cultural elements are embedded in the overall environment and atmosphere of the neighborhood, which spans more than two decades. Offices and residences are the main functional elements, with some of the spaces on the second floor used for commercial purposes. The neighborhood's open spaces also perform the functions of performing arts, gatherings, exhibitions, and other civic activities.

3.4.3 Linking the material spaces

3.4.3.1 Linking up public spaces

There are no rigid axes or hierarchies in the overall layout of the building complex. Instead, the openness of the public space is uniformly visible throughout the complex,

and multiple permeable relationships connect the buildings to the city. In the Hillside Terrace Complex, the first floors of phases one to six are relatively open to enhance the continuity of the buildings. Maki has created various levels and types of rich public spaces here: small spaces formed by buildings and streets, courtyards formed by buildings and terraces, or sunken plazas and elevated spaces on the first floor. They are interconnected in a rational and continuous way, forming the thread that connects all the parts.

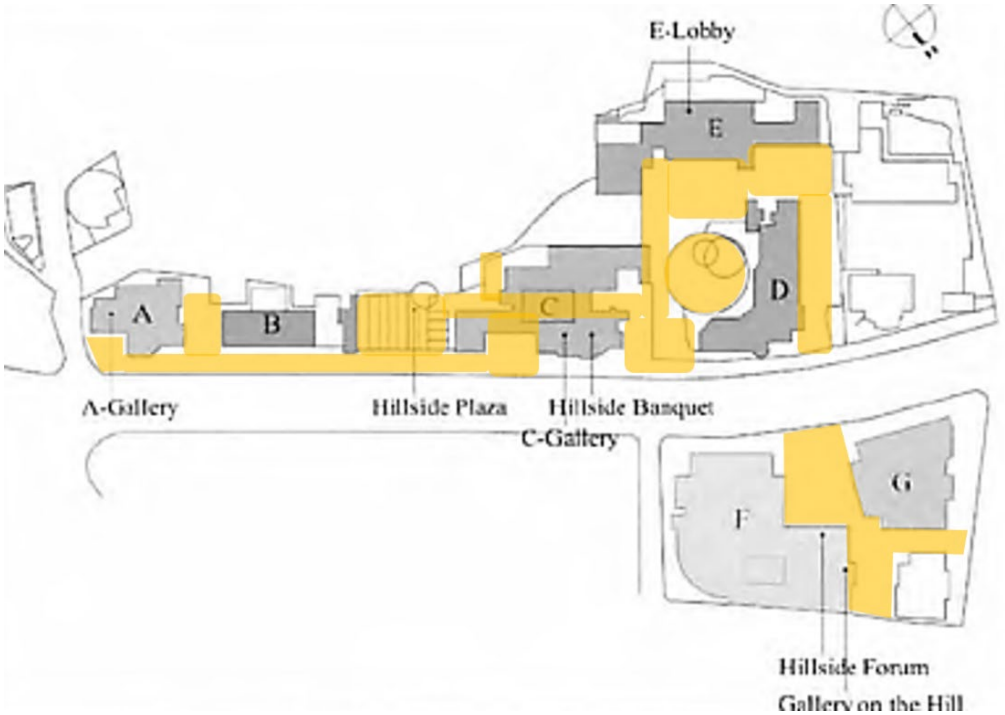


Fig. 3-22 Schematic diagram of the open space of Hillside Terrace Complex
(Source: self-drawing)

Fig. 3-23 Overhead space of Building C
(Source: Archiposition)

The public space of Hillside Terrace is divided into three main levels: the first level is the square, the second level is the outdoor open platform, and the third level is the indoor public space, such as the spatial design of the entrance, stairs, and other places. The three levels are progressive and form a continuity and richness of space.

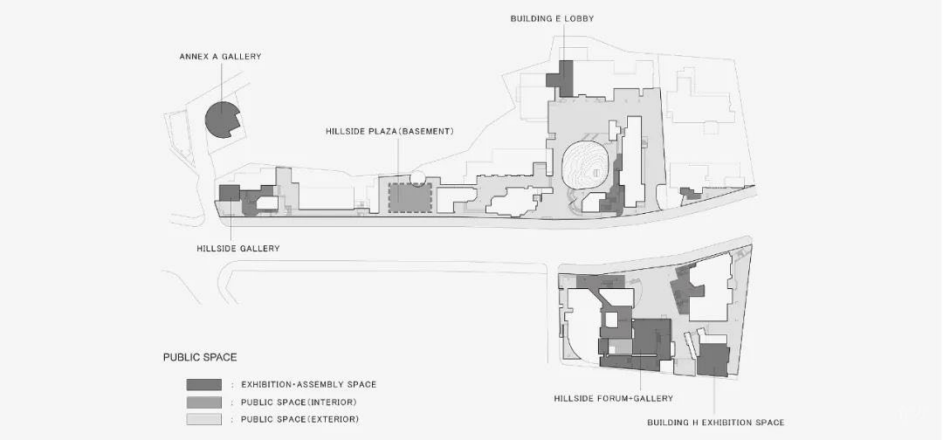


Fig. 3-24 Public space hierarchy diagram
(Source: DOCOMOMO)

3.4.3.2 Continuous facade

It also forms the continuity of temporal and physical dimension in external processing. In the temporal dimension, the correlation coupling of the interface is mainly reflected in the meaningful application of materials. Fumihiko Maki hoped that each phase could not only be harmonized with the previously constructed buildings, but also reflected the current architectural features.

Hillside Terrace Complex also forms a continuum of temporal and physical dimensions in its external design. In the temporal dimension, the coupling of interfaces is reflected primarily in the rational application of materials. Fumihiko Tseng wanted each phase to form a unity with the previous buildings and to reflect the current architectural features. Therefore, he did not use the same stuccoed concrete for all building materials in the entire cycle as in the previous two phases, but kept adding new building materials that corresponded to technological developments at that time. For example, in the third phase, stuccoed concrete was sometimes used as a transition, while in Building D a new material, hard tiles, was used. In the VI phase, metal materials such as aluminum and perforated metal panels began to be used, and glass facades were also increasingly used, giving the buildings time. Although the use of materials reflects the change of time, the detailing of each phase of the building allows a connection to

emerge, such as the consistency of material tones and the uniform use of perforated metal balustrades, making the entire complex rich and full of detail and also taking into account its continuity and evolution as a whole. In his article "The Qualities of a Modernist" he said: “We live in an age of industrial products - from glass to metal to all other man-made products - and I want to use these materials in a more sincere way, dealing with the smallest details and little things that can create a richer feeling. I am interested in how we can use modern materials to create the same kind of architecture that these old houses have.”

Fig. 3-25 External facade in Phase III
(Source: Archiposition)

Fig. 3-26 External facade in Phase VI
(Source: Archiposition)

In addition to temporal continuity, Maki's careful treatment of the facade also achieves visual interface continuity. In the design of the sixth phase, the building height of Building F reached 19.5 m, with one floor below ground and five floors above ground, as it is located on the north side of the street and is no longer constrained by the building regulations of 10m height limit and 150% floor area ratio[34]. However, Maki has cleverly selected a horizontal eave of Building F at 10 m height and set back the volume of the 4th and 5th floors to diminish the oppressive feeling caused by the

increased volume. When pedestrians walk around the building, they have the same spatial experience as the 10-metre-high building volume of the first three phases.

3.4.4 Coupling multiple elements

From a holistic perspective, Hillside Terrace Complex respects subtle topographical changes. Maki breaks up the building volumes and staggers them back and forth rather than smoothing the base, creating a correlative coupling of the natural urban environment and the man-made construction. The design of each phase corresponds to Tokyo's changing environment, forming a good relationship with the street on the facade, and the various public spaces take a consistent approach to the street openings, creating a unified order. All these measures show the harmonious connection between the Daikanyama Collection residences and the city as a whole. The mixed-use complex with residences, stores and offices integrates various functions and enhances the vitality of the place. Over the past 10 years, various cultural events such as art exhibitions and musical performances have been held here, integrating urban culture into the physical form of the city.

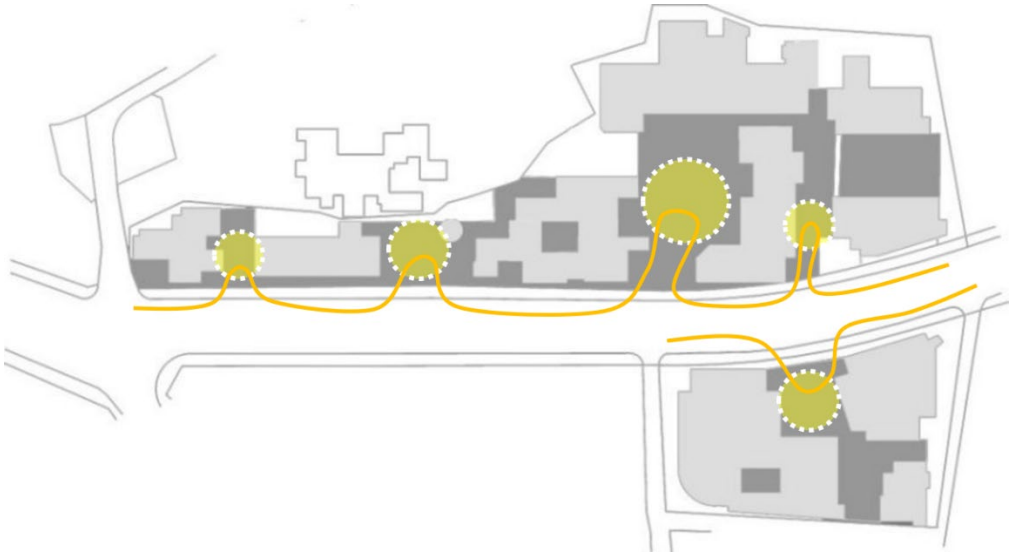


Fig. 3-27 Relationship between buildings and streets of Hillside Terrace Complex (Source: self-drawing)

3.5 Historical context as the linkage: Kuanzhai Alleys Transformation Project in Chengdu

3.5.1 Project overview

Kuanzhai Alleys is located in the east of Qingyang District in Chengdu, Sichuan Province, and has a core area of about 6.66 hectares. This historic district mainly consists of three parallel streets, namely Kuan alley, Zhai alley and Jing alley. Dozens of traditional quadrangles are distributed between the three alleys. Most of the buildings in this district are courtyard buildings from the Republic of China period, and most of them are in the traditional architectural style of Western Sichuan. A few buildings date back to the Qing Dynasty, but their styles and features have been severely damaged by wars or other human influences. As the "orphan" of the architecture of Kuanzhai Alleys in northern China in the south, the urban structure and architectural style have remained almost unchanged.

Since the beginning of the Qing Dynasty, Kuanzhai Alleys were mainly used for residential and retail businesses as a place to live and stay for troops stationed in the army. After the 1911 Revolution, many dignitaries built many mansions here. After 1949, the government allocated Kuanzhai Alleys to employees of state-owned enterprises as a welfare house for employees of state-owned enterprises. To this day, Kuanzhai Alleys have retained their main function as a residential home. Until 2003, Kuanzhai Alleys in Chengdu merged the cultural industry with the tourism industry, forming a complex historical and cultural area with distinctive regional characteristics and rich Sichuan cultural atmosphere.

Fig. 3-28 Location of Kuaizhai Alleys (L) Fig. 3-29 Aerial view of Kuaizhai Alleys (R)
(Source: Kuanzhai Alleys analysis report)

3.5.2 Sorting out the elements

Kuanzhai Alleys in Chengdu, which served as a resting and living place for Qing Dynasty soldiers in China, houses a large number of historical relics of Qing Dynasty architecture. The three parallel streets and the open spaces such as the eastern square at the entrance are the main spatial elements. Historic buildings, traditional courtyards and scenic vignettes with folkloric features, as well as historical memories conveyed through cultural activities, are the historical and cultural elements that fill the entire area. The main functional elements of the entire district are tourism and commercial functions, with the main business forms being bars, cafes and other leisure and entertainment venues, specialty restaurants and shopping.

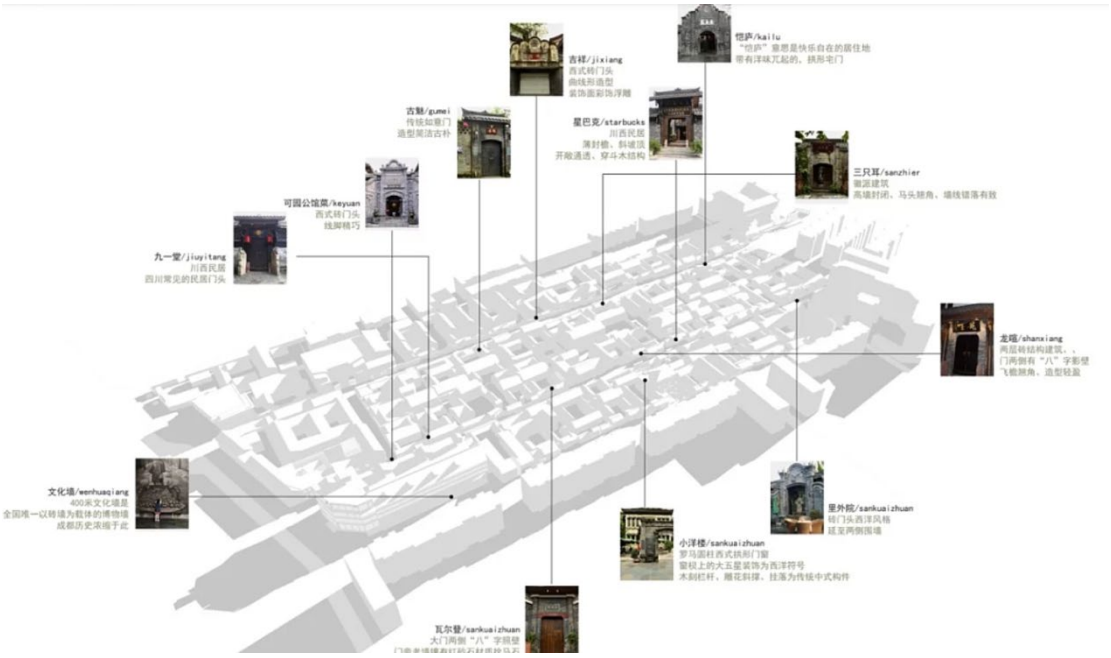


Fig. 3-30 Distribution of historical and cultural elements of Kuanzhai Alley (Source: www.zcool.com.cn/work/ZMTY2NTIxMjQ=.html)

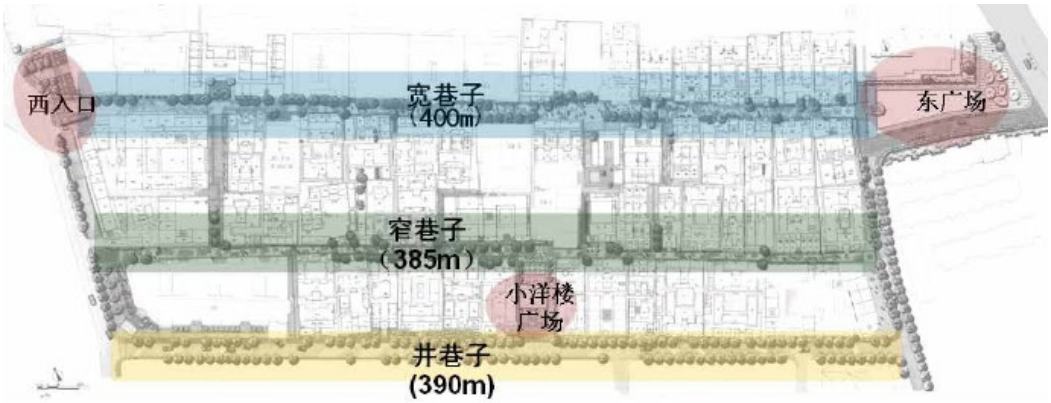


Fig. 3-31 Distribution of spatial elements in Kuanzhai Alleys (Source: Analysis and explanation of Kuanzhai Alleys Historic District)

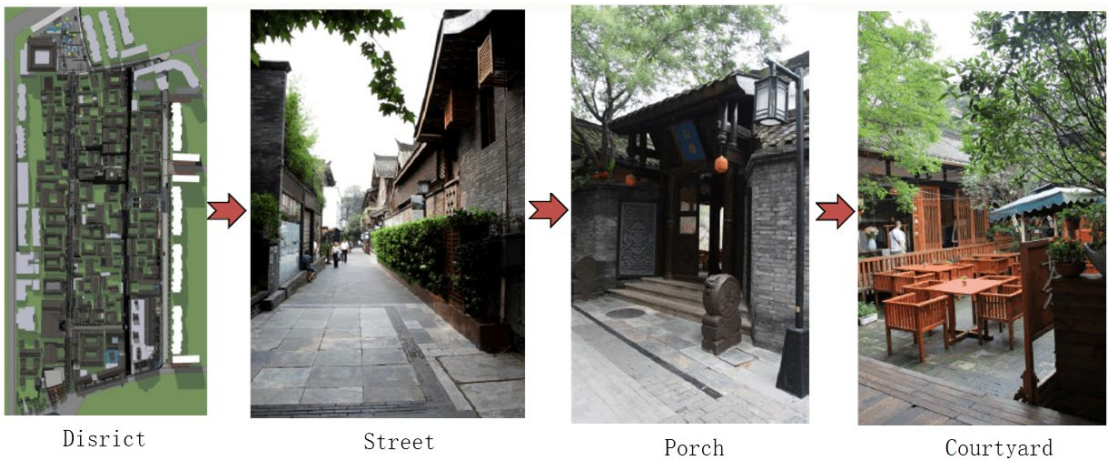


Fig. 3-32 Spatial level: District-Street-Porch-Courtyard
(Source: Kuanzhai Alleys analysis report)

3.5.3 Linking the material spaces

3.5.3.1 Three alleys as a structured walking system

The road network pattern of the Kuanzhai Alleys district is laid out in a mesh pattern, with a good match to the traditional herringbone pattern of the surrounding area. The pedestrian system in this area is mainly based on the horizontal Kuan Alley, Zhai Alley and Jing Alley as the main streets, and the three main streets are connected by eight vertical alleys, with a total street length of about 2150 meters in this area. The complete pedestrian system links Chengdu's urban folk culture, tea culture, Sichuan opera culture and other historical information, and connects them with the carefully created nodes to form a spatial sequence with storytelling, enabling people to recall special historical memories in every place in this area.

Fig. 3-33 Road pattern in surrounding area (L)
（Source：Google map）
Fig. 3-34 Pedestrian system in Kuanzhai Alleys (R)
(Source: www.zcool.com.cn/work/ZMTY2NTIxMjQ=.html

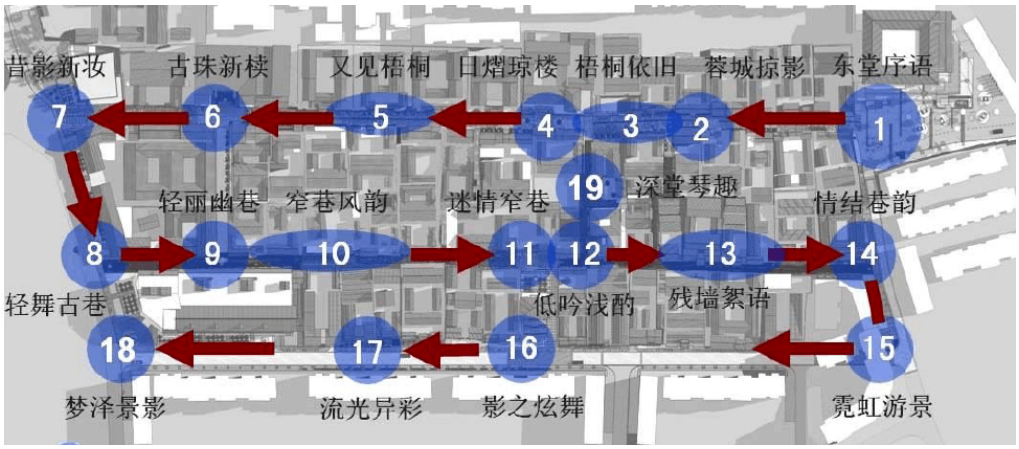


Fig. 3-35 Landscape nodes and spatial sequence of Kuanzhai Alleys
(Source: Kuanzhai Alleys analysis report)

3.5.3.2 Harmony of external interfaces

The interface of Kuanzhai Alleys is rich and unified, providing an important thread of connection for the entire area. The renovated building complexes essentially continue the stylistic features of the original old buildings. Building materials and structural forms have been retained in a more comprehensive manner. In the vertical interface, for example, on some larger walls, in order to eliminate the drabness of some areas, some modern materials or different collages are used in accordance with the features of the historic landscape, which enrich the street facade without causing a sense of conflict at the same time. Alternatively, the original facade is maintained and another wall is built on the outside of the building with a frame of modern materials such as glass and steel, while a collage of tiles with classical patterns is placed on the inside of the frame, creating a fusion of modern and traditional, such as the residential facade of Residence 38.



Fig. 3-37 Fig. 3-38 Fig. 3-39 Façade forms of Kuanzhai Alleys
(Source: Kuanzhai Alleys analysis report)

Fig. 3-40 Kuanzhai Alleys 38 residence outer wall
（Source： From the Perspective of authenticity on the Protection and Reconstruction and Development of Kuanzhai Alleys in Chengdu）

In the horizontal interface, the same stone paving is used as the main tone, and the uniformity of paving materials suggests the relevance and uniformity of the historic area. The matching of the different paving forms enriches the streetscape and plays a certain role in the articulation of the streetscape. Fine paving is laid at the landscaped intersections to strengthen the attractiveness and significance of the intersections.



Fig. 3-41 Fig. 3-42 Fig. 3-43 Pavement forms of Kuanzhai Alleys
(Source: Kuanzhai Alleys analysis report)

3.5.4 Coupling multiple elements

The original culture of Chengdu is the soul and main attraction of Kuanzhai Alley: Gaiwan local tea, exquisite door ornaments, sycamore trees, courtyards, tea houses, Sichuan Opera and other scenes of the cultural atmosphere of ancient Chengdu are important elements that make up the attraction of Kuanzhai Alleys. The coupling of Kuanzhai Alleys is mainly reflected in its deep penetration of Chengdu's history and local culture into the spatial-material elements of the district. For example, the use of three alleys as structured walkways connects the important historical and cultural nodes in the area into experiential walkways with a sense of narrative, or the use of

creating a cultural wall to visually represent history, whether it is a post office, daily necessities, or a barracks-themed wall design, all of which show how the residents of Kuanzhai Alleys once lived. On the other hand, integration is reflected in the mutual adaptation of function and neighborhood culture. Areas with a single residential function, such as Kuanzhai Alleys, are always in a disadvantaged position under the influence of economic development. Therefore, when preserving historic districts, other functions that do not affect the character of the landscape should be added in an appropriate manner, and the added functions should not be considered in isolation, but should be placed in the context of the overall culture of the city and the region. All commercial symbols are based on the theme of "Sichuan" culture, which highlights the cultural characteristics and spirit of the place. The district also uses open spaces such as squares to carry out a series of activities that convey history and culture, such as tea learning activities, traditional musical instrument playing activities, Sichuan opera activities, etc., so that people can recover the sense of authenticity from the modern commercial atmosphere and continue the spirit of the place.

Fig. 3-44 South cultural wall of Jing Alley
(Source: Analysis and explanation of Kuanzhai Alleys Historic District)

Fig. 3-45 Fig. 3-46 Cultural display walls of Kuanzhai Alleys
(Source: Analysis and explanation of Kuanzhai Alleys Historic District)

3.6 Method summary and inspiration of case study

Table.3-1 Case method Summary

Case		Philadelphia Renewal Program	Bastille Greenway Viaduct Renewal	Hillside Terrace Complex	Kuanzhai Alleys Transformation Project
Core Linkages		Traffic System	Walkway	Public Space	Historic Context
Connecting Elements	Physical Elements	Historic buildings, modern buildings	Abandoned elevated rail facility	Residential buildings	Historic buildings, Historical component
	Spatial Elements	Streets, squares, landscape spaces	Streets, landscape spaces, nodes open spaces	Square, courtyard	Streets, squares, courtyard
	Cultural Elements	Historic districts, historic buildings	Industrial sites, traditional crafts	Urban culture	Local culture, historic buildings
	Functional Elements	Urban functions	Commerce, leisure, culture, transport	Residence, office, commerce, culture	Commerce, leisure, culture, tourism
Linkages of Physical Spatial Elements	Axis	Green corridor, transverse axis	Organic green axis	No reflection	3 main alleys
	Route	Multiple motion system	Greenway linear park	Using paths to connect public spaces	Using paths to connect historic nodes
	Interface	Transition of old and new building forms	Similarity of building materials and unification of craftsmanship	Unification of building materials and building height	Unification of building styles, wall materials and pavement forms
Multi-element Coupling	Function	Use the pedestrian continuum to link commercial activities, recreation and working life.	The space on the bridge is coupled with the functions of walking traffic and recreation, and the space under the bridge is coupled with the functions of commerce, culture and art.	The community combines residential, office, commercial and other functions.	Mainly for tourism and commercial functions.
	Fabric	Retaining the general pattern of the 17th century.	Coincide with the original fabric.	The rear part refers to the original fabric.	The original urban fabric is preserved.
	Culture	Restoration historic district.	Continuation of traditional local craftsmanship and art.	Tokyo's urban culture is embedded in the community's public spaces.	Chengdu's ancient culture and historic culture are embedded in the alley space and modern functions.
	Nature	Use greenway systems and sunken gardens to connect important historic buildings.	Ecological nature and walking system integrated into linear park.	The arrangement of the complex respects the original terrain.	Preserve ancient trees and create landscapes related to historical scenes.

(Table source: self-drawing)

By analyzing the above four cases, the author summarizes the following rules that the integration of the old urban areas with linkage coupling thoughts has:

(1) There are many ways to classify urban elements, but the entity elements, spatial elements, cultural elements and functional elements must be considered when integrating the old urban area.

In the old urban areas, physical elements are generally based on traditional buildings and industrial sites and often overlap with historic and cultural elements, such as the traditional courtyards in the Kuanzhai Alleys, abandoned viaducts in the Bastille case or other industrial relics. Spatial elements on a large scale are mainly represented as landscape spaces and road or plaza spaces, such as the plaza nodes in Philadelphia and the green nodes linked by the Bastille Viaduct. At a smaller scale, the spatial elements are mainly street or alley spaces and small public open spaces, such as the various public spaces in Hillside Terrace Complex and the traditional alley spaces in Kuanzhai Alleys. The cultural elements are reflected in the physical and spatial elements mentioned above, on the one hand, and in the regional customs and cultural characteristics on the other, such as the handicraft culture in the case of Bastille Viaduct and the local tea culture in Kuanzhai Alleys. The functional elements are determined by the type of the old urban areas and the development trend of that area.

(2) Whether it is the urban reconstruction of the old urban area or the renovation of the old urban infrastructure, the axes and the path are important linear correlation paths, and the effect is also the most important.

In the Philadelphia Renewal, for example, the structure of the entire city is more clearly defined by strengthening the east-west axis with a pedestrian system. In the case of the Bastille Viaduct, its transformation into a pedestrian greenway effectively ties the city's nodes while providing a cohesive effect to the areas on either side of the linear viaduct. The three parallel alleys and branches in Kuanzhai Alleys serve as a pedestrian system. They create the tangible conditions for the linear connection of the scattered historical heritages and at the same time give them a certain spatial sequence, so that the various elements can form a system.

(3) Urban public space is the most important place for people's urban activities. It has a strong mediating character, which can guide various activities to achieve the effect of connection. Therefore, using the linear urban structure to connect the urban public space is the most common linking and coupling method, which is suitable for the old urban area at different scales.

In Hillside Terrace Complex, public space is the most important form of linkage and

coupling. The different levels of public space have varying degrees of connecting effects. In addition, the rational organization of various types of open spaces such as entrance squares, elevated spaces, and pocket parks gives the public space a systematic and cohesive character, thereby giving the neighborhood an intrinsic spatial connection. On a larger scale, the various large public squares that serve as intersections in Paris and Piazza San Marco in Venice are strongly coupled spaces and embody this approach.

(4) The interface of a city has a direct impact on the vision. Echoing the interface form is an important design technique to realize the connection between the new and the old and give people a sense of harmony and unity.

In the renovation of Bastille Viaduct and the renovation of Kuanzhai Alleys, the new construction parts are integrated into the historical environment, and the unity of modernity and tradition is achieved through the treatment of the interface. Hillside Terrace Complex has undergone nearly thirty years of construction, and the building facades have been renovated in terms of materials and construction measures, but the harmonious unity of the neighborhood has also been achieved through the treatment of details.

(5) For the integration of the intangible level, the coupling is achieved by attaching the intangible elements (cultural elements, functional elements) to the physical urban environments. Through the linkage and coupling of function, urban fabric, history and culture, connections will be built in the temporal dimension and psychological dimension, making the city a complete system.

The culture, history, fabric, and other intangible elements of the old urban areas are difficult to grasp systematically, and to make them interrelated as a whole they must be considered together with the tangible elements. For example, in the regeneration of Philadelphia, the coupling of commercial, recreational, office, and transportation functions is achieved through the connection of three-dimensional spaces. In the case of Kuanzhai Alleys, the clear spatial structure allows people to experience the traditional cultural atmosphere continuously.

3.7 Summary of the chapter

The four cases selected in this chapter show how urban planners use linkage coupling thoughts to integrate old urban spaces from different eras and regions into a continuous, complete, and new urban space. In terms of scale, the four cases are of different scales and are divided into the urban-scale: Philadelphia Renewal Project and the Bastille Greenway Viaduct Renewal, and the neighborhood-scale: Hillside Terrace Complex and the Kuanzhai Alleys Transformation Project. Through the difference in scale, it makes more sense to summarize the methods of linking the old urban areas with the surrounding urban space at a large scale and the methods of integration at a small scale within its own area, in order to make the spatial integration of the old urban areas as comprehensive as possible.

Despite the different contexts of the projects, the author tries to find regularities between them, such as connecting elements that can be roughly divided into four categories: material elements, spatial elements, cultural elements and functional elements. As well as generally applicable integration methods, such as the use of axes, roads, and interfaces to establish spatial linkages, and the use of coupling functional, urban textural, cultural, and natural with other tangible elements to strengthen the connection of various elements. In this chapter, the author analyzes and summarizes relevant cases to pave the way for the elaborations of detailed strategies and illuminate how future designers will judiciously treat old urban space and realize the linkage and coupling with modern functions and historical heritages.

CHAPTER 4: Spatial Integration Strategies of Old Urban Areas Based on Linkage Coupling Thoughts

Peter Smithson once claimed that “buildings should be thought of from the beginning as fragments, containing within themselves a capacity to act with other buildings and be themselves links.” [1] Urbanization, in their understanding, should be considered as the product of a linking process that leads from a point to a line, from a line to a surface, and then from a surface to space[35].

4.1 Principles of establishing connections

The connection of the various elements in the city is not accidental. Unreasonable connections not only do not contribute to the integration of the urban environment, but also destroy the original sense of order in the city. Only when certain principles are followed do such connections contribute to the unity and order of the city, making the external environment an organic whole. Generally speaking, the connection between elements should have the three principles of mutual interaction, continuity and convenience.

4.1.1 Mutual interaction

Linkage coupling thoughts advocates not only formal and external connections, but deeper and internal connections reflected in interactions. It can help us find clues in the environment so that the design can be integrated into the existing order and integration with the environment is achieved, and it also helps us create a new order from the disordered environment. For example, in I.M. Pei's East Wing of the National Gallery of Art in Washington, D.C., the order of the East Wing was created by taking the order of the longitudinal axis of the old wing and integrating with the order of that axis. (Fig. 4-1). Another example is the design of the Piazza Ananzetta in Florence, Italy, where the three buildings were built in different historical periods but work together harmoniously to create the same urban space. This is because the successors, recognizing the forms created by their predecessors, adopted the same arcades by interacting with the older buildings to determine the connection, while finally constituting a perfect square. (Fig. 4-2). When creating new connections in the urban

[1] Peter Smithson, manuscript in: Baker, John (Ed.), ‘A Smithson File’, Arena. The Architectural Association Journal, February 1966, p.21.

environment, it is important to grasp the relationship between the urban environment and the new elements and spaces, paying attention to the forces and counterforces between them, in order to obtain a new order that essentially has a real connecting effect in essence.

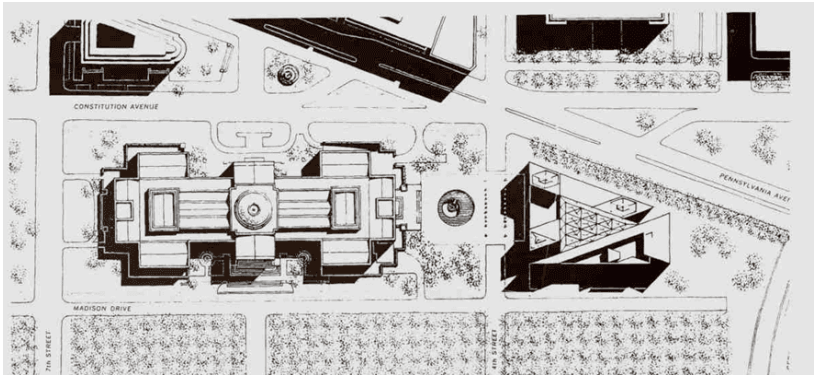


Fig. 4-1 National Gallery of Washington, East Hall and West Hall
(Source: https://read01.com/zh-mo/2zzB2P.html#.YrHtbdpBzb0)

Fig. 4-2 Plan and Section of Ralanzeta Plaza in Italy, Florence, Italy
(Source: *Urban Space Design*)

4.1.2 Continuity

The establishment of a connection must also provide the possibility of growth[36]. This connection is infinitely open and expansive, and it should have the tendency to grow outward to accommodate all kinds of elements and forms of activity in its vicinity, while itself serving as a lifeline that sustains the whole, like the stem of a plant, the spine of a human being, and so on. As the "linkage line" continues to grow, it will provide more open space, allowing the open system to expand throughout life, organizing the complex urban environment. Continuity enables the orderly expansion and expansion of areas and groups, and such expansion and expansion can effectively maintain and continue the existing morphological order, which is meaningful for the sustainable development of the environment, the renovation of old cities and the expansion of building clusters. For example, the development process of the second phase of Charles de Gaulle Airport in France, from the design of both Terminals A and B in 1972

to the design of Terminal E in 1997, spans a period of 25 years, but the entire building complex is integrated, with the idea of opening and growing along the axis of the "linkage line" and leaving room for further opening and acceptance as the basis of its success[37].

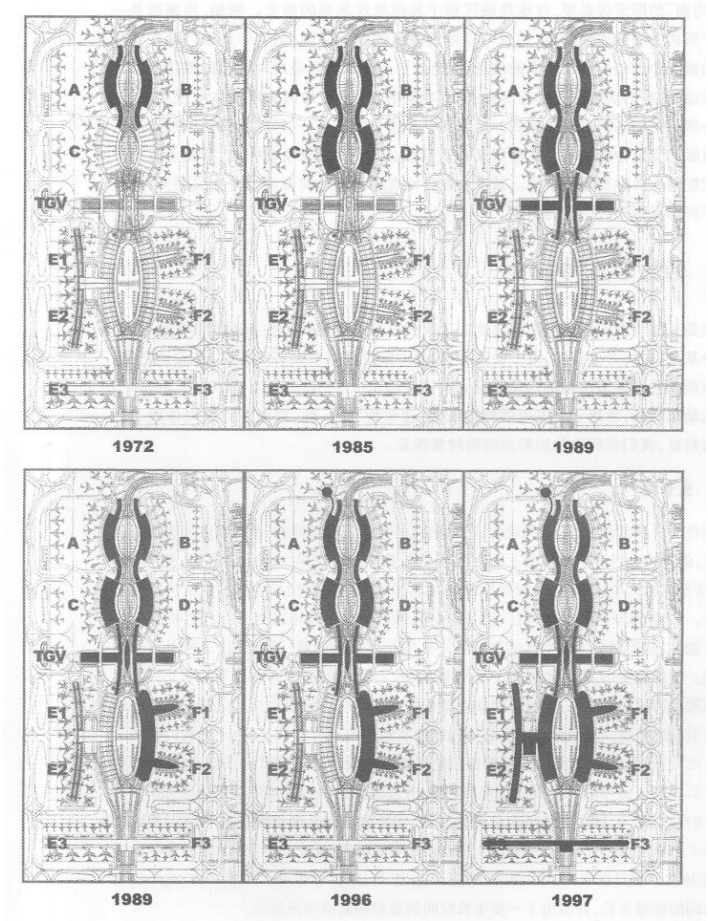


Fig. 4-3 The development process of the second phase project of Charles de Gaulle Airport in France

(Source: *Urban Architecture*)

4.1.3 Convenience

Linking and coupling between urban spaces should help maintain the road network and strengthen connections between surrounding neighborhoods. Only convenient connections can promote the use by people, stimulate more the vitality of places and create a positive interactive relationship between elements within the connected network. For example, in the Roman conversions of the Baroque period, the addition of diagonal paths greatly improved the ease of movement between key nodes. The association of multi-level transportation systems and the city's three-dimensional vertical connections reflect a concern for convenience and efficiency as an effective urban link.

4.2 Classifying the linking and coupling elements

These urban spatial problems are often due to the fact that old and new elements are not harmoniously integrated or that more spaces have been lost due to the demolition and construction of the city. According to the author, the spatial elements of the old city can be mainly divided into four categories: physical elements, spatial elements, historical and cultural elements, and functional elements. These four types of elements can be divided into two major parts. One part is categorized as material elements, that is, physical elements and spatial elements, and the connection between the elements in this part mainly emphasizes the explicit connection and focuses on the relevance of the material environment. The other part is the non-material elements, i.e. historical and cultural elements and functional elements. The connection between them focuses on the integration, mostly the implicit connection, and emphasizes the coupling of the perceptual environment.

4.2.1 Tangible elements

The tangible elements in the city can be divided into physical and spatial elements.

