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Politecnico di Torino

专业学位硕士学位论文

Application of "Plug-in Design" in public space of old city in Guangzhou: Taking Xudi-Gaodijie area as an example

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论文提交日期	

Application of "Plug-in Design" in public space of old city in Guangzhou: Taking Xudi-Gaodijie area as an example

A Dissertation Submitted for the Degree of Master

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Abstract

In the context of the urban regeneration in Guangzhou, the old city has become an important area to improve the urban environment and the appearance. The existing urban regeneration design methods, such as the rapid regeneration of large-scale demolition and construction, the small-scale regeneration without unified planning, and the acupuncture regeneration that needs to be analyzed in combination with the actual situation, are not applicable to the old city of Guangzhou today; Therefore, Guangzhou's old city regeneration needs to be supplemented with a new approach, which can not only ensure the applicability to a series of spacial problems, but also maintain the previous regeneration strategy to adopt precise methods in the face of specific projects, while have a certain degree of sustainability.

In order to propose a new updating methodology, This design research integrates and considers the theories and cases learned in recent years. By exploring the theories of "Plug-in City" and summing up the design methods of relevant urban regeneration cases at home and abroad, this thesis puts forward the values of "Plug-in Organic regeneration", and then summarizes the old city regeneration methodology of "Plug-in Design". The "Plug-in Design" which pursues organic regeneration without destroying the overall urban texture has little impact on the spatial changes of the old city of Guangzhou. Its ultimate goal is to energize and revitalize Guangzhou’s old city and inherits the historical context through the insertion of various plug-ins.

This design research applies the methodology to the Xudi-Gaodijie area in the core area of the old city of Guangzhou. The geographical location here is unique and the surrounding commercial atmosphere is strong. Its internal urban texture is compact, preserving a great number of historical sites. With diverse architectural types and complex street forms, it is a very typical spatial pattern of the old city in Guangzhou. However, the decline of public space has affected the life and production of local people. Business formats based on commerce and wholesale are in decline. The internal functions of the block are mixed with prominent population and environmental problems, and the urban landscape has been greatly damaged. By combing the internal public spatial structure of Xudi-Gaodijie area, this study discusses

rigid plug-ins that enhance structural space and flexible plug-ins to improve business functions. Three dimensions of urban acupuncture, including macro, meso and micro are analyzed through the case study. The "Plug-In Design" not only improves the public spatial environment of the old city, but also injects new urban forms and inherit the historical context of the city.

This study not only aims at provide a specific solution to the current problem of urban regeneration of the old city if Guangzhou, but also attempts to supplement the current methodology, conceive the development of urban regeneration theory by providing a thinking pattern of "Plug-In Design". It is expected that in the future urban regeneration of Guangzhou, designers can make use of the advanced science and technology to combine new theories with practice, pay more attention to the preservation of historical context, and achieve people-oriented urban regeneration.

Key words: old city regeneration, plug-in design, public space, Xudi-Gaodijie area

摘　　要

在广州市城市更新的背景下，旧城成为整顿环境，提升面貌的重要区域。现有的旧城更新设计手段，如大拆大建的快速更新、缺乏统一规划的小规模更新、需结合实际情况具体分析的针灸式更新，均不适用于当今的广州旧城；因此，广州的旧城更新需要补充一种新的方式，既能保证更新方法针对一类空间问题具有适用性，又能延续以往的更新策略，在面对具体项目时采用精确的设计手段，同时具有一定的可持续性。

为提出新的更新方法论，本设计研究对近年来所学的理论和案例进行整合与思考。通过归纳“插件城市”等技术主义和有机更新的理论，总结国内外相关城市更新案例的设计手法，本文提出“插件有机更新”的价值观，总结得出“插件式设计”的旧城更新方法论。“插件式设计”对广州旧城空间变化的影响较小，追求在不破坏整体城市肌理和文脉的前提下进行有机的更新。其最终目标是通过各类插件的插入，以点带面的激发广州旧城的活力，延续历史的文脉。

本设计研究将该方法论应用于广州市旧城核心区域的许地-高第街地区。这里地理区位得天独厚，周边商业氛围浓厚。其内部城市肌理紧致，保留了大量的历史建筑，建筑类型多样，街道形式复杂，是十分典型的广州旧城空间格局。但是公共空间的衰落影响了当地人民的生活生产。以商业和批发业为基础的业态面临凋敝。街区内部功能混杂，人口和环境问题突出，城市风貌遭到巨大破坏。通过梳理许地-高第街内部公共空间，本设计从宏观、中观、微观三个维度，插入提升结构空间的刚性插件及改善业态功能的柔性插件。“插件式设计”既改善旧城公共空间环境，又注入新的城市业态，还延续了城市的历史形态和文脉。

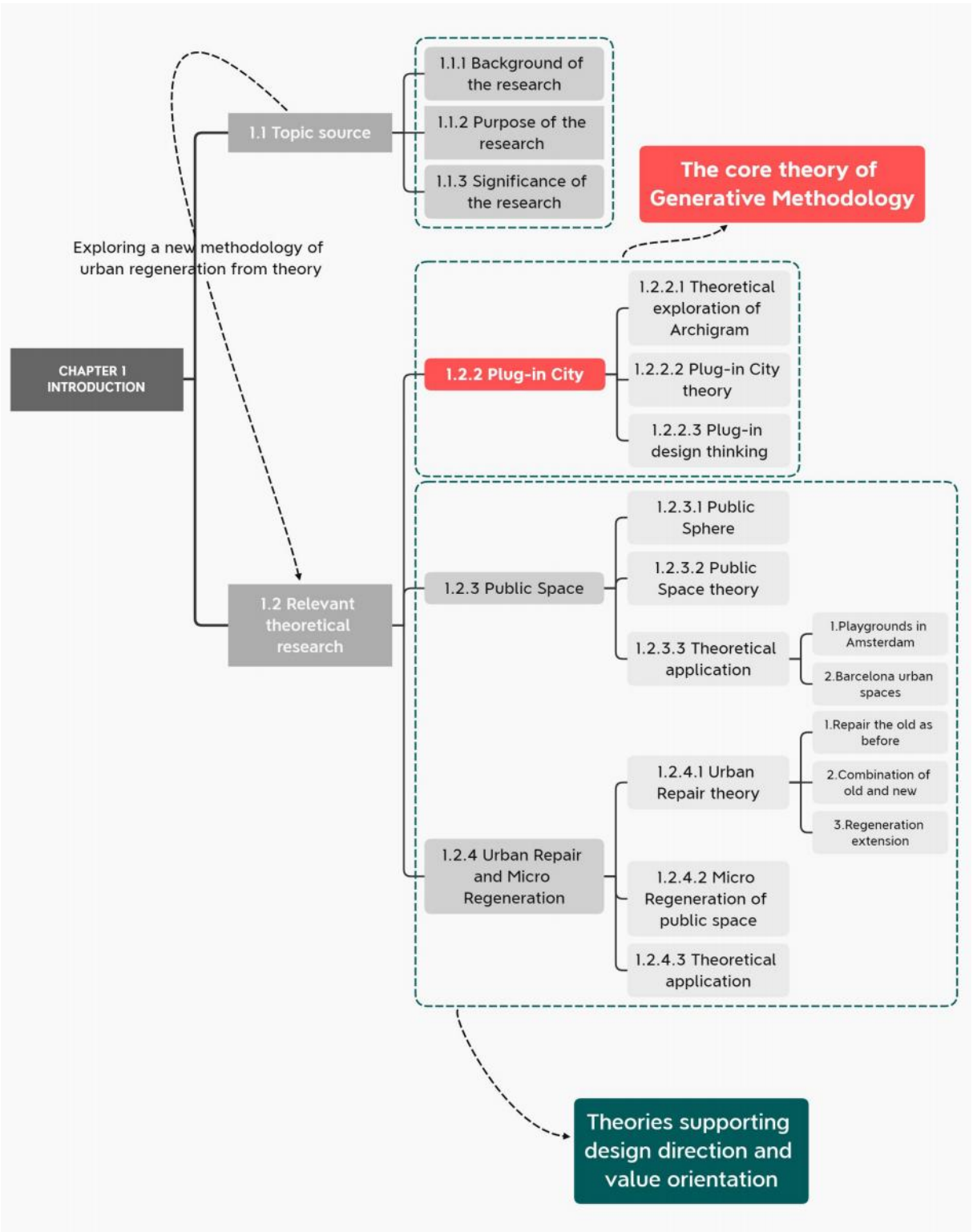
本研究不仅对当下的广州旧城更新问题提供一个具体的解决方案，也试图通过提供一种“插件式设计”的思维，补充当前的更新方法，展望城市更新理论的发展。希望在未来的广州市城市更新中，设计师们能利用科学技术的进步，结合新的理论进行实践，更加注重历史文脉的保护，实现以人为本的城市更新。

关键词： 旧城更新；　　插件式设计；　公共空间；　许地-高第街

CONTENTS

FIGURE LIST

CHAPTER 1 INTRODUCTION



This design thesis is divided into the following four parts: the first is to introduce the topic source, and summarize the relevant theories involved to obtain value inspiration. The second part is to analyze and summarize the relevant cases at home and abroad

in recent years, looking for the regularity and commonness of their design methods. The third part is through the comprehensive analysis of the above theories and cases, and obtains the design methodology. The last part is to apply the design methodology to the specific project involving the regeneration of the old city in Guangzhou, try its feasibility, and finally draw a conclusion.