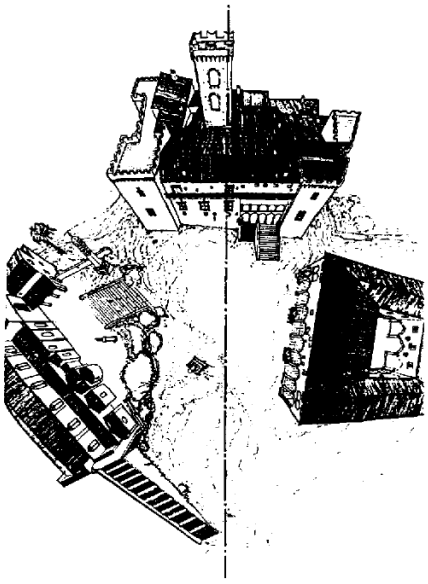
4.2.1.1 Physical elements

The physical elements in the city mainly refer to buildings, structures, signs, greenery and trees, natural hills and so on[38]. In the old urban areas, the historical protective buildings, historical relics, ancient bridges, ancient city walls, famous sculptures and other physical elements are all physical elements.

In urban renewal, we should focus on sorting out the scattered and fragmented physical elements, such as the listed historic buildings. Jonathan Barnett's famous saying that "urban design is designing cities, not buildings"[39] means that not designing buildings is not the same as not studying them. To integrate the relationships between urban elements, it is necessary to analyze the relevant elements, including buildings, and anticipate their functional and morphological possibilities. Taking into account their adaptability to the environment, it is then determined whether they should be preserved, removed or renewed and adapted. In turn, we analyze how to achieve the combination of old and new, functional replacement and interface treatment, etc.

In the treatment of the physical elements, unity and harmony with the surrounding environment is the constant principle. According to Maki in the modern urban structure

there is no isolated building or space that is not connected to the surrounding city. All buildings and spaces have a "multilateral relationship" with the site and the surrounding environment. This architecture and space are the "fundamental particles" of the city.[40] For example, the Piazza del Capito in Rome, Italy, was originally built in the Roman era and added to and renovated many times until the Renaissance, when Michelangelo led the renovation and additions, and finally became a complete group picture after more than 700 years[41]. Originally, the square had two buildings from the Middle Ages (the Senate in the middle and the Supervisory Courtyard on the right), which had an ambiguous angle between them. Michelangelo designed a new building on the other wing (the new addition of the Temple Museum in front of the Cathedral on the left), whose height and form were the same as the renovated Supervisory Courtyard on the right and formed the same acute angle with the Senate in the middle as the Supervisory Courtyard, thus The axis symmetry of the group is established, forming a complete trapezoidal square, with the short side of the trapezoid facing the city and introducing the landscape below the hill into the square[42]. The new physical elements do not disturb the original balance, and the three buildings from different periods are integrated, but rather create and complete the place.



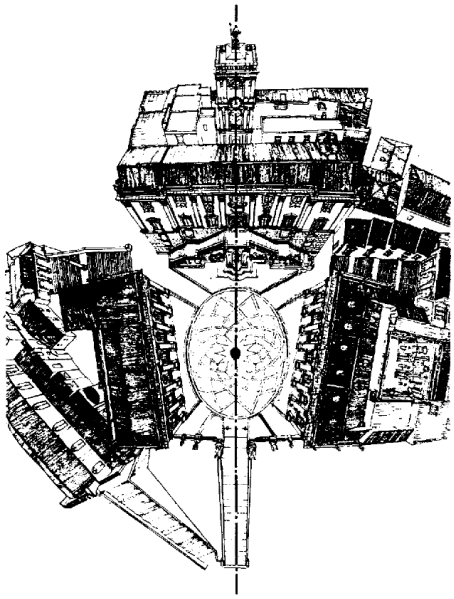


Fig. 4-4 (L) Cabido Municipal Square in Rome before transformation by Michelangelo
Fig. 4-5 (R) Cabido Municipal Square in Rome after transformation by Michelangelo
(Source: *Urban Architecture*.)

4.2.1.2 Spatial elements

Robert Krier considers squares and streets as the most basic spatial elements in the city[43]. Outdoor squares, pocket parks, and open activity spaces in the city that citizens can access are typical urban spatial elements. In addition to human-made spaces, natural spaces are also important spatial elements, such as green spaces and waterfront spaces.

In the old urban areas, the most important spatial elements are the traditional street space, squares with historical value, and memory places that house people's habitual behaviors. However, under the pressure of urban development, the preserved spatial elements in the old urban areas are very scarce and fragmented. In urban renewal, it is usually necessary to apply the method of "implant" to create new urban open spaces that meet the needs of modern life of the old town residents, taking into account the existing construction condition of the site. The realization of the "implant" depends on the connection between the new elements and the original urban environment, emphasizing the integration with the surrounding environment.

4.2.2 Intangible elements

Regarding the aesthetics of the urban environment, Team X believes that cities need something solid in addition to the physical environment, namely points that can act as a unifying force during insignificant cyclical changes. Based on these points, people can judge and unify ephemeral things (such as houses, stores, facades), and the beauty of urban environment should appropriately reflect the appropriately cyclical changes of the objects. Therefore, certain historical buildings or buildings and open spaces of great significance, which are signs and symbols of a certain region, can be seen as relatively fixed things, which is called "Aesthetic of Expendability". As a result, urban design has begun to emphasize culturalism and the spirit of place, focusing on the value of intangible elements. In this paper, the intangible elements are divided into historical and cultural elements and functional elements.

4.2.2.1 Historical and cultural elements

In the old urban areas, the urban elements, in addition to the tangible elements in a general sense, place more emphasis on the continuation and integration of historical and cultural elements, so that the historical and cultural features are the main

difference between the old urban areas and other areas of the city. The historical and cultural elements mainly include urban fabric and historical and cultural information. etc.

(1) Urban fabric

Urban fabric is an important factor affecting the development of urban spatial layout renewal, it is a dynamic evolutionary development clearly reflects the changing trends of urban political, economic and social development, associated with the lifestyle, values and behavior patterns of urban residents, closely related to the natural environment of the city and the heritage of historical and cultural concepts, it is both an important historical and cultural element, as well as an associated coupling clue in the time dimension.

(2) Urban historical and cultural information

The historical and cultural information of the city is the common memory of urban residents on the material and spiritual carriers of the urban cultural environment, the common perception of the urban spatial environment and the material and spiritual cultural traces of the local cultural traditions. The historical and cultural information of the city is mainly divided into material historical and cultural information and intangible historical and cultural memories in the old urban space.

Tangible historical and cultural information refers to historical and cultural structures such as historical buildings, streets and monuments in the city, as well as tangible supports of the urban space such as city walls, streets and squares. Intangible historical and cultural memories mainly refer to traditional cultural customs, religious rituals, traditional lifestyles, collective memory of residents, and sense of belonging to certain historical scenes.

4.2.2.2 Functional elements

The function of the urban space is developed and improved according to the development of the city and the diversification of human needs. To couple the functions of the old urban areas means that the functions carried by these spaces must have a great diversity. The common functions of the city are commercial functions, residential functions, cultural and educational functions, etc., which meet the needs of various people in the city, such as interpersonal interaction, leisure and entertainment, shopping and sightseeing, traditional activities, commercial offices and other various

urban activities.

The functions performed by the old urban space are singular and often cannot meet modern needs, and the original functions are gradually lost with the change of time. At the same time, the old urban space has many lost activity spaces and abandoned old buildings that have not acquired functions and are vacant. The key to the continuity of these physical and spatial elements is to provide them with appropriate functions so that they can be reintegrated into the existing urban environment and connected and coupled with the functional areas of the urban environment.

The sunken plaza at Rockefeller Center, for example, was built in 1936 but is now considered one of the most vibrant and popular public spaces in American cities. Although the plaza is not very large, it is used very efficiently. Pergolas are erected in the summer, with café seating underneath, flowers above, and an ice-skating rink in the winter. First-class restaurants are located in the basement around the plaza, and visitors can observe the various activities in the plaza through the large floor-to-ceiling glass windows. Rockefeller Plaza effectively uses the spatial environment of the square to improve the efficiency of the urban space, and it revitalizes urban space by incorporating diverse and modern functions.

a) Summer Scene b) Winter scene

Fig. 4-6 Summer & Winter scene of Rockefeller Center sunken plaza
(Source: https://huaban.com/pins/1226299721; https://www.meipian.cn/2c7qtcdl)

4.3 Sorting the linkage coupling clues

The clue in linkage coupling thoughts is the process of finding the "linkage line" in the different elements of the old urban areas[44]. After sorting, the "linkage lines" can be divided into two types: explicit and implicit. Generally, the clues reflecting the linkage between the elements are the explicit clues, while the clues reflecting the coupling between the elements are the implicit clues, and the implicit linkage lines are more reflected by the behavior and psychological level.

4.3.1 Explicit clues

4.3.1.1 Axis

Axes are often the structural benchmarks for the organization of spatial elements and the most obvious "linkage lines." From the "Grand Cross" structure in Paris to the urban axes in Washington and Canberra, axes are the most integrated and visible clues that organize urban functions and connect buildings to their external spatial environment and are closely linked to urban change, public space, and the natural environment.

4.3.1.2 Path

Lynch defines the term " path" as: the route that the viewer is accustomed to or can follow, such as streets, alleys, transportation lines, and other elements that are often arranged around the path[45]. The "linearity" of the path is the most common material connection between the elements of urban space.

4.3.1.3 Water system

The water system is actually a kind of path, but it has the role of landscape, so it is not the same in function and form as a street or alley connecting buildings and spaces.

4.3.1.4 Interface

The interface in urban space can be defined as the faceted elements that link spaces or domains at the same time. In terms of spatial composition, interfaces can be divided into vertical interfaces and horizontal interfaces. The former includes all building facades along the street, fences, street trees, etc., while the latter are carriageway pavement, sidewalk pavement, river, lawn, steps, paving, etc. The connection and repetition of interface forms is also a special "linkage line".

4.3.2 Implicit clues：

4.3.2.1 Urban fabric

The urban fabric develops gradually during the long-term historical accumulation of the

city and can comprehensively represent the historical lineage of the city and the identification of the citizens with the existing space. It is a kind of link between the old and the new, an implicit clue that reflects the depth of time.

4.3.2.2 History and culture

Urban history and culture is a product of specific historical development conditions, which not only contains elements of different periods of urban spatial transformation, but also affects the principle of combination between these elements, which is a dynamic and permanent link between people and natural environment, needs of the time and historical background.

4.3.2.3 Spatial sequence

On a psychological level, spatial sequence conveys a sense of direction and continuity by connecting various elements in an orderly manner, expressing the connection between space and spatial change in a coherent manner. In traditional Chinese gardens, for example, the spatial sequence of "moving steps" gives people a sense of flow and continuity.

4.4 Exploring the approaches for linking and coupling

The stacking of various isolated and scattered elements on top of each other does not form a good urban environment, and interweaving of various types of urban clues only makes urban space more complex. Only when urban elements are linked and integrated in a specific order or guideline can they form an organic urban spatial structure system. In order to integrate the elements of the old urban space, we should first grasp the "skeleton" of the old city spatial structure. Guided by the idea of association and coupling, the integration of the elements of the old urban areas can be divided into two parts: the first is the way of association between material elements, and the second is the way of coupling between immaterial elements and material elements.

4.4.1 Establishing linkages between tangible elements

The relationship between the material elements focuses on the connection of the material plane in the old city environment. The related objects are mainly physical and

spatial elements, and the "connecting lines" are usually explicit clues. There are three types of correlation from large scale to small scale: the establishment of axes, the organization of paths, and the treatment of interfaces.

Linkages between tangible elements focuses on the creation of material connections in the old urban environment, and the objects of connection are mainly physical and spatial elements, and the "linkage lines" are generally explicit clues. The scale of connection from the large to the small can be summarized in three ways: creating axes, structuring the paths, and harmonizing the urban interfaces.

4.4.1.1 Creating axes

Axes are the most critical and visible clues for linkage and coupling of urban elements and the most comprehensive form of organization of the urban form structure. As a rule, axes can effectively connect the space for human behavior, material space and social space, while showing the historical culture and characteristics of time accumulated in the city. In general, urban axes are shown in the relationship between buildings and external open spaces such as streets and squares, and play a leading role in the spatial pattern of the city, often in combination with the physical forms of buildings, streets, squares and greenery of the city. Therefore, the construction of axes can link and couple all parts of the city on a large scale and play a comprehensive role in urban integration from various aspects such as urban landscape and functional development.

（1）Determination of axis type

The essence of the axis is a reference point, a generator of form that defines the main structural order of the form, and the establishment of the reference point is the basis for the design of the axis. Therefore, before defining an axis, it is necessary to define the main role that this reference point will play: Whether it is organizing functions, directing traffic, or forming a spatial order, different functions determine different forms of the axis.

①Tandem form to organize functions

The tandem form of the axis facilitates the formation of an orderly sequence of functional organization. In Paris, for example, the axes were created from scratch and now run through the Louvre, the Palais du Luxembourg, the Place de la Concorde and the Place de la Concorde, the Palais de Chaillot, and other representative buildings

from the 16th to the 20th centuries. In Washington, D.C., the United States, two monumental axes, the Capitol-Lincoln Memorial and the White House-Jefferson Memorial, were formed with a series of monumental sites between them. The intersection of the axes is the Washington Monument[46].

② Corridor form to organize traffic

As society has evolved, travel patterns have changed, leading to differences in the mode of transportation corridors along the axis. The Champs-Élysées on the Paris axis and the axis between the Capitoland the White House in Washington, D.C., are both boulevard-style transportation corridors, with pedestrian and vehicular traffic separated and public transit stops at key locations, combined with open space on both sides of the axis, again facilitating the distribution of people.

③ Sequence form to organize space

Whether in Rome, Paris, or Washington, axes are used to connect buildings, squares, green spaces, and other public spaces to enhance the continuity of public life. The Washington Monument, for example, serves as a landscape node at the intersection of two axes, the Capitol to the west and the White House to the south, with the Lincoln Memorial and Jefferson Memorial as counterpoints at each end of the axis to reinforce the sense of spatial sequence of the axis.

（2）Roles of axis for linking elements

In the form of the axis, the datum is organized by the "field," which can be divided into two modes of action, control and domination, depending on the strength of the "field" . In both the axis and its derivatives, all elements are inseparable from these two roles. The structure of each axis consists of a combination of these two types of elements in different proportions. The elements under control are usually orderly and uniform, but the forms are dull and lack tension and dynamism. Most traditional axis structures are of this type; in contrast, when there are many elements subject to control, the forms are less ordered and loosely structured, but the forms are flexible and full of flexibility and tension. The extremely orderly church sequence and the extremely natural linear village are examples of the two ways in which the axis functions, a contrast between order and disorder, unity and change, rigidity and liveliness. Many works by Japanese architect Katsuhiro Kobayashi, for example, use this technique to correlate

organizational elements. In most of these works, the parallel or cross-axis benchmark is established first, and then the elements controlled by the axis are arranged. At this point, the overall form is strict and ordered, and then the free and random elements are arranged so that the ordered form unites them and finally forms a form characterized by unity and order without losing the tension of change, as in Figure 4-7.

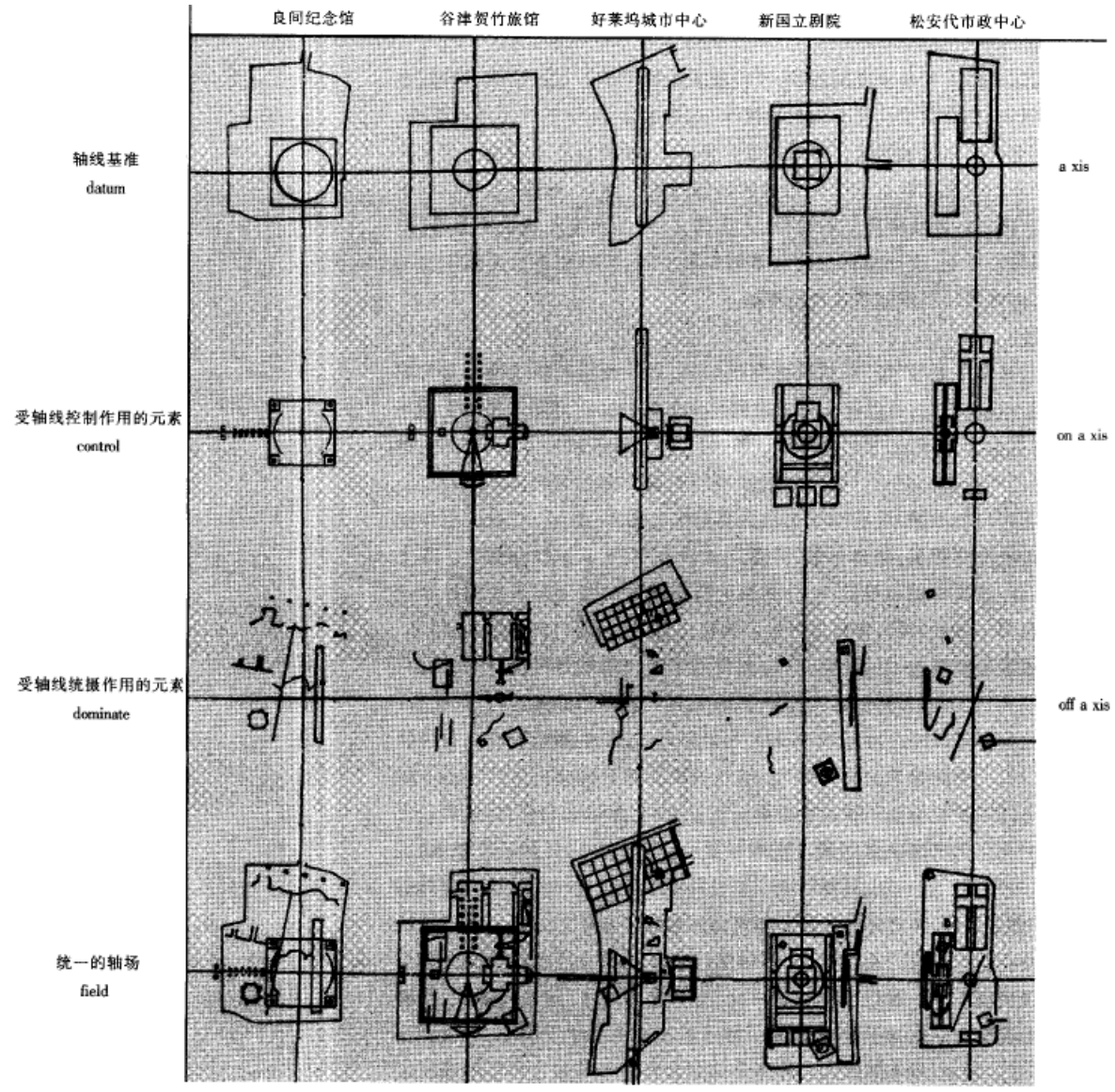


Fig. 4-7 Illustration of Katsuhiro Kobayashi 's works
(Source: *Design of Cities*)

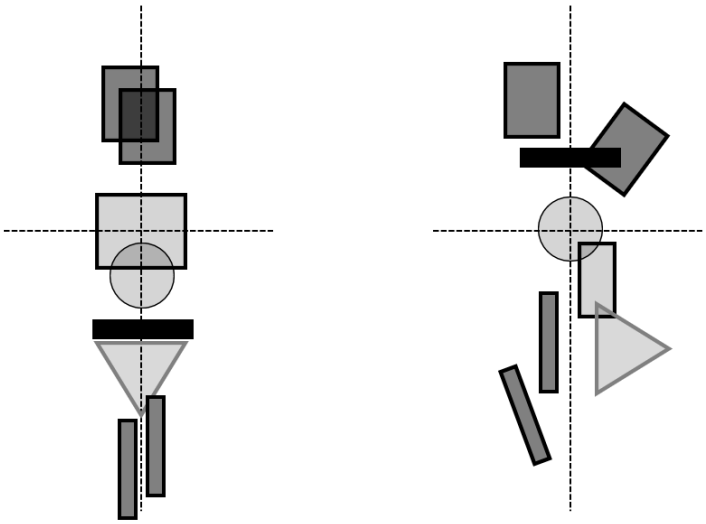


Fig. 4-8 Axis of two different roles
(Source: Self-drawn)

（3）Contents of the axial connection

① Connecting movement systems

The city is constantly in motion, and it can be said that human movement has a profound influence on the structure of the city. In his "Simultaneous Movement System", Edmund Bacon argues that the structure of the city is the skeleton (urban pulse) that forms the function and image of the city from the movement system, and that the various urban nodes are organically connected to the city and their changes and growth are all related to the development of the entire city. In many cities, the axes overlap with the movement flow of the city. The urban layout guided by the axes organizes the flow of people through orderly flow lines. Conversely, the orderly and unified flow of traffic ensures that the axes come into practical play in spatial design and functional organization. The flow of traffic in traditional Chinese cities was mostly in the north-south direction, with only one main axis, and the traffic flow of the ancients was usually related to their hierarchy. In early western cities, the construction was not based on axes, but on a square grid layout. Later, when new cities were transformed or founded, the axes were more diverse, with buildings as the center of the axes, forming single, crossed, radial and other forms of traffic flow lines. (Fig.4-9)

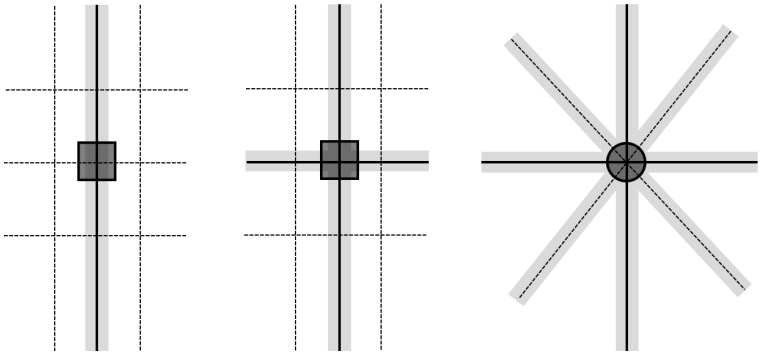


Fig. 4-9 Three types of axes that overlap with traffic flow lines
(Source: Self-drawn)

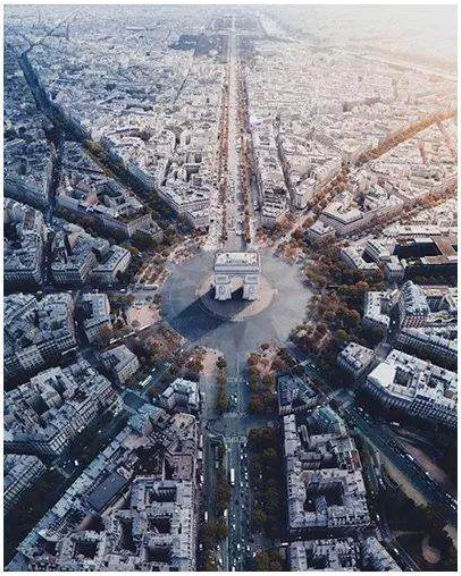


Fig. 4-10 Axis position of the Arc de Triomphe in Paris
(Source: agoraimages.com)

First of all, the planner needs to fully investigate the pedestrian movement flow around the site before design, and skillfully resolve the contradiction between the flow inside and outside the site through some design techniques, determine the main flow and the main open activity space, and finally use the target object of the design to relate the movement flow of the coupled site. In terms of experience, the design of axes that can well coordinate the traffic factors must be able to strengthen the initiative for people's activities, including the ability to make people stay spontaneous and participate in urban activities. The coupling of transport axes is not only the coupling of functional aspects such as the direction and sequence of people's activities, but also the design of the environment of the axes through landscape elements of urban space, the latter of which has more to do with human experience and perception of the environment. In terms of efficiency, some fragmented urban elements often lead to obstruction of the

urban movement system and make the overall operation of the city inefficient. We can consciously analyze the trajectory of human activities in the urban material space at certain moments and occasions, and compare the related material structures with each other to easily find the close relationship between the material space and human behavioral activities, and find the close relationship between the movement flow and human behavioral activities. It is easy to find the close relationship between the material space and the human activities, find the contradiction between the movement flow and the spatial structure, and fix the fragmented elements of the city.

② Connecting public spaces

The composition of axes in Western cities is characterized by the intersection of iconic buildings with urban squares, green spaces, and monumental sites, focusing on the connection between public space and architecture. Whether for political or functional purposes, axes effectively link and couple urban elements of public activity and avoid their disorderly distribution in the urban network. To reinforce the urban axis, many cities combine the original access arteries with the city's green open spaces and activity plazas, using the axis as a linear spatial benchmark of the urban public space.

When linking urban public spaces by establishing axes, attention must be paid to the order in which the spaces are arranged, i.e., the sequence of spaces. The spatial sequence focuses on their direction and continuity. The order in which the elements of a sequence appear gives people the appropriate psychological experience from which they interpret the urban themes and messages conveyed by the sequence. In designing the axes, we should create varied and rich public spaces, choose the axis forms of streets and sequences appropriately, repair the existing open spaces, focusing on the sense of rhythm and hierarchy of the axis sequences, and clarify the coupling mechanism between the axis sequences and other urban elements. The main purpose is to closely connect the originally discontinuous spatial fragments so that people have a strong sense of direction, order, predictability and strong recognition of the whole urban space.

For example, the most famous axis of the Champs-Elysees in Paris has four stages of spatial narrative: The head of the axis unfolds with the Arc de Triomphe as its visual symbol and extends east along the long Champs-Elysees to the Place de la Concorde,

followed by the vast and open Tuileries Garden as a further development of the axis. The garden design, characterized by rationalist rigor and axial symmetry, is laid out in layers eastward to the apex of the axis, the Place du Louver and the Main Hall, and then eastward across the City Hall to another radial point of convergence, the Place du Bastille[47]. This sequence of axes is a classic urban axis, with a clear sense of hierarchy and rhythm, linking and coupling several of the most central public spaces in Paris.

Fig. 4-11 Axis of Paris Champs Elysé es
(Source: self-drawn according to the map.)

③ Creating visual connections

People live in the city, and the spatial order and morphological relationship of the city correspond more to the actual situation from the people's point of view. The author believes that the definition of the axis from the visual perspective is a visual quality of the material form of the urban street space, which is an important reflection of the expression of the aesthetic spirit of the city based on the coupling clues of the urban spatial experience. From this perspective, this paper summarizes two aspects to construct a visually friendly axis, namely: guiding the visual nodes of the axis and creating rich layers of the axis.

First, the axis leads to the visibility of important buildings or landscape nodes. The end view of the axis sequence is often the urban element that the axis is intended to highlight and focus on. Such an urban landscape element is not only an important node of the axis connection, but also the visual focal point of the urban axis. The visual focal point can create a good visual composition for the axis space and at the same time play the role of a sign and guide that leads the visual order of the whole space.

The creation of the rich layers of the axis is also an important aspect. The two-dimensional ground pavement with guiding effect, the trees planted with visual unity and order, the leisure space for people and the street vignettes and other urban elements all play a supporting role in connecting the visual axis.

④ Connecting new and old

In the urban form, the new and the old can find a bond in the span of time[48]. The urban form is a concept of evolution, and if it is expressed as a collage of multiple construction activities over time, it is certain that in most urban properties with a certain history there is always some evidence of a more or less strong morphological evolution, and the axis, because it was widespread in every era, is the best mirror of this evolution and, therefore, an important clue for linking the urban past and the future.

The urban form is a concept of evolution, and if it is expressed as a collage of multiple construction activities over time, it is certain that in most urban properties with a certain history there is always some evidence of a more or less strong morphological evolution, and the axis, because it was widespread in every era, is the best mirror of this evolution and, therefore, an important clue for linking the urban past and the future.

The most direct way to connect new and old urban elements through the axes is to use the continuity of the axes so that the new design follows the inherent axes, thus integrating them and reinforcing the original morphological order. This is a simple but effective technique. For example, in the urban design of the Desfonts district of Paris, planners disagreed on whether to connect the Desfonts district to the inherent axis system of Paris. Some believe that the new Desfonts district is far from the center and that the content and form of the buildings are so different from the old city that it is not necessary to associate it with the axis system of the old city, while others believe that the district is an integral part of Paris and an integral part of its urban morphological development and that it cannot be separated in time and space from the inherent morphological character of Paris[42]. In fact, the traces of the gradual evolution of the Parisian urban form are recorded on these intersecting axes (as shown in the figure 4-12), which are the most distinctive features of the Parisian urban form. The end result is the most famous axis of the city of Paris, the Champs-Elysées, which extends to the center of Devonshire (as shown in Figure 4-13). It integrates the new area into the inherent morphological order of the old city and contributes to the fame of this prestigious axis.

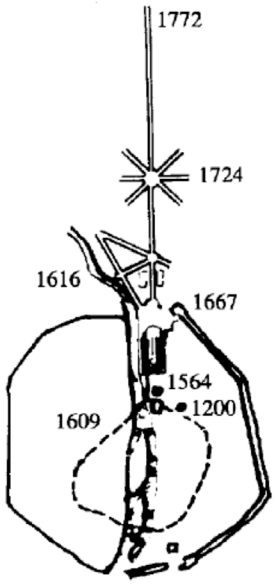


Fig. 4-12 The phenomenon of axial advancement in the development of Paris's urban form (Source: *Urban Architecture*)

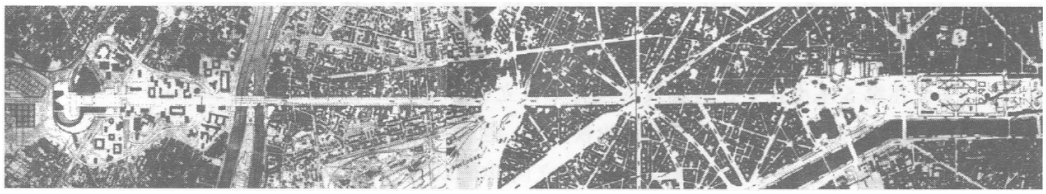


Fig. 4-13 An extension of the axis of the Champs Elysé es (Source: *Urban Architecture*)

4.4.1.2 Structuring the paths

The paths in urban public space refers to the network that urban transportation forms to connect the various units of public space, and which is the skeleton of the city. Kevin Lynch said in Urban Imagery, "For many people, it (the path) is the dominant element in the image. People observe the city as they move along the street, and other environmental elements are also arranged along the street so that they are intimately connected to it. "By designing and optimizing the path in a meaningful way, urban elements can be better integrated and related to each other in the urban network.

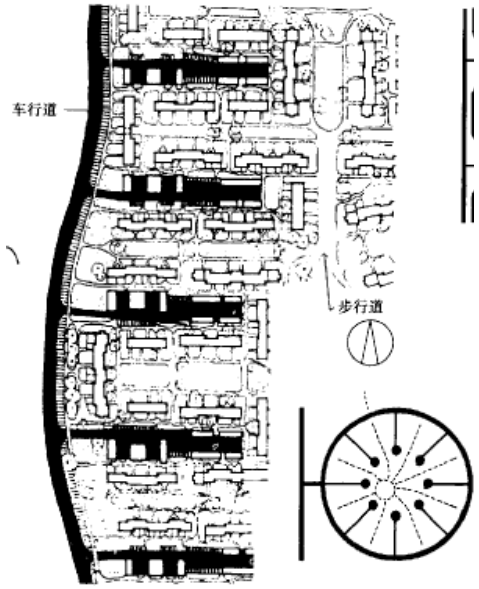
The path in urban public space, that is, the network formed by urban transport to connect various public space units, is the skeleton of the city. In *The Image of The City*, Kevin Lynch says, "For many people, the path is the dominant element in imagery. As you move along the path, you are looking at the city, and other elements of the environment are laid out along the path and therefore closely related to it[45]." Thus, the rational organization and optimization of paths allows urban elements to be better woven into the urban network and to relate them to each other.

（1）Integrating pedestrian traffic with car traffic

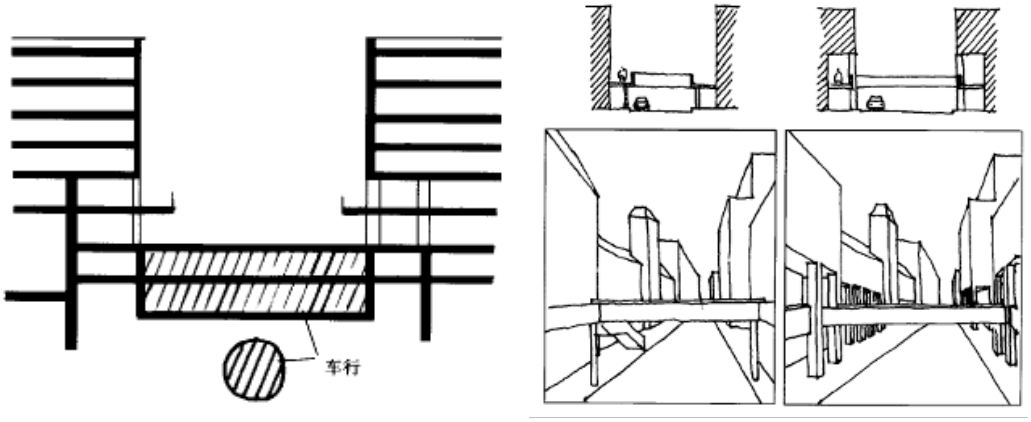
In the early days of industrial society, street life and traffic were closely linked, and movement and rest coexisted on city streets. However, in modern cities, there is an increasing separation between the space of movement and the space of rest. With the progress of society and the development of the city, the level of the urban road network is becoming more and more refined, and the division of labor is becoming more and more obvious. The original road is for both pedestrians and motorists, the functional boundary is not clear, later, with the change of the road section, the pedestrian becomes a sidewalk, motor vehicles have an exclusive road. The organization of the roads is basically the integration of the multi-level transportation system in the city, dealing with the problem of moving and stopping in the city to achieve the purpose of connection.

The principles of efficiency and convenience should be observed in the integration of different modes of transportation. The general possible solution for traffic systems of various speeds is to separate them from each other, each with its own lane, but this brings some other problems. A paradox we often encounter in daily life is that separating people and vehicles has become a common planning tool to improve urban efficiency and the sense of travel experience, but urban cabs only work if there is no strict separation between pedestrians and vehicles; cabs need to be able to find employers in a large area, and pedestrians want to have a cab at hand at all times. Therefore, pedestrian and vehicle systems must find appropriate ways to overlap and balance efficiency, safety, and convenience.

In many western new cities, the street system consists of central major streets, urban collector streets, block feeder streets, and alleys within neighborhoods with a separate, complete system of pedestrian walkways (Figure a). This type of detour is primarily two-way separation with three-dimensional crossings at intersections. The other type of detour is a vertical one, where the pedestrian paths and the roadways are at different elevations and do not interfere with each other, as in the case of the new Paris-des-Fonts district (Figure b). Such vertical branches are more common in urban centers where traffic volumes are high and land is scarce. The sidewalks are integrated into the internal pedestrian systems of the buildings on both sides, with car lanes at the bottom, creating a free and safe environment for pedestrians (Figure c).



a) rebons pedestrian-vehicle diversion system



b) Pedestrian-vehicle diversion in La Dé fense. c) Pedestrian-vehicle diversion in urban center new district

Fig. 4-14 The diversion mechanism of the new district of Paris-Defans

(Source: *Urban Architecture*)

There are two main strategies for integrating pedestrian and motorized traffic: In places where motorized traffic is not heavy and pedestrian traffic is not heavy, establishing sidewalks on both sides of the street is an effective way to integrate pedestrians and motorization; when pedestrian traffic is heavy and pedestrian streets need to be established, pedestrian streets need to be supported by good motorized traffic around them so that people can easily enter or leave the pedestrian area; This is also a common model for old urban areas, where motorized traffic is first improved near the old urban areas to make the area easily accessible, and then the pedestrian walkway is completed in a specific area of the old district to create a good pedestrian experience. When motorized traffic is fast or heavy, a three-dimensional approach can be used to

connect pedestrian and motorized traffic through some fixed points. When the different traffic conditions are particularly complex, more integrated facilities are needed to connect pedestrian and motorized traffic, and the intersection of the different traffic types is carefully designed to make it as convenient as possible for pedestrians to reach the different traffic facilities.

（2）Upgrading pedestrian system in old urban areas

Unlike other modes of transportation that confine people to fixed routes, walking is characterized by great flexibility and is therefore best suited to connect dispersed spaces through people's behaviors. Walking is the mode of transportation by which people experience their environment most intensely, and it plays an extremely important role in maintaining the vitality of urban centers by promoting social communication. Because human activity in the pedestrian environment is a continuous process, a complete pedestrian system can provide a place for people to perceive and experience the city, and is thus a typical material basis for linking and coupling human behavior with public elements of the city. However, the large number of motor vehicles in China's old urban areas and the mixed traffic of people and vehicles have serious impacts on the public space of walking in the city, and the walking space in the old urban areas is broken[49]. Therefore, "linkage" is needed to realize the systematic renewal of pedestrian space on the street, and connect the squares, parks and various elements of the old city into a network of public space, a system of public space with the advantages of convenience, safety and efficiency.

① Building the trunk for pedestrian space structure

Blind widening of roads in old urban areas is currently a common phenomenon in urban construction in China. However, after the road is widened, cars tend to occupy the new space very soon, so that the capacity is soon saturated again, causing a vicious circle. If the main street in the old city becomes a beautiful boulevard that forms the structural backbone of the pedestrian network by improving its pedestrian facilities, and then is widened and expanded by urban bypasses, the pedestrian environment will naturally "grow" and the structural backbone of the pedestrian area will become clear as the renewal progresses. Measures can be taken to widen sidewalks, pave pedestrian spaces with character, add green space, and design beautiful and functional street furniture. Juliet Street in Barcelona is an example of this model (figure 4-15).

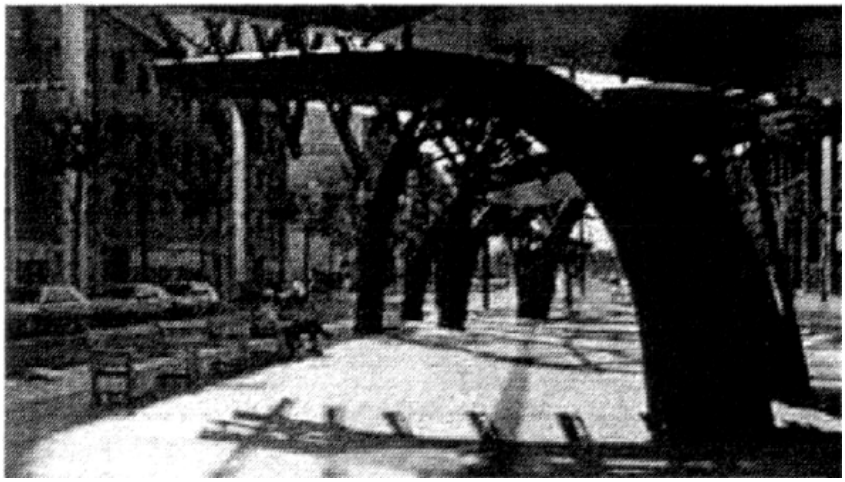


Fig. 4-15 Barcelona Juliet Street View
(Image Source: jan gehl, Lars Gimson New City.)

② Systematization of pedestrian space on branches

Branch roads are an important part of the urban street system, and in European cities with a developed road transportation system, the status of branch roads is irreplaceable. Most of the old urban areas in China also have the characteristics of rich branch roads, such as the ancient city of Qingdao, basically retains the newer street pattern. The spacing of the branch roads are mostly 50-80 m, and the street density is about 20%. With the aging of the infrastructure in the old city, not enough attention has been paid to the renewal of the sidewalks in the streets. They have either been converted into a lane for cars or have aged further and are no longer suitable for walking, resulting in a gradual decline in the charm of the streets in the old urban areas. Given the current situation of decline of feeder streets in urban areas, the author proposes a model of street renewal with a systematization of pedestrians as a precursor.

The systematic renewal of the pedestrian area in the branches of the old urban areas into a high-quality pedestrian area is beneficial for the development of the old urban areas. First, it should define the scale of the block with appropriate scale and large size and improve the accessibility of squares, parks and other spaces. Second, the original structure of the branch roads should be protected, because the small lots enclosed by the branch roads are easier to control in terms of development and building, which is conducive to the continuation of the historic fabric of the old town. Third, give the side streets a variety of urban functions and establish squares along the streets to

encourage residents to linger, contributing to the vitality of the old urban areas. Also, strengthen the connection of some side streets with the pedestrian streets in the central area of the old town, so that they can gradually become part of the pedestrian network in the central area of the old town. Fourth, control the one-way traffic regulation and speed limit on the feeder streets to reduce the conflict between traffic junctions, relieve the main roads and improve the microcirculation function of the streets. Even though this increases the detour distance for vehicles, it is beneficial to the overall traffic environment and widens the pedestrian path.

（3）Improving the psychological accessibility of the path

The streets in the old urban space are narrow, crowded and chaotic. Even when spatial accessibility is achieved, people will not tend to slow down in their travel decisions unless psychological accessibility is improved. This will result in a lack of awareness of many historic spaces, which in turn will exacerbate the loss of various parts of the historic district. For example, the streets and spatial organization of the old city block each other's view, restricting the user's vision to a small space and creating an uninteresting sensory experience for the user. The old and new spaces in the old urban areas are mixed together, with a disorganized urban interface and a "zero recognition" spatial environment that does not take into account the user's psychological adaptation and satisfaction. Such an environment leads to a decrease in people's enthusiasm and willingness to visit the city and engage in various activities, directly limiting the activities of people as the main actors, and the street becomes an increasingly neglected space.

In *The Image of The City*, Kevin Lynch writes: "A clear impression of the environment can be a universal frame of reference, giving people a sense of security and belonging, and enhancing the depth and intensity of their inner experience[45]." Enhancing the "depth and intensity of their inner experience" means, in layman's terms, "creating a desire to be here." To achieve this, the road should first facilitate people moving around the road for an extended period of time. This includes good, well-developed street furniture, appropriate resting benches, and public restrooms. Whether people sit there to chat, sunbathe, or simply observe passersby on the street, there are props that allow people to stay on the street for longer periods of time. Second, the comfort of the external environment is equally important. Adequate street width and good greenery are the basic means to ensure walking comfort. Pedestrian walkways must provide at least 3 meters net width of passage and a safe pedestrian area, and this width does

not include space for parking, landscaping, vignettes, street art, benches, etc. At the same time, adequate landscaping must also be provided, continuity of landscaping must be maintained, and attention must be paid to plant maintenance to prevent the street from feeling like it is deteriorating. Moreover, if the road can give people a real and strong sense of belonging, it will increase its accessibility on a spiritual level. Certain features of the path are extremely important, not necessarily in the sense of a special appearance or a great clash of senses, but in the sense of the connection that people can feel with everything around them while walking. In the old urban environment, paths must connect as many commemorative sites, historical landmarks, and environmental elements with commemorative value as possible, so that the paths themselves are recognizable and have the value of being preserved and activated.

4.4.1.3 Harmonizing the urban interfaces

Making connections between faceted elements of a space or domain is also an important form of linkage and coupling. The interface is literally the "sub-interface" of space or the "intersection of space and bodies." The interface shows the physical properties of objects such as shape, color, texture, lightness and darkness and the way they are combined. The street in the city is like the artery and skeleton of the human body, while the interface in the city is the "skin" attached to the outside of the skeleton. The most sensitive impression of a city is the city street, and the city street is remembered by people because of its external characteristics - material interface and spatial composition. Therefore, the interface in the city is responsible for the cognitive function of the city and makes up the impression of the city[50]. When continuity and connection are reflected in the urban interface, people's overall perception of the city becomes more unified and urban elements can be better coupled with each other.

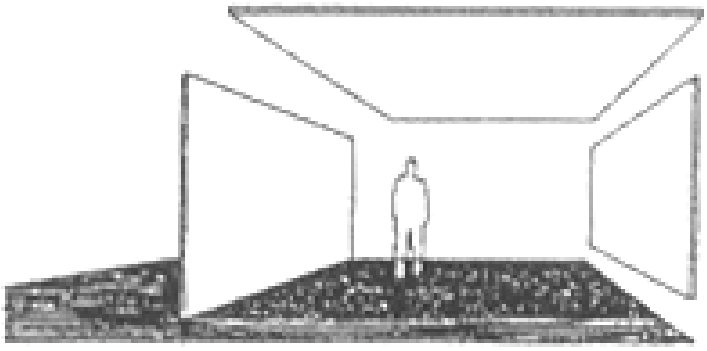


Fig. 4-16 Analysis of face in space
(Source: Environmental Psychology)

The interfaces in the city include:

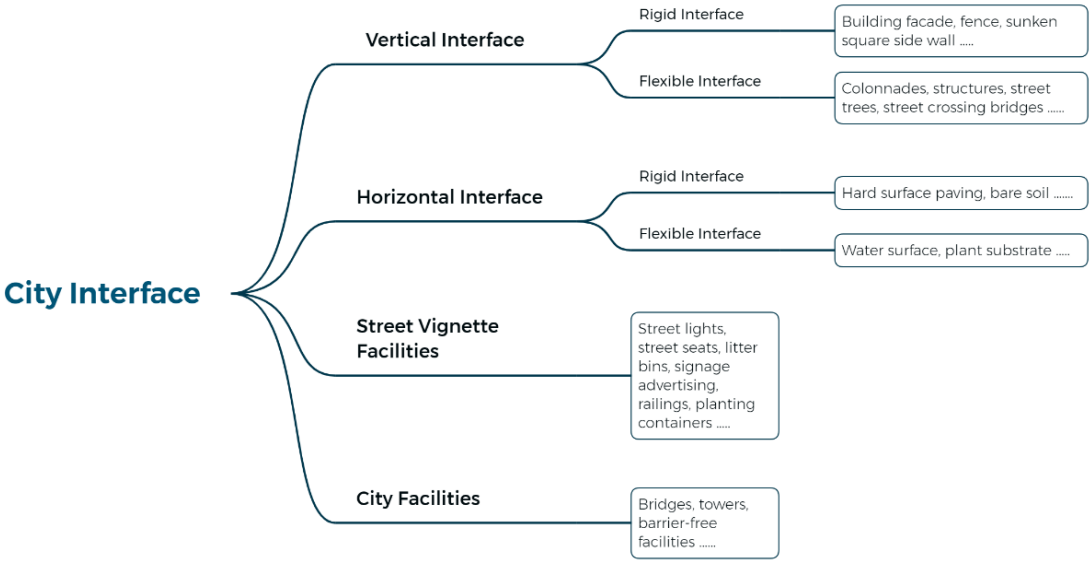


Fig. 4-16 City Interface
(Source: Self-drawing)

In *Linkage in Collective Form*, Fumihiko Maki summarized that one of the specific operations of linkage is to repeat "Give each element a feature common to all in the group so each is identified as part of the same order[51]." This method is the most direct way to establish specific links between different interfaces. By repeatedly assigning the same elements and characteristics to all elements in the group, you can achieve unity among the elements, giving a sense of continuity and wholeness. This is evident in the repetition of similar scales, shapes, textures, materials, colors, and other features in two or more entity elements or spatial elements to create linking or coupling relationships.

In the four elevations that surround the square of Piazza San Marco, the colonnade is interconnected on the ground floor, forming a continuous repetition of the arcades on the facade, and the shape of these arcades is also repeated on all floors above the first floor of the building. The square controls the integrity of the square through the repetitive use of coupons and columns in form, scale, material and color both horizontally and vertically, emphasizing the continuity of the square with the connection of interfaces. (Figure 4-17)

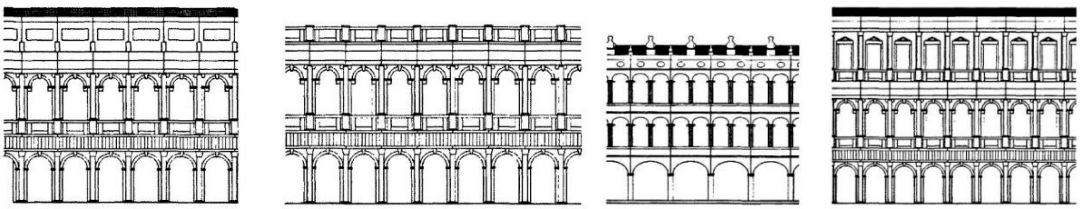


Fig. 4-17 Facade coupon gallery of Saint Kyle Square
(Source: http://image.baidu.com)

The difference in spatial interfaces is the result of the incongruity between the forms of the elements of the old urban areas and those of the new city. All kinds of elements in the old urban areas have a sense of the era of urban development and a strong sense of history, and most of them also reflect the application of construction technology and materials at that time; while the interfaces in the new city mostly conform to the minimalist modernist trend, and the materials are mainly modern materials such as reinforced concrete, glass facades and veneer tiles. The spatial interface between the old and new buildings brings a certain visual effect to the city, causing confusion in the urban space and weakening the integrity of the city. Through the "interface", the author tries to find clues about the linkage and coupling of the spatial forms of the old urban areas. By extracting the local characteristic elements of the old urban areas and applying them to the new urban elements, the old and the new can be linked and coupled. In this context, I would like to emphasize that when inserting new elements into the old urban environment, we should consider the city as a whole and try to harmonize with the space of the old city areas.

（1）Treatment of vertical interface

In the spatial environment of the old urban areas, the new building facade and the original building facade of the old urban areas abruptly differ in style, and the building height differs greatly. The designer should firstly improve the vertical interface of the original buildings in the old urban areas and design the facade of the new buildings to achieve a coordinated coupling of the vertical interface. Secondly, the continuity of the interface should be emphasized. The layout of story height or vertical interface should be consistent with the buildings in the old urban areas as much as possible, and it is better to use similar facade materials, colors and building type elements, etc., to create visual continuity of the vertical interface. In the old city environment, old buildings on the same lot may have different styles or even different building structure types in themselves. The coordination between two types of buildings with different styles can be adjusted by the rhythm of the architectural interface for the transition and unification of the facade.

The main control elements of the vertical interface of the urban space include the upper

treatment of the building (including roof shape, contour line, gable, etc.), the treatment of the grounding of the building, the concave and convex changes of the main body of the building (including the treatment of window and door openings, etc.), and the material and texture of the building facade. At the same time, it is possible to break the pallor caused by completeness by collecting, rotating and penetrating the space to provide people with a rich spatial experience in the linear space. For example, the urban planning of Manhattan in New York City has clear and uniform requirements for the street walls of buildings to ensure that the city as a whole is harmonious and unified while providing diversity.

For example, Foster designed the Carré d'Art Nimes in Nimes, France, which gives a new expression and play to the classical colonnade typology of the temple through modern technology and materials, realizing the echo of the colonnade in the interface, expressing the new spirit of the times while permeating the classical heritage, continuing and developing the site. This is the excavation and recreation of the meaning of the place around the temple, bringing new vitality to the ancient area and making people feel even more the fallout of history.

Fig. 4-18 Spatial relationship with the art museum.
(Source: https://www.douban.com/note/230621814/?_i=4601126WfrZ92T)

（2）Treatment of road interface

The road interface is the bottom interface of the urban space, which includes the topography, the shape of the road surface, and the material and type of road paving. The coordination between the old urban space and the bottom interface of the new city is mainly reflected in the road surface. For example, in most traditional Chinese cities,

most streets and alleys are paved with flagstones and stones. In coordinating the interface between streets and ground, we should pay attention to the use of traditional paving forms and materials, which is also an important way to coordinate modernity and tradition.

4.4.2 Coupling intangible elements with tangible elements

As an organic large-scale system, in order to achieve the effect that 1+1 is greater than 2, we must examine the combination of elements[52]. In order to achieve the real purpose of integration, the research field of urban design should be expanded from the purely material space to the urban connotation behind the form. Especially in the old town, linking intangible elements such as cultural background, living conditions, local traditions and regional characteristics with material forms can better integrate the urban context, establish the image of urban characteristics and meet the requirements of modern development. Generally speaking, there are four types of coupling: coupling between historical fabric and modern urban form, coupling between new functions and the old urban environment, coupling between historical context and walking system, coupling between living scenes and landscape space.

4.4.2.1 Coupling historical fabric with modern urban form

From the perspective of morphological composition, urban texture is an abstract urban form. The main and arterial streets subdivide the urban parcels into neighborhoods, which in turn are subdivided by smaller streets, and this subdivision creates a specific texture. Fabric can vary from era to era and from region to region in the same era. The dynamic, evolutionary development of urban texture clearly reflects the changing trends in the political, economic, and social development of the city. It is related to the lifestyle, values, and behavioral patterns of urban residents, and is closely linked to the city's natural environment and the heritage of historical and cultural concepts. A good urban fabric is characterized by wholeness, continuity, collage, dynamism and locality, and also has the value of preservation and inheritance.

The old urban spatial fabric with its fine street network, narrow lots and monotonous use features is gradually replaced by wide streets, large lots and complex functional areas in the development of modern urban spatial environment. The development of spatial structure and the renewal of spatial environment in the new era will inevitably lead to the transformation of part of the urban fabric. However, the street network

skeleton and street pattern of the old city inherited over many years are the concentrated reflection of the characteristic texture of the city. If you protect the original street network skeleton, you can preserve the characteristics of the old city and continue the traditional spatial vein[53]. Especially by adjusting the pedestrian network, building shape and street scale, we can bridge the conflicts and contradictions between the old and new urban fabric, protect the original street network skeleton and street pattern, and realize the coupling of historical fabric and modern urban form.

(1) Increasing sub-level streets

The streets are the skeleton of the fabric, and the relationship between the streets and the division of the land complement each other. The traditional streets of the city represent an irregular spatial organization and subdivide the site on a small scale. In the historic neighborhoods where the status quo has been preserved, it can be seen that in addition to the outer city streets, the traditional streets and alleys within the lots further subdivide the land. In modern urban renewal, the lots subdivided by urban streets are developed as a whole, the subordinate street and alley system within the lots no longer exists, and the traditional urban fabric is eliminated. In the renewed modern urban areas, the scale of the streets and sites contrasts greatly with that of the unrenewed historic lots, and the continuity of the secondary streetscape in the historic lots is interrupted. In the new urban areas, the streets appear to be designed for cars only. There are only streets used by cars and no paths reserved exclusively for pedestrians to pass.

It is difficult to increase the density of the road network in the existing urban areas, but there are a large number of paths and roads in the city that are enclosed by the walls of the housing units, and there is a large amount of resources in the road network that are wasted. Therefore, the impact on traffic and the environment, as well as the specific situation in the old urban areas and within the city walls, should be assessed to ensure appropriate treatment. They should be removed if it is possible. When building new areas, fences should be eliminated or reduced. At the same time, there should be more roads and a denser road network, and sufficient pedestrian walkways should be constructed.

(2) Introducing transitional buildings

The conflict of building forms is also an important reason for the variation in spatial fabric, manifested in the differences in building volumes and layout methods. The

building volume of the historic site is small and the layout is tight and continuous; the modern building volume is large and the layout is loose, and there is a lack of organic connection between the buildings[54]. The fragmented historical environment, in which historical buildings and modern buildings are interspersed, spatially manifests the contradiction between the high density of historical land and the low density of modern spaces, and the modern buildings do not take into account the echo of traditional buildings in the layout, and each of them works in its own way, and the plan looks disorganized.

In order to avoid an abrupt change in the fabric of old and new buildings, transitional buildings should be built between the towers of high-rise buildings and the traditional, small-scale buildings, echoing each other in form while balancing high-density neighborhoods and low-density neighborhoods. The design should also establish a connection between street space and the courtyard formed by traditional buildings to avoid the arbitrariness of new buildings.

(3) Controlling street scale

The street scale is the ratio of the height and width of the street to the building interface. In Paris, for example, the ratio of street width to building height is 1:1.5, while in Italy the ratio is higher, 1:2 or 1:3 (Fig. 4-19). In American cities, the ratio of street height to width is generally 1:6 or 1:10, which is too wide and beyond the perceptual ratio. [23] Thus, streets that are too wide can destroy the cohesiveness and coherence of the urban fabric. In traditional urban neighborhoods, the street profile matches the human scale and is within the human perceptible range. However, in modern cities, the streets are mainly used for automobile traffic, the streets are too wide, and there are many high-rise buildings in the city center, so the scale of such streets far exceeds the human-perceivable range, and the role of streets as interaction spaces is lost.

Therefore, in the construction of new cities or the renewal of old urban areas, it is also necessary to ensure the human scale of the street space, and these streets should maintain the continuity of spatial form and experience with the traditional streets of the surrounding old cities. The street profile also requires a certain degree of continuity. When interesting spaces need to be designed, buildings should be appropriately set back from the urban interface to avoid abrupt changes in the urban street profile due to drastic changes.

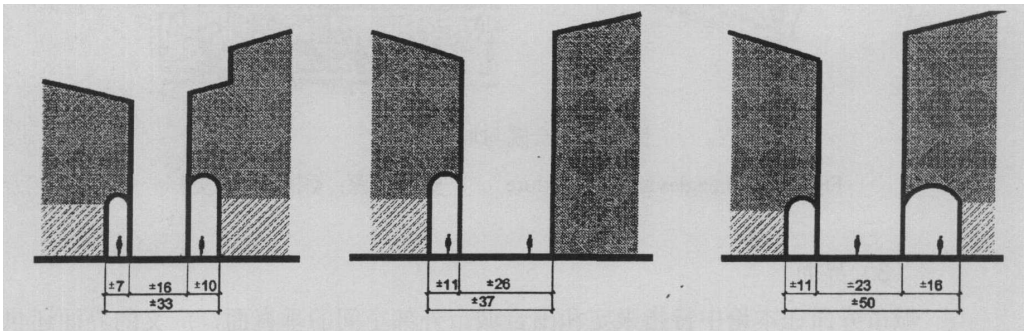


Fig. 4-19 The street section of Italian city
(Source: Wholeness-Continuity-Vitality)

Mandaworks and Hosper's "Inside - Outside" city plan for the city of Vaasa, Finland, uses the old city's existing network of the city of Vaasa, Finland, to organize the spatial elements of the new city (Figure 4-20, 21). The designers tried to use the extension of the old urban area's fabric to integrate urban life around the site and base, and to refine the scale of the fabric grid to create public spaces, pedestrian walkways, and landscape systems to form the urban skeleton of the area.

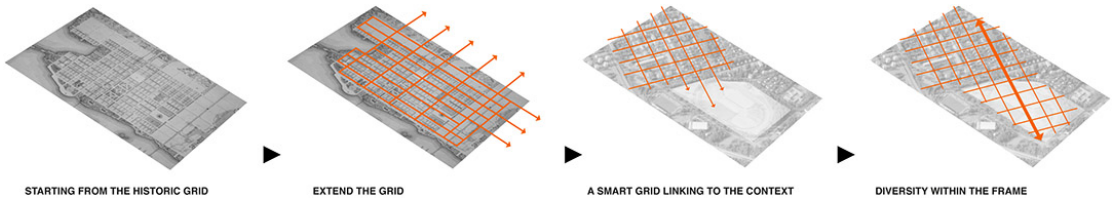


Fig. 4-20 Using the original grid texture
(Source：gooood)

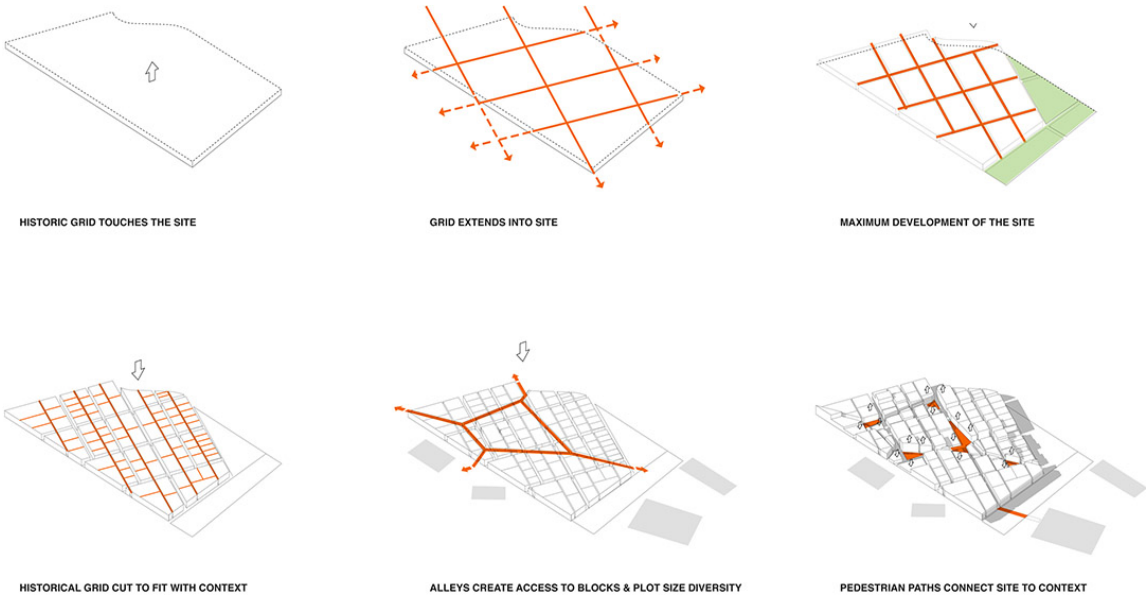


Fig. 4-21 Texture Continuation Concept
(Source: gooood)

Mandaworks and Hosper have refined and developed the old urban fabric, first to make it more compatible with the urban context, second to maximize its connectivity, and finally to extend it southward to directly connect the city center to the project area (Fig.4-22, 23). The plan connects the urban fabric with the city center, the coastal area and the eastern green belt through three elements: the main road, the existing bicycle path and the existing forest. It also reorganizes public transportation and vehicular access to ensure pedestrian safety and make the updated street system more hierarchical.

Fig. 4-22 Full-scale Axometric View
(Source: gooood)

Fig. 4-23 Figure-ground Analysis
(Source: Self-drawing based on data)

4.4.2.2 Coupling new functions with old urban environment

American urban design theorist Lynch said, "The key to urban design is how to ensure the interweaving of various urban activities in terms of spatial arrangement[45]." To meet the diverse and complex demands of urban life, the new and old functional elements must interpenetrate and integrate with the surrounding spatial environment. The functional elements of the old urban areas must be adapted to modern urban life in terms of content and approaches.

（1）Achieving the transformation and inheritance of functions

The most dynamic aspect of urban transformation is the function of the city, and the function of a given time is clearly contemporary. Even today, the transformation of the urban form corresponds to the functions of the contemporary urban form. The transformation of function means the creation of new forms of life. But the transformation of function does not mean a complete change of form; the past form can also serve for the new life form. The urban form is independent of the function to a certain extent, and under certain conditions, the transformation of the function can

be achieved while preserving the historical information of the city. In addition, the functions of the city have a certain continuity and are constantly enriched. Certain urban functions meet the most basic needs of people and have a certain timelessness, based on which the spirit of the place can be continued.

With the continuous development of society and urbanization, modern urban construction is increasing, the industrial structure is transformed, a large number of factories are closed down, old factories are abandoned and become wasteland, these old industrial areas, as part of the city, have caused a great impact on the development and overall image of the city. There are many typical models of functional transformation in modern cities, such as the transformation of old warehouses into cultural and creative technology parks, or the transformation of abandoned ports into coastal industrial parks. There are a large number of such areas in the old urban space, such as old industrial zones, old commercial areas, ports, docks, airports, etc., which were left behind in the process of industrialization. As permanent supports in the city, they are selectively reused through replacement, which not only makes them less costly in social and material terms, but also allows people to have a dialog with history while meeting the needs of urban development and human use. It is a clever combination of old and new, a showcase for history and memory and a vibrant space for modern life, showing its specific characteristics of the place and restoring vitality and liveliness to such an area.

Take Qijiang Park in Zhongshan, Guangzhou, as an example. Qijiang Park used to be the Zhongshan Yuezhong Shipyard. As a symbol of the development of socialist industrialization in Zhongshan, it started in the early 1950s and finally ended in the late 1990s. For several decades, it experienced the arduous and meaningful historical vicissitudes of industrialization in New China. Against this special historical background, the arduous pioneering process of several generations has been reflected here as a genuine and precious memory of the city. In 1998, Zhongshan City decided to transform the site into an open recreational area. After Guangdong Shipyard stopped production in 1999, many shipyard facilities, lifting equipment, water and power supply facilities, machinery and equipment remained on the original site. Instead of removing the old shipyard site, the designer chose the solution of selectively preserving and using the existing elements of the site, using the old boathouse, transformer, gantry crane, and even the smokestack as design materials. The original cement tower on

the site was also preserved and covered with a transparent high-tech glass box, "like an ancient insect frozen in glorious amber thousands of years ago." In the end, the industrial facilities, the plants and flowers that grow naturally here, and the people who play and rest here form a unique urban park with historical memory and a sense of place.

a) Yuezhong shipyard (Before park renovation)

b) Qijiang Park, Zhongshan (after park renovation)

c) Qijiang Park, Zhongshan (after park renovation)

Fig. 4-24 the Picture of Zhongshan Qijiang Park before and after renovation (Source:https://bbs.zhulong.com/101020_group_201864/detail10120405/?checkwx=1&from=timeline)

（2）Embedding diversified modern functions

For cities, functions are diverse, and no function is absolutely crucial or primary, but the mix is the main content, and the mutual support of functions is the order. A single urban function will detract from the vitality of the area. For example, a historic residential neighborhood will lose its vitality and become isolated as an urban "fragment" because it has only one structure, making it difficult to integrate with the rich and diverse modern city. The diversity of urban functions is a universal and important principle, and working with cities in a categorical way will break the links

between the elements of the city.

In terms of how the diversity of urban life emerges, Jacob divides urban functions into two levels: "basic functions" and "subordinate functions." The "basic functions" are the urban functions that themselves attract people to a particular place, such as offices, factories, housing, recreation, and education. The "subordinate functions" are the urban functions that arise in response to the basic functions and provide some kind of service to the people attracted to the basic functions, such as retail stores, restaurants, and other amenities. A "subordinate function" refers to an urban function that arises in response to a basic function and provides a service to the people attracted to the basic function, such as retail stores, restaurants, and other small businesses. A single basic function can only have some impact on people's activities in a given period of time, but only the more complex and effective combination of multiple basic functions can effectively form a gathering center of urban functions, and the commercial and service industries that serve this center will flourish in terms of quantity, time and type because they have sufficient customers, thus making the vitality of the area flourish. The vitality of the area will be prolonged.

Quincy Market on Boston Harbor, with its three two-story buildings, was originally used for produce storage and the meat trade. As the market grew, the area became crowded and the buildings became too old, gradually losing its function as a food distribution center. In the mid-twentieth century, the Boston Redevelopment Authority included Quincy Market in its renovation plan and successfully transformed it into a new commercial center and tourist and shopping destination. After the renovation was completed, Quincy Market was divided into rational functions and revitalized its commercial atmosphere. The number of visitors to the market exceeded 10 million, of which more than 60% were tourists. Of Quincy Market's 3 buildings, the main central building is used for food sales and restaurant operations, while maintaining its original grocery function. The other two buildings house stores for fashion, decorative items, jewelry, and gift items that cater to modern consumer habits. The outdoor plazas at the east and west ends of the market provide space for street performers and small street stalls, often hosting artistic performances and gatherings, integrating urban functions that enrich people's lives into the old urban environment. Stallholders from all walks of life display their carts of goods and decorate them neatly and varied, but not cluttered. The outdoor market-oriented area not only meets the needs of local residents for low-

cost business and tourists for low consumption, but also provides the public with a space for leisure and entertainment in a festive atmosphere. The flexible integration of new functions in Quincy Market respects history and meets the consumer needs of the future market.

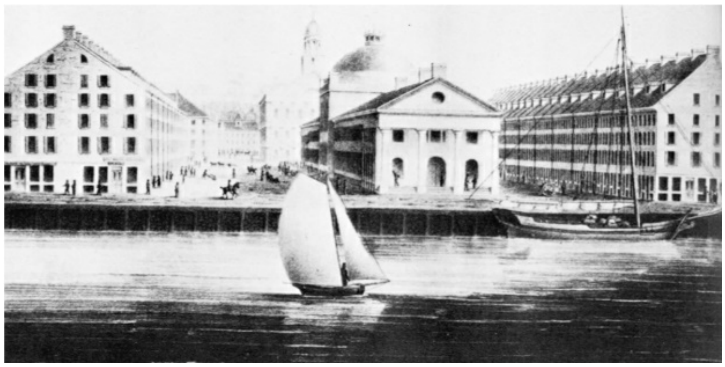


Fig. 4-25 Quincy Market in 19th Century
(Source: http://www.iboston.org/mcp.php? pid=quincyMarket)

Fig. 4-26 The reformed Quincy Market
(Source: http://travel.qunar.com/p-oi7526997-kunxishichang)

（3）Ensuring the flexibility and fuzziness of functions

Another point to consider is that the modern city should be vague and flexible in its functions. It is unnecessary and impossible to assign a precise and rational function to every space in the modern urban space. In addition to the rational thinking, material functions and constant static behaviors and events of space, there are also meaningful irrational thinking, indeterminate behaviors and emergencies and so on. With the increasing development of science and technology, the scope of functional inclusion is becoming more and more limited, and the only way to satisfy the indeterminate behavior of modern man is to create a space that is complementary and mutually beneficial, and is ambiguous and diverse: the opening and closing of spaces, the

flexible arrangement, the flexible change of space layout and functional content, and the introduction of rooftop gardens, places for rooftop activities, and the combination of above-ground and below-ground spaces, etc. are all concrete manifestations of the ambiguity of space.

For example, Japanese architect Shintaro has proposed the concept of "smooth space." He believes that in the past, the planning of many spatial environments was often limited to a fixed function, which seemed stereotypical and rigid. However, the concept of "indeterminate space" takes more into account the factors of human behavior, including conscious, unconscious and accidental behavior, and induces various new behavioral activities through spatial planning, making the environment more dynamic with multiple functional activities and more Spatial planning induces various new behavioral activities and makes the environment more dynamic with multiple functional activities. While our urban space is full of different levels of publicness, it is interested in the ambiguity of publicness itself and connects it with tradition. His designs are interconnected and permeate landscapes between spaces of different publics. His design of Japan Rissho University is a concrete implementation of this idea of using limited space to accommodate people's multiple activities and interpersonal exchanges. (Figure 4-27). In the spatial environment of the old city, it is more important to maximize the use of space and the blurring and flexibility of functions due to limited land use. For example, the square can be used as a leisure and recreation space, but at the same time it must also fulfill the functions of festivals, performances and market trade. The focus of the design is to explore the possibilities of the space and improve its adaptability to meet more needs.

Fig. 4-27 Rissho University Kumagaya Campus, Japan
(Source: https://www.xuehua.us/a/5ebb870786ec4d140febd52e?lang=zh-hk)

4.4.2.3 Coupling historical context with walking system

As Alexander said, "Men cannot maintain their spiritual roots and their connection to the past if the physical world they inhabit does not sustain this historical element." A simple space becomes a "place" only when it is coupled with a particular urban culture and has cultural and spiritual properties above the material level. As the most active element in the city, place is the product of the overlap between the physical form of the city and human activities, and it is the most meaningful space for the subject of the city - human beings. The question of how to systematically connect the historical elements of the city is therefore the focus of urban planners.

In actual practice, designers must integrate the scattered historic elements into the physical structure of the city, usually through a complete system of walking system to link them. The benefits of walking system as the coupling clues are: First, the walking paths often overlap and coincide with the historical fabric, and can be interwoven with the historic elements to form a network that continues the cultural information as a whole. Second, by viewing people as subjects of perceiving the historical lineage, the walk has a higher accessibility, so it strengthens the linkage of fragmented historic and cultural elements through its behavior.

In this coupling approach, the following points must be considered: 1. Reduce the number of interrupted paths in the system of walking system to ensure the connectivity of the path. 2. attempt to locate historic heritage elements at the intersection of the street to improve their accessibility. 3. the pedestrian streets must be of an appropriate scale to provide a medium, comfortable experience on foot. 4. the style of the pedestrian streets should be consistent with the historic and cultural district in which it is located to avoid visual inconsistencies. 5. the walking system should be appropriately integrated with modern elements and functions, so that it has the vitality of sustainable development, rather than being completely inherited, resulting in a lack of vitality.

The historic district of "Kuanzhai Alleys" in Chengdu, China, was once called "Shao Cheng"for civilians and merchants after the Qin Dynasty destroyed Shu. "The 45 courtyards from the late Qing Dynasty and early Ming Dynasty have been preserved intact. Kuanzhai Alleys consists of three parallel linear streets, Kuan Alley (400 m), Zhai Alley (385 m) and Jing Alley (390 m), each less than 400 m apart, which is a pleasant walking length. Between the three alleys, there are also five side alleys

running in the north-south direction, which, together with the courtyards, form a rich and clear network of well-defined streets, offering a variety of options. The street atmosphere and thematic stores of the three alleys are different, and visitors can enjoy the different ancient life of Chengdu and the rich history of the traditional streets while walking through the alleys. The style of countryside in Kuan Alley mainly shows the life culture of Chengdu, the Zhai alley shows the courtyard culture and the Jing alley shows the brick culture.

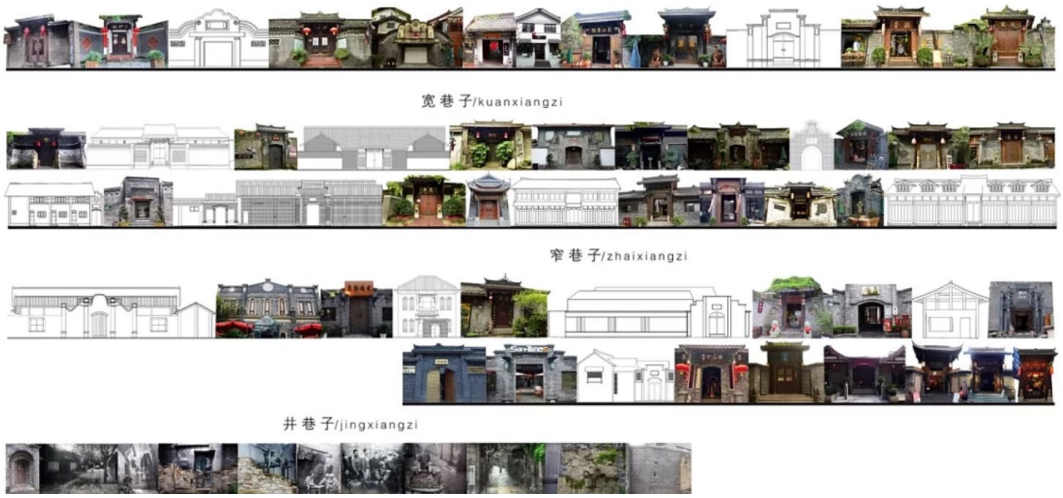


Fig. 4-28 Kuanzhai Allyes' historical and cultural elements
(Source: www.zcool.com.cn/work/ZMTY2NTIxMjQ=.html)

In the case of the preservation and renovation of Kuanzhai Alley, the preservation of the cultural connotation of the old city is realised through a pedestrian network. The designer takes the courtyards and old buildings in Kuanzhai Alley as the coupling elements and designs a series of nodal spaces, using the physical paths as clues to connect these nodal spaces and link the spatial elements of the old urban areas, so that all elements in the area are well connected and integrated.

Fig. 4-30 Walking system and node sequence of Kuanzhai Alley
(Source: Self-drawing)

4.4.2.4 Coupling living scenes with landscape space

Both places and natural landscapes are important components of the city, the former inseparable from human activities and the latter an important physical environment of the city. A. Madanipour, in Design of Urban Space, offers his own view on the interconnected yet distinct concepts of place and space: "It is this direct interaction between people and their environment that makes place fundamentally different from the ordinary areas around it. If space provides movement, then place provides pause[55]." He sees place as a special space with a sense of enclosure and a sense of psychological identity[56]. The old urban environment contains a large number of memory places, which are the spiritual carriers of the people who have lived here. As society changes, the places are often demolished and renovated, and the former habits and patterns of behavior are no longer present. If we can link the place closely to the physical environment in which it is located, we can ensure the stability of the physical space and thus maintain the spirit of the place. In general, there are two common modes of coupling living scenes and landscape spaces: preserving the original life scenes and perpetuating historical spirit and memory.