The chapter 1 mainly introduces the research background and theoretical sources of this thesis. By analyzing the problems existing in some design methods of urban renewal, this paper puts forward the goal, that is, to seek to propose a new design methodology to supplement the original design method. This has certain significance for the current urban regeneration of Guangzhou. In the process of studying and summarizing the urban design concepts, the author provides theoretical basis for the new methodology proposed in this thesis. Plug-in city is an ancient theory half a century ago, but the concept of plug-in City, such as replacement at any time, technology first, plug-in catalytic work, is still worth learning from. Combined with the concepts of organic regeneration, urban restoration and micro regeneration put forward by the current society, it may have a new chemical effect in the public space. Therefore, the further exploration of new methodology has a direction.

1.1 Topic source

With the development of society, the problem of urban development is becoming more and more prominent[25]. Urban construction has made many old city blocks lose their original characteristics and can not give full play to their historical and cultural values. Most of the old urban blocks in the last century are located in the center of the city. Their surrounding areas have good environment, complete infrastructure and convenient transportation. However, up to now, the quality of life in the old city has declined and the urban form has been seriously damaged. In addition, there is a lack of management in the block, the business is chaotic, the gap between the rich and the poor is too large, and the health environment is getting worse and worse. The

regeneration of the old city has become the key task of rectifying the urban environment, reviving the space and inheriting the context.

Therefore, these backward old cities urgently need to transform the environment, enhance the image and stimulate the vitality of the city through the urban regeneration of design methods. This design thesis is to explore a design methodology to solve the above problems.

1.1.1 Background of the research

In recent years, as an important part of the old city regeneration, the reconstruction of public spaces such as streets，lanes and public buildings has attracted much attention of scholars. There are many design methods for urban regeneration.

For example, with the rapid expansion of the city, large-scale urbanization driven by economic interests has adopted the regeneration method of large-scale demolition and construction. From the perspective of development, this is actually an unsustainable development model, which reflects the disregard for social factors in the process of blind urban expansion. It regards economic growth as social development. As a result, the living environment of the city will deteriorate, and the original texture of the old city will be damaged. The scale comparison between new and old cities is outstanding. Almost all cities have adopted the same approach to solving development problems, resulting in a situation of "thousand cities following the same pattern". The regeneration process ignores the role of people as the core of the city, and the urban context is broken, causing serious social problems. The gap between the rich and the poor has widened, and the social network has been seriously disrupted[32].

Small scale progressive regeneration without unified planning is another way. In the long time after the completion of urban regeneration, cities have experienced reconstruction and expansion and illegal development and construction in different forms and ways. Due to the lack of overall planning, this approach surpasses the

overall urban planning in terms of construction intensity. In previous studies on urban regeneration, it is generally believed that small scale progressive regeneration is a positive model of sustainable development. However, on the issue of old city regeneration, progressive regeneration shows obvious negative effects. It has created insurmountable obstacles for the survival and development of old cities[32].

In recent years, the city has entered a stage of high-quality development, and the urban acupuncture regeneration is gradually emerging. On the one hand, It corrects the original extensive way of regeneration, pays more attention to humanistic care, consumes less time and money in the face of huge urban problems, and is easier to intervene. On the other hand, if there is no overall planning guidance, urban acupuncture may become a "fragmentary" regeneration, and its hidden defects will also be revealed. Too individualistic regeneration may lead to the situation that the old city transformation too pursues individual interests and ignores the overall interests. At the same time, the regeneration process of urban acupuncture needs to pay attention to the different characteristics of different regions, and use this method according to the actual situation of each region[27]. Only by carrying out more in-depth research, analysis and design according to different specific conditions, can the urban acupuncture better repair the old city and revitalize the vitality of the city. To some extent, this approach is more refined, but it seems to lack universal tools to solve urban problems.

In this context, the current regeneration of Guangzhou's old city seems to need supplement a new method, which can not only complement the original urban regeneration methods, form a set of design methodology with applicability for a kind of old city space, but also continue the advantages of the original urban regeneration methods, in the face of specific projects, accurate design methods are adopted. And this method also has a certain degree of sustainability[12].

1.1.2 Purpose of the research

This thesis intends to explore a new methodology of urban regeneration based on the theory of the plug-in design concept extended by the concept of Plug-in City.

This methodology starts from the perspective of old city regeneration of Guangzhou. It not only integrates the future development of the city with the local historical background, continues the original urban form and context, but also optimizes the urban space and function. Small scale and replaceable elements such as plug-ins will also be inserted to avoid large-scale demolition and transformation and ensure the accuracy and sustainability of regeneration[1].

The design research uses the distinctive plot named Xudi-Gaodijie area in the old city of Guangzhou. The scheme is to explore the feasibility of a new methodology of form continuation and business format regeneration in the future urban development. The purpose of this thesis is to understand and then transform the old city of Guangzhou with the thinking of small-scale gradual regeneration, apply the theory and method of "Plug-in Design" to the public spaces in the historical urban area of Guangzhou, and create a unique "spirit of place" and historical context inheritance for it. "Plug-in Design" complete the transformation of public spaces from negative space to positive space by excavating the inspiring characteristics in them[12].

1.1.3 Significance of the research

This design research considers the urban space in a larger context. From the perspective of sustainability, sociality and history, urban design is regarded as a summary of the past and a positive force to improve the future. Urban regeneration design is regarded as an artificial ecosystem integrated with urban residence, commerce, landscape, climate and social background. Urban designers can create a sustainable environment, stimulate the vitality of the city and improve people's physical and mental health.

At present, the research on "Plug-in Design" at home and abroad is relatively preliminary, and most of them put forward the feasibility in the conceptual design. Scholars mainly conduct systematic research on the theory of Archigram group. This design paper makes an in-depth exploration and synthesis of Peter Cook's Plug-in City, and applies its thinking in practice. Finally, this design thesis hopes to form a methodology system with logic integrity, theory enrichment and practice.

Applying the methodology of "Plug-in Design" to Xudi-Gaodijie area has practical significance for studying whether this methodology can stimulate the vitality of the old city space in Guangzhou[40]. Through design and application, we will explore a new way to regenerate the old city. This maybe provides a reference for the old city regeneration of Guangzhou, enriches the methods of urban regeneration and provides a new scheme for urban development.

1.2 Relevant theoretical research

Before generating the methodology of "Plug-in Design", it is necessary to summarize and integrate the relevant theories involved. First is Peter Cook's concept of "Plug-in City". The concept of organic regeneration of small-scale plug-ins in urban space seems to meet the needs of urban regeneration in Guangzhou. Second, in the design process, in order to determine the design direction, it is necessary to sort out the definition and characteristics of Public Space and emphasize its importance. Third, the related concepts of Urban Repair and Micro Regeneration emphasize the value orientation of design pursuit. It should be noted that the relationship between different theories is juxtaposed rather than inherited from each other. The first theories are extracted relevant concepts to serve methodology, while the latter two theories control our design direction and value orientation.

1.2.1 Plug-in City

The Plug-in Design concept of Plug-in City is very avantgarde. Plug-ins that change over time conform to the values of organic regeneration. The plug-in is small in scale and has a catalytic effect similar to that of a catalyst, driving big changes with small changes in urban development[13]. Under the framework of urban design, this theory has been constantly improved in recent years, which has great reference significance for the design research of old city in Guangzhou. Making full use of the variability and catalysis of "plug-ins" and strategically inserting new elements will realize the planned and gradual regeneration of the old city. By studying the ideological value of Archigram and the concept of Plug-in City, The author can summarize the idea of Plug-in Design and apply it to the new methodology of this thesis.

1.2.1.1 Theoretical exploration of Archigram

Since the 1950s, there has been an architectural trend of extreme worship and expression of new technology in the west, known as the High-Tech school, including

the Archigram group in Britain, which pursues machine aesthetics[9]. Archigram group was founded at the Architecture Association in 1960 and is composed of six architects and designers headed by Peter Cook.

Today, the first impression of this group is its experimental research activities and works full of avant-garde and even cynical attitude, as well as its unconventional content and exaggerated forms of expression, as well as its sense of smell and rapid and fierce response to the social atmosphere[18].

In 1961, Archigram, a magazine with the same name (its name comes from the combination of "architecture" + "telegram"), was born. Its content is mainly to promote and explore the fluidity and transformation in architecture through poetry and drawings. The 8th issue of the magazine, completed in 1968, began to discuss the open environmental system with the theme of "control and choice", and summarized the important concepts of Archigram, such as Metamorphasis, Nomad, Comfort, Soft/Hard, Emancipation, Exchange and Response. This marks that the overall value orientation of Archigram begins to show a pursuit and praise for the entertainment spirit and humanistic value. In their view at that time, the future development direction of the city was to integrate the development of technology and social changes[18]. Optimism about technological progress and a bright future is the typical view of the idealistic generation of "experimentalists" in the early 1960s[22].

Archigram is an avant-garde architectural group. It draws inspiration from technology and tries its best to express the latest materials in architecture; Try to show assembly, modularization and standardization; It advocates "high technology" such as automation, electronic technology and computer. It tries to use advanced technology to solve the problems of social life flow, change and urban development. The original intention of Archigram is not to design the city like designing industrial plants. Based on this position, what they try to create is a creative system, and try to incorporate their own ideas and designs into it.

In its limited and short active time of ten years, Archigram's architectural concept and value orientation seemed to be an act of breaking away from the tradition and classics.

But in fact it was a critical rescue for modern architecture while seeking a way out for the future city.

Although Archigram's architectural drawings are seemingly unrealisable due to their fascination with the future, it cannot be said that they are not in touch with reality, as they draw from everyday life and the actual phenomena of the contemporary world - from pop culture, mobility, advertising and fashion to state-of-the-art technology, use of materials and space engineering[22].

For a long time, the comments of the design community on Archigram have shown a polarization phenomenon. On the one hand, the work of the construction telecommunication school shows obvious media characteristics. On the other hand, as an architectural group that mainly focuses on architecture and urban issues, its few actual completed works have not only been preserved so far, but also have a great distance from their most famous paper schemes with strong experimental and critical colors, so people can hardly examine and test their ideas in their completed works[17].

Archigram's concept has influenced us to this day, and their works have shaken the setting that the city is a static historical condition, providing an attractive vision for the charming future machine age[10]. However, at the same time, due to the limitations of the times, many of Archigram's concepts are only illusory. Although it denies the permanence of western traditional values inherited by the modern bourgeoisie, its practice seldom considers economic factors, and social and environmental problems have not been solved, which also provides a foothold for future explorers[18].

1.2.1.2 Plug-in City theory

Archigram member Chalk believes that the technological society will encourage more and more people to co-create their individual environment, in which architects create conditions for liberation from the restrictions presented by chaotic situations in the home, at work and in the entire built environment[22].

From 1960 to 1974, Archigram created more than 900 images, including Peter Cook's

"Plug-in City", which represents the best example of early efforts by the Archigram Group and individuals within it. He advocated practicing functionalism in cities, building a very flexible city and operating in an efficient and flexible way. With his radical concept, he wanted to realize the mobility of urban environment[18].

Plug-in City is not an independent scheme completed by Archigram, but a continuous exploration about the future of the city through the development of Archigram, which is specifically reflected in several "Plug-in City" schemes with different versions and backgrounds, as well as some related case designs.

The design exploration of Plug-in Cities can be traced back to the fourth issue of Archigram magazine, which was completed in 1964. Members have a clear understanding of the difficulties encountered by architecture in the consumer era, and their position has also changed from the early values of the elite of modern sports to the anti cultural position of embracing pop art, which also reflects their basic attitude of trying to solve problems from a broad perspective of integrating social, cultural, artistic and other factors.

In the process of designing the preliminary scheme, Cook found the combination mode of the main components of the residential unit (Fig 1-1).

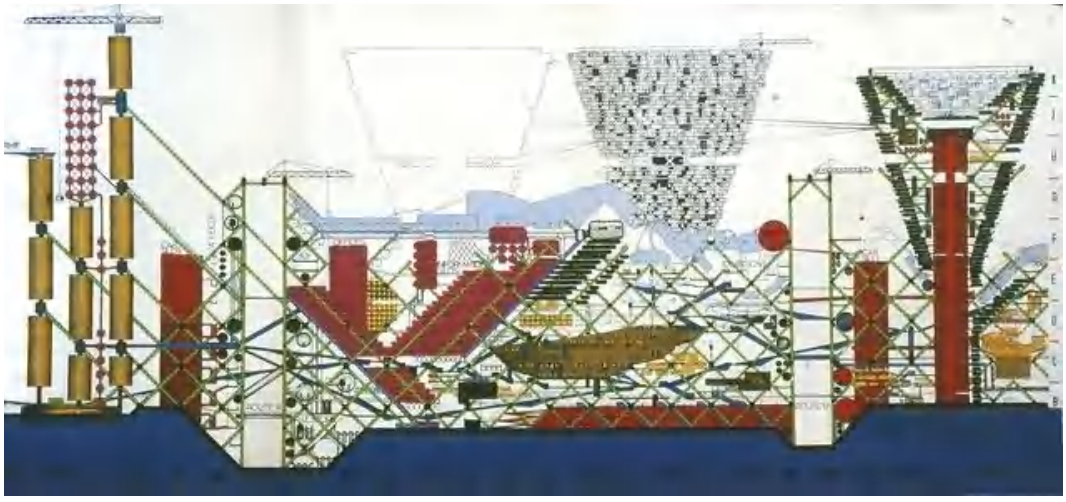


Fig 1-1 Plug-in City preliminary scheme, data from www.archdaily.cn

On the basis of the preliminary scheme, he adopted a new structural system after modification and optimization. In this structural system, Cook adopted the more

common practices at that time: first, complete the deployment and connection of the horizontal surface layer according to the specific functional requirements; Second, the main structure presents a hierarchical design feature; Third, the secondary structure is stacked on the main structure in a clear and regular order. However, in the Plug-in City scheme at this stage, the freedom and mobility of the idealized city of Archigram have not been fully reflected. In the following scheme, they strengthened this point (Fig 1-2). This sectional drawings show the basic functions and detailed deployment of this scheme.

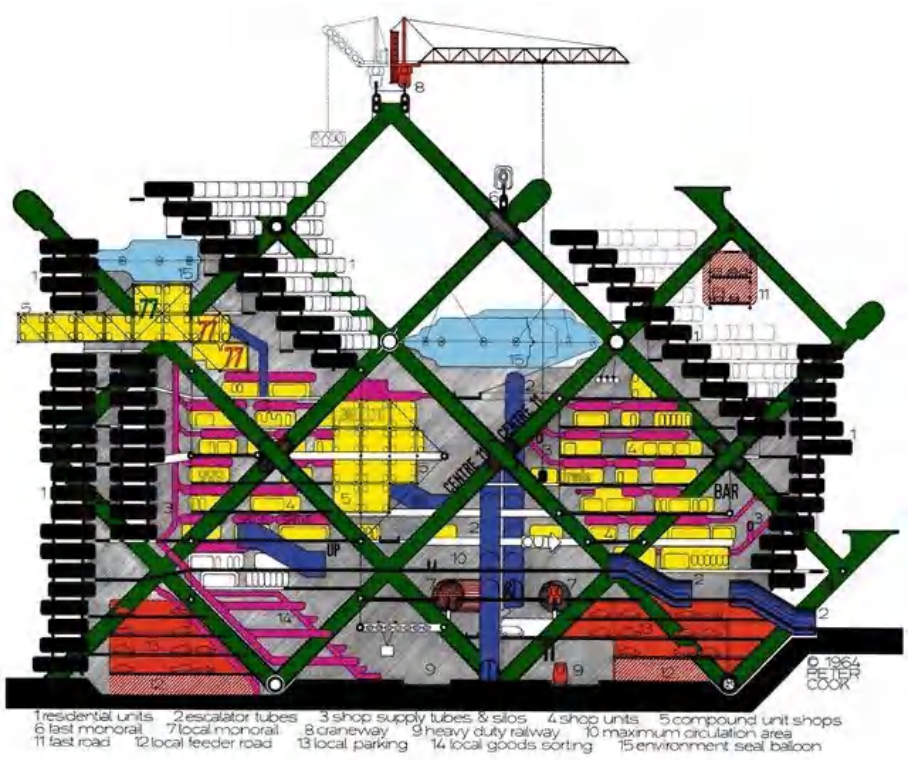


Fig 1-2 Plug-in City further scheme, data from www.archdaily.cn

In Peter cook's view, the most important and representative version of the "Plug-in City" program was published in the 5th issue of the Journal published in 1964. From then on, the focus of the group's thinking began to rise to the level of the city, and the group's thinking on various issues was also reflected in this plan. In the mainstream academic view, the Plug-in City completion scheme in the general sense is shown below (Fig 1-3). The clear and dense details, distinctive overall posture and strong heroism of the scheme constitute the overall image of the plug-in City, which is

completely different from the traditional city image in reality. The highly precise and vectorial sense of science and technology, the sharp sense of speed and form like a cliff, the mechanized detail composition and sense of order, and at the same time, there is no lack of a sense of hierarchy and scale - the comprehensive feeling given by the Plug-in City makes people believe that this is the orthodox successor of the futuristic lineage.