（1）Preserving the original life scenes

This coupling mode consists in using the landscape space as a material carrier of the spirit to create a new scene adapted to modern urban life, but at the same time the original life scenario of the place must be preserved. This coupling mode does not try to change the original function of the place, but only optimizes its material environment to adapt it to the needs of contemporary urban spatial development. This coupling mode is generally used for smaller spaces. For example, the life scenes of citizens fishing, drinking tea, and playing cards by the river are maintained, but the environmental quality of the waterfront space is improved. Another example is the Barangaroo Reserve project in Sydney Harbor, which provides a place for citizens to relax on the beach, sunbathe, and engage in other daily activities. People's lifestyles are coulped with more beautiful and comfortable landscape spaces, which is conducive to the continuation of place memory and makes the connection between people and nature and history closer.

Fig. 4-31 Citizen's life and waterfront space (Source: shoot by author)

Fig. 4-32 waterfront space of Suzhou (Source: tuchong.com)

a) b)

Fig. 4-33 Barangaroo Reserve, Sydney: Recreation and gathering (Source：gooood)

（2）Perpetuating historical spirit and memory

The second way is to integrate natural elements into the old urban environment with the spirit of the place, such as industrial heritage and abandoned public facilities, replacing the original production and transportation functions of the place with ecological functions. At the same time, elements with historical symbolic meaning are left behind and people use them to recall scenes from the past, realizing the coupling of physical environment and spiritual memory. This coupling model is applicable on a large scale. Common examples include the transformation of abandoned elevated train tracks into walking paths in parks and the transformation of old shipyards into waterfront parks. Famous cities such as Sydney, Philadelphia, New York, and Paris have examples of transforming transit systems into linear parks.

High Line Park in New York, for example, is a linear urban park transformed from a historic freight rail line located above the streets of Manhattan's West Side[57]. The core of the High Line Park renovation is "preservation" and "reuse" to revitalize the historic site in an ecological way. The design reflects the former identity of the High Line

railroad through the use of rugged industrial materials (e.g., concrete, weathering steel, recycled wood) and creates a sense of desolation in the abandoned landscape; the selection of grasses and perennials and their arrangement create a dynamic wild landscape; old elements such as tracks and switches are reintroduced; and the original structures at special locations, entrances, and crossings are retained and revealed. As you stand and look out over the new park, these points constitute a new interpretation of the project area. High Line Park successfully couples urban waste infrastructure with landscape space while providing a variety of functions such as ecological planting, social outings, and recreational sports. This successful renovation project manages to reinvent the place. New places such as theaters, gardens, woodlands, and activity platforms will create new memories.

Fig. 4-34 New york's scene picture
(Source: gooood)

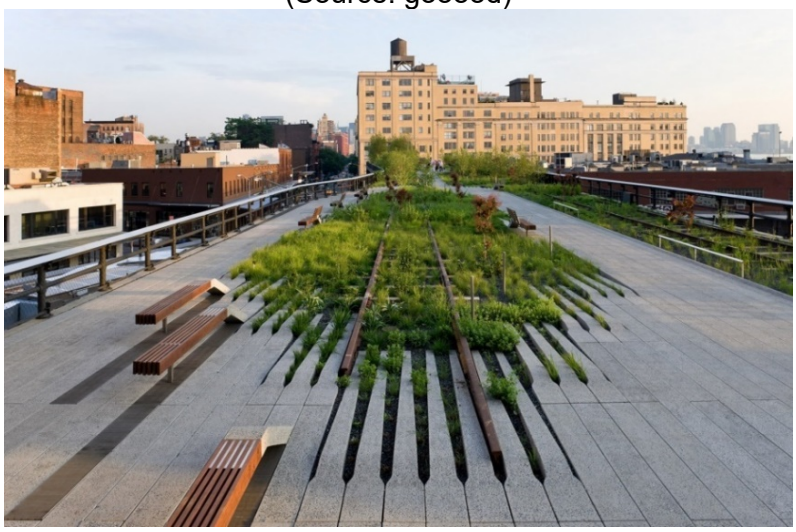


Fig. 4-35 Rail elements in high line park Image
(Source: gooood)

4.5 Summary of the chapter

Based on the analysis of relevant practical cases in Chapter 3, this chapter summarizes the strategies of spatial integration of the old urban areas based on linkage coupling thoughts, hoping to provide some inspiration for the design in this field. First, it is stated that the principles of establishing connections must satisfy mutual interaction, continuity and convenience. After that, from the tangible level of space, material, etc., and the intangible level of historical context, this paper elaborates the elements that need to be linked and coupled in the old city, as well as the possible connection clues in the environment of the old areas. Finally, this paper divides the approaches of linking and coupling into two categories: approaches of linkages between tangible elements and approaches of coupling intangible elements with tangible elements. The former can be correlated under three aspects: Axis, Path and Interface, while the latter can combine functions, historical context, texture, life scenes with physical urban environments, and finally a new order is created for the old urban space to achieve comprehensive integration. The goal of both kinds of linkage and coupling approaches is to shape the old urban space into an organic whole so that it can no longer exist in isolation from the modern city. In this way, the vitality of the old urban area is restored, its historical value is brought to the fore, making it adapt to the complexity and contradiction of urban development and realizing sustainable development.

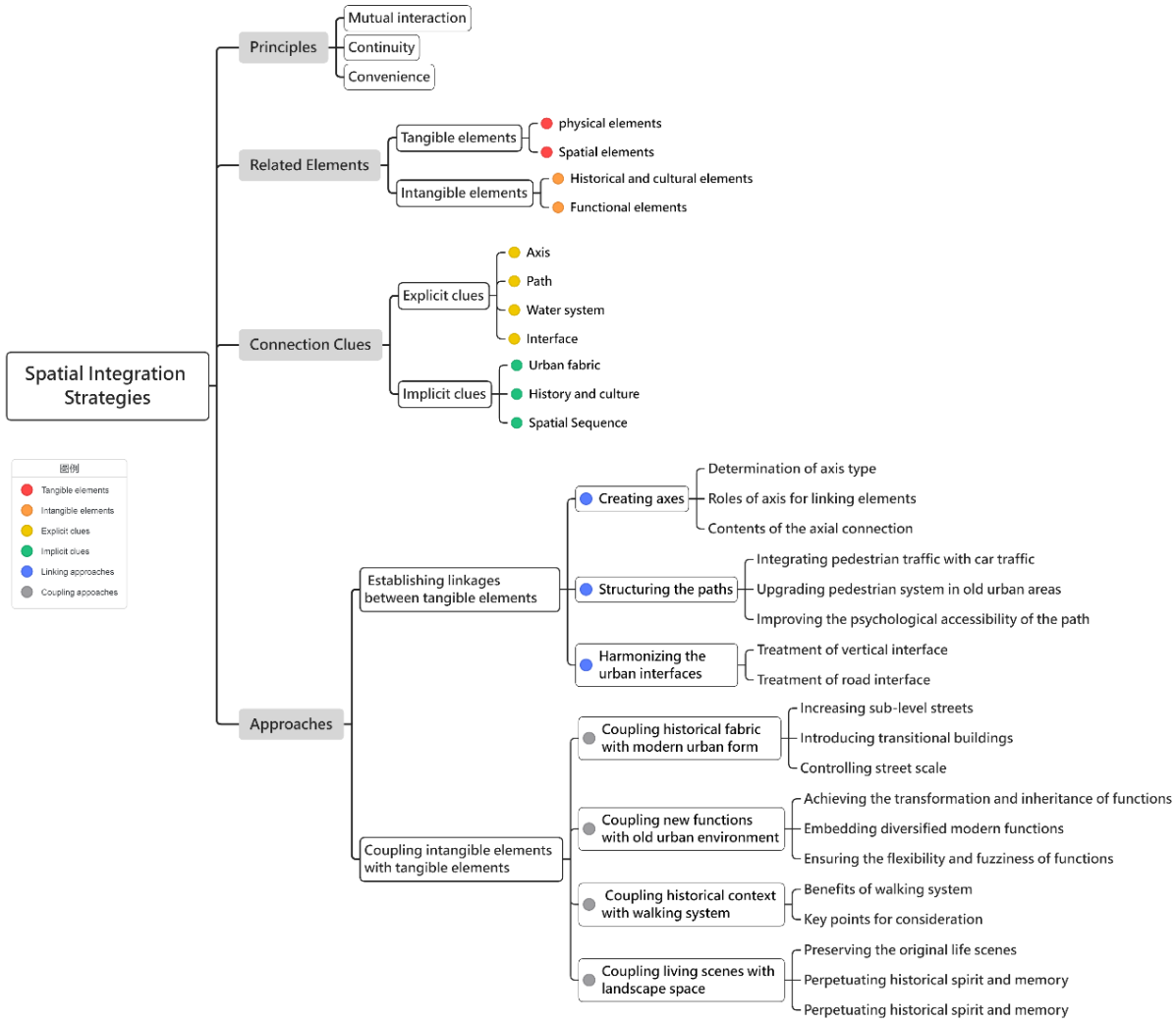


Fig. 4-36 The framework of spatial integration strategies
(Source: Self-drawing)

CHAPTER 5: Investigation and Analysis of Changhua Historic District

5.1 Project overview

5.1.1 Project location

Changhua Historic District is located in Liwan District, Guangzhou, and covers an area of 6.05 hectares. The core protected area starts from Longjin West Road and Enning Road in the east, reaches Changhua River in the west and Fengqing River in the south, and reaches Duobao Road in the north[58]. The core of the protected area covers 4.82 hectares and has a boundary length of about 850 meters. It got its name because it was the former site of Changhuayuan in the Southern Han Dynasty.

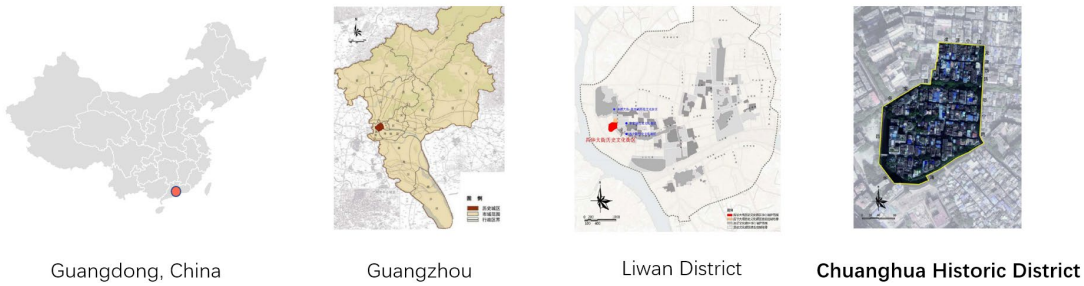


Fig. 5-1 Location of Changhua Historic District
（Source: Conservation and Utilization Planning of Changhua Historic District）

5.1.2 Background analysis

Changhua Historic District is also referred to as Changhua Street for short. Changhua Street, in a strict sense, is the old place name of Xiguan, Guangzhou. It is a residential area developed by Xiguan in the late Qing Dynasty and the beginning of the Republic of China, that is, the present Changhuayuan residential community. Xiguan, where Changhua Historic District is located, is outside the western city of Guangzhou. Due to its low terrain, it is near the Pearl River. In the past, there were two rivers and lychee trees here[59]. The Xiguan area used to be a rural area in Shui Ze, where famous officials and rich nobles competed to build gardens in previous dynasties. With the change of dynasty and the development of the times, the former ruling area of dignitaries and the former royal garden have also developed into residences of common people and concentrated dwellings. With the prosperity of Guangzhou's foreign trade in the Ming and Qing Dynasties, especially under the influence of the thirteen banks' trade with Europe and America, Changhuayuan gradually became a

block consisting of Xiguan Dawu, bamboo houses, Xiguan mansions and congregating housings in the 1930s. Nowadays, there are still a considerable number of buildings in the community, and the structure and architectural features of the streets and alleys are still well preserved in the initial stage of completion, and it is known as the living "Xiguan Residential Architecture Museum".

Changhua Historic District is an important cultural showcase in Xiguan area. Its emergence reflects not only the changes in Guangzhou's historical urban geography in the late 19th and early 20th centuries, but also the modern transformation of urban lifestyle. Due to the beautiful environment, Changhua Street gradually developed from rural areas to private houses and finally to a new residential area in Xiguan area. From the perspective of space production, this process is not only the result of urbanization in the western suburbs of Guangzhou at the end of the Qing Dynasty, but also the materialization of the allocation and utilization of spatial resources through the development of Xiguan. Due to its excellent geographical location, Changhua Historic District is adjacent to many representative historical sites and cultural attractions in Xiguan, Guangzhou, such as Liwan Lake Park, Xiguan Dawu, Liwan River and Yongqingfang Scenic Spot. The sights are interconnected and together form the Guangzhou Xiguan historical experience route.

5.1.3 Historical development

5.1.3.1 Historical evolution

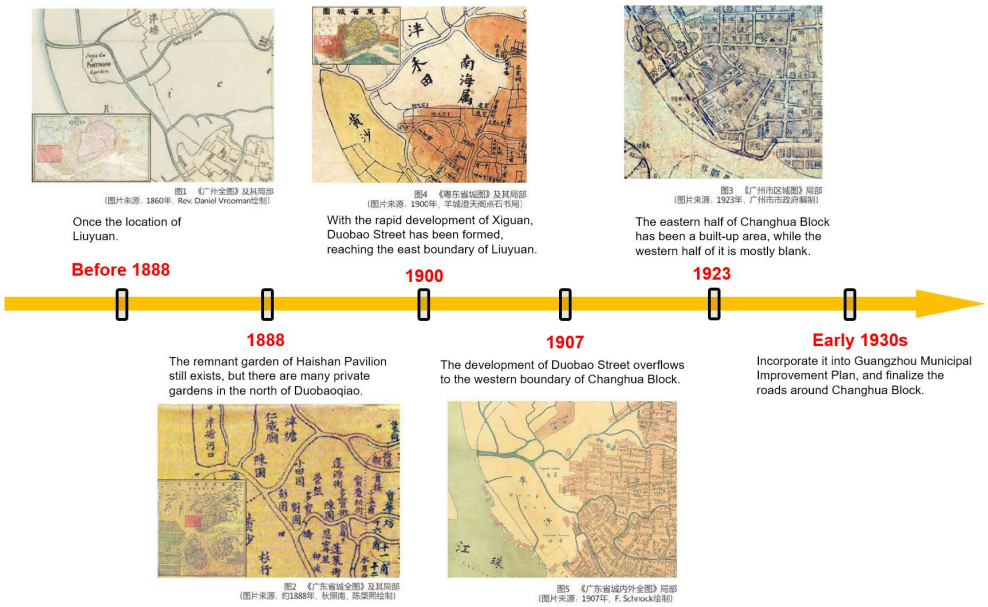


Fig. 5-2 Evolution of spatial form in Xiguan Area
(Source: Self-drawn according to the data)

From the perspective of historical evolution, the royal garden built by the Liu family in the Southern Han Dynasty was enclosed here, and in the Tang and Song Dynasties, the dam was built near Liwan Chung. After the construction of the Western City in the Song Dynasty, the population in Xiguan gradually condensed, and in the Ming and Qing Dynasties, it became the main direction of Guangzhou's outward expansion and experienced rapid development after the middle of the Qing Dynasty. The emergence of Changhua Historic District is the result of the continuous expansion of the urban construction area and the spillover of the construction of Duobao Road. In the great development of Xiguan in Guangzhou at the end of the Qing Dynasty and the beginning of the Republic of China, it was the last completed block in Xiguan and became a business center with trade, commerce and handicrafts as its main components. Based on the economic structure and economic activities, this commercial city residence forms a special urban layout with trade, commerce and handicrafts as the main features, which complements with commerce and residence. There are various architectural forms in Changhua Street, including traditional houses from the late Qing Dynasty, modern buildings and modern congregating housing. In the 1930s, the overall spatial structure of Changhua Historic District was basically completed.

Fig. 5-3 Historical evolution map of Changhua Historic District form
(Source: Self-drawn according to the data.)

5.1.3.2 Natural evolution

In the Sui and Tang dynasties, the Xiguan area was full of rivers, streams, ditches and ponds, which did not yet form land, but gradually became flat land due to constant alluvion. It was not until the Ming Dynasty that the city began to be expanded. Changhua Historic District borders the Changhua River, which determines the waterfront characteristics of its spatial structure. The Changhua River has been part of the Liwan Landscape System since the late Qing Dynasty, especially in the 1920s and 1930s, the "River Tour" water amusement project was established in Litchi Bay, and the Changhua River became one of the places where cruise ships docked. In the 1990s, due to the siltation of the river, the Changhua River was covered with cement pavement and turned into an underground drainage channel, and some temporary buildings occupied the pavement. In recent years, the Guangzhou Municipal Government has started the renovation of Changhua river, and the waterfront space of Changhua river has been greatly restored and upgraded through renovation works such as uncovering and re-flooding, repairing old buildings and constructing embankments.

5.1.3.3 Social evolution

In the Qing Dynasty, Xiguan District, where Changhua Historic District is located, became a prosperous urban area with commercial residential groups. During the reigns of Tongzhi and Guangxu in the Qing Dynasty, lords, rich people and businessmen successively built houses on a large scale in this area, which was the beginning of large-scale construction. The initial emergence of the neighbourhood was a spontaneous gathering of people from the bottom up, mainly middle- and high-income people, who mainly built the existing historical features of the neighbourhood; in the second period, low- and middle-income people were the main residents. In the special historical period, the main population of the block was directly replaced by policies, avoiding the result of vacant and dilapidated blocks, which was a population replacement forced from above. In the third period, the middle-income group was the main group. During the reform and opening phase of the reconstruction of the old city, policies were relaxed to allow spontaneous population exchange from the bottom up. In this process, Guangzhou residents formed the main group, and residents of the surrounding areas of Guangzhou were added, but there were no real foreign residents.

However, the vitality of this group began to decline, and the population began to age[60]. The economic status of some people declined and they stayed behind, while the economic status of others rose and they began to move away. Only in the last five years did the real migrant workers appear.

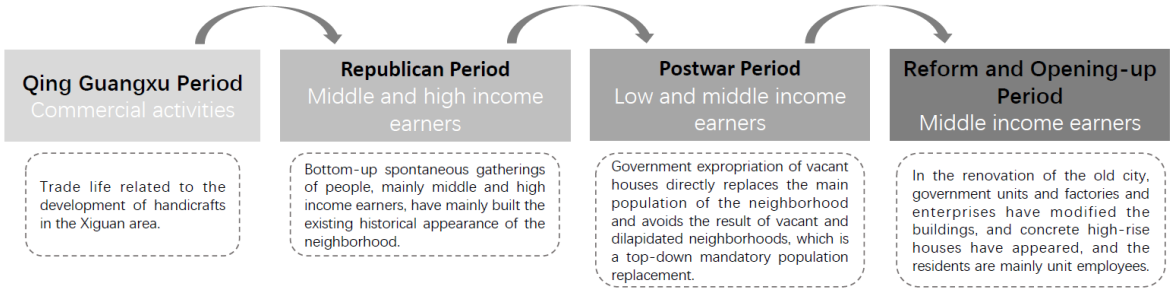


Fig. 5-4 Schematic diagram of social evolution of Changhua Historic District
(Source: Self-drawing)

5.2 Conservation and utilization

5.2.1 Conservation scope and control requirements

The protection area of Changhua Historic District is divided into a core protection area and a construction control area. The core protection area extends east to Enning Road, north to Duobao Road, west and south to Changhuayong, covering an area of 4.84 hectares. The building height of new and expanded necessary infrastructure and public service facilities in this area should be less than 12 metres. The control area is east to Longjin West Road, west to the wall of Guangzhou Xiguan Peiying Middle School, south to Duobao Road and north to Fengyuan Zhongyue, with an area of 1.22 hectares. The protection and control measures for this area stipulate that the building height of new buildings and extensions will be limited to less than 18 metres. It can be seen that the protection area covers most of the communities including the water system, reflecting the importance attached to the protection of cultural relics and historic buildings.

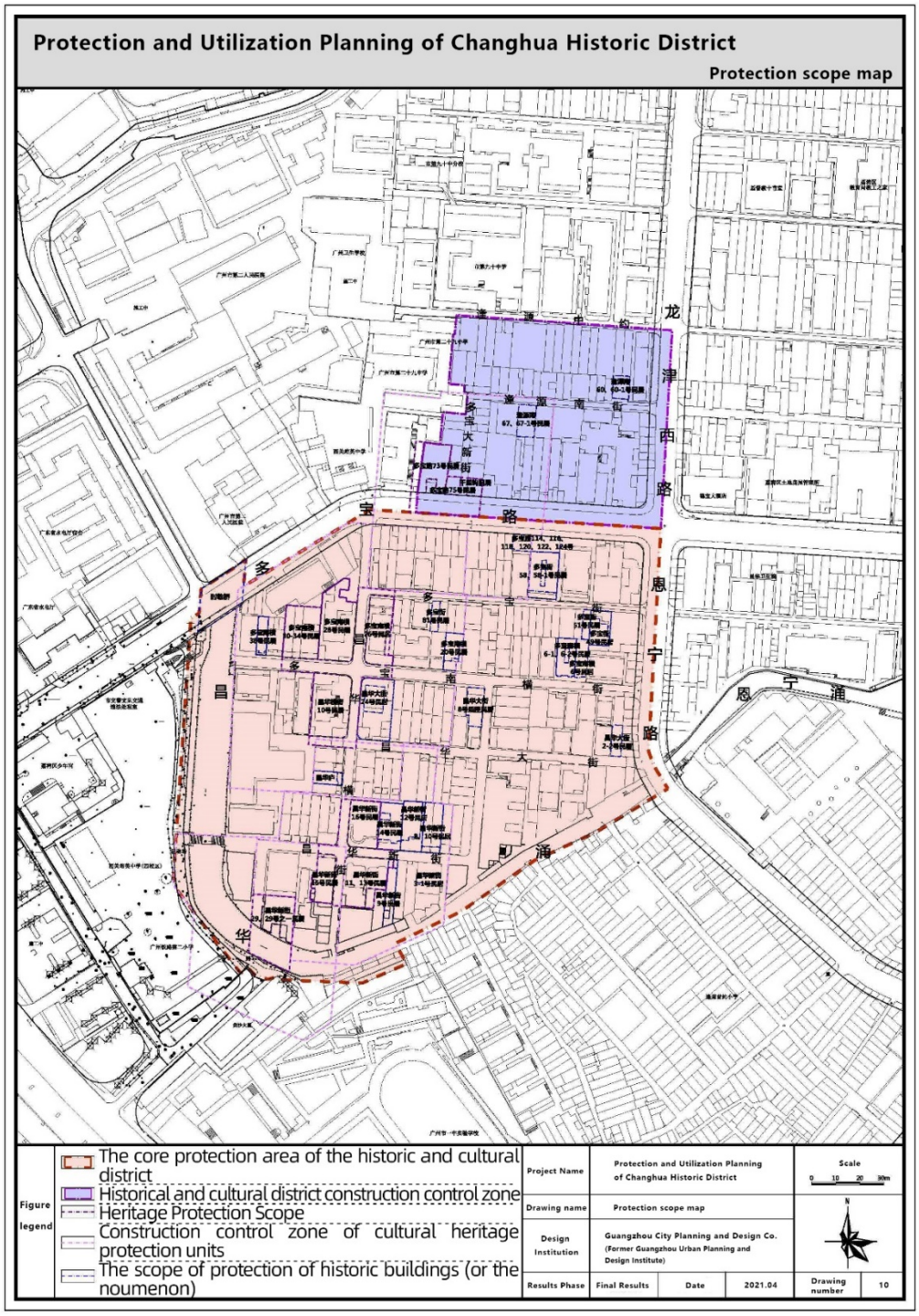


Fig. 5-5 Conservation Scope of Changhua Historic Block
(Source: Conservation and Utilization Planning of Changhua Historic District (Text-Atlas))

5.2.2 Conservation of tangible cultural heritage elements

The protection of material elements in Changhua Historic District includes the protection of immovable cultural relics, historic buildings, traditional style buildings, indications for the protection of immovable cultural heritage, buildings worthy of protection, traditional streets and alleys, historical and ecological elements and so on.

Table 5-1 Material Heritage Elements Protection Object

Heritage System	Type of heritage		Heritage Elements
Elements of physical cultural heritage	Immovable cultural relics (11)	District-level cultural relics protection units (4)	Residence 73, Duobao Road、Duobao Road, No. 75, Residence、Qianliju's former residence、One of the residential houses at 27, 29 and 29 Chang Hua Xin Street
		District registration protection of cultural heritage units (7)	House No. 26, Duobao South-cross、House No. 28, Duobao South Crossing、House No. 34, Duobao South-cross、7 places such as No.10 residential house in Changhua cross street
	Historic buildings (21)		Duobao South Cross 20 Residence、Duobao south cross 38 residential and 21 other places
	Traditional style building (1)		House No. 65, Fengyuan South
	Immovable cultural heritage protection clues (8)	Traditional style building clues (8)	House No. 22, 22-1, Changhua New Street、House No. 24, 26, 28, 30, Changhua New Street、Residence No. 6, Changhua New Street、Changhua Street, No. 1-3, the riding building and 8 other places
	Other buildings with conservation value (2)		Duobao Daxin Street Residence No. 2、Duobao South Cross 33 Residence
	Traditional streets and alleys (10)	The first type of cavalry street (2)	Yongjin West Road、Enning Road
		The first category of traditional streets and alleys (3)	Inner streets: Duobao South Cross, Changhua New Street, Changhua Cross Street
		Second-class traditional streets and alleys (5)	Main Street: Duobao Road Inner streets: Fengyuan South, Duobao Daxin Street, Dabao Street, Changhua Street
		Lane gate (5)	Changhua Yuan, Duobao Street, Duobao South Crossing, Changhua Street, Duobao Daxin Street

	Historic Environment Elements (12)	Masonry street and alley(5)	Feng Yuan Zhong Yi, Feng Yuan South Street, Dabao Da Xin Street, Dabao Street, Dabao South Cross
		Water system (1)	Changhua river
		Ancient and valuable trees (1)	Yellow kudzu tree (44010300510400205, No. 3 South Street, Changhua Street, Duobao Road)
	Celebrity Stories	Revolutionary industrialist Liu Xuexun and the ruins of Liu Yuan	Establishment of an exhibition hall for the display of photos and relics; compilation of street stories

(Source: Protection and Utilization Planning of Changhua Historic District)

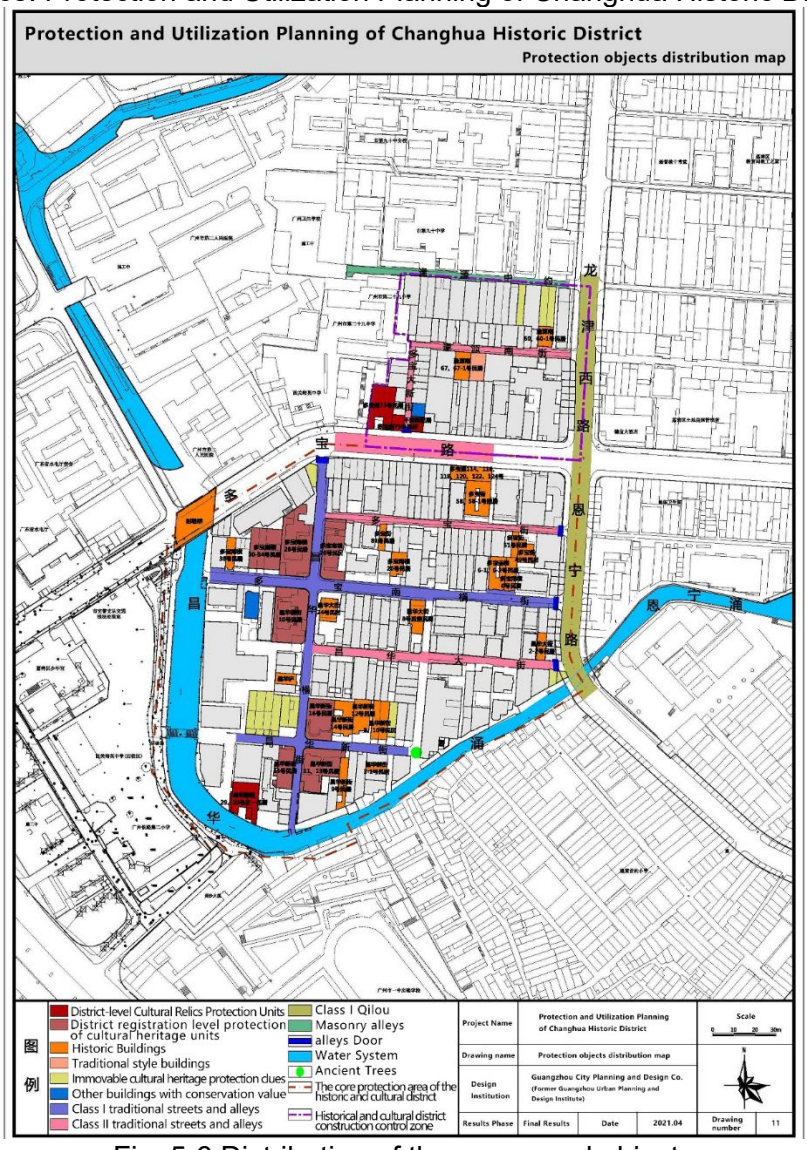


Fig. 5-6 Distribution of the conserved objects
(Source: Protection and Utilization Planning of Changhua Historic District)

5.2.2.1 Building protection

Architectural protection objects include protection units for cultural relics, historical buildings, traditional buildings, immovable cultural heritage protection notices, other buildings worthy of protection, other buildings and structures, etc. In Changhua Historic District, there are more than 40 buildings that need urgent protection as they are the most important elements of material and cultural heritage. In conjunction with the conservation planning, existing research results and architectural status, and taking into account factors such as history, living form and architectural space characteristics, the protected objects (buildings) are divided into six categories: independent garden-style houses, congregating housing, bamboo houses, Qilou-style buildings, Xiguan Dawu and Xiguan mansions.

All the protected properties were built in the Republic of China, but due to the different construction period, they have different structures, spaces and details, and most of the buildings have incorporated Western architectural styles to a greater or lesser extent; the protected properties along Duobao Road and Enning Road are mixed commercial and residential buildings, No. 16 Changhua New Street is a public service building, and other buildings are purely residential, including single-family and multi-family houses.

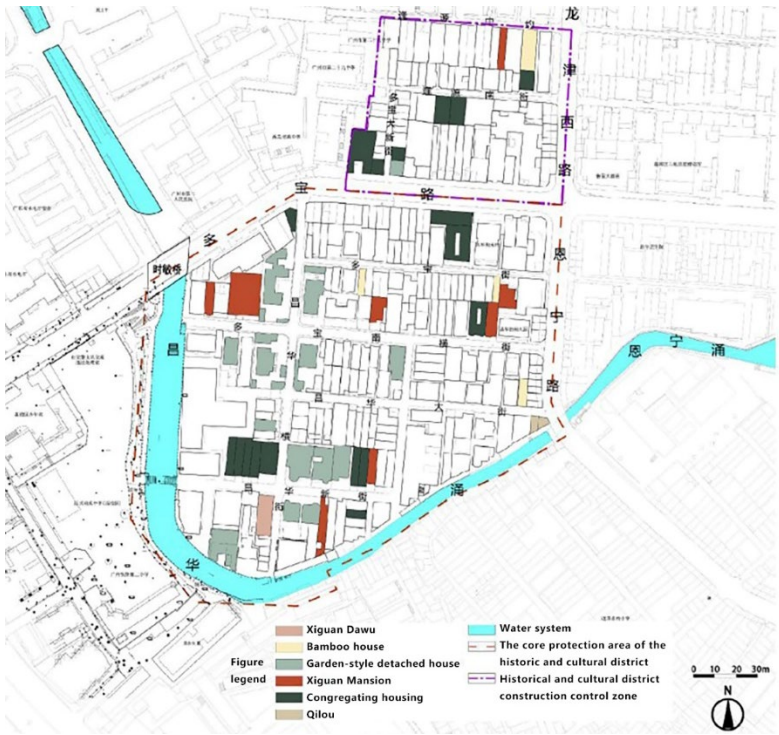


Fig. 5-7 Distribution map of protected objects
(Source: Self-drawn according to data.)

There are some vacant houses in the neighbourhood, mainly historic buildings, with the vacancy rate of houses on both sides of Changhua New Street being high, which is consistent with the abandoned location of Changhua New Street. Some garden houses on Changhua Street are also vacant. Suitable commercial, cultural and public service functions can be established for the use of this part of the building to meet the residential needs of the area, activate the historic buildings and promote the vitality of the area.

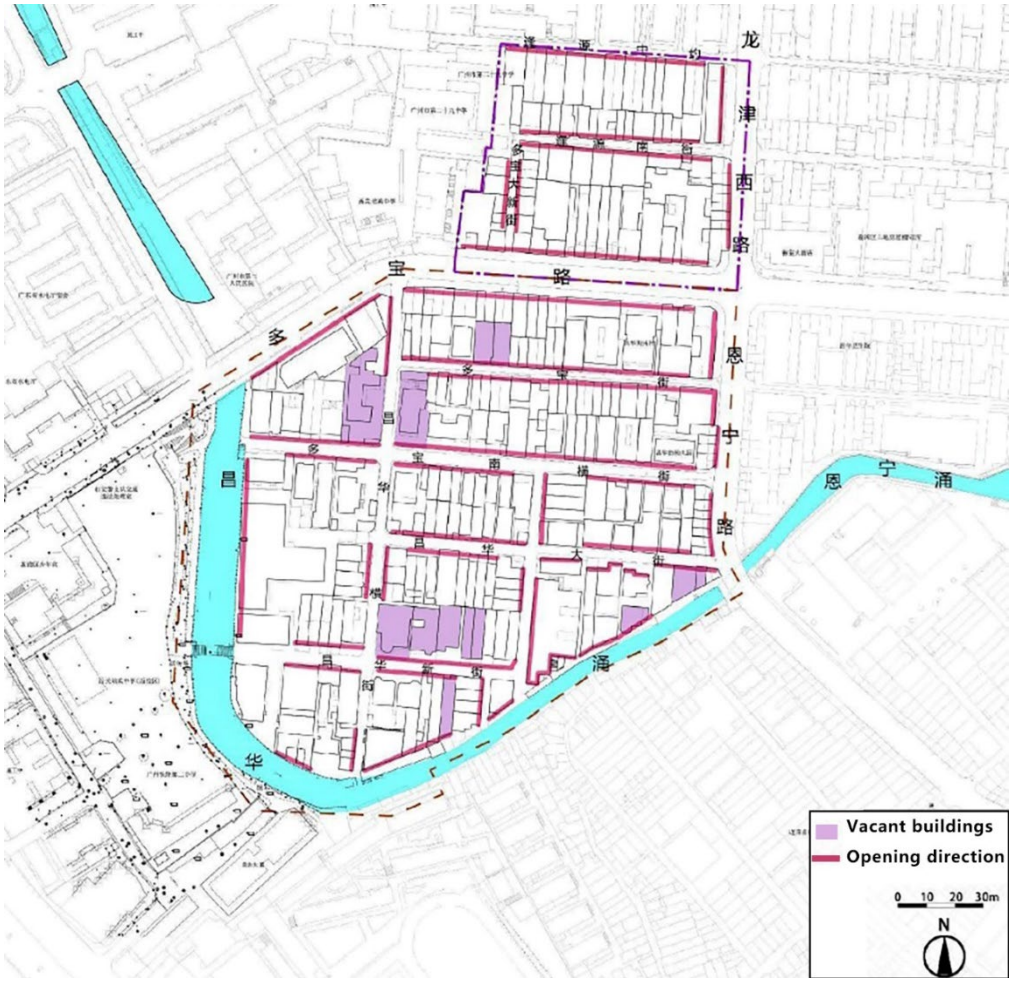
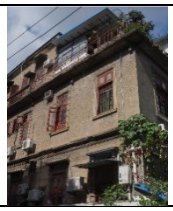
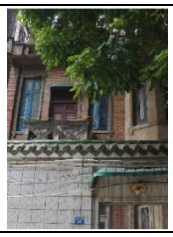
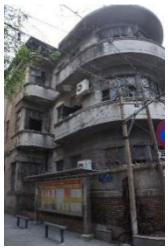


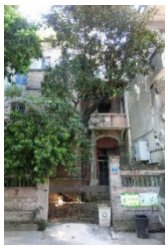
Fig. 5-8 the Marking of vacant buildings
(Source: redraw according to the data.)

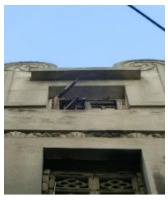
Table 5-2 Statistics of historic building elements

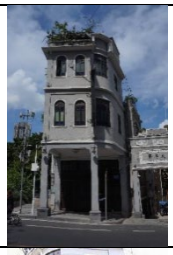
Types of historical elements	Name	Photo	Present situation	Renewal intention
Xiguan Dawu (Typical style architecture)	Changhua new ST No.15 dwellings		The overall layout and shape of the building are basically preserved, but the top floor and front yard are seriously added.	Repair-oriented. Demolition of illegal additional structures.

Bamboo house (Traditional dwellings）	Duobao ST No.51 dwellings		The overall layout and shape of the building are basically preserved, and the external wall is partially peeled off.	Repair-oriented. Demolition of illegal additional structures, repair of damaged components.
Bamboo house (Traditional dwellings）	Duobao ST No.81 dwellings		This building is a brick-concrete structure in the Republic of China, which combines Chinese and western styles.	Repair-oriented. Demolition of illegal additional structures, repair of damaged components.
Bamboo house (Traditional dwellings）	Changhua ST No.2-No.2 dwellings		The overall layout and shape of the building are basically preserved, and the external walls are partially damaged.	Repair-oriented. Demolition of illegal additional structures, repair of damaged components.
Garden-style detached house (Typical style architecture)	Changhua New ST No.11 and No.13 Dwellings		The building is a brick-concrete independent residence with a courtyard, and several doors and windows are equipped with anti-theft nets.	Display-oriented. Demolish the fence and show the architectural style to the public again.
Garden-style detached house (Former residence of celebrities）	Duobao South-cross ST No.28 dwellings		The building is a villa-style building with courtyard brick-concrete structure, with many external walls peeling off and damaged terraces and corridors fences.	Transform-oriented. Repair damaged components, remove additional buildings and walls, add corridors on the second floor, and transform it into a museum.
Garden-style detached house (Former residence of celebrities）	Duobao South-cross ST No.26 dwellings		The building is a villa-style building with courtyard brick-concrete structure, with multiple doors and windows plus anti-theft nets.	Transform-oriented. Repair damaged components, remove additional buildings and walls, add corridors on the second floor, and transform it into a museum.
Garden-style detached house (Typical style architecture)	Changhua cross ST No.10 dwellings		The building is a brick-concrete structure with a courtyard and a detached house with a combination of Chinese and western styles, which is well preserved.	Transform-oriented. Repair damaged components, remove additional buildings and walls, add corridors on the second floor, and transform it into a museum.