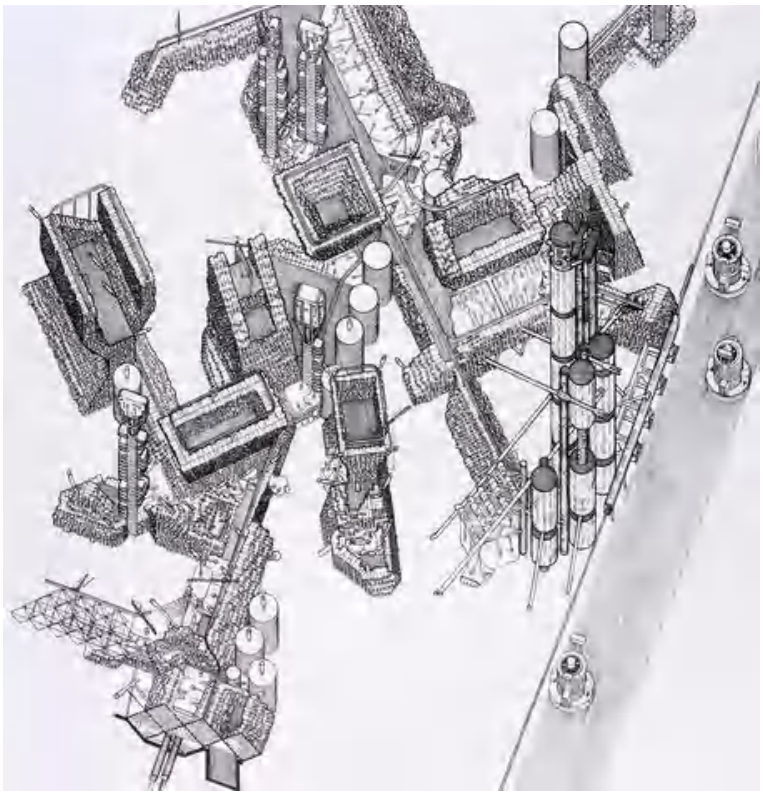


Fig 1-3 Plug-in City completion scheme, data from www.archdaily.cn

In this way, Archigram showed such a scene in the scheme: people, machinery, buildings, and various facilities required by the city are deployed in the same artificial system with high mobility, integrity and standardization. As the scheme shows such characteristics, the definition of Plug-in City is also clear: the core characteristic of the whole city is decentralization.

According to Cook's assumption, urban design activities will gradually change from a top-down planning behavior to a bottom-up group activity. The design process will also change from a phased static operation to a dynamic development behavior characterized by high frequency and sustainability. The local or overall planning

adjustment cycle of the city will be greatly shortened, and the changing urban pattern will become a new normal. There is no doubt that this urban operation state, which takes change as the normal, is based on the premise of overall order and various internal standards of Plug-in City[16].

"Plug-in City" includes the modular mobile metal cabin as the basic component. With such a basic construction unit, mobile communities of different sizes can be disassembled and reorganized according to the population size, and then "inserted" into the "megastructure of concrete" of the central infrastructure according to different needs[21].

"Plug-in City" is not actually a city, but a giant structure that will continue to develop. Among them, housing, transportation and other basic services can be moved by giant machinery. They can be pulled out and plugged in by hoisting equipment every 20 years. In other words, with the dramatic changes in production and life and the leap forward of science and technology, the houses and various facilities in the city can be updated periodically. The replacement of specific components according to the service life reflects the thinking of the Archigram on "Consumption", and their understanding and response to the mobility of mega structures[18].

Peter Cook did not have an in-depth discussion on the design and actual functions of such a city. Reyner Banham also believes that the concept of Plug-in City is "short on theory, long on draughtsmanship and craftsmanship". But he didn't care much about the possibility of functional megastructure Plug-in City, because he believes that its visualization is more important for the progress of technical architecture. "Archigram can't tell you for certain whether Plug-in City can be made to work, but it can tell you what it might look like[22]." it provides the aesthetic potential of the city image to guide the future development of the city.

In the idea of a Plug-in City, the operation and management of the whole city, the layout and transformation of urban industries, government functions, and the way in which architects and planners use professional forces to intervene in the whole process have not been considered and deployed in detail. In addition, due to the

limitations of objective realistic conditions such as real construction technology, economic and energy conditions, the whole scheme finally stayed in the experimental paper scheme stage. Although this is only a conceptual design, it is avant-garde to discuss the issues of architecture, technology, and social and historical development together. It provides a refreshing solution for urban regeneration at that time, breaking the concept of traditional infrastructure.

1.2.1.3 Plug-in design thinking

The plug-in design concept of "Plug-in City" is still of critical significance in today's society. Lang further defined the Plug-in City based on typology, which refers to the design and implementation of infrastructure projects to obtain the catalytic effect of spatial intervention[18]. With the development of productivity, designs that once existed only in fantasy may be put into practice. Recently, concepts of Archigram’s Plug-In City have materialised both in specific niches of architectural designs as well as in the form of digital furniture in public spaces. Shipping containers, for example, have been used as temporary dwelling units, movable hotels or structures for pop-up community markets[22].

The previous modular and organic regeneration theory can also provide more guidance and inspiration for the current design. The concept of plug-in design provides an attractive new method for urban regeneration and reverses people's traditional concept of the role of infrastructure in the city. Especially when dealing with the relationship between the new entity (plug-in) and the original urban structure (Infrastructure) in the old city regeneration, making full use of the variability and catalysis of the "plug-in" and strategically inserting new elements will realize the planned gradual regeneration of the city[10].

Plug-in design is not only a design concept proposed for the needs of future urban design, but according to the study of relevant theoretical concepts, it can be found that its characteristics are very consistent with the regeneration of many old cities. It embodies the characteristics of strategy and diversification in the goal of urban

regeneration, and the principle of cautious, small-scale and gradual regeneration in the way of specific regeneration and transformation.

The plug-in design concept provides an attractive new method for urban regeneration, reversing people's traditional concept of the role of infrastructure in the city. In particular, when dealing with the relationship between new entities (plug-ins) and the original urban structure (Infrastructure) in the regeneration of old cities, making full use of the variability and catalytic nature of "plug-ins" and strategically inserting new elements will realize the gradual regeneration of cities[10]. The "plug-in" involved in urban space is like a stone thrown into the water, which will have a significant impact on the infrastructure and public service facilities in the adjacent area[24]. Therefore, plug-in design can effectively catalyze the vitality of the city with a small impact and bring sustainable development to the city from point to area.

1.2.2 Public Space

A clear definition and understanding of public space from relevant cases are the premise for us to select public space for design. This provides theoretical support and design direction for the Xudi-Gaudijie area regeneration project. Therefore, understanding what is public space is a necessary prerequisite.

1.2.2.1 Public Sphere

Public space is part of the concept of the public sphere. The vocabulary of the Public Sphere comes from the Declaration of the Rights of Man and the Citizen. It is a field that can form public opinion and citizens participate in social life in an unrestricted way. It is a place where people can act rather than work, and a stage where people can express themselves. The emergence of public sphere consciousness makes the exploration of public space gradually form a set of theories.

1.2.2.2 Public Space theory

Public Space is a form of space that provides communication. Its goal is to create a micro field of public participation, realize the diversification of public activities, and create a temporary, situational space that is always suitable for human needs. Relying on people's wisdom and thinking, public space closely connects people, nature and community information through various means, so as to realize the thinking exchange between people, the emotional exchange between people and nature, and the information exchange between people and the network, so as to create a diversified living space, working space and communication space[39].

The theory of Public Space began in the 19th century. Squares and boulevards provide a realistic basis for the development of public space. With the development of the modernist movement, public space has been paid more and more attention, and a great open space has been born. At the end of the 20th century, public space has entered a nostalgic era. New Urbanism advocates returning to the practice of public space as a closed space, and theme parks and shopping centers have become new forms of public space. In modern times, public space has become a space full of great potential. In this space, public activities are intensive, which shows the public value and collective story of activities in this space, thus forming a continuous and intersectable space. In addition, the new public space theory is affecting the contemporary social movement, and people pay more attention to the practical activities that occupy the collective space. The new public space does rewrite sharing in another way: it is nomadic, fragile and temporary.

The main purpose of developing public space is to provide local residents with a new way of living and lifestyle: creatively connect work, leisure and life closely to form a trinity spatial way, which will be the direction of urban regeneration and development in the future.

1.2.2.3 Theoretical application

1.Playgrounds in Amsterdam

With the end of World War II, Amsterdam started reconstruction. The whole plan adheres to the principle of radical frugality, that is, do less to reduce unnecessary waste, but do not lose the effectiveness and functionality of the project. The goal of reconstruction is to renew many empty spaces or overcrowded ruins in the city.

Since 1947, Aldo van Eyck has designed and built more than 700 playgrounds in Amsterdam. They are marginal space and surplus space, and they are fragments of public space. They are not only a playground for children, but also a space for social interaction and emotion generation. These playgrounds have established a dense spatial network of relationships within the urban texture (Fig 1-4).

Fig 1-4 Playground in Amsterdam rebuilt after the war, data from urbanism

2.Barcelona urban spaces

Barcelona is a successful case of urban regeneration. The "Reconstruction" of its public culture and social values is full of foresight, wisdom, determination and cohesion. the author may be able to find the truth from the regeneration of its public space.

In 1975, Franco's dictatorship ended, Barcelona's industry grew and its population began to decrease. Cities needed to solve the problems brought by the recession of nearly 40 years - the boundary of urban space was unknown; The historical core of medieval city was decline; The connection between the city and the sea was lack of accessibility; "Between spaces" needed to be given a new meaning.

Barcelona is the sum of many urban space fragments. In the 1980s, the focus of urban regeneration was to provide solutions for the interrupted urban space fragments. On the basis of public space and social characteristics, through the regeneration process, make the historical core of the city livable again, and improve the quality of the city and the utilization of the existing city[19]. For example, by demolishing the city block to the dense area of medieval cities, the new square in front of Baroque churches has become a new public space and gathering space (Fig 1-5). Another example is the open-air museum project in Barcelona. The core goal is to build a multi center urban public space. Through cooperation with artists, public space, as an urban fringe space, has a new central position, a new identity, and has become a new dense area.

Fig 1-5 Square space in front of a church in Barcelona, data from urbanism

1.2.3 Urban Repair and Micro Regeneration

The attitude of Urban Repair and Micro regeneration towards the old cities has played a leading role in the design values of this paper. It systematically combs various elements in the urban pattern and "repairs" the prominent problems with a cautious attitude according to local conditions[8]. This idea of ingenious combination of new and old, which not only protects the original texture but also allows construction to occur, will become the key attitude of this design methodology.

For the old cities in China, the theory of Urban Repair and Micro Regeneration is more

in line with the value orientation of this design methodology. Therefore, in this part, the author specifically studies the methods of Urban Repair, the theory and application of public space Micro Regeneration, and obtains design experience and methods from the Guangzhou Enning road regeneration project. In the later design application, these theories will guide the methodology to find micro space with a cautious repair attitude and carry out small-scale transformation and improvement[37].

1.2.3.1 Urban Repair theory

"Urban Repair" is a concept of urban development with more Chinese characteristics. Although the concept of "Urban Repair" has only been put forward in recent years, the author believes that similar planning concepts have been discussed and practiced for a long time, which can be traced back to Colin Rowe's Collage City in the 1970s. In this book, Colin Rowe clearly put forward the idea that the fragmentation of modern cities can be collaged with the strategy of contextualism. With the rapid expansion and development of China for more than 40 years, many old urban areas are facing the decline and shrinkage of various functions, the accelerated destruction of urban style and the decline of people's quality of life. Urban Repair achieves the purpose of improving urban public facilities and restoring townscape by using abandoned land, increasing public space and green land, improving travel conditions, transforming old buildings and protecting history and culture[11].

"Urban Repair" systematically combs various elements in the urban space, and gradually moves towards a new "organic order" through prudent urban "organic regeneration"[29]. In view of the prominent problems, it uses the overall design method and takes the small-scale and gradual repair method as the core to "repair" according to local conditions. It can be understood as two means of "repair" and "supplement" of the city. "Repair" is to repair and regenerate various decaying urban functions and spaces. "Supplement" is to supply and increase various public functions missing or omitted in the process of rapid development[32]. The specific methods include the following.

1.Repair the old as before

Repairing the urban spaces according to the form characteristics of the city with time changes is called "repairing the old as before". In fact, this "old" mainly refers to the historical style of the urban form. For the maintenance and transformation of this kind of old city, restoring its historical authenticity and continuing its context is the purpose of Urban Repair.

2.Combination of old and new

The "combination of the old and the new" is the key point of Urban Repair - not only to protect the original texture, but also to allow new construction to occur. The combination of old and new generally adopts contemporary materials, composition methods and aesthetic characteristics, which are in sharp contrast with the original urban and architectural forms. The buildings in the old city retain more original parts and structural components and become the "old" part of the architectural space transformation. The "new" part is implemented by modern materials and modern technical means. The combination of the two creates a sense of beauty of the intersection of the old and the new. The collision between the new and the old times and the comparison of history and culture bring rich visual feelings and ideological enlightenment to the audience.

3.Regeneration extension

The regeneration extension fully retains the form of old buildings or related building components, maintains the typology of the old city structure, serves as the basis and model for the construction and development of new buildings and new spaces, and provides inspiration for new design and construction. It makes rational use of the historical and cultural background of the old buildings and integrate them into the new construction projects, so as to make the old buildings become the support of the new buildings and the new buildings become the extension and expansion of the old buildings.

1.2.3.2 Micro Regeneration of public space

Urban existing public spaces are the carriers and gathering places of citizens' activities. they have different spatial forms and spiritual connotations from other forms. With the change of economic and social development background in western countries, the regeneration of material environment and social network have entered a more slow and cautious stage. The local micro regeneration mode with small public space as the main transformation object has become a new way to improve urban vitality and improve the quality of urban space.

Micro regeneration has the characteristics of micro scale, micro input and micro entry point. First of all, its regeneration object is the idle public space in the city. Through the regeneration of small places such as small squares and small parks, it can improve the quality and shape the function; Secondly, the basic investment of micro regeneration is small, which makes the practice itself have a lower access threshold, and can realize various forms of cooperation at the same time; Finally, the entry point is often to start from the problem, provide temporary strategies, solve small needs and realize small function improvement[26].

1.2.3.3 Theoretical application

Wu Liangyong proposed that relying on the inherent development structure, urban construction can adopt a small-scale and gradual transformation model to achieve the purpose of sustainable development of urban space[28].

Based on the theory of Urban Repair and Micro Regeneration, Guangzhou Enning road block recreates the micro space of historical blocks, optimizes the space of streets and lanes, improves the environment of streets and lanes, and continues the historical style of streets and lanes on the premise of respecting the historical context and not damaging the historical buildings, street texture and spatial layout of the original blocks (Fig 1-6).

Fig 1-6 Yongqingfang, Enning Road, Guangzhou, data from [20]

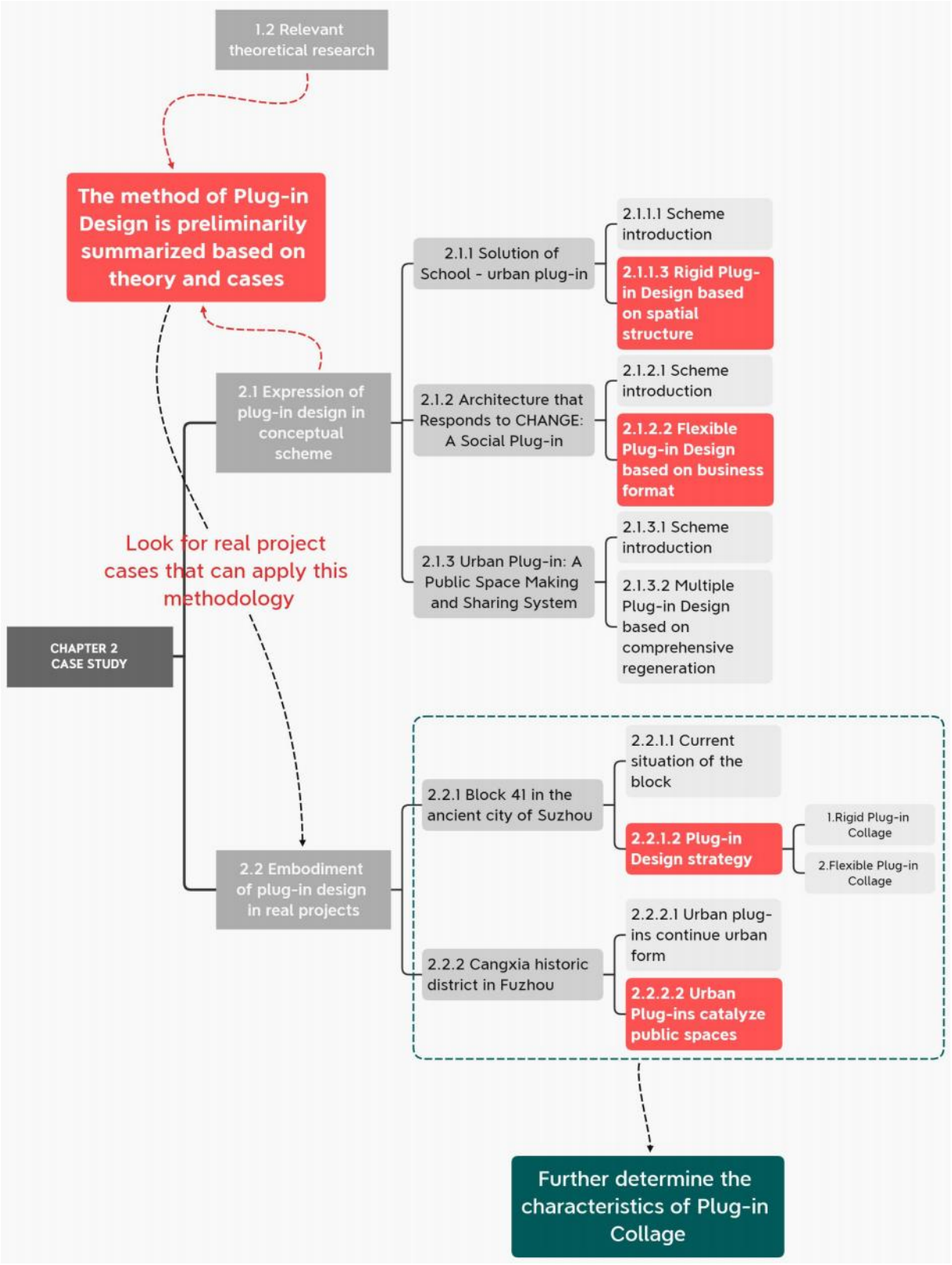
It improves the current situation of the decline of texture, aging facilities and insufficient functions of historical blocks, makes the regeneration of historical blocks more in line with people's scale, and further extends the idea of urban regeneration to pay more attention to the diversity of space design[20].