Garden-style detached house (Typical style architecture)	Changhua ST No.24 dwellings		The building is a modern independent residence with courtyard brick-concrete structure and a combination of Chinese and western styles, and its exterior wall is made of red brick.	Transform-oriented. Repair damaged components, remove additional buildings and walls, add corridors on the second floor, and transform it into a museum.
Garden-style detached house (Typical style architecture)	Duobao South-cross ST No.33 dwellings		This building is an early modern independent residence with courtyard brick-concrete structure, and the courtyard walls are now pasted with white tiles.	Repair-oriented. Demolition of illegal additional structures, repair of damaged components.
Garden-style detached house (Typical style architecture)	Changhua ST No.8 dwellings		The building is a modern independent residence with courtyard brick-concrete structure and a combination of Chinese and western styles, some doors and windows have been replaced.	Display-oriented. Demolish the fence and show the architectural style to the public again, transform courtyard space into corner pocket park.
Garden-style detached house (Typical style architecture)	Changhualu		The building is a modern independent residence with garden brick-concrete structure combining Chinese and western styles, and the courtyard walls are made of concrete.	Display-oriented. Change the form of the fence to show more architectural features.
Garden-style detached house (Former residence of celebrities）	Changhua New ST No.16 Dwellings		The building is a brick-concrete detached house with a courtyard, and some doors and windows are damaged and replaced, now it is vacant.	Display-oriented. Demolish the fence and show the architectural style to the public again, transform courtyard space into green public space.
Garden-style detached house (Former residence of celebrities）	Changhua New ST No.14 Dwellings		The building is an early modern independent residence with courtyard brick-concrete structure, with doors and windows damaged on the facade and some windows closed, now it is vacant.	Display-oriented. Demolish the fence and show the architectural style to the public again, transform courtyard space into green public space.
Garden-style detached house (Former residence of celebrities）	Changhua New ST No.12 Dwellings		The building is a modern independent residence with courtyard brick-concrete structure and a combination of Chinese and western styles. Courtyard wall have collapsed, and other components are well	Display-oriented. Demolish the fence and show the architectural style to the public again, transform courtyard space into green public space.

			preserved, now it is vacant.	
Garden-style detached house (Former residence of celebrities）	Changhua New ST No.27, No29, No.29-1 Dwellings		The building is a brick-concrete detached house with courtyard, and some walls are corroded and weathered by rain, now it is vacant.	Transform-oriented. Repair damaged components, facade, and the internal space, build an expanded building and square outside, and transform it into a Cantonese Opera Celebrity Museum.
Xiguan Mansion (Traditional dwellings）	Duobao South-cross ST No.38 dwellings		The building is a brick-concrete structure with Chinese and western styles, and many doors and windows are replaced.	Repair-oriented. Demolition of illegal additional structures, repair of damaged components. Restore the traditional door and window style.
Xiguan Mansion (Traditional dwellings）	Duobao South-cross ST No.6 dwellings		This building is a modern independent residence with brick-concrete structure combining Chinese and western styles, which is well preserved.	Repair-oriented. Repair the damaged components. Improve the indoor environment to meet the needs of modern living.
Xiguan Mansion (Traditional dwellings）	Duobao South-cross ST No.20 dwellings		The building is a modern independent residence with courtyard brick-concrete structure and a combination of Chinese and western styles, and the external wall is partially damaged, now it is vacant.	Display-oriented. Repair the damaged components. Demolish the fence and show the architectural style to the public again.
Xiguan Mansion (Traditional dwellings）	Duobao South-cross ST No.30-34 dwellings		This building is a detached house with brick-concrete structure in front yard. Balcony railings, doors and windows, wooden stairs and walls have been replaced due to damage.	Repair-oriented. Repair the courtyard walls and balcony railings, and restore the traditional facade form.
Xiguan Mansion (Traditional dwellings）	Duobao ST No.49 dwellings		The building is a reinforced concrete structure with a courtyard, an early modern style modern independent residence, and is well preserved.	Repair-oriented. Repair the damaged components. Improve the indoor environment to meet the needs of modern living.

Xiguan Mansion (Traditional dwellings）	Changhua New ST No.9 Dwellings		This building is an early modern independent residence with courtyard brick-concrete structure, and some windows are damaged.	Repair-oriented. Demolition of illegal additional structures, repair of damaged components.
Congregating housing (Traditional dwellings）	Changhua New ST No.8 and No.10 Dwellings		The building is an early modern style modern congregating housing with a courtyard reinforced concrete structure, which is well preserved.	Display-oriented. Repair the damaged components and demolish the illegal additional structures and the fence to show more architectural features.
Congregating housing (Traditional dwellings）	Changhua New ST No.3-1 Dwellings		The building is an early modern style modern congregating housing with a courtyard reinforced concrete structure. Some doors and windows are damaged and replaced.	Repair-oriented. Demolition of illegal additional structures, repair of damaged components. Restore the traditional door and window style.
Congregating housing (Traditional dwellings）	Changhua New ST No.24, 26, 28, 30 Dwellings		The building is a brick-concrete structure with early modern style and modern congregating housing. Illegal construction is serious.	Repair-oriented. Repair the damaged components and demolish the illegal additional structures and change the fence style to show more architectural features.
Congregating housing (Traditional dwellings）	Changhua New ST No.22, No.22-1 Dwellings		The building is an early modern style modern congregating housing with a courtyard reinforced concrete structure. Illegal construction is serious.	Repair-oriented. Repair the damaged components and demolish the illegal additional structures and change the fence style to show more architectural features.
Congregating housing (Traditional dwellings）	Duobao ST No.58, No.58-1 Dwellings		The building is a modern congregating housing with a courtyard reinforced concrete structure and a combination of Chinese and western styles, and the top floor is partially added.	Repair-oriented. Repair the damaged components and demolish the illegal additional structures and change the fence style to show more architectural features.
Congregating housing (Traditional dwellings）	Duobao South-cross ST No.6-1, No.6-2 dwellings		The building is a brick-concrete structure with early modern style and modern congregating housing which is well preserved.	Repair-oriented. Repair the damaged components and demolish the illegal additional structures and change the fence style to show more architectural features.

Qilou (Typical style architecture)	Ennin Rd No.30 Qilou building		The building is a reinforced concrete structure with a combination of Chinese and western styles, which is well preserved.	Repair-oriented. Repair damaged components and restore the traditional door and window style.
Qilou (Typical style architecture)	Changhua ST No.1-3 Qilou building		The building is a brick-wood structure with a combination of Chinese and Western styles, which is well preserved.	Repair-oriented. Repair damaged components and restore the traditional door and window style.

(Source: Self-drawn according to the data.)

5.2.2.2 Traditional Street Protection

Changhua Historic District includes two first-class Qilou streets, three first-class traditional streets and five second-class traditional streets and alleys. There are 10 traditional streets in total.

Table 5-3 Protected objects of traditional streets and alleys

Traditional streets and alleys (10)	The first type of cavalry street (2)	Yongjin West Road、Enning Road
	The first category of traditional streets and alleys (3)	Inner streets: Duobao South-cross, Changhua New Street, Changhua Cross Street
	Second-class traditional streets and alleys (5)	Main Street: Duobao Road Inner streets: Fengyuan South, Duobao Daxin Street, Duobao Street, Changhua Street

(Source: Protection and Utilization Planning of Changhua Historic District)

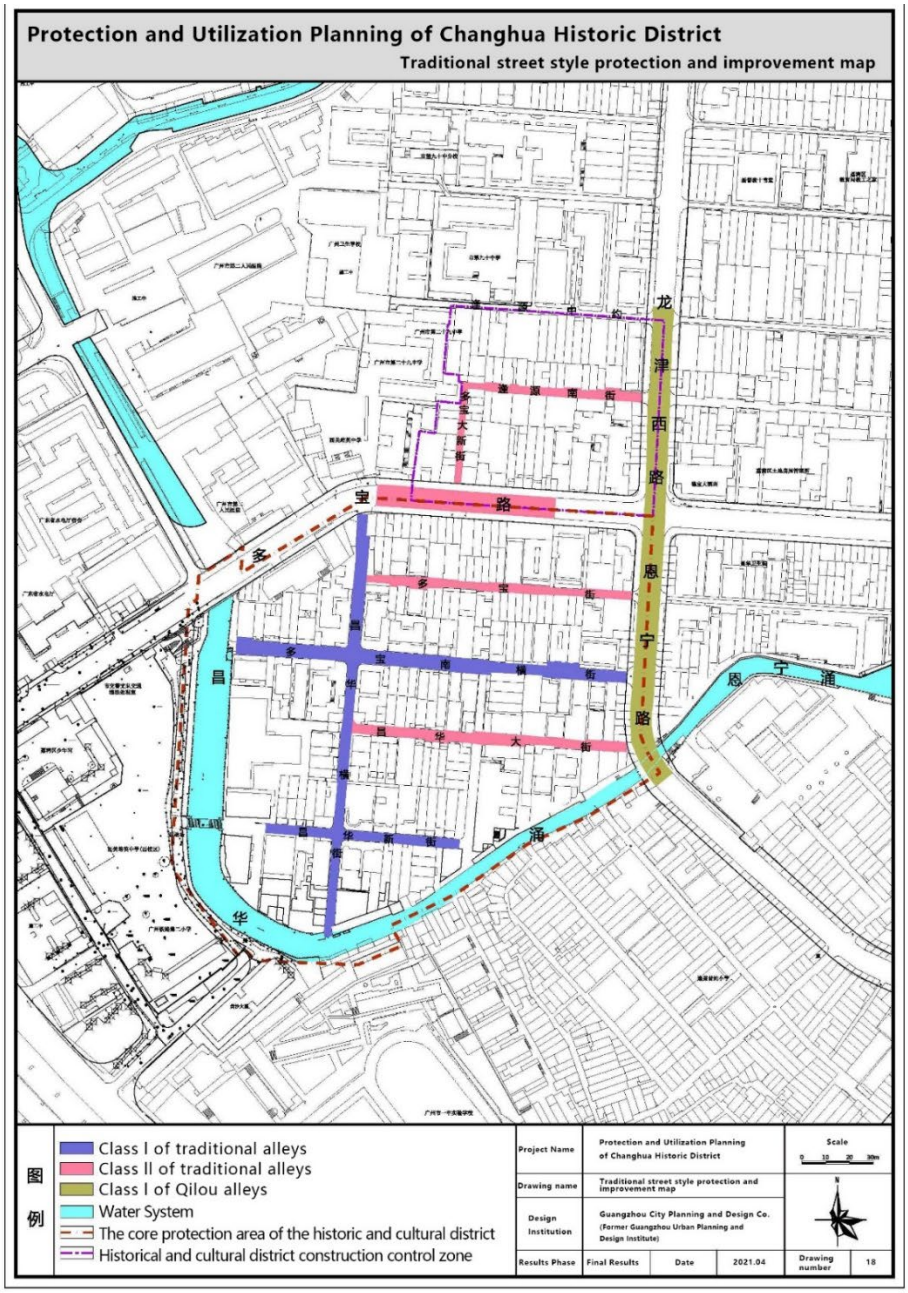


Fig. 5-9 Distribution map of traditional street protection objects
(Source: Protection and Utilization Planning of Changhua Historic District)

For Qilou Street, the principle is that the protection and renovation measures for traditional streets and alleys should maintain the original width, and traffic is still dominated by slow-moving traffic and public transport. The new building should be in line with the traditional Qilou building style, but it is not appropriate to copy the traditional Qilou building style. Architectural colors and materials that harmonize with or reflect the traditional Qilou style should be used to avoid large-scale glass facades destroying the original traditional style. The height, spacing and shape of colonnades along the street should be controlled as a whole. Renovate all kinds of billboards, store

signs, awnings, security windows and outdoor units of air conditioners, etc., which are in disorder, to maintain a uniform style. For traditional streets and alleys, maintain the scale and direction of the original streets and alleys, and maintain the height of the buildings on both sides to ensure continuity of the façade and coordination and uniformity of color features. Protect the existing street pavement of stone and gradually restore the traditional street pavement under the premise of preserving the historical authenticity. Protecting the green environment and street features in conjunction with the renovation and renovation of some poor style and poor-quality buildings can appropriately widen the poor style streets and improve traffic capacity.

5.2.2.3 Protection of Historical Environmental Elements

The historical and environmental elements of the area include an ancient and valuable tree, five alleys, five stone streets and a water system.

Table 5-4 List of historical environmental elements protection

Historic Environment Elements (12 locations)	Lane gate (5)	Changhua Yuan, Duobao Street, Duobao South-cross, Changhua Street, Duobao Daxin Street
	Masonry street and alley(5)	Feng Yuan Zhong Yi, Feng Yuan South Street, Duobao Daxin Street, Duobao Street, Duobao South Cross
	Water system (1)	Changhua river
	Ancient and valuable trees (1)	Yellow kudzu tree (44010300510400205, No. 3 South Street, Changhua Street, Duobao Road)
Celebrity Stories	Revolutionary industrialist Liu Xuexun and the ruins of Liu Yuan	Establishment of an exhibition hall for the display of photos and relics; compilation of street stories

(Source: Protection and Utilization Planning of Changhua Historic District)

To protect historic environmental elements, the existing five lanes and doors in Changhua Historic District should be fully preserved, repaired and their recognizability improved. The existing stone paved street in the district should be strictly protected and not removed or covered over. The original pattern, texture and style of stone Street should be preserved and considered as one of the elements of morphological connection and coupling in the district. The current Changhua River water system should be strictly protected from being filled in, and at the same time, waterfront public spaces and waterfront landscape nodes should be created, and varied slow-moving riverfront systems, waterfront parks, theme parks and small wetlands should be created.

5.2.3 Protection of Intangible Cultural Heritage Elements

Table 5-5 Protection measures for excellent traditional culture and intangible cultural heritage

Intangible Cultural Heritage Elements	Category	Name	Protection measures
Intangible Cultural Heritage(1 item)	Traditional Theater	Cantonese Opera	Protection of Artworks; Academic exploration and research; song inclusion and dissemination; The transmission of folk skills and the protection of artists; handling the relationship between creators, owners and protectors of intangible cultural heritage
Excellent traditional culture (2 items)	Folklore	Folklore Catchphrase	Academic research and study; audio-visual recording and dissemination; protection of traditional artists and cultural inheritors
	Celebrity Stories	Revolutionary industrialist Liu Xuexun and the ruins of Liu Yuan	Establishment of an exhibition hall for the display of photos and relics; compilation of street stories

(Source: Protection and Utilization Planning of Changhua Historic District)

Xiguan district of Guangzhou, where Changhua Historic District is located, is one of the most characteristic areas of Guangzhou with strong historical culture and humanistic spirit, full of representative Lingnan culture and traditional folk culture[61].

（1）Tea culture

In Guangzhou, there are few public spaces for people's social activities. At the same time, with the development of trade and commerce, a large number of people are flocking to Guangzhou, especially to the Xiguan area. These people need more public spaces to carry out their public life. Due to the humid and rainy climate in Lingnan, the utilization of outdoor spaces is particularly low. Compared with outdoor squares, people prefer to enjoy the cool scenery and drink tea in the tea house, which provides a comfortable communication space for citizens. The public activity space by the river is also a spontaneous place where people drink tea in Guangzhou.

（2）Cantonese opera

The prosperity of various industries in Xiguan and the prosperity of Cantonese Opera influence each other, resulting in a positive interaction. The shrinkage of the water system and the decline of economic status in Xiguan, the prosperity of Xiguan no longer, and the decline of the trade, leisure and entertainment industries have led to the decline of Cantonese opera. The cultural sites of Cantonese opera in Xiguan

include Bahe Guild Hall in Yongqingfang Scenic Area, the Guild of Cantonese Opera Artists, the newly built Museum of Cantonese Opera Art, the Cantonese Opera Stage in Liwan Lake Park, and the former residence of Cantonese opera stars Liang Shaojia, Lang Junyu (No. 29 Changhua New Street, Enning Road) and Qianli Ju (No. 77 Duobao Road). Through renovation and refurbishment, the corresponding exhibition spaces will be set up like museums, which can serve as the material basis for the dissemination of Cantonese opera culture and Cantonese opera performers. Establishing a proper connection between them will form a complete experience path of Cantonese opera culture, and it will also be beneficial to pass on Cantonese opera culture to future generations.

Fig. 5-10 Cantonese Opera Image
(Source: https://huaban.com/pins/1420263888/)

（3）Renwei Temple Fair (the third day of the third lunar month)

The Renwei Ancestral Temple in Changhua Street held a Renwei Temple Fair with activities such as praying and wishing, acrobatic cross talk, folk songs and dances, lion dance and so on. New activities were added to the traditional blessing ceremony and parade of He Bei Emperor, the pen opening ceremony to face the pagoda, such as the application for folk activities at the Pantang Baiwei Banquet, the Taoist Heaven Offering Ceremony, a creative fair, a river lantern, a puppet show, and so on.

Fig. 5-11 Photo of Renwei Temple
(Source: https://www.poco.cn/works/detail_id5584697)

（4）Water Flower Market

The annual Lunar New Year flower market was established in the Republic of China. At that time, the flower market sold not only flowers but also other goods such as antiques and various New Year items. This kind of folk activities reflects the customs formed in Lingnan due to the unique climatic conditions, and is closely related to the daily life of Guangzhou people.

Fig. 5-12 Litchi Bay Water Flower Market
(Photo source: https://baijiahao.baidu.com/s? id=1624039965248481884)

The protection of intangible cultural heritage elements can be divided into two frames, namely, time frame and space frame.

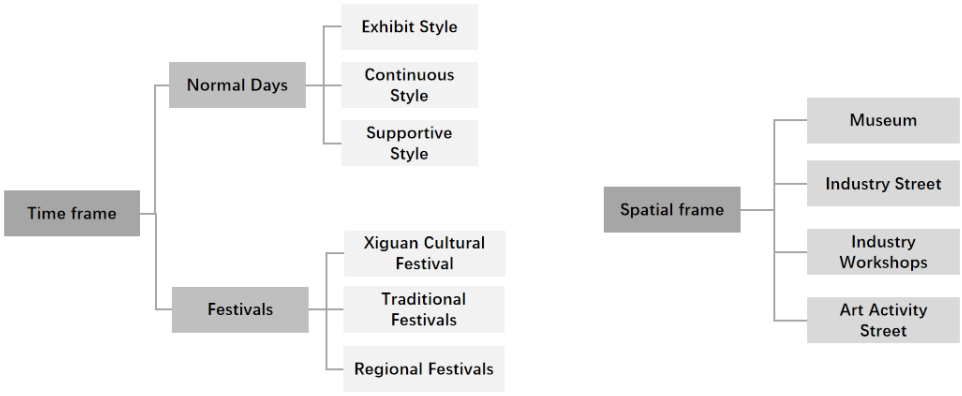


Fig. 5-13 Schematic diagram of intangible cultural heritage protection framework (Source: Self-drawn based on data.)

The time frame is divided into two states: Peace time and festival. The usual protection modes include exhibition, continuation, and supporting protection.①Exhibition style: exhibition of intangible traditional cultural assets related to historical figures, historical events, lost traditional festivals, folk crafts, folk art activities, traditional business activities, etc. in the Xiguan area in museums or Liwan Customs Exhibition Area. ② Continuation: continuing the business model in the established trade route. The government provides a good business environment for traditional business, promotes the development of these business activities, and develops the cultural potential of business activities combined with tourism. ③ Supportive: the government supports folk artists and craftsmen with special skills and encourages them to carry out folk art activities and teach skills. The government provides policy support for the modernization, upgrading and improvement of folk art, so that there are space and opportunities for the development of folk craft products and folk art activities.

Pay more attention to propaganda work based on the usual protection work at festivals. The framework of the festival includes: ① Xiguan Culture Festival: Choose the time most convenient for the presentation of Xiguan culture as the Xiguan Culture Festival. During the festival, activities are organized to show and promote Xiguan culture throughout the region, such as food festival, museum exhibition, handicraft competition,

folk art competition, etc. ② Traditional festivals: New Year Festival, Spring Festival, Lantern Festival, Tomb Care Day, Dragon Boat Festival, Chinese Valentine's Day, Mid-Autumn Festival, Double Nine Festival and Winter Solstice. Traditionally, activities are organized during the festivals according to the different contents of the festivals. ③ Regional festivals: Renwei Temple Temple Fair on March 3, Xiguan Mid-Autumn Festival Dance Ye Long, etc. Following the traditional activities of the local festivals, we will hold the local festivals with a colorful program.

There are four types of spatial framework: ① Museum: selecting a suitable site as a special museum, exhibiting the disappeared intangible traditional cultural relics, and protecting these disappeared relics in combination with educational and tourism activities. ② Trade route: traditional crafts and industries are operated in the trade route. ③ Industrial Workshop: Choose a suitable place as an industrial workshop, restore the dilapidated traditional craft production and operate it in combination with tourism industry. ④ Street of artistic activities: Choose a suitable place to conduct, perform and teach folk art activities.

5.3 Status quo analysis

5.3.1 Status quo overview

Changhua Historic District is rich in material culture and has good communication among residents. Although it is aging strongly, its original residents still have a certain quantity, and it is one of the historical and cultural neighborhood with vitality and moderate development. There are traditional Guangzhou bamboo houses, Qilou-style streets, vacant garden houses of overseas Chinese and modern concrete residential buildings here, with rich architectural diversity, and the dense first floor block structure is basically intact. The building types are mainly brick and concrete modern residential buildings, and other building types are staggered. The style is generic but continues and preserves the lively atmosphere of the neighborhood.

5.3.2 Status quo of populations

According to the data of the Fifth Population Survey, as of November 1, 2000, the total population of Changhua Street was 33,327.

The Fifth Population Survey Data

Projects	Unit (A)
Total population	33327
Male	16452
Female	16875
Households Number of households	9767
Total family household size (Total)	30417
Male Family Household	15053
Female Family Household	15364
Age0-14 (total)	4560
0-14 years old Male	2410
0-14 years old Female	2150
Age 15-64 (total)	25001
15-64 years old Male	12401
15-64years old Female	12600
65 years and above (total)	3766
65 years and above Male	1641
65years and above Female	2125
Local residence in the household	21897

According to the data of the sixth population survey, as of November 1, 2010, there were 32,778 people residing in Changhua Street.

As of 2011, the household population of Changhua Street was 31,871.

Fig. 5-13 The data of the fifth census in Changhua Historic District
(Source: Data of the Fifth National Census)

According to the data, the following three characteristics of the current population situation in Changhua historical district can be deduced: First, the population structure is overaged, with the elderly accounting for the largest proportion, followed by children, and the young population and middle-aged people being a minority. Second, most of them are indigenous, and there are fewer foreign tenants. Third, the ratio between men and women is balanced. After about 20 years of development, the main population of Changhua historical district has not changed much. The vitality of this group has declined, the population has begun to age, some people have lost their economic status and stayed, and others have increased their economic status and moved away. Combined with the problems caused by the aging of the entire building, a new wave of displacement will take place in the next ten years, although Changhua Street can still be considered a well-preserved historical and cultural block. However, the block lacks the ability to reflect the lives of upwardly mobile middle-income people (the block is not allowed to undergo large-scale reconstruction, there is no opportunity to construct new

types of buildings, and the living environment is not clean and hygienic enough), making this block face the crisis of future decline under the protection of historical and cultural blocks, especially the problem of migrant workers caused by the current rental situation. If the main population is replaced by migratory, insecure housing groups with higher prices, the communication vitality of the block will drift with the coming and going of these groups.

5.3.3 Status quo of surroundings

Changhua Historic District has a good geographical location, a short distance to surrounding major functional areas, complete support facilities for residents, many schools in the residential area, and many activities for school-age children. The educational and medical facilities of the selected site are perfect. There are 10 primary and secondary schools and two types of medical facilities within a 5-minute walk. At the same time, there are shopping centres, banks and other facilities evenly distributed in the vicinity to meet the needs of life.

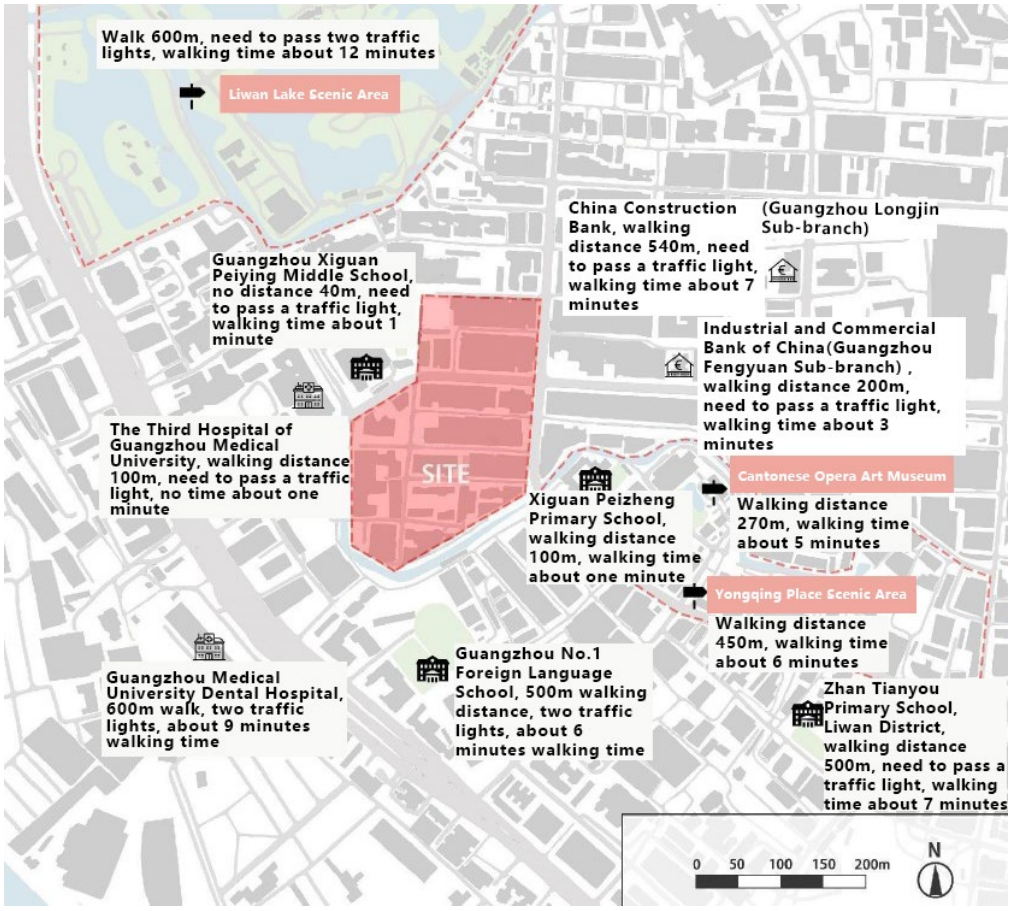


Fig. 5-14 Map of the surrounding environment
(Source: Self-drawn according to the data.)

At the same time, Changhua Historic District is located in the centre of the old urban area of Liwan, Guangzhou, and is adjacent to several scenic spots (Liwan Lake and Enning Road), so it is very convenient for tourism. Since it is located between Liwan Lake Park and Yongqingfang, it is the only place that connects the two attractions. The attractions can bring considerable traffic to the selected place, and the continuation of the tourist routes can become the starting point for economic development. In addition to economic potential, Changhua Historic District is bordered by the traditional Xiguan Dawu settlement to the north, the entire Guangzhou traditional Qilou-style street to the east, and the historical and cultural block of Enning Road to the southeast. It has excellent geographical conditions to connect the historical and cultural nodes of Xiguan, forming a complete and cohesive Xiguan cultural exhibition area.

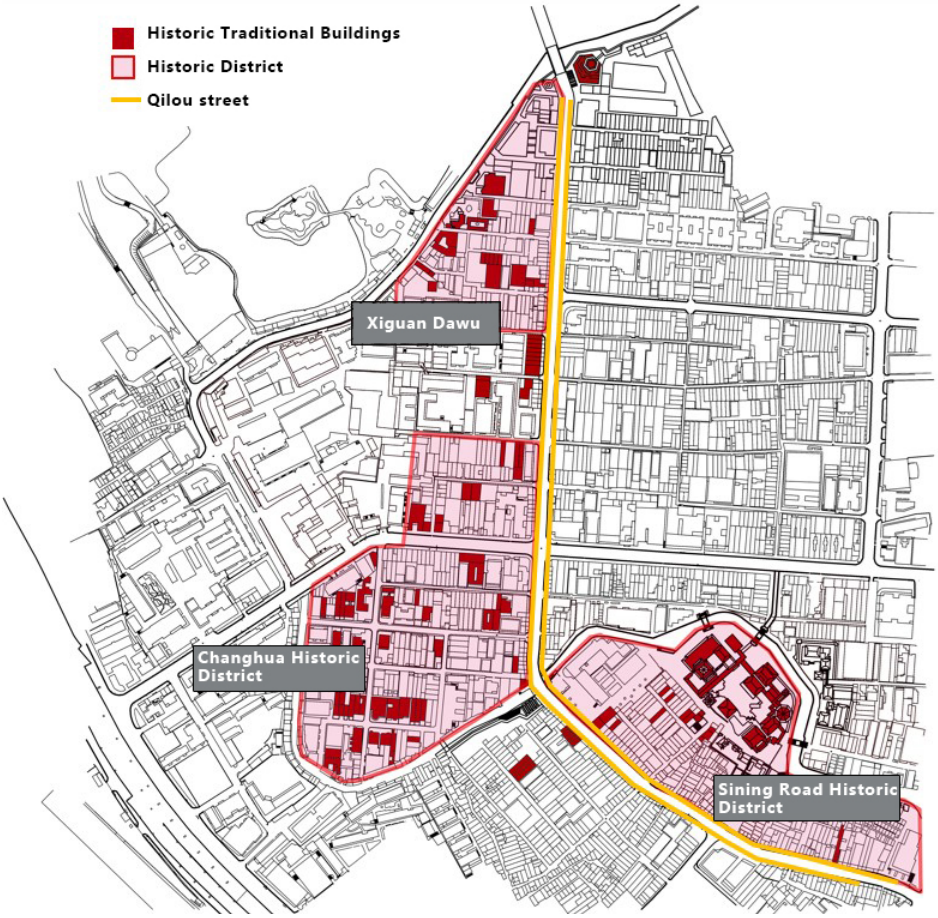


Fig. 5-15 Present situation map of the surrounding historical environment
(Image source: self-drawn by the author)

5.3.4 Status quo of spatial structure

The street structure of the district is "four horizontal and two vertical" - the vertical streets run in the north-south direction and mainly include Changhua Street, Changhua East Street and Changhua South Street, which follow each other; the horizontal street

runs in the east-west direction and includes Duobao Street, Duobao South Street, Changhua Street and Changhua New Street from north to south. The north-south and east-west streets are orthogonal. From the point of view of street naming and historical geography, Duobao Street and Duobao South Side Street are the overflow parts of Duobao block development, which were built in the late 19th century. Duojie Street is the narrowest street in Changhua Street, with an average width of 4 to 5 m and a relatively complete macadam pavement on the ground[62]. Except for the overflow area of Duobao Block, the development of Changhua Historic District began at Changhua Street. Compared with Duobao Street, there are new changes in the block development: widening the streets, increasing the width to 5 to 7 metres; increasing the north-south streets and reducing the block width. Compared with Duobao Street (140 m), Changhua Historic District has formed a combination of several square residential blocks by widening the streets and reducing the block width by almost half. The above changes are inseparable from the improvement of urban structures and living environment in the early days of the Republic of China.

From the point of view of block structure, although the overall achievement is the graphic texture created by the combination of small-scale residential buildings, but from the perspective of block fabrics, although the overall image is characterised by the combination of small-scale residential buildings, Changhua Historic District has formed a variety of residential groups due to the different development sequence and housing types, showing a diversity of block fabric[63]. The architectural remains of Changhua Historic District, a typical modern housing estate in Guangzhou, include almost all types of residential buildings from the Qing Dynasty and the early Republic of China in Guangzhou. Xiguan Dawu, bamboo houses and their improved forms, the western style residential house, the garden house and congregating house, etc, they are all preserved in the area and formed their own fabrics.

Fig. 5-16 Texture map of Changhua Historic District
(Image Source: Self-painted by the author)

5.3.5 Status quo of buildings

There are five types of buildings in Changhua Historic District: modern garden villas, modern brick- concrete residential buildings, traditional bamboo houses, Qilou-style buildings and concrete high-rise residential buildings. Chinese and Western garden villas have a gatehouse, a large garden and two- to three-story buildings. The gate is wide enough for cars to enter, and the road in front of the gate is wide enough for cars to drive. Another type of building in the Republic of China is a modern brick concrete residential building with three to four stories and a small garden in front. Modern residential buildings made of brick concrete are the main type of historical buildings in today's blocks. After the reform and opening up, and in the process of rebuilding the old city, some government departments, factories and enterprises have rebuilt some of the houses they took over, and high-rise concrete buildings have been built in the blocks.

There are five types of buildings in Changhua Historic District: modern garden villas, modern brick and concrete residential buildings, traditional bamboo cane houses, arcade streets and concrete high-rise residential buildings. Chinese and Western

garden villas and bungalows have a gatehouse, a large garden and two- to three-story buildings. The gate is wide enough for cars to enter, and the road in front of the gate is wide enough for cars to drive. Another type of building in the Republic of China is a modern brick concrete residential building with three to four stories and a small garden in front. Modern residential buildings made of brick concrete are the main type of historical buildings in today's blocks. After the reform and opening up, and in the process of rebuilding the old city, some government departments, factories and enterprises rebuilt some of the houses they took over, and high-rise concrete buildings were built in the blocks.

The old buildings of the neighborhood have an average history of 60 years. Most of the houses are aging, and those that cannot be repaired, or are difficult to repair, are rented out or are vacant. Rentals are divided into warehouse rentals and rentals to migrant workers, while vacant buildings become dangerous buildings. About half of the bamboo houses and a few brick-concrete residential buildings are rented to low-income migrants, and almost all modern garden houses are vacant.

Fig. 5-17 Photo of the interior architecture of Changhua Historic District
(Photo source: taken by the author)

The first-class buildings, i.e. important historic buildings, cultural relic protection units and immovable cultural relics, are concentrated in Changhua Street, while the second-class buildings, i.e. historic buildings and traditional buildings, are scattered. There are a few buildings with 7 to 9 stories in the block, and the construction quality is consistently good. In general, the construction quality of buildings with more than 4

stories is good, and the construction quality of 2-3 stories is mostly good and average. Some 2-3 story buildings along the street are generally of high quality, so it is necessary to consider some repairs or renovations at a later stage.

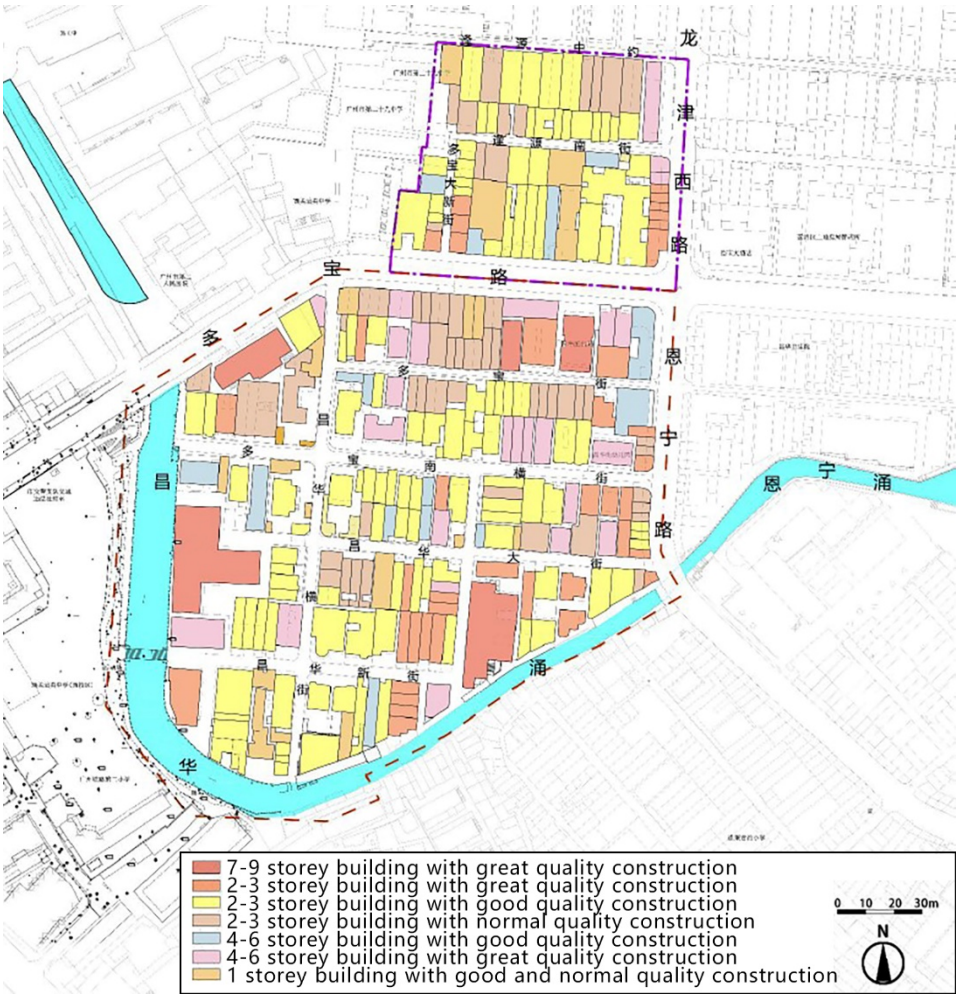


Fig. 5-18 Architectural quality and height analysis
(Source: redrawn according to the data.)

Most of the buildings on the block, especially those of historical value, are surrounded by walls. On the one hand, this makes the group and street structure of the block clearer; on the other hand, the style of the walls is mainly a white concrete wall, which does not harmonize with the historical and traditional style. In addition, all kinds of advertising leaflets are attached to the wall, which greatly affects the cleanliness of the interface on both sides of the street. The height of the fence is nearly two meters, greatly shielding the historic buildings, which does not help passers-by to see their historic features. In the later stage of reconstruction, unnecessary building walls can be removed or changed in shape, so that the style of the blocks can be unified and a visual blockade can be avoided.

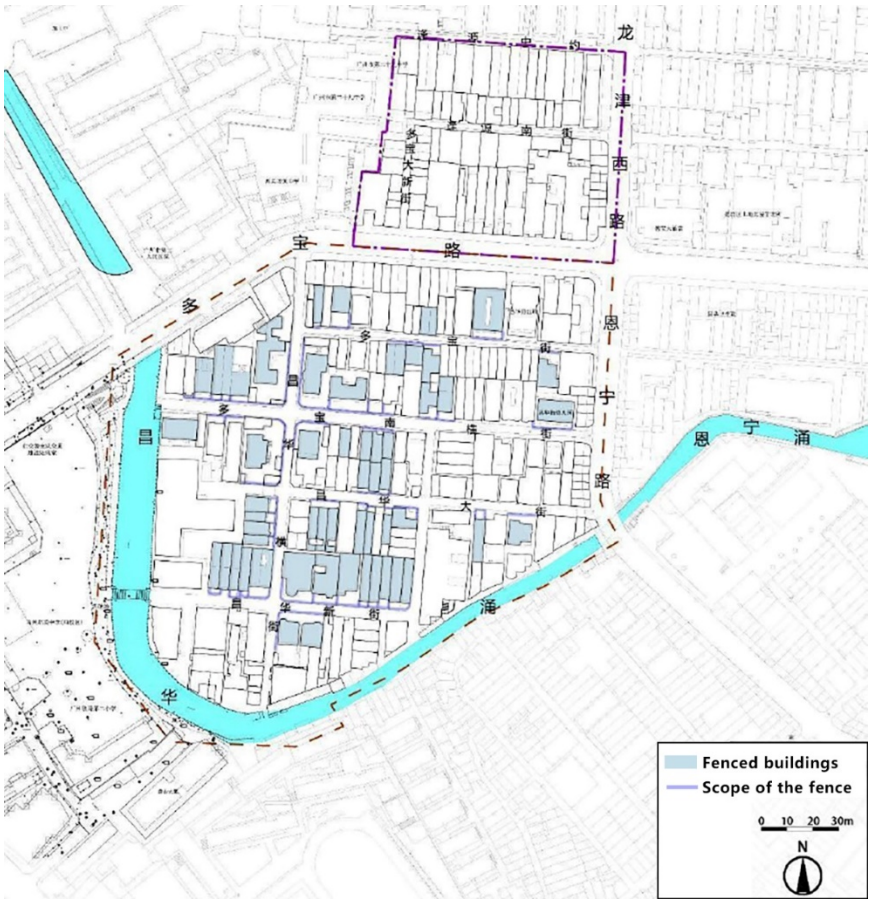


Fig. 5-19 the marking of building fence
(Source : redrawn according to data.)

Fig. 5-20 Building fence in the block
(Source: self-pictured)

5.3.6 Status quo of function use

Changhua Historic District is surrounded by commercial space, mostly residential, complemented by public services. Public space in the district is less extensive, mainly streets and alleys and less open space. Most of the peripheral businesses in the area are food service establishments, including tea restaurants, fast food shops, breakfast stores, pastry stores, and some clothing stores. There are no vegetable markets or supermarkets within the neighborhood. Businesses on the block include hair salons, training classes, flower stores, tailors, etc. Public services include kindergartens, community clinics, activity centers for the elderly, youth communities, etc. From the point of view of functional use, the public service area in Changhua Historic District is scattered and chaotic, and there is also a lack of public activity spaces, so more integration is needed.

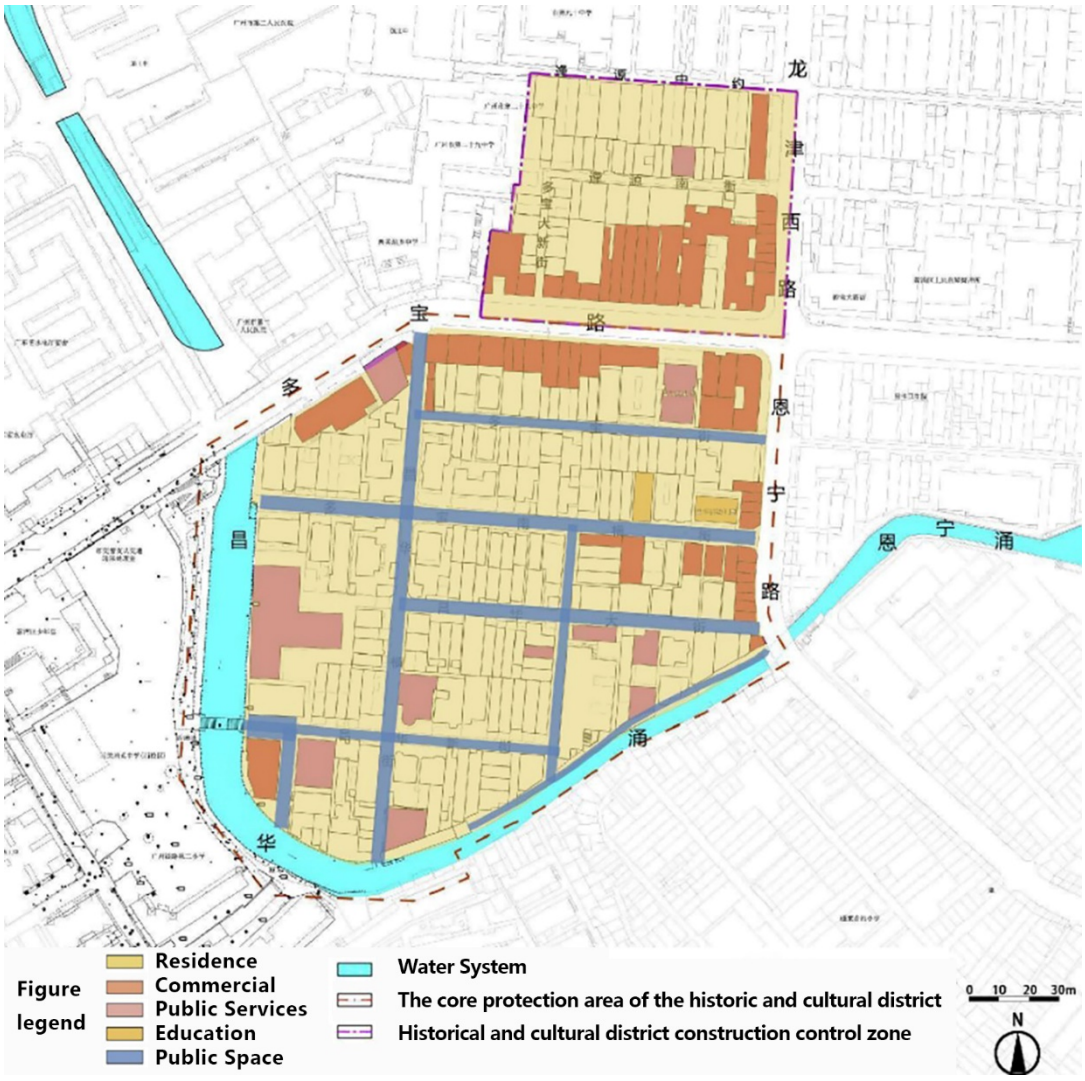


Fig. 5-21 Functional zoning map
(Source: Protection and Utilization Planning of Changhua Historic District (Text-Atlas))

5.3.7 Status quo of traffic

There is only one entrance and exit for motor vehicles in the block, and motor vehicles can only pass in the western part of the block. There are several road interruptions in the street. At the same time, the intersection of Changhua Street and Duobao South Street has become a major traffic junction due to the road width, congestion and other problems. Motor vehicles make frequent turns here and are under great traffic pressure. Non-motorised vehicles can only access the block through the three driveways on the west side of Enning Road. The block is easily accessible to pedestrians and can be entered from 8 entrances and exits, namely Duobao Road, Enning Road and Changhua South Bank. Parking spaces for motor vehicles are mainly located in some wide areas of Changhua Street, Duobao South Street, Changhua Street and Changhua New Street. In these streets, one side of the street is used for parking, which significantly affects the street space for pedestrians and at the same time causes congestion.

Fig. 5-22 Map of internal road traffic conditions in Changhua Historic District (Source: Self-drawn according to the data.)

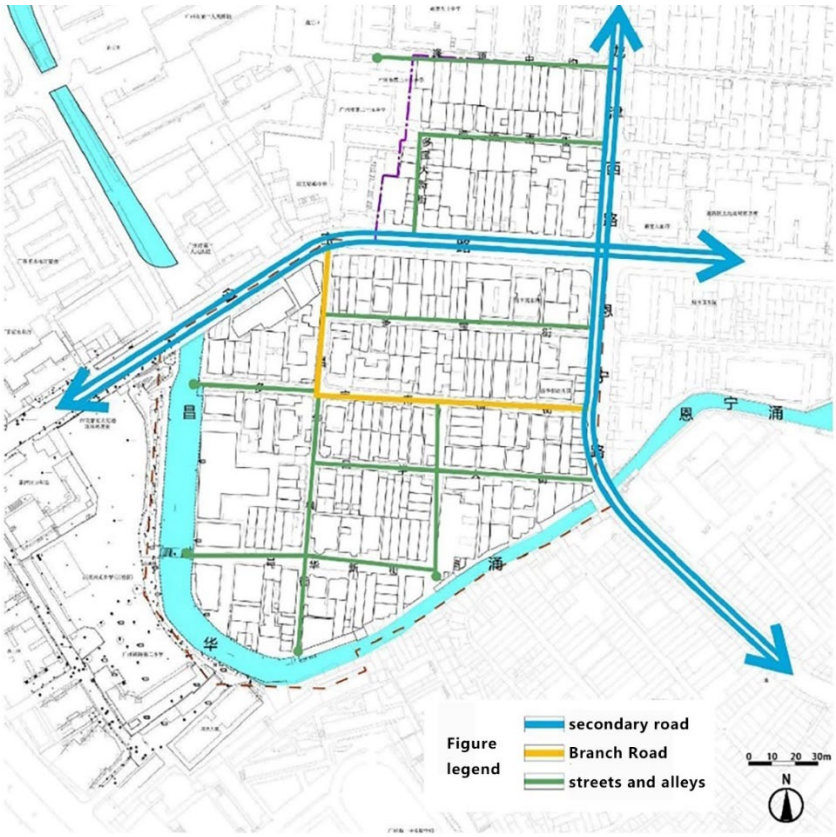


Fig. 5-23 Road classification map of Changhua Historic District
(Source: Self-drawn according to the data.)

5.4 Behaviors and demands

5.4.1 Analysis of crowd behavior

It is evident from the illustration that few recreational and leisure facilities are provided in the residential block, and only two or three squares are arranged along the river. Many residents place unused old furniture as their own resting facilities, forming resting places from the bottom up. An on-site observation revealed that the active residents throughout the block are mainly elderly, with a small number of couriers and citizens passing through the block. Since there are no open spaces within the block, few people stop and linger. Only service-oriented people, such as delivery services and garbage collectors, move within the block. The main activities of citizens are concentrated along the river, such as playing cards and chess, drinking tea to enjoy the coolness, fishing, walking dogs, and walking. From the signs of people's behavior, it can be seen that the residents of the neighborhood value the riverside space as an open activity space. Since there are continuous sidewalks and hydrophilic wooden paths on the south bank of Changhua River, the scenic environment is good, which attracts many tourists and

citizens to walk by or rest. However, the sidewalks on the north bank of the Changhua River are not continuous, the streets are crowded, and there is no hydrophilic space. At the same time, there are fewer community entrances on the north bank and more on the south bank, so the interaction between the waterfront on the north bank and the community is relatively low. The distribution of activities is characterized by intense activities at the ends and fewer and scattered activities in the middle, presumably due to the large recreational space and the large flow of people at the ends and ends. It is also evident that more people are on the south shore and fewer people are on the north shore. In terms of the type of activities, the south bank is more public and the north bank is more private, which is also related to the characteristics of the space itself.

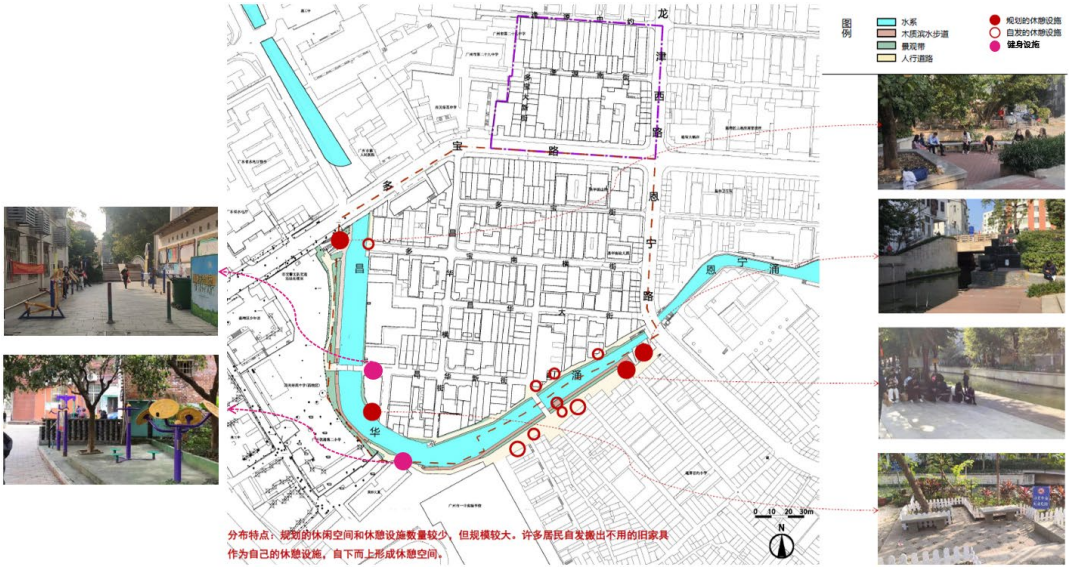


Fig. 5-24 Distribution map of activity facilities in the block (Source: self-drawing.)

Fig. 5-25 Distribution map of people's vitality in the block (Source: self-drawing)

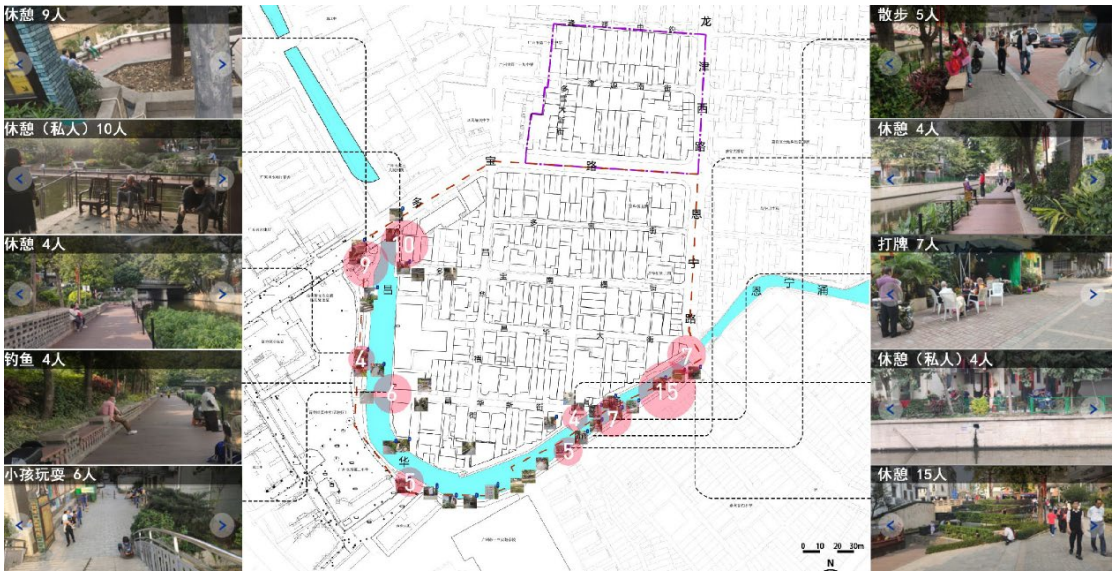


Fig. 5-26 Marking map of crowd activities in the block (Source: self-drawing.)

5.4.2 Summary of people's demands

Through the issue of questionnaires and observation of interviews, it is concluded that the requirements of residents for the renewal of the site are mainly the following: At the residential environment level, the living facilities are not perfect, and the express delivery service and property management are not professional enough. It is hoped that the relevant areas will be allocated according to the needs of modern community development, such as providing a proper location and space for express lockers and garbage sorting facilities to improve the autonomy of residents. On the other hand, the lack of public space leads to the failure to meet public life needs such as fitness and communication. Regarding public space, there are very few public spaces in the entire area, only one public green space and one fitness space. There is a severe lack of activity spaces, few recreational opportunities, and no pocket park. Residents would like to see more space and facilities for sports activities. According to the results of the block renewal survey, most residents hope for an improvement in the physical environment and indicate that they can accept a certain number of convenience formats, but generally prefer a quiet living environment and also hope that the historical and cultural values in the blocks can be publicized.

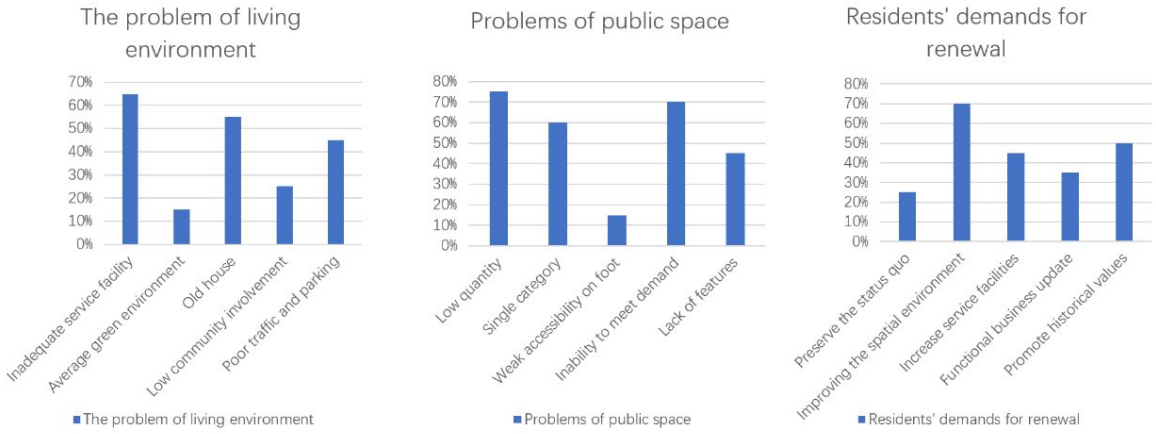


Fig. 5-27 Reflections and demands of residents
(Source: Self-drawing)

5.5 Strengths and Problems

5.5.1 Advantages of the present situation

5.5.1.1 Policy benefits

Flexible policy for the protection and use of historic buildings in the block. According to the notice of the Ministry of Housing and Urban-Rural Development, "Broaden funding channels and maintain a virtuous cycle of funds. Abolish the fund model of one-time government investment and promote the participation of diversified investors, social forces and residents in the protection and management of historic buildings. "According to the Guangzhou City Ordinance on the Protection of Historic and Cultural Cities, the municipal and district people's governments can put historic buildings owned by the state to good use by transferring or leasing them. They can also give preference to formats conducive to activating neighborhoods or protecting cultural traditions, such as promoting science and technology, cultural creativity, protecting intangible cultural heritage, operating time-honored Chinese brands, heritage folk crafts in Lingnan, showcasing traditional manufacturing industries, and other formats promoted by the city government. A rent-free period will be granted for one year, and the rent will be halved from the second year.

5.5.1.2 Location benefits

The base is located in the heart of Guangzhou Old Town, with good geographical location and accessibility; adjacent to Liwan Lake Scenic Area, Yongqingfang Scenic Area and Xiguan Dawu Community, the surrounding area is rich in tourism resources, and the abundant flow of people can bring vitality value to the land. The ecological environment of the community is good, it is located near Changhua River, and the continuous river bank area can be used as a link between the neighborhood and the surrounding cities.

5.5.1.3 Historical values

Changhua Historic District is rich in historical elements, with 10 traditional streets and more than 40 fully preserved historical buildings. All the intersections of the district have good traditional architectural features, including Qilou Street with Guangdong characteristics. The historical residential buildings from different periods, such as independent garden houses, collective houses, bamboo houses, Qilou buildings, Xiguan Dawu and Xiguan mansions, together form the Guangzhou Museum of Modern Residential Buildings. The building complex also houses some intangible cultural assets and traditional cultures, such as Cantonese opera.

5.5.2 Sorting out problems

5.5.2.1 Lack of public space

the spatial fabric in the neighborhood is tight, and most open spaces in the community, with the exception of the streets, are surrounded by walls and become private courtyards. Residents generally complain about the lack of places for community activities or daily exchanges and exercises, and it is difficult to get people to stop because of the lack of appropriate places to rest. There are only four public open spaces in the neighborhood. The sports facilities besides the bridge in the southwest corner of the community are the only places for community activities. The other three places are scattered along the river, and there is virtually no open space in the center of the area. Because there is no uniformly planned parking, chaotically parked vehicles also occupy some of the main street space. The lack of public space is not conducive

to creating community life and continuing traditional cultural activities. In planning and implementation, we should consider the placement of public space in combination with the spatial form of the block and the needs of residents.

Fig. 5-27 Present situation of public space
(Source: self-drawing)

5.5.2.2 Worrying status of historic preservation

There are many historic buildings in the plot, but their distribution is scattered. Since most of them are covered by walls, not enough attention has been paid to them. For example, in Changhua Street, there are six independent garden-style houses with historical value scattered along the street. However, because of the barrier wall and the mountain wall running parallel to the main street, there is no dialogue between the street and the historic buildings. The listed building is dilapidated, the building condition is not very optimistic, the vacancy rate is high, and it is not well activated and used. The traditional streets and alleys lack historic features due to parking issues.

Fig. 5-28 Pictures of historical buildings covered by walls
(Source: by author)

5.5.2.3 Poor connection with urban environment

The newly-built school buildings in the neighborhood and the newly-built nursing homes in the neighborhood interrupt the continuous waterfront space, resulting in a discontinuous walking system along the river, low comfort and insufficient attraction, which in turn leads to a separation of spatial form relationship with the scenic Yongqingfang and a discontinuous activity experience for residents and tourists. The block is located between Liwan Lake Scenic Area and Yongqingfang Scenic Area, but it does not take advantage of the geographical advantages and lacks contacts. There are many of the same historic elements with other nearby historic blocks that originally had the potential for coordinated regeneration and development to promote the continuation of the historic context, but now they are isolated from each other.

Fig. 5-29 Fracture of waterfront space at the junction with Yongqingfang
(Source: by author)

5.5.2.4 Loss of vitality due to unified function

The internal format structure of the block is uniform, with only a few small daily stores such as barber stores and flower stores, and the lack of cultural creativity or formats conducive to the presentation of traditional culture hinders the vitality of the block. In addition, there is only one type of population in the neighborhood, essentially local elderly and a small number of foreign tenants, and there are problems such as an aging age structure and population loss. The activity space in the community is a single one that lacks hierarchy and vitality.

5.6 Summary of the chapter

Through field research and data collection, this chapter provides a detailed overview of the Changhua Historic District site. First, by understanding the background and historical development of the site, it becomes clear that the Changhua historic District is an old residential district and is regarded as an important cultural exhibition site in the Xiguan area of Guangzhou due to its rich historic resources and a large number of various traditional residential buildings with complete protection. By sorting its conservation and utilization, the author has a detailed understanding of the historical and cultural resources of the site, especially the distribution and renovation direction of the five types of typical traditional residential buildings, and a corresponding understanding of the regional cultural customs of Xiguan. By analyzing the current situation of architecture, spatial structure, surrounding environment and traffic, the author concluded that the Liwan River, its own alley structure and historical and cultural clues are the potential "linkage lines" of the place, and the author concluded that the advantages of Changhua Historic District are its support of conservation policies, its excellent geographical location and its high historical value. Finally, through site visits, observing people's behavior and understanding residents' demands, the problems of Changhua Historic District can be summarized in the following four aspects: Lack of public space; worrying status of historic preservation; poor connection with urban environments and loss of vitality due to unified function. The above conclusions provide effective ideas for the specific design practice, which can better apply linkage and coupling strategies in the spatial integration of Changhua Historic District.

CHAPTER 6: Design Practice of Spatial Integration in Changhua Historic District

6.1 Design positioning

Changhua Historic District is located in the heart of the ancient city of Xiguan in Guangzhou. It borders many historical districts and ancient rivers, and has a well-kept and continuous arcade, rich and varied historical relics and sites, and well-preserved ancient city life. Therefore, it has a very special significance for Guangzhou. However, over time, the situation in the old city has become very chaotic, with mixed buildings and valuable old buildings. In recent years, many simple buildings have been newly constructed, but there are also unauthorized buildings and dilapidated houses that have been empty for a long time. Faced with the lack of public space, the loss of urban vitality and the neglect of history and culture, various elements must be integrated to create a new order. The old town, unable to keep up with the pace of urban development, eventually degenerates into a "fragmented" space of the city, and its connection with the surrounding urban environment becomes weaker and weaker, so that the old town in the center of the city tends to be marginalized and becomes a neglected space that lacks diverse life scenes and is forgotten. For this reason, the design practice for the renewal of Changhua's historic district formulates the following intentions:

（1）Organize and utilize the historical elements centering on the modern residential buildings in Xiguan in a meaningful way, so that people can systematically perceive the history and culture of this area.

（2）Strengthen contact with the surrounding important areas such as Yongqingfang historical district, Liwan Lake scenic area, Xiguan Dawu township, etc., to reflect the overall style of the ancient city.

（3）Integrating multiple functions into historic buildings and public areas, changing the unified function and integrating with modern life.

（4）Under the premise of preserving the structural fabric of the area, sorting out the streets, highlighting the level of streets and alleys, and

designing the street network with clear structure.

（5）Creating a variety of public spaces to provide a place for the continuation of the living habits and traditional customs of the old urban areas.

（6）Redesigning the spatial interface of the area to ensure the coordination and unity of the environment in this district.

6.2 Design scheme

6.2.1 Overall strategies

The overall strategy for the spatial renewal of the historic district of Changhua is divided into four steps： organizing the spatial structure, linking the historic elements, renewing the functional elements and linking the surrounding areas.

(1) Organizing the spatial structure

Reorganizing the road network and hierarchy and improving connectivity and quality of roads.

(2) Linking the historic elements

Use of axes, pedestrian systems, and visual corridors to enhance the connection of historic elements.

(3) Renewing the functional elements

Restore and revitalize vacant traditional historic buildings and give them appropriate functions. Add public service functions to the community through place-making.

(4) Linking the surrounding areas

Improve connectivity between the district and its surrounding environment by optimizing pedestrian systems, water systems, and interfaces.

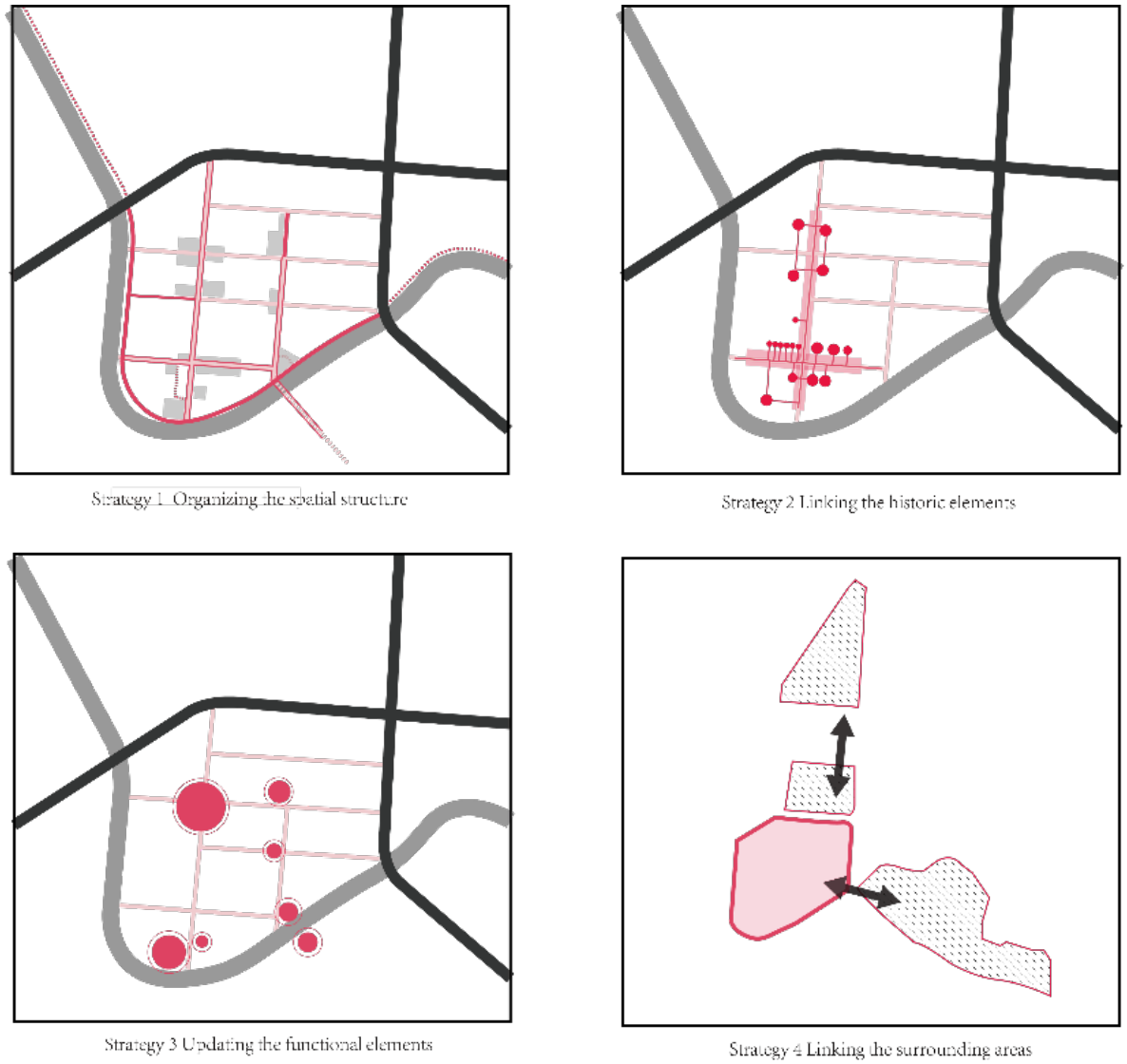


Fig. 6-1 Overall strategies （Source: self-drawn）

Fig. 6-2 Original Master plan （Source: self-drawn）

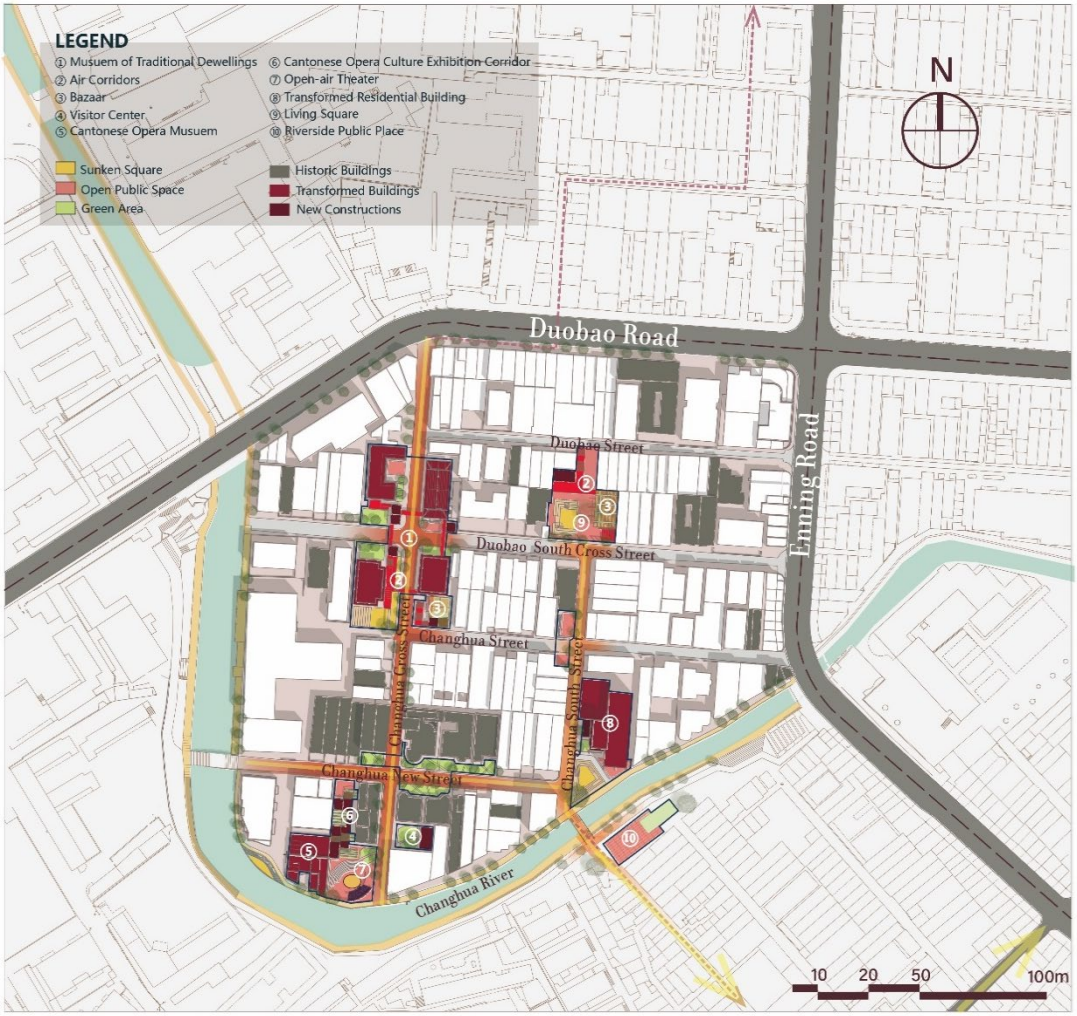


Fig. 6-3 Master plan （Source: self-drawn）

6.2.2 Sorting out the elements to be linked

(1) Physical elements

Fig. 6-4 Historic buildings

Fig. 6-5 Fences

Fig. 6-6 Building condition

Fig. 6-7 Reorganizing

（Source: self-drawn）

The historical district of Changhua is an old residential district, and most of its physical elements are residential buildings, but the most important part to be integrated is scattered historical traditional residential buildings. By sorting, we can find that their distribution follows a certain rule, that is, they are distributed along the transverse axis, which provides some clues for finding related contexts later. There are also a large number of walls of different shapes on the site, which cause a chaotic visual impression on the facade of the block, and it is also a part that needs to be reordered. By sorting out the low quality and inconsistent style buildings in the block and combining them

with the comprehensive arrangement of the physical elements such as historic buildings and public service buildings, we can assess which buildings need to be demolished and which need to be rebuilt and repaired.

（2）Spatial elements

The spatial elements of the site can be divided into three main categories: Open spaces, street and alley spaces, and riparian areas. The original open space of the site is very limited and not well utilized due to lack of planning and organization. The street and alley space is the most important spatial element of the site to be protected. The principle of its design is to protect its original historical value and activate it. The waterfront space is another important spatial element. Field research has shown that the waterfront area to the south of the block is continuous and can be used by citizens for walking and resting. However, the riparian area to the north is very narrow, lacks concentrated places for activities, and has many interruptions, so it needs to be replanned. By re-planning and placing new public spaces, a new public space system is formed by connecting the spatial elements with potential linkage to meet residents' demand for outdoor spaces.