The "Micro Regeneration" of yongqingfang at Enning Road not only connects the traditional and modern urban style, but also catalyzes the vitality of the block through the injected of modern business forms. By studying the theory and practice of urban restoration, this thesis further clarifies the attitude to be maintained in the face of urban regeneration, and what methods should be adopted to design urban regeneration under the guidance of this value. This has guiding significance for the regeneration practice of Xudi-Gaodijie area.

1.3 Summary of chapter 1

The chapter 1 mainly introduces the research background and theoretical sources of this thesis. By analyzing the problems existing in some design methods of urban renewal, this paper puts forward the goal, that is, to seek to propose a new design methodology to supplement the original design method. This has certain significance for the current urban regeneration of Guangzhou. In the process of studying and summarizing the urban design concepts, the author provides theoretical basis for the new methodology proposed in this thesis. Plug-in city is an ancient theory half a century ago, but the concept of plug-in City, such as replacement at any time, technology first, plug-in catalytic work, is still worth learning from. Combined with the concepts of organic regeneration, urban restoration and micro regeneration put forward by the current society, it may have a new chemical effect in the public space. Therefore, the further exploration of new methodology has a direction.

CHAPTER 2 CASE STUDY



The cases referred to in this chapter are urban regeneration design cases at home

and abroad, from which some plug-in design methods can be extracted, which has reference significance for the generation of methodology. This thesis mainly analyzes and summarizes contemporary specific cases from the following two aspects: From the case of conceptual design, the author excavates ideas similar to plug-in design concepts, and summarizes and classifies them according to the characteristics of design methods. In the real project cases, the author looks for a method that can reflect the plug-in design, and further determines the scale and conditions of the application of the design method in China.

2.1 Expression of plug-in design in conceptual scheme

In recent years, in some design competitions, there are many works using "plug-in design". Through the summary and research of these conceptual schemes, we can further analyze the feasibility of "plug-in design" and study the specific design methods.

2.1.1 Solution of School - urban plug-in

2.1.1.1 Scheme introduction

The plan is located in Datong District, Taiwan Province, China. The designer took the epidemic as an opportunity to rethink the situation of people's life and learning under the influence of the COVID-19. This new spatial form for modern education will be different from the previous teaching and learning process that fixed the same group of students in a specific position (Fig 2-1)[42].

Fig 2-1 Solution of School - urban plug-in, data from www.youfab.info

"Solution of School" is a new educational space system. People can choose the space type of plug-ins together with their neighbors through social networks, and spontaneously build a school. The urban learning space formed by the "Solution of School" can adapt to various situations in the city[42]. With its universal design features, the plug-in can always adapt to the characteristics of the street and form a school suitable for local children (Fig 2-2).

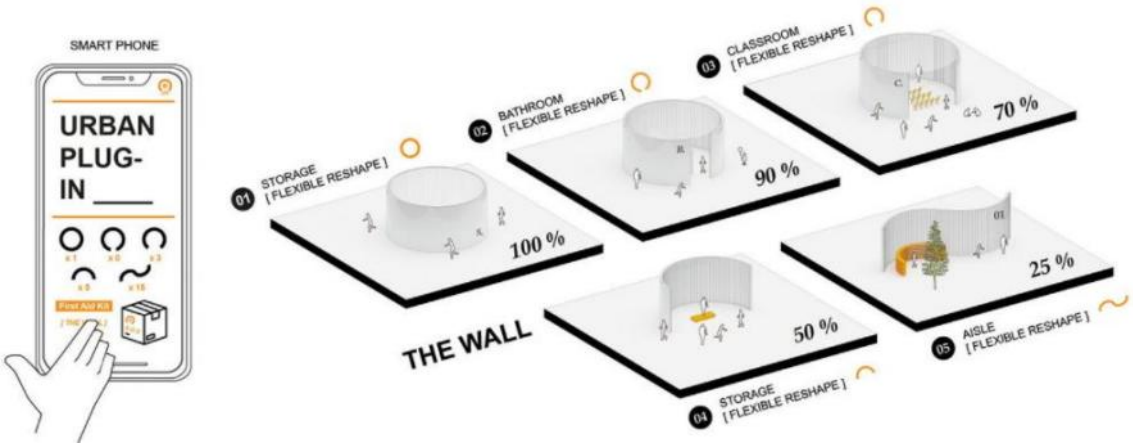


Fig 2-2 Select plug-in, data from www.youfab.info

The designer believe that learning cannot be separated from daily life, so plug-ins of Solution of School cannot be separated from the blocks. Therefore, the learning space

will evolve into an urban space with diversity and more possibilities. In this scheme, the urban plug-ins enable themselves with school function to be inserted into a square (Fig 2-3). With the help of plug-ins, activities can be carried out in classrooms and squares at the same time. A reading room with some green plants constitutes its internal core space[42]. In addition, the designer uses the curved surface of the plug-in to blur the old boundary.

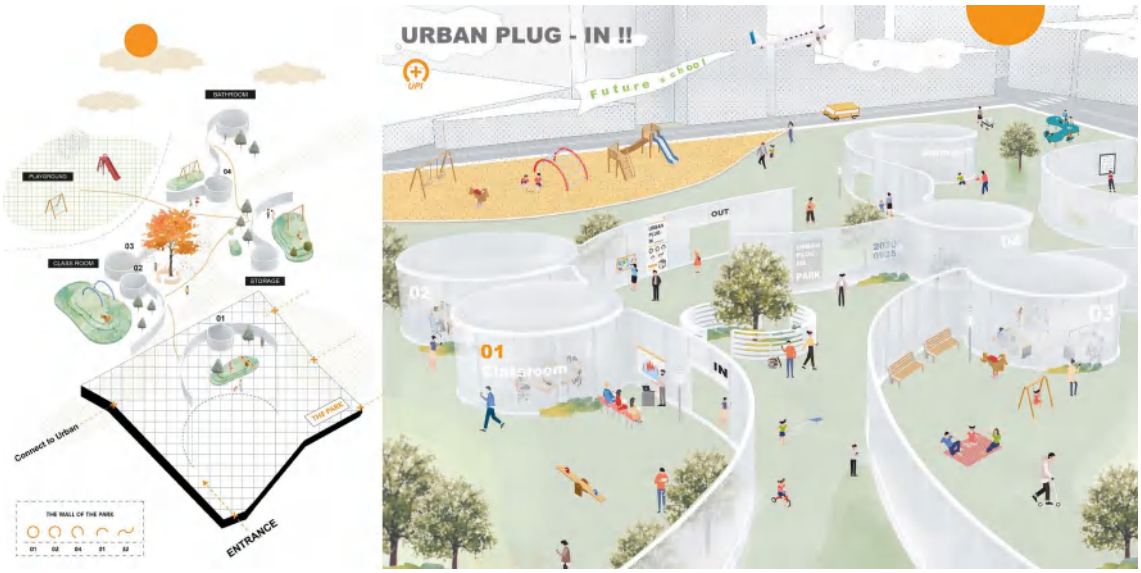


Fig 2-3 Insert plug-ins, data from www.youfab.info

In the design of the "Solution of School", the main material of the plug-in for the curved wall is 4 meters high translucent PP material, and the steel structure is used to build the frame. This material is chosen not only because it can have a natural dialogue with the base, but also because it can see the shadow of children on the wall, so that parents can feel the atmosphere in the classroom even if they are unable to attend class. At the same time, it provides a more open park space in the city (Fig 2-4).

Fig 2-4 Technicality of plug-in material, data from www.youfab.info

During the covid-19 pandemic, when students cannot easily access the classrooms that are uninhabited and isolated from the area, the scheme can create temporary classrooms outdoors, it can not only maintain social distance, but also serve as an optimal "connection" to connect the relationships between people in communities they do not know[42]. The city plug-in brings local residents, including adults and children, together in one place. Through the space composed of plug-ins, people know and communicate with each other, strengthening the relationship network in the region (Fig 2-5).

Fig 2-5 Section space, data from www.youfab.info

2.1.1.2 Rigid Plug-in Design based on spatial structure

Through the research and thinking of the conceptual design of "Solution of School", The author can get a specific method for the urban regeneration, that is, on the existing basis of the urban space, we should innovate in materials, structures, spaces, composition and other aspects, and use plug-in design methods to insert physical structures such as buildings, infrastructure or public space into the original urban space by means of new construction or transformation, so as to catalyze the urban regeneration.

Because the insertion of the solid structure is mainly new construction and transformation in operation, and it is not easy to change in the short term, It can be named as Rigid Plug-in Design.