Fig. 6-7 Unused open spaces （Source: by author）

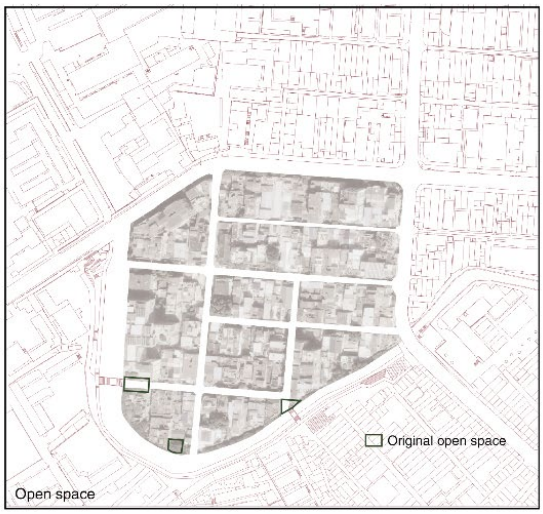


Fig. 6-8 Open space

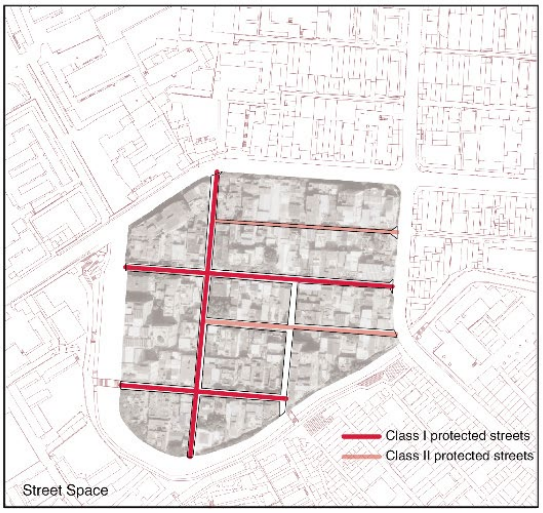


Fig. 6-9 Street space

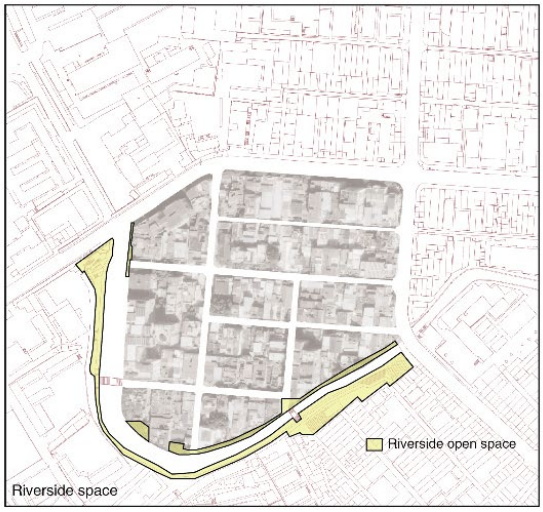


Fig. 6-10 Waterfront space

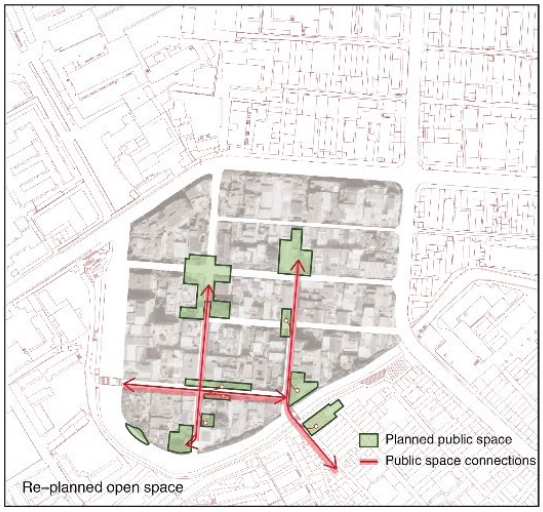


Fig. 6-11 Re-planned open space

（Source: self-drawn）

（3）Historical and cultural elements

The historical and cultural elements of the site are highly consistent with the elements of the historical physical elements. Specifically, they are all modern traditional residential buildings in Guangzhou, which can be divided into five categories: Residential communities, garden-style detached houses, bamboo houses, Xiguan Dawu and Xiguan Mansion. Garden style detached house has many styles and special shapes, which are of great protection and utilization value. It is worth mentioning that Xiguan Mansion, the former residence of Cantonese opera stars, is empty. If used, it can protect the historical value of residential buildings and promote traditional Cantonese opera culture in Guangzhou. The east side of the venue borders Qilou

Street (Enning Road) with its continuous Qilou-style buildings, which are an expression of Qilou culture in Guangzhou.

Fig. 6-12 Types of historic buildings

Fig. 6-13 Qilou-style buildings

（Source: self-drawn）

（4）Functional elements

The function of the site is relatively simple and consists mainly of residential buildings with some public services, and the interface along the street is commercial. The historic buildings on the site are mainly residential, but some of them are vacant and new functions need to be created. The functional area of the site can be roughly divided into three parts: the historic exploration area to the west, the residential area to the northeast, and the waterfront recreation area to the southeast. Through planning, there should be a node in each area as a connection point, and the potential connection of each functional area can be created by connecting nodes.

Fig. 6-14 Building Function

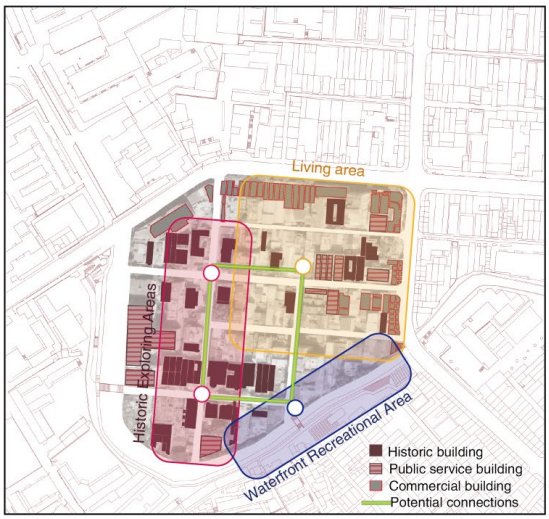


Fig. 6-15 General functional area

（Source: self-drawn）

6.2.3 Establishing the linkages of physical space

（1）Creating axis of historic exploring and axis of community life.

Although the historical structure of the site is regular, it lacks hierarchy and recognizability, making people feel lost. By creating an axis that connects the surrounding historical and cultural elements, the public spaces and the specific places, the core structure of the place can be given and it can play the most comprehensive integration role.

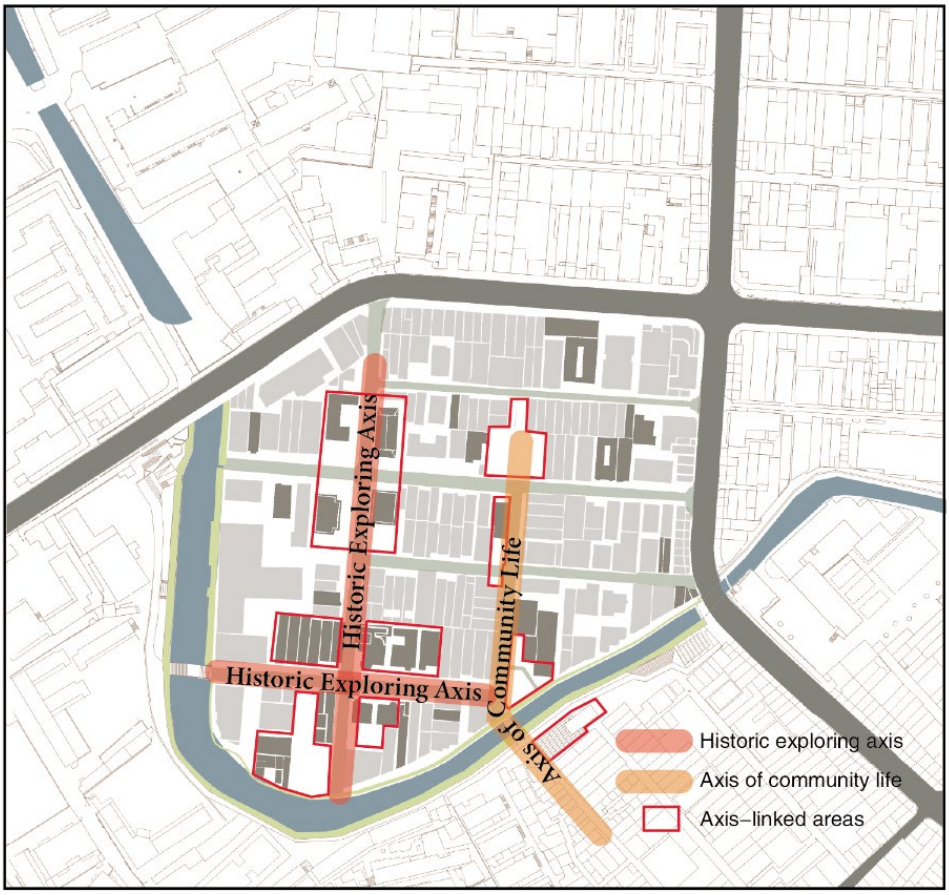


Fig. 6-16 Axes analysis （Source: self-drawn）

The principle of axis formation is to connect and link the various important elements of the site as much as possible. Depending on the distribution of historical relics and residential and service facilities in the block, a cross-shaped axis of historical exploration and an axis of community life can be established in the place. The historic axis leads people to pay attention to the historic and cultural part of the block and create a sense of order in the block. The community axis can help strengthen social relationships on both sides of the river, organize the neighborhood's lifestyle, and revitalize the neighborhood.

Fig. 6-17 Aerial view of axes （Source: self-drawn）

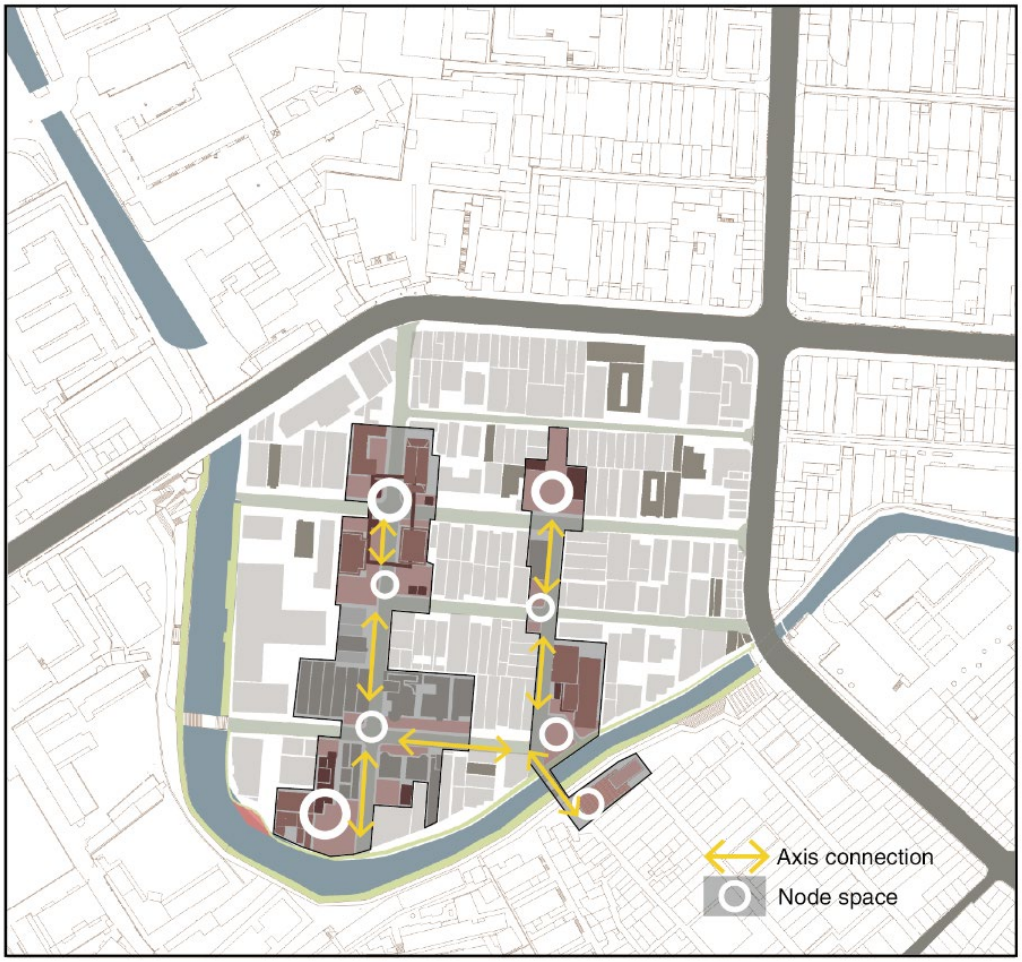


Fig. 6-18 Sequence of the axes （Source: self-drawn）

（2）Optimizing the road network and improving connectivity

After the replanning, the roads and paths are mainly traveled on foot, which is characterized by a great flexibility, unlike other modes of transport that limit the behavior of people to a fixed route. Therefore, a complete and systematic road network is the most effective way to connect the scattered spaces through people's behaviors. Some roads and trails in the area are interrupted roads, especially along the river, and the trail along the river is the best way for people to cross the area. Therefore, the key to reorganizing the road network is to complete the footpath along the river to provide a continuous walking experience. Second, some branches should be created to improve accessibility to historic features that can be easily overlooked. The final road network must ensure that the scattered important historic buildings and public spaces can be connected as much as possible.

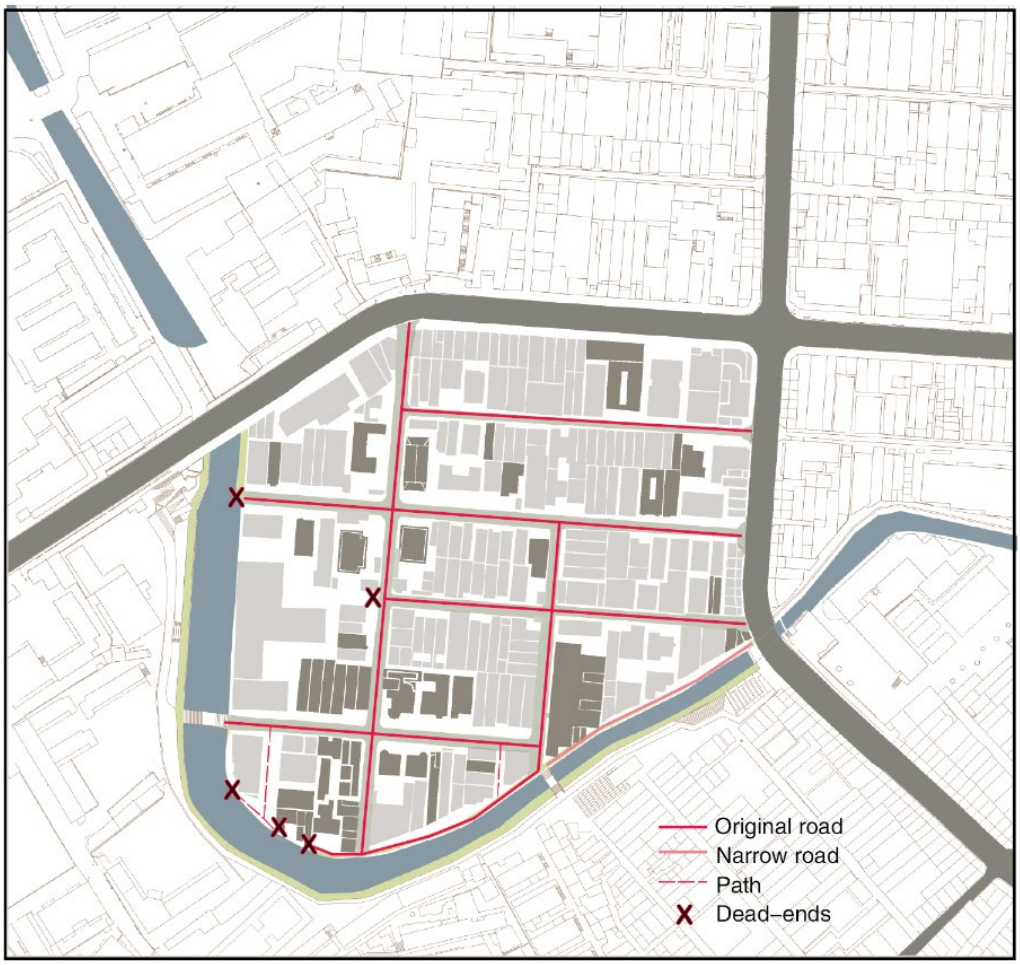


Fig. 6-19 Original road network （Source: self-drawn）

Fig. 6-20 Narrow paths by the river （Source: by author）

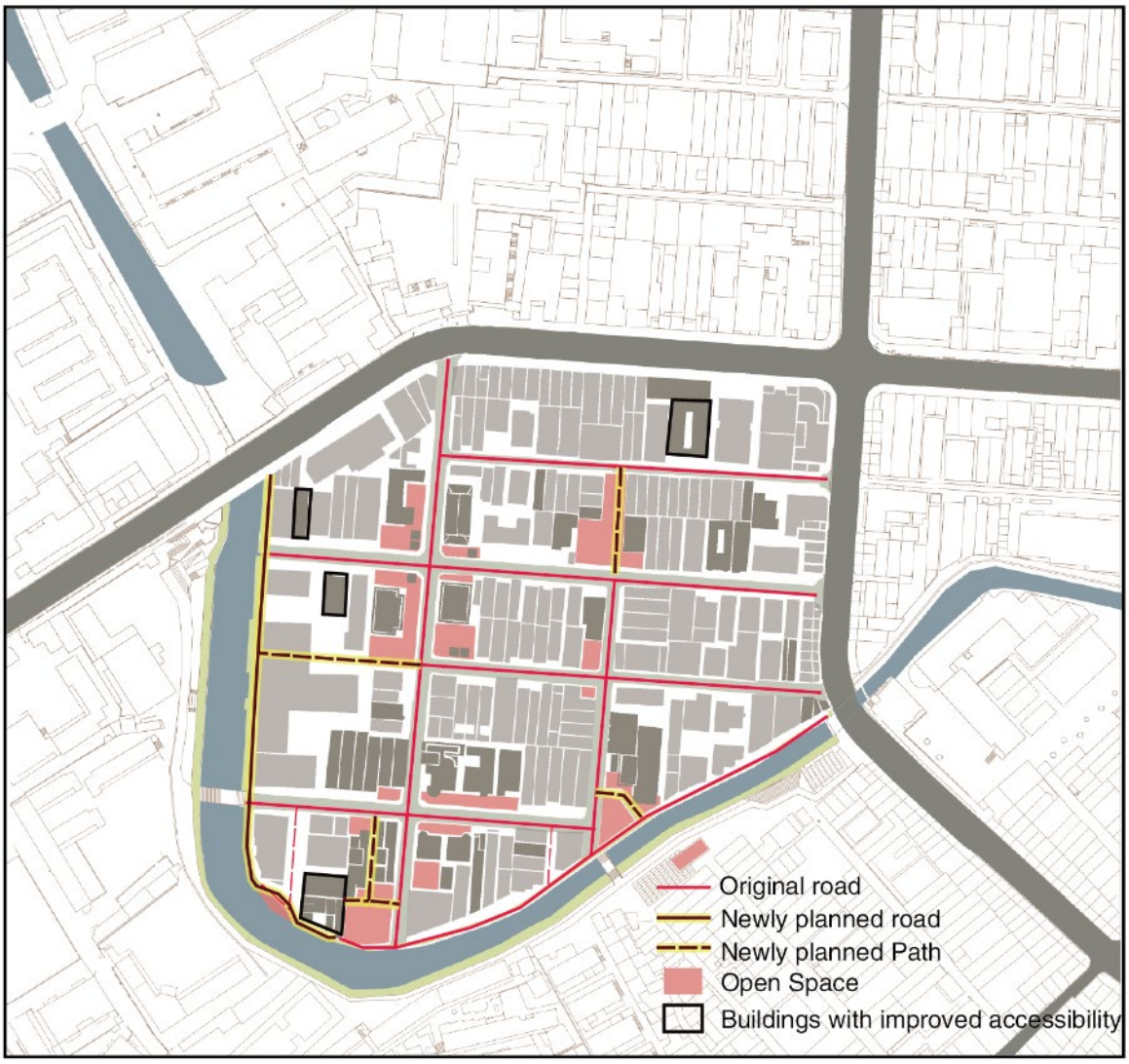


Fig. 6-21 Re-planned road network （Source: self-drawn）

（3）Creating a continuous and unified interface

① Unifying the fence form

Fig. 6-22 Fences of the site （Source: by author）

The different types of fences have created a mess in the vertical interface of the area, and the posters and advertising graffiti on the fences have destroyed the original historic look of the area. In the design, there are three ways to deal with the fences: 1. For the courtyard and the inconspicuous fences, which should be kept intact; 2. For the historic buildings that should be reused or have a show value, the outer fences are removed to make them accessible to the public; 3. For some private houses, the original different fences are replaced with a form or similar fences, but they must harmonise with the style of the area and not look abrupt. For example, the shape of the fence shown in the figure consists of a lower brick structure and an upper solid part. Residents can adjust the ratio between the brick structure and the solid part according to their requirements for the privacy of the yard, to avoid blocking the area with solid walls, but at the same time ensure the unity and harmony of the fence surface.

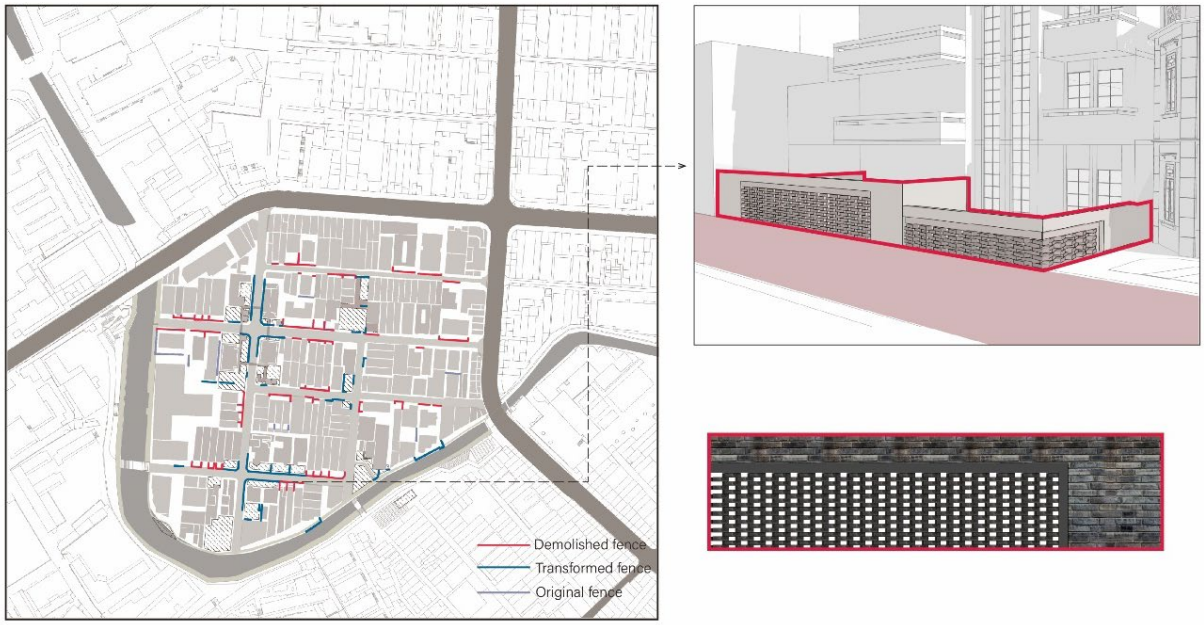


Fig. 6-23 Designed fences （Source: self-drawn）

② Simplifying paving style

Pavement is an important interface of the city ground and also influences people's overall perception of the city. As the figure shows, there are six different types of complex pavements in the area, such as traditional stone streets, concrete streets, brick paved streets, etc. Regardless of the material and shape, they lack the sense of harmony and unity. In the context of the current situation of street protection, the new plan will provide the area with three types of paving: 1. the restored stone alleys in the extension of the protected alleys; 2. the ecological and natural paving on the footpath along the river bank; 3. the modern stone path in other parts to realize the coordination between the old and new elements.

Fig. 6-24 Paving styles in the site （Source: self-drawn）

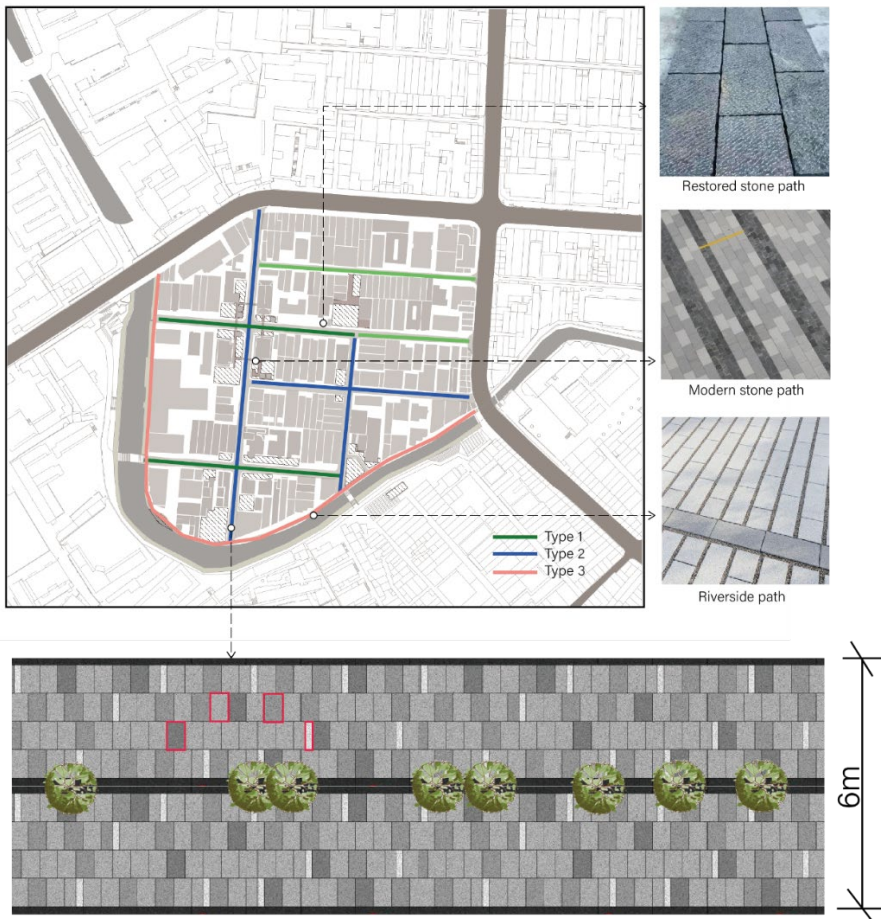


Fig. 6-25 Reorganized paving styles （Source: self-drawn）

③ Continuing Qilou interface

Changhua Historic District is adjacent to Enning Road, which is a Qilou-style street, and the whole interface of Qilou is also an expression of Guangzhou regional culture. However, in the process of urban development, some of the Qilou buildings have not kept their Qilou shape, so part of the Qilou street interface is no longer there. Therefore, the restoration of this kind of interface with the same elements and new forms can not only form a continuous and unified external urban form on the material level, but also realize the connection between the historical culture and the present future.

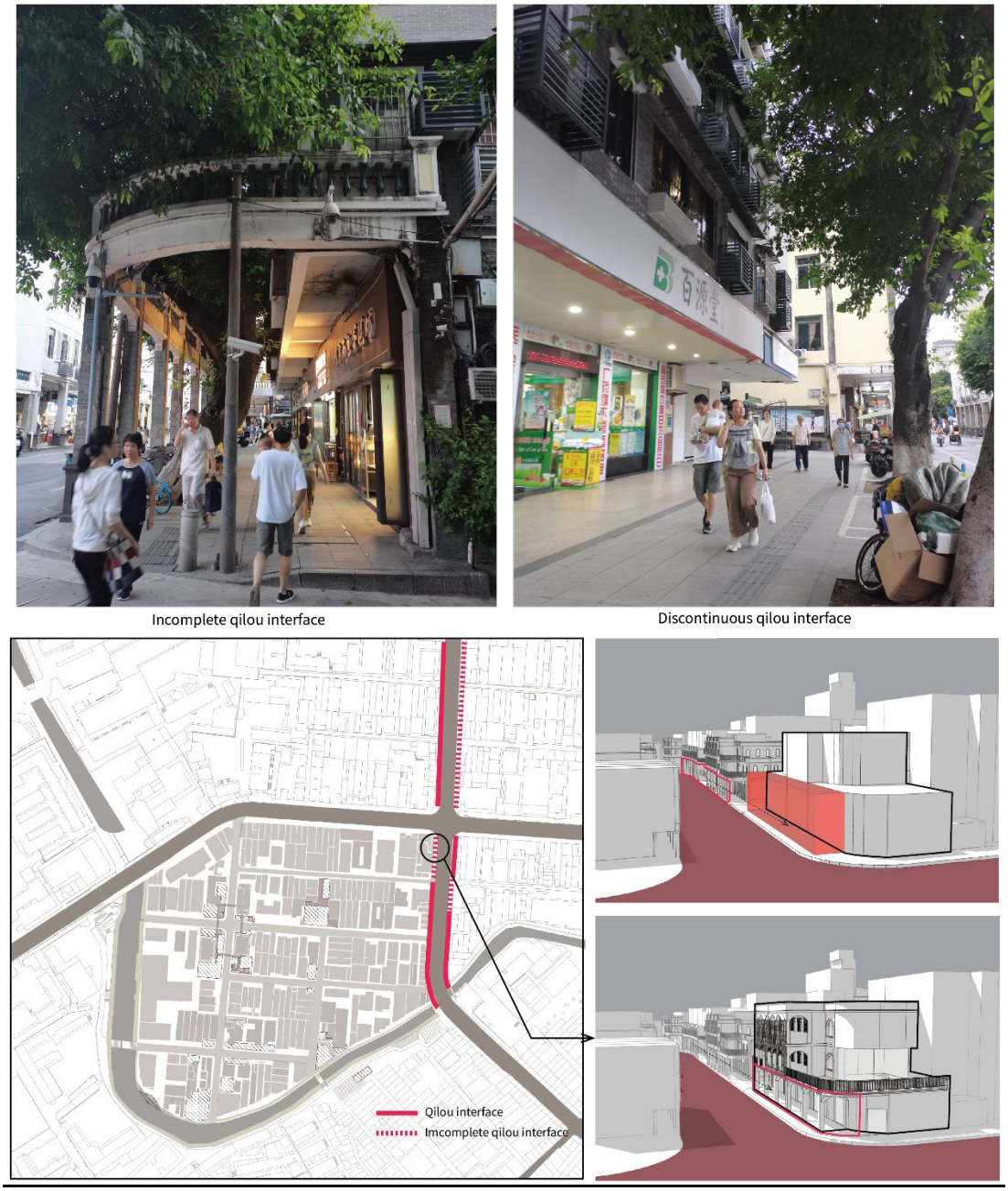


Fig. 6-26 Status of the Qilou street and the renovation diagram
(Source: self-drawn)

6.2.4 Coupling culture and function with tangible forms

（1）Introducing multiple functions, connecting modern life with old culture.

The site is located between the commercialized Yongqingfang scenic area and the traditional Xiguan Dawu residential area. As a transitional area between commercial and traditional history, the site can use the commercial attraction to bring people to the community and draw more attention to the historic district. Accordingly, the neighborhood should change its original function as a purely residential area, introduce some commercial functions in the area closely related to the Yongqingfang, introduce more young and fresh elements, and fundamentally revitalize the old urban area. In the predominant residential areas, the original cluttered and negative spaces should be improved, and more public spaces should be created to provide a leisure platform for people to stay, entertain and move around, and to fulfill the life functions of the original residents. By reusing historic buildings, such as turning them into thematic museums, more people can develop a deeper understanding of the area's culture and history.

Fig. 6-27 Identification of the function （Source: self-drawn）

The design aims to transform the shabby and inactive street into a new space that serves as a link between new life and traditional culture, reviving ordinary community life in this old urban area. Modern elements are used to bridge the gap between the old neighborhood and the young people. In this way, the integration of the old and the new, and the clash between modernity and tradition, will give every visitor and resident a sense of belonging and a better way of life.

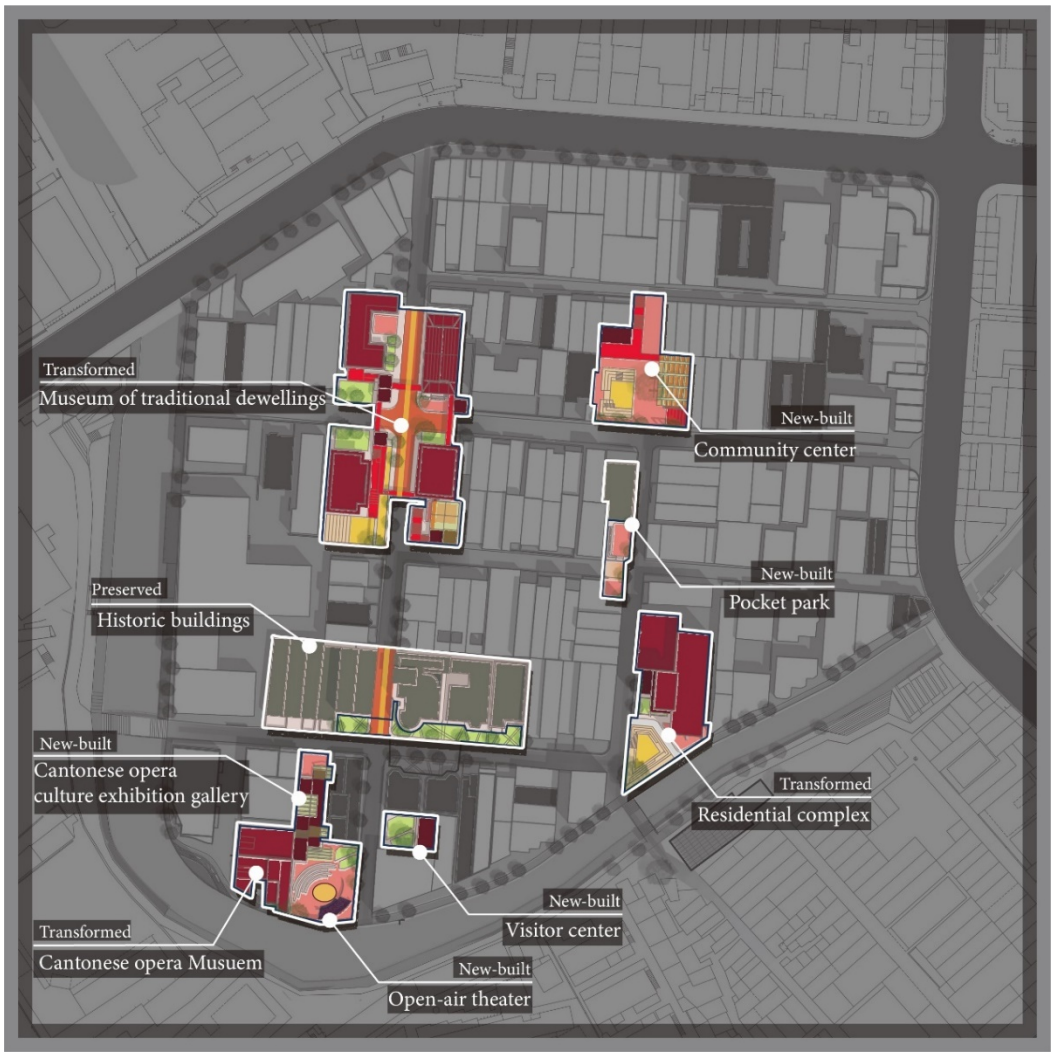


Fig. 6-28 Functional implantation （Source: self-drawn）

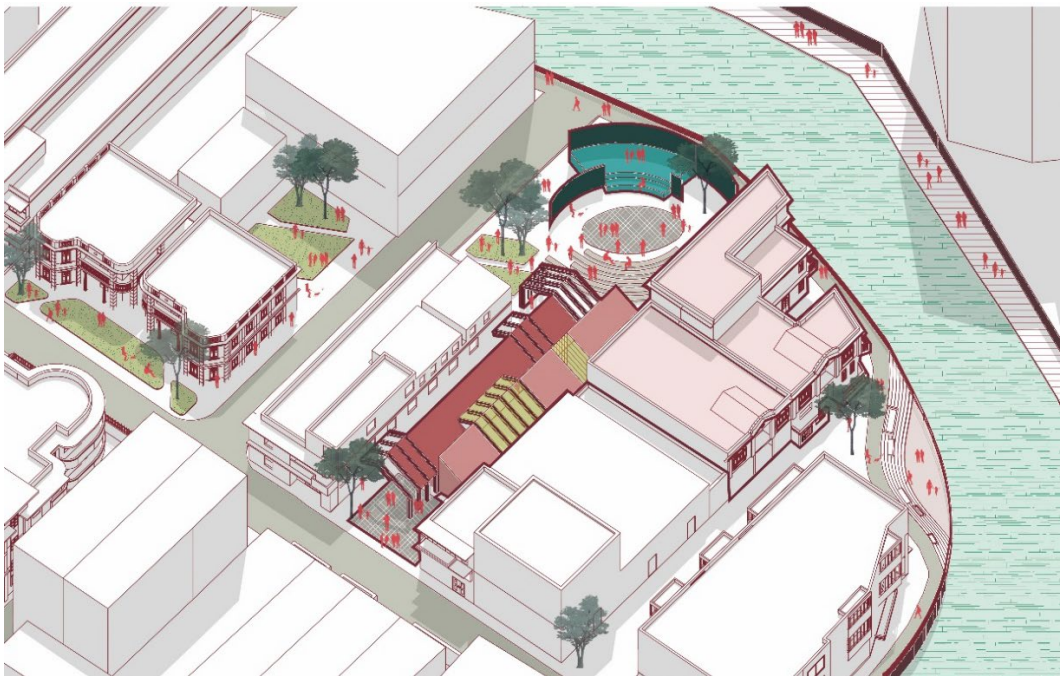


Fig. 6-29 Transformed Cantonese opera culture area （Source: self-drawn）

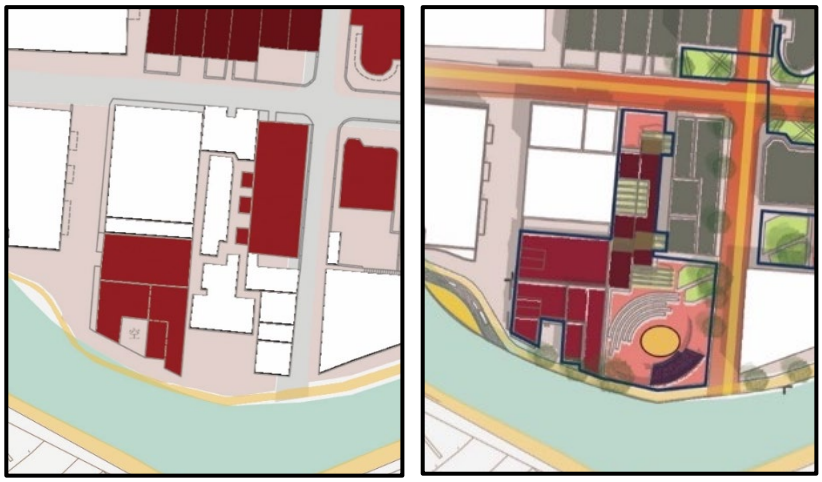


Fig. 6-30 Before and after transformation comparison-A（Source: self-drawn）

On the site is the former residence of a Cantonese opera star, which is currently vacant. The design is to transform it into a museum for Cantonese opera stars, based on the Cantonese Opera Museum in Yongqingfang, forming a continuous path to experience Cantonese opera culture. At the same time, a promenade for Cantonese opera culture will be built in front of the renovated museum to boost pedestrian traffic, as the original building is in a peripheral location. A Cantonese opera culture plaza is planned on the riverbank with an open-air theater to provide a performance venue for Cantonese opera lovers and also serve as an event venue for the community. By restructuring the functions, the whole area will be filled with cultural vitality.

Fig. 6-31 Newly built community center （Source: self-drawn）

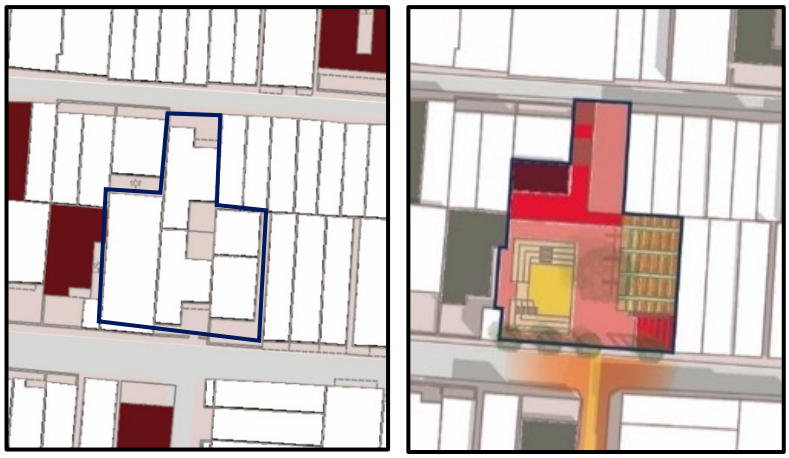


Fig. 6-32 Before and after transformation comparison-B（Source: self-drawn）

There is a great lack of community public space of a certain size and specific functions, resulting in a lack of quality of life and social interaction throughout the area, and there is no outdoor space to linger and rest. In the design, the quality of life in the old town is improved and the life in the old town is enriched by the placement of the square, the creation of a flexible market, the establishment of a community activity center and the perfection of the housing format.

（2）Improving the pedestrian system and connecting historic nodes

The historic elements of the site are scattered, and with the creation of axes and connecting paths, the pedestrian system of the area is well developed and easily accessible. As can be seen in the figure, almost all the historical artifacts can be connected to the structural axis and the main nodes, giving these historical elements a new order and centripetal force.

Fig. 6-33 Connections between historic buildings （Source: self-drawn）

The four single-family garden-style houses, located in the center of the site, have a very high historical and cultural value. In the design, they were collectively converted into museums to show the history of modern traditional houses in Guangzhou. The four buildings are connected by two-story corridors, forming a whole that provides people with a continuous cultural experience.

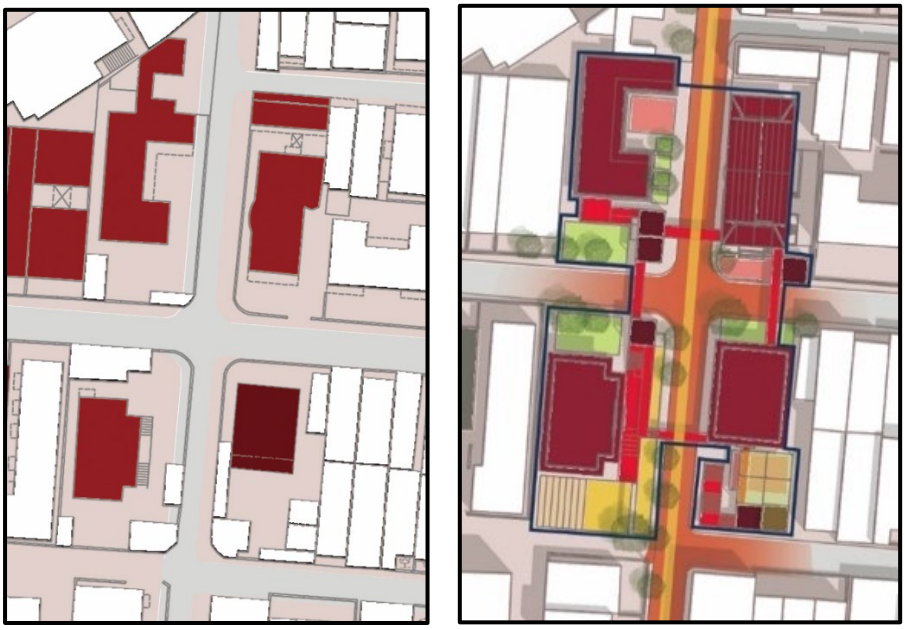


Fig. 6-34 Before and after transformation comparison-C（Source: self-drawn）

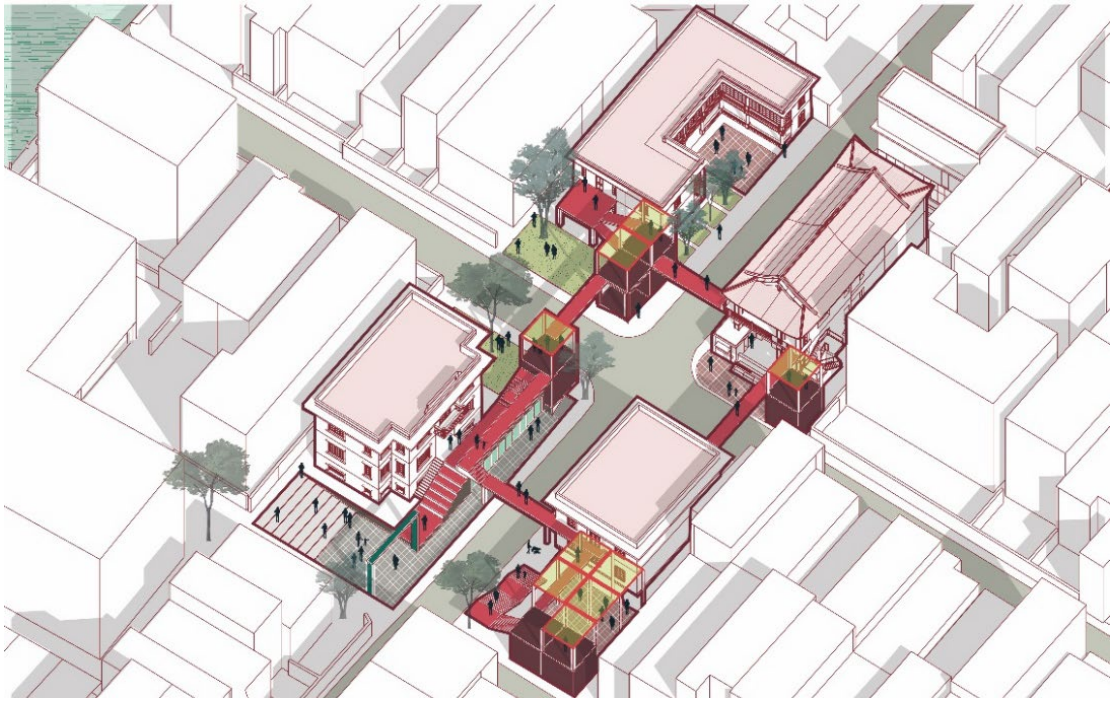


Fig. 6-35 Transformed traditional dwellings museum （Source: self-drawn）

Fig. 6-36 Scene diagram of main axis（Source: self-drawn）

（3）Optimizing the space on the waterfront and Continuing original lifestyle

The location of the site provides a good place on the waterfront, and the life of the residents is closely related to it, such as fishing, walking, drinking tea, playing chess, watching dragon boat races, etc., all of which reflect the vibrant culture of the ancient city. However, urban development has compressed the waterfront space, and the traditional lifestyles of the residents of the old town have also been affected. The aim of the design is to improve the environment of the waterfront, restore the living spaces and let the collective memory of the residents live on.

Fig. 6-37 Living scenes by the river （Source: by the author）

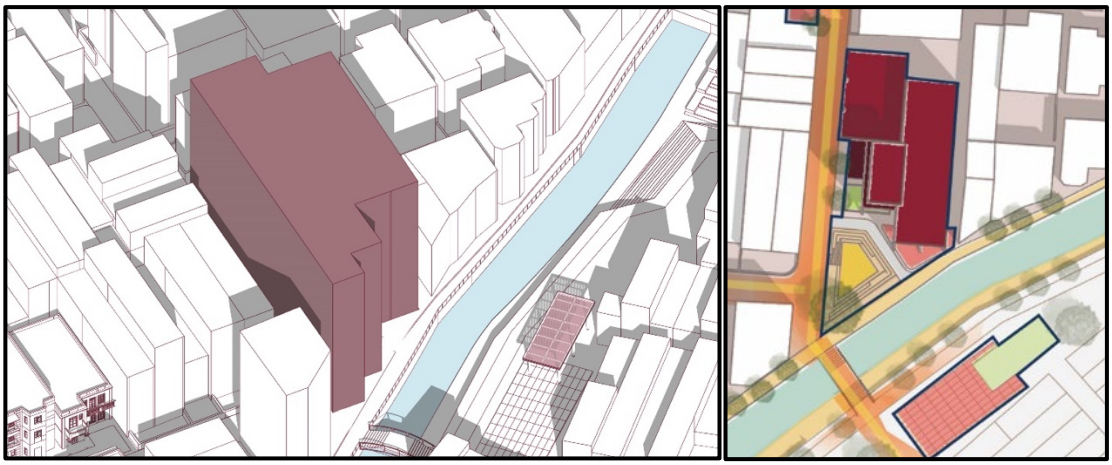


Fig. 6-38 Before and after transformation comparison-D （Source: self-drawn）

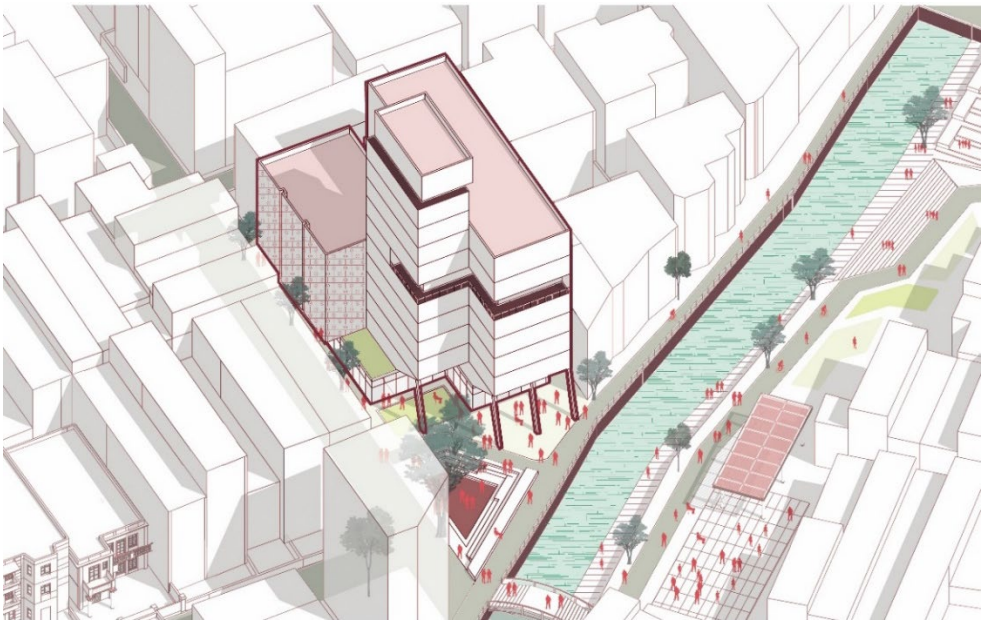


Fig. 6-39 Designed waterfront space （Source: self-drawn）

Fig. 6-40 Scene diagram of waterfront space（Source: self-drawn）

As can be seen in the illustration, the original high-rise residential buildings created a sense of isolation between the two sides of the river. During the renovation, a concept for a raised first floor and ground level commercial space was adopted to create more public space along the riverfront, allowing the entire neighborhood to connect with the outside world while strengthening the connection between the two sides of the river and encouraging communication between neighbors. In addition, a sunken plaza was designed next to the original old tree, allowing people to continue to rest and chat under the tree, and also becoming a symbolic place at the entrance to the neighborhood.

6.2.5 Strategies for linking and coupling the district with the surroundings

The connection between the Changhua Historic District and the surrounding area can be divided into the following three aspects: Continuous Qilou-style street interface, river system and pedestrian system linking the historic Xiguan area.

(1) Strategy 1：Qilou-style building road as the linkage

Strategy 1 takes the Qilou-style building road as the linkage to restore the qilou interface of Ennin Road, creating a continuous and complete street frontage, and providing a harmonious overall impression of the city.

Fig. 6-41 Linkage1: Qilou-style building road.

(1) Strategy 2: Liwan river system as the linkage

Strategy 2 takes Liwan river system as the linkage and optimize the urban water system, creating a continuous waterfront space and surrounding green spaces for walking and relaxing, and making the river one of the clues for linkage and connection.

Fig. 6-42 Linkage2: Liwan River System

(1) Strategy 3: Pedestrian system in the historical areas of Xiguan as the linkage

Strategy 3 takes pedestrian system in the historical areas of Xiguan as the linkage, creating a continuous walk system that allows people to experience the traditional historical buildings of the Xiguan area and experience the history and culture of Xiguan up close, so that the regional characteristics can be passed on.

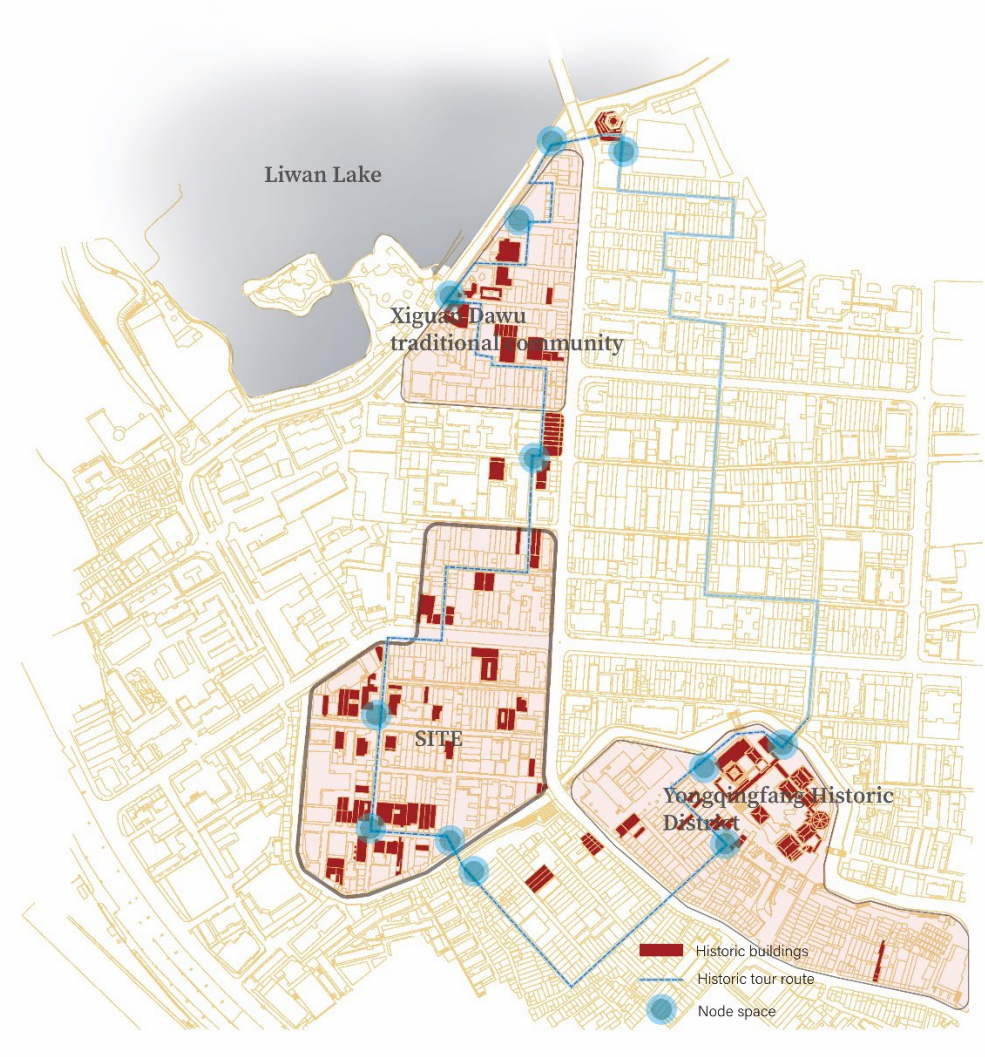


Fig. 6-43 Linkage2: Pedestrian system in the historical areas of Xiguan

(4) Overall strategy

As shown in the figure, by superimposing the three linkages, the relationship between Changhua Historical District and the surrounding cities can become closer, the whole Xiguan area can form a new order, the vitality of the ancient city can be restored, and the connection between the ancient and modern cities can be truly realized.

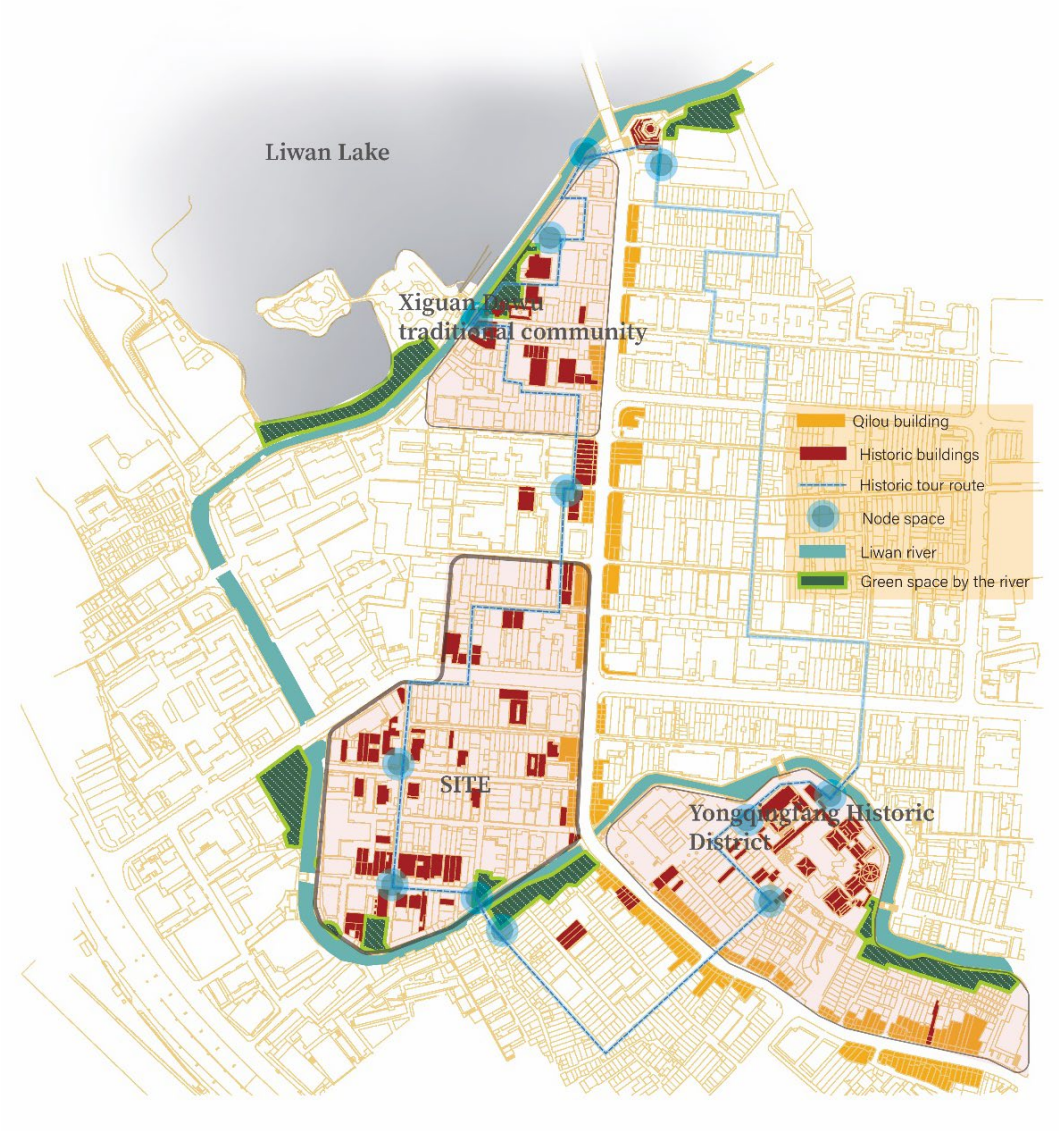


Fig. 6-44 Overall strategy of integration in Xiguan area

6.3 Summary of the chapter

In this chapter, the summarized integration strategy is applied to a specific old urban area by taking the Changhua Historic District as an application object to verify its feasibility and adaptability. First, six design intensions are proposed for the situation of this area, and then the following overall strategies are developed: organizing the spatial structure, linking the historic elements, renewing the functional elements and linking the surrounding areas.

The first step of the design is to sort through the elements of the site and identify the buildings that need to be demolished or rehabilitated; the public spaces that need to be re-planned or re-installed; the historic resources that need to be preserved and utilized; and the multiple functions that need to be meaningfully embedded. The

second step is to make connections at the physical level, for example, by creating axes to strengthen the overall structure of the area. Optimize the street network and reduce the number of turnoffs to improve accessibility to historic resources, enhance the pedestrian experience, and form an interconnected system of important historic buildings, public nodes with the street network. The morphological aspect should also focus on the harmony of the interface, which is effectively managed within the neighborhood by removing and replacing the chaotic fences, simplifying the different paving forms, and avoiding the break of the Qilou-style interface. The third step is to realize the connection of cultural and functional elements with physical forms at the intangible level. For example, incorporating multiple functions to connect the new modern life with the old culture, improving the pedestrian system and connecting historic nodes and optimizing the space on the waterfront for continuing original lifestyle.

Finally, the neighborhood can be optimized in terms of spatial structure and external morphology, and at the same time, the continuation of historical culture and the preservation of regional characteristics can be achieved. Finally, the author proposes three strategies for the Xiguan area to achieve a greater degree of linkage and coupling, improve the connection between the neighborhood and the surrounding area, make the Xiguan area an organic whole, rejuvenate it, and achieve sustainable development.

CHAPTER 7: CONCLUSIONS

7.1 Conclusion

With the increasing intensity of modern urban development, urban space is becoming more complex and diverse, and the trend toward spatial integration is gaining momentum. Against this background, this thesis takes the fragmented old urban space in need of integration as a starting point, introduces the linkage coupling thoughts as a theoretical basis, and explores the necessity and positive effects of integrating the old urban space as much as possible. The main conclusions of the thesis are as follows.

(1) The importance of the spatial integration of cities. The salient features of contemporary urban development are, first, diversification and, second, rapid change. Diversification leads to the increase of heterogeneous elements in cities; rapid change means that urban development is no longer a gradual process, but contains a large number of breaks and sudden progress, leading to contradictions and imbalances in development. Integration is based on the need of development to actively change or adjust the relationship between urban components by excavating the intrinsic correlation of various urban elements and using the mechanism of interaction of different functions, in order to overcome the tendency of separation of morphological components in the process of urban development and achieve a new synthesis. If the idea of integration is absent, the heterogeneous components of the city will be arbitrarily removed and demolished, the whole urban form will be broken and divided, and the lost old urban space will be the part that is most easily arbitrarily treated. Therefore, in this thesis, the old urban areas are considered as the most important object that need integration. From the linkage coupling thoughts, indications for correlation are derived to change the situation of fragmented old urban space, establish the organic connection of the city, and form a whole with internal order to meet the development of the times.

(2) Classification and sorting of spatial elements in the old urban areas. The old urban space is rich in resources and has a variety of elements, which can be roughly divided into tangible and intangible elements, and can be divided into physical elements, spatial elements, historical and cultural elements, and functional elements. It is worth mentioning that, in addition to the spatial-material elements, the old urban areas generally pay more attention to the continuation and integration of the historical and cultural elements. Therefore, for example, historical relics, protected buildings,

traditional streets and alleys, or an old tree or a preserved gate are not only physical or spatial elements in this place, but also historical and cultural elements, and it is necessary to organize them in detail and consider specific integration strategies to make the environment of the old city environment harmonious and integrated, and ensure that all elements are connected and persist.

(2) Establishing the connection of the physical space in the old urban areas. At the level of urban morphology, the connection methods of the old urban space can be summarized by modern case analysis as the construction of axes, the organization of paths and the treatment of interfaces. The axis can serve as a skeleton that gives the city a clear structure and strengthens its integrity. The street design of the old urban areas is generally no longer applicable to modern cities. The old urban areas dominated by pedestrian paths should emphasize the continuity of paths to ensure the accessibility of all lost spaces of them, connect all parts through street spaces, and reduce the creation of debris spaces. Other streets in the old town should be optimized, such as the integration of vehicle and pedestrian routes and the connection between the streets of the old town and the new trunk roads, to ensure the smooth operation of the urban network. The urban interface provides people with the most immediate sensory experiences. The old areas often give people a sense of chaos and complexity because the buildings of different eras are independent of each other and have no connection with each other. The unity and harmony of the urban interface can give people a continuous and comprehensive psychological feeling, which is also an important method of spatial integration.

(3) Summary of methods for making material-spatial connections in the old urban areas. Using current and modern case studies, the methods of linking old urban spaces at the level of urban form can be summarized as the construction of axes, the organization of paths, and the treatment of interfaces. Axes can act as a skeleton that gives the city a clear structure and reinforces its integrity. The road planning of the old urban space is generally no longer applicable to the modern city. The pedestrian-oriented streets in the old city should emphasize the continuity of paths to ensure the accessibility of each lost space in the old city, connect all parts through the street space, and reduce the creation of fragmented spaces. Other streets in the old city should be optimized, such as the integration of car and pedestrian routes and the connection between old city streets and new main roads, to ensure a smooth urban network. The urban interface

is the most direct sensory experience for people. Old cities often give people a confusing and complicated feeling because the construction of different periods are separated and unconnected. The unity and harmony of urban interface can give people a continuous and comprehensive psychological feeling, which is also an important method of spatial integration.

(4) Exploring methods for integrating intangible elements into old urban areas. Urban space is ultimately a site for human behavior and a material support for people's urban memory. Therefore, it should incorporate intangible elements that couple with it as it is transformed to achieve the purpose of integration. The old urban spaces often the areas that best reflects the characteristics of the city and holds the most historic resources. Therefore, the old city environment should focus on the historical and cultural values, regional characteristics and collective memory, and comprehensively consider the behavior, psychology and activity needs of the people in these areas to realize the connection of the old urban areas with the modern city in terms of spatial form and humanistic history.

7.2 Innovation

The innovation of this thesis includes the following three aspects:

(1) In this thesis, linkage coupling thoughts is divided into "linkage" and "coupling", which correspond respectively to the connection of physical spatial forms and the integration of tangible elements and intangible elements in the old urban areas. It not only pays attention to the integration of urban forms, but also takes into account the re-integration of the historical context, traditional customs with old urban areas, and realizes the connection between the psychological level, behavioral level and cultural level with physical environments, which embodies the spirit of humanism.

(2) In this thesis, linkage coupling thoughts is fully interpreted into the old urban areas, and the coupling elements, coupling clues and coupling methods are matched with the elements of the old urban area to inspire designers to discover the potential structures and connections in these places, and then intentionally strengthen the systematics and integrity of the urban space in the design process.

(3) Through the research of theoretical basis and case analysis, the summarized integration strategies are universally applicable, such as creating axes, structuring the paths and harmonizing the urban interfaces. These methods can simultaneously affect the old urban area at the block scale and at the city scale, and strengthen the

interrelation between the old urban area itself and its relevance with the surrounding urban space.

7.3 Shortcomings

The integration of old urban area is a very extensive and complex system project and a research topic that needs to be considered in the context of the social development trend, so this paper as a preliminary study is not yet comprehensive and needs to be deepened. This research direction will raise many issues worthy of further study, and the following two points can be highlighted from the insufficient part of this thesis.

(1) Insufficient involvement in interdisciplinary subjects. Research on integration is a large topic that involves many factors such as sociology, psychology, economics, geography, aesthetics, culturology, etc., all of which will be addressed. The research content of this paper includes humanistic and historical factors, but the theoretical foundation of related disciplines is not solid enough. For example, the research on sociology and environmental psychology is not extensive. Therefore, subjective judgments may occur, and the research results obtained may not be the best answers.

(2) The selection of practice objects is not comprehensive enough. Due to time and energy constraints, this study only examines and analyzes one type of old urban area in the design practice part, but does not fully cover all types of old urban area in the city. Therefore, the proposed strategy of linking and coupling at the specific operational level is not comprehensive enough and can only play an informative role for this type of old urban area. This study also needs to explore more linking and coupling ways according to different types of old urban areas.

BIBLIOGRAPHY

[1] Lu Shaoming, Ma Cheng. The Linkage Strategy of Discrete Memory Place During the Transformation of the Old City: A Case of the Moat of Wuyuan Town[J]. Architectural Journal,2013(S2):1-7.

[2] Wang Xinyi. A Study on Several Issues About the Conservation and Regeneration of Historic Fragment [D]. Qinghua University,2004.

[3] Hu Yuyu. Study on Collaborative Development of the Fragmentary Historic Environment and the Modern City Space in Yuzhong Peninsula of Chongqing[D]. Chongqing University,2010.

[4] Stephen Dobney. Kisho Kurokawa[M].Translated by Zheng shiling, Xue mi. Beijing: China Architecture & Building Press,1997:230

[5] Liu Jie. Integration of urban form[M]. Nanjing: Southeast University Press,2004.

[6] Jin Duo. Research on spatial renewal design of urban vegetable market based on linkage coupling theory[D]. Nanjing University of Science and Technology, 2020.

[7] Bai Ruyue. Research on the Integration of Urban Public Space based on the Perspective of Linkage Coupling[D]. Zhengzhou University,2017.

[8] Mei Zhengrong. “Renewing,Connecting and Webbing”Study of Public Space Renewal Patterns in Old City[D]. Shandong Jianzhu University,2008.

[9] Wu Liangyong. The old city of Beijing and its Juer Hutong neighbourhood. Beijing: Architecture & Building Press,1994:225.

[10] Song Daijun. Application and consideration of Linkage Theory in Urban Design – Cases Studies of HanZhong, ShanXi, Province[D].Tongji University,2007.

[11] Ran Enyu. Research on the relationship between the ancient city wall and urban space based on the linkage coupling theory[D]. Henan University,2020.

[12] Qiu Ran. Design Research of Linkage Thoughts in Urban Space Renewal[D]. Chongqing University,2015.

[13] Gibberd,F. Town Design[M]. London: The Architectural Press,1967.

[14] Jin Chenshan. Strategic exploration of old city renewal based on relevance coupling theory[C]//. Space governance for high-quality development——the Proceedings of Annual National Planning Conference in 2020(02 Urban Renewal)., 2021:358-369.

[15] Lee S H, Han J. Intermediate Design Strategy of Candilis-Josic-Woods′ Urban Complex[J].

Journal of Asian Architecture and Building Engineering, 2016, 15(1): 89-94.

[16] Vianna F B. Revisitando Toulouse Le Mirail: da utopia do presente ao futuro do pretérito[J]. Pós. Revista do Programa de Pós-Graduação em Arquitetura e Urbanismo da FAUUSP, 2018, 25(47): 34-50.

[17] Yin Shi.The Research of Coupling Design Between Productive landscape and Urban Renewal —— Taking the Eight Classes of the Wuchang Ecological Culture Corridor as an example[D]. Hubei Institute of Fine Arts,2014.

[18] Maki Fumihiko. Investigations in collective form[M]. The School of Architecture, 1964.

[19] Tuo hang. Research on the form of architectural clusters[D].Central Academy of Fine Arts, 2013.

[20] Edmund Bacon E. Design of cities[M]. The Viking Press,1967.

[21] Zhang Wenhui. Structure and Context: Comprehension to the Beautiful Urban Morphology[J]. Urban Development Studies,2016.

[22] Trancik Roger. Finding lost space: theories of urban design[M]. John Wiley & Sons, 1991., P110

[23] Ye Hong. Integrated, Sustainable & vitalistic - The Study of the spacial form design for "city fragments [D]. Chongqing University,2004.

[24] Lu Feng, Liu Yazhi. The Origin and Development Context of the Linkage Theory[J]. Urban Planning International,2016,31(03):29-34.

[25] Wu Jingfei. Research on Design of Outdoor Public Space in Urban Old Community Based on the Metabolism Theory[J]. Wuhan University of Technology,2020.

[26] Zhang Dan. Research on Design of Public Space in Old Community Based on Urban Acupuncture and Moxibustion[D]. Chongqing University,2019.

[27] Jin Qiuping. The Reconstruction of Public Space in Shantytown Transformation Based on Urban Organic Renewal: Take Chengdu For Example[D]. Southwest Jiaotong University,2013.

[28] Morris E S. The Planning of Philadelphia[M]. 1962.

[29] Annis Whitlow. Vision and Blindness: Edmund Bacon’s 1963 Plan for Center City Philadelphia[J].

[30] Garvin A . Philadelphia's Planner: A Conversation with Edmund Bacon[J]. Journal of Planning History, 2002, 1(1):58-78.

[31] Sennett R. The fall of public man[M]. WW Norton & Company, 2017.

[32] Li Mingliang. On the practice of Maki Fumihiko's cluster modeling theory - Analysis of Daiguanshan collective residence[J]. Urban and Rural Development,2011.

[33] Zhang Zaiyuan. The Image of ——'s Memory [J].World Architecture Guide. 1993:11

[34] You Yi. Research On The Devei Opment Of Collective Form By Fumihiko Maki [D].Nanjing: Southeast University,2016.

[35] Kiss Danie, Kretz Simon. Theories of Urban Form[M]. Department of Architecture, Network City Landscape, ETH Zürich, Switzerland, 2016.

[36] Chen Tian. Concept of Integration on Urban Design[D]. Tianjin University,2007.

[37] Liu Lixin. Join key-City Public Space Combine On Method Study[D]. Chongqing University,2003.

[38] Luo Xiaofang. Research on the integrity principle in the design and construction of urban public space in China[D]. Qinghua University,1999.

[39] Jonathan Barnett. Urban Design as Public Policy[M]. McGraw-Hill Education,1976.

[40] Zhang Zaiyuan. Humanity and Regionality of Space[J]. Journal of World Architecture,2001(1).

[41] Shen yulin. History of Foreign Urban Construction[M]. Beijing: China Architecture & Building Press,2007

[42] Qi Kang. Urban Architecture[M]. Nanjing: Southeast University Press. 2001.7

[43] Krier R, Rowe C. Urban space[M]. London: Academy editions, 1979.

[44] Zhang Sai, Jin liming. Relationship of Places —— An important way to integrate urban context[J]. Planners.2003(04):21-25.

[45] Lynch K. The image of the city[M]. MIT press, 1964.

[46] Hu Xiaotong. On the continuation and development of urban axis on the linkage theory[C]//. Vigorous City and Countryside, Beautiful Human Settlements——the Proceedings of Annual National Planning Conference in 2019(07 Urban Design).,2019:1306-1313.

[47] Li Zhenmao. Research on Urban Landscape Based on Generalized Association Coupling Theory[D]. North China University of Technology,2018

[48] Zhang Zhiyan. Study on the Integration of Public Space in the Background of City Renewal[D]. Nanjing University of Technology,2006.

[49] Wang Xiaofang. Study on the construction of pedestrian system in Xiguan area of Guangzhou[D]. South China University of Technology,2009.

[50] Bell P A, Green T, Fisher J D, et al. Environmental psychology[M]. New Jersey, 2001.

[51] Maki F, Goldberg J. Linkage in collective form[J]. Ekistics, 1962, 14(82): 100-104.

[52] Lu Jiwei. Integrating Mechanism of Urban Design[J]. Architectural Journal,2004.

[53] Ni Yang,Yao Han. Renewal and Regeneration of the Old City Texture: Study On the Renewal Design of the Duobao Section of Enning Road[J]. Architectural & Culture,2021.

[54] Huang Jianwen. Integration and Making of the Public Space in the Historic Urban Areas Redevelopment[D]. South China University of Technology,2011.

[55] Madanipour A. Design of urban space: An inquiry into a socio-spatial process[J]. 1996:P23

[56] Hou Dongwei. Response of memory -- Landscape Design generated in the process of site change[D]. Southeast University,2003.

[57] Li Lingyue, Li Wen, Wang Lan. Urban Entrepreneurialism and Green Renewal of Industrial Heritage: Mechanisms and Impacts — Implications and Reflections on Highline Park[J]. Landscape Architecture,2021.

[58] Su Guoyan. Research on the Form of Boundary Space of Historic Districts in Guangzhou[D]. South China University of Technology,2012.

[59] Wu Min. A Research About Reconstruction And Protection On The Landscape Of Historic Sites In Guangzhou[D]. Tongji University,2007.

[60] Lv Yingyi. Analysis of communication vitality of historical and cultural blocks in Changhua Street - Thinking about the connection mechanism between building types and communication vitality[J]. Architectural Practice,2017(04):51-53.

[61] Zhou Kebin.The study of the planning control in the protection of Xiguan's featured streets in Guangzhou[D]. South China University of Technology,2010.

[62] Peng Changxin. From The Rural to The City: Space Prduction and Construction Evolution of Guangzhou Changhua Street[J]. Urbanism and Architecture,2018.

[63] Wang Piaoyi. Study on the optimization strategy of Street Space of Guangzhou Xiguan District Based on public activities[D]. South China University of Technology,2017.