2.1.2 Architecture that Responds to CHANGE: A Social Plug-in

2.1.2.1 Scheme introduction

The design scheme is located in Mumbai, India. The designer aims to propose a cultural plug-in with Mumbai's regional characteristics. The plug-in takes leisure and entertainment as its business formats, and the cultural center as the receiving space equipment. It is a machine that catalyzes social interaction and highly adapts to the changing cultural and social conditions with time and place[41].

Cultural center is a building that changes over time and is deployed in urban space that has failed or is failing. The cultural center is a flexible building that adapts to social transformation and surrounds the business function of social interaction in the framework structure (Fig 2-6). It is a building that integrates art and technology.

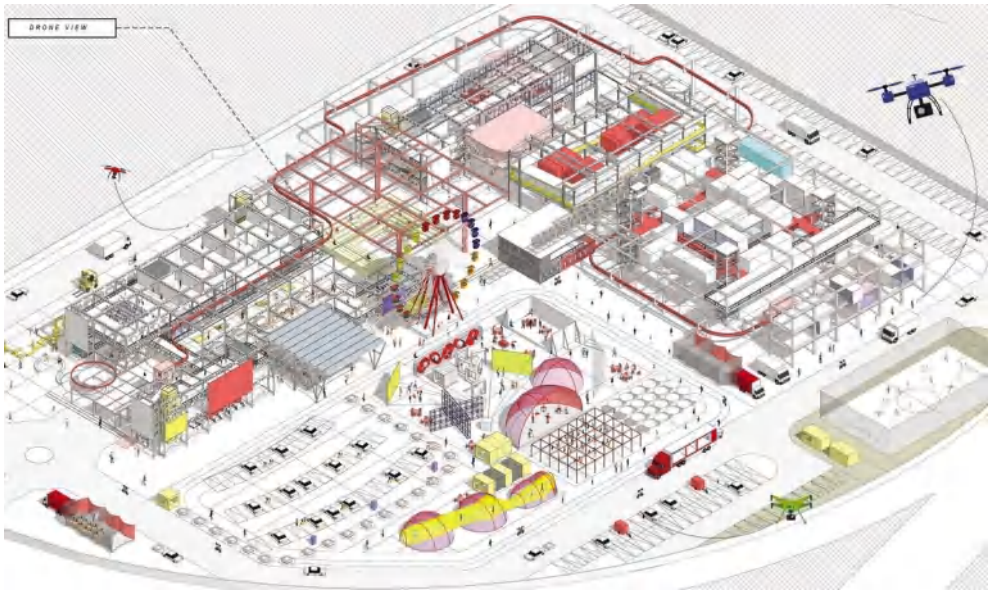


Fig 2-6 Cultural center, data from awards.re-thinkingthefuture.com

As the cultural center is located in a specific urban space as a cultural carrier, the cultural center will respond in different urban spaces according to needs. It reflects the culture of its surrounding environment through its adaptability to hold activities and programs, and changes its architectural facade, spatial form, planning and arrangement, user groups, etc. according to the needs of context. In the conceptual design, the cultural center is not a museum, nor a school, theater or playground, but it

may be all these things at the same time or at different times[41]. This is an environment of constant interaction and response. This is a multi-functional space, which is endless in size, shape, and accessibility.

The plug-in with leisure and entertainment as its function will be inserted into the entity of the cultural center (Fig 2-7). Its essence is that its function changes with the demand, allowing a variety of uncertain uses to adapt to the changes of space, culture, society and so on in the city. In the process of plug-in insertion, disassembly and reassembly, an improvisational building with continuous activities is generated in urban space[41]. The cultural center will be stimulated to start or modify the existing cultural formats. The scale and number of plug-ins will depend on the changing needs of users and the increase in passenger traffic, which will also generate more activities and business opportunities, thereby adding more complex layers.

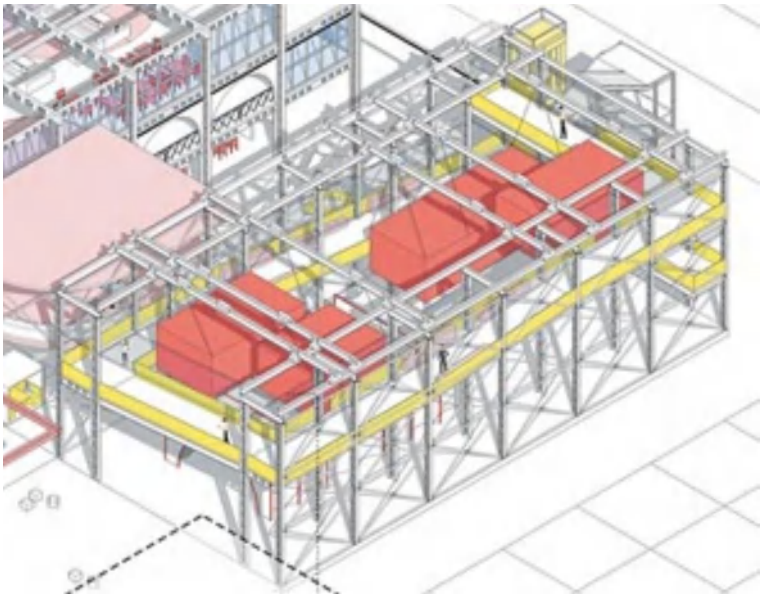


Fig 2-7 Insert function in entity, data from awards.re-thinkingthefuture.com

The plug-in has certain mobility. In these places where local culture develops slowly, it will produce or change cultural formats (Fig 2-8). Once people use this plug-in, it will react to its context over time. It is adaptive, convertible, mobile and interactive. It uses the nature of leisure and entertainment business function intervention as a plug-in to catalyze the regeneration of the city.

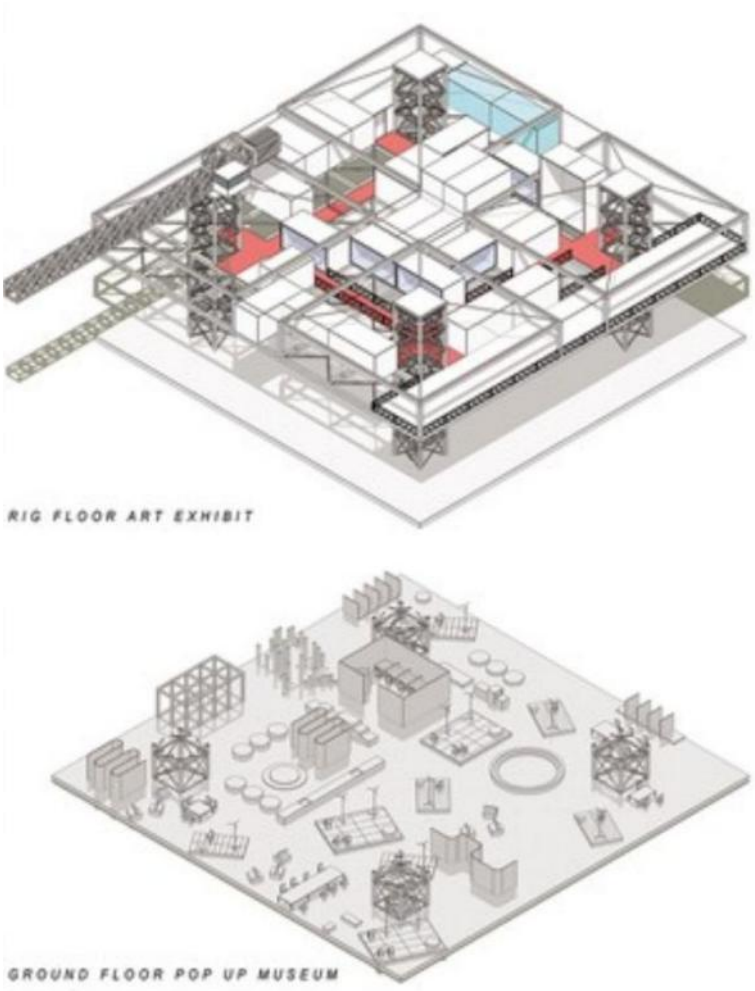


Fig 2-8 Layout of plug-ins, data from awards.re-thinkingthefuture.com

2.1.2.2 Flexible Plug-in Design based on business format

The conceptual design of the cultural center continues the spatial structure of the original building, and even does not carry out large-scale demolition or reconstruction of the building entity. The main method of the design is how to insert new business formats and gently insert new functions to activate the urban vitality of the region.

This design method of using the original entity to insert new functional plug-ins can be classified as flexible plug-in design because it can convert from one function to another quickly and cheaply, and it is easier to change in the short term.

2.1.3 Urban Plug-in: A Public Space Making and Sharing System

2.1.3.1 Scheme introduction

Although everything in China is changing rapidly, Beijing's urban historical area seems to be lagging behind. The demand for life, commerce and society in the new era requires the continuous development of urban space, but the dense old urban area lacks these spaces. Many people occupy public space with illegal buildings[43]. This has a certain danger and worsens the quality of the urban environment.

Therefore, designers propose to meet people's needs through legal, although informal facilities. In this conceptual design, designers find inspiration in the sharing economy and put forward the concept of urban plug-in (Fig 2-9). Change urban space by sharing prefabricated urban furniture units (Urban plug-ins).

Fig 2-9 Master plan of Synagogue square, data from urbanresearchtable.com

By using the Internet, every user can design their own public space. Once the space is designed and ordered, users will quickly receive prefabricated units (Fig 2-10). In addition, users can set the way they want to share space with others. The service team will provide various urban plug-ins, including instant toilets with skylights, cartoon shaped Wi-Fi spots, oversized carpets for outdoor gatherings and smoking area makers[43]. By consulting designers, users can also choose to customize plug-ins as needed.

Fig 2-10 Synagogue square, data from urbanresearchtable.com

Through the real-time map, users will be able to see all the plug-ins installed in the city and know who the provider is or whether others can share space. In general, through the urban plug-in, people will be able to create a new city bit by bit. A new public space is about to be born.

2.1.3.2 Multiple Plug-in Design based on comprehensive regeneration

The conceptual design of Beijing public space not only inserts the plug-ins of new physical space structures, but also inserts the plug-ins of new business functions. Activating the urban vitality of the region through the comprehensive insertion of Rigid Plug-ins and Flexible Plug-ins is a design method of Multiple Plug-in Design.

2.2 Embodiment of plug-in design in real projects

The spirit of plug-in theory can also be found in real-project cases. The author further explored the concept of "Plug-in Design" embodied in these cases, and also referred to the scale and quantity of plug-ins in these old city blocks of similar condition. This has certain guiding significance for us to define the specific classification and scale of plug-ins.

2.2.1 Block 41 in the ancient city of Suzhou

2.2.1.1 Current situation of the block

Suzhou is an ancient city with a history of 2500 years. Block 41 in the ancient city of Suzhou is divided into East and west by the Jinshi riverside. It has a number of historical lots, cultural relics protection units, ancient wells and ancient trees.

Block 41 is a distinctive neighborhood. Buildings of different ages have divided different plots in the neighborhood, and at the same time, they penetrate each other to form a special texture (Fig 2-11). These buildings of different ages fit each other, forming the current texture of block 41.

Fig 2-11 block 41 in the ancient city of Suzhou

Depending on the age of architecture, the form of architecture will also be different. In block 41, the Ming and Qing Dynasties architecture, the Republic of China architecture, modern architecture and other forms exist together, forming a multiple coexistence of plan and facade (Fig 2-12). A building will experience a series of situations in its architectural life, such as completion, aging, renovation, collapse and reconstruction. The difference between the repair time and the completion time of the building will lead to an interesting state of its architectural form[15].

Fig 2-12 Pluralistic coexistence of facade form, data from map.baidu.com

2.2.1.2 Plug-in Design strategy

From the perspective of the protection of the traditional features of the ancient city, the small-scale transformation based on Plug-in Design not only respects the dynamic development process and multivariate characteristics of the ancient city, but also is more good to the continuation of the traditional architectural features.

In the protection and regeneration urban design of block 41 in the ancient city of Suzhou, small-scale and dynamic plug-in regeneration is adopted to sort out the neighborhood traffic, clarify the regional boundary, create landscape nodes, improve functional facilities, and mobilize the enthusiasm of residents to make the neighborhood a "healthy, livable and dynamic" ancient city block.

1.Rigid Plug-in Design

By placing a Rigid Plug-in, block 41 of the ancient city of Suzhou will create a cultural and leisure pedestrian belt around the ancient city, connecting the inner city rivers, and catalyzing the activation of the regional context.

On the basis of the existing roads, some roads are improved to be one-way roads with limited time. The slow traffic plug-in enhances the internal connection between subway station and the neighborhood. At the same time, several public parking lots are planned.

The placement of plug-ins in the open space complements many cultural nodes, including cultural park, conference center, Xiangyang new village, art life square, etc. It is planned to form a neighborhood public space system with "waterfront, park, square, street, corner and bridgehead" in series, forming a pedestrian Lane loop (Fig 2-13).

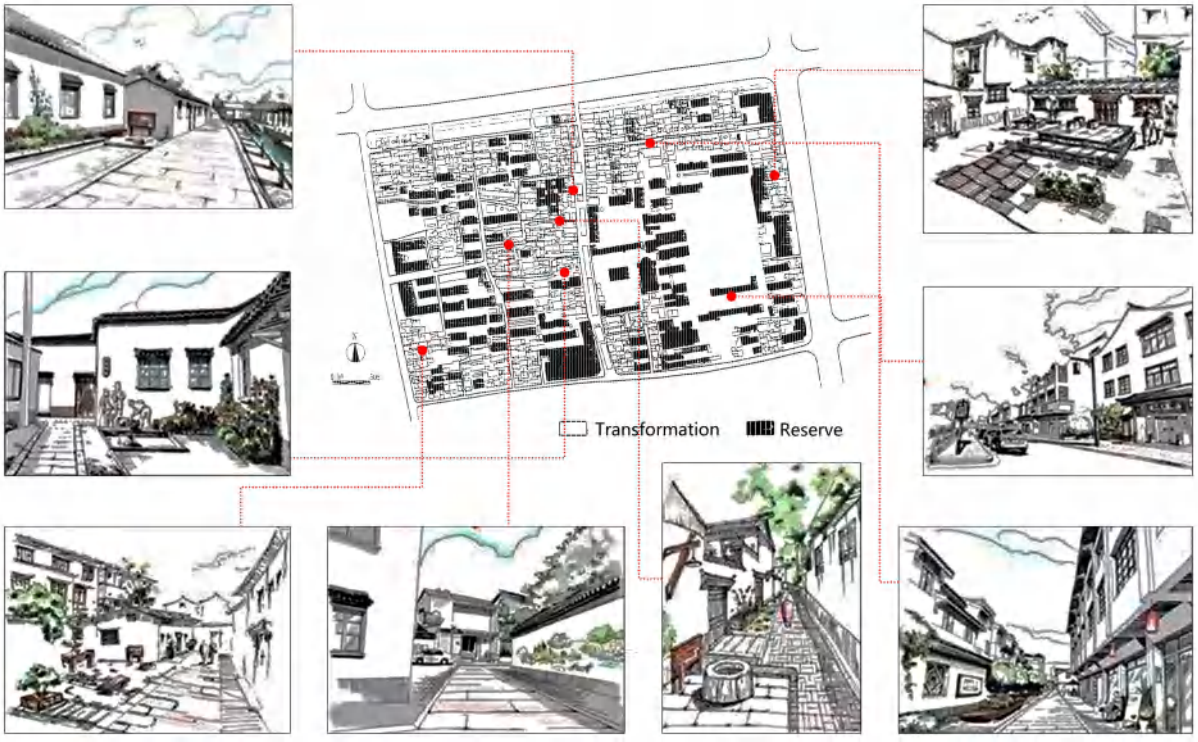


Fig 2-13 Public space node reconstruction

Take the Jinshi riverside as an example. It is a very important road in the neighborhood, and its current situation is chaotic, with serious phenomena such as

road occupation, illegal parking, road collapse and disorderly erection of wires. Therefore, corresponding plug-ins need to be designed for its streets, including roadway plug-ins, river landscape plug-ins, commercial business plug-ins, public building plug-ins, etc (Fig 2-14). In addition, a certain number of public space plug-ins need to be inserted in the neighborhood according to the appropriate proportion, and the alley entrance should be properly combed in the design as a public space. Landscape layout also should be carried out along both sides of the alley to enhance space identification and guidance.

Fig 2-14 Design intention of Jinshi riverside, data from data from [15]

2.Flexible Plug-in Design

In combination with the Flexible Plug-in of the neighborhood home-based elderly care demonstration area planning, block 41 has been functionally transformed into home-based elderly care block, meeting the needs of elderly care facilities in the ancient city (Fig 2-15). At the same time, the modern residence on the east side of the block was changed into a public service function and opened to the surrounding spaces.

Fig 2-15 home-based elderly care block, data from data from www.sohu.com

In the protection and transformation of traditional blocks, block 41 makes use of Flexible Plug-ins, such as formulating policies for residents' independent regeneration, innovating property rights policies, introducing economic incentive system, stimulating public enthusiasm, enabling some residents to spontaneously participate in the transformation, "replacing residence with business", transforming the original residential function into commercial and residential function. All these plug-ins realized the regeneration of urban vitality.

2.2.2 Cangxia historic district in Fuzhou

2.2.2.1 Urban plug-ins continue urban form

The protection and regeneration of Fuzhou Cangxia historic district focuses on inheriting its unique "wharf spirit" context and creating a space for dynamic development from the perspective of urban plug-in (Fig 2-16).

Fig 2-16 Master plan of Cangxia historic district, data from www.gooood.cn

As a trading port a hundred years ago, Cangxia's cultural diversity and multi-level highlight its inclusiveness, and its spatial form also presents diversified development. Residential houses, courtyards, school buildings, warehouses, shops, churches and other architectural spaces are scattered among them, form a colorful and prosperous community scene.

The accumulated culture in cangxia is a overlapping of the old and new symbiosis in different times. This project uses the "plug-in design" method to deal with the spatial relationship between old and new buildings. Through the reorganization and integration with a sense of the times, the historical structure of the city can participate in the current and future urban development.

2.2.2.2 Urban Plug-ins catalyze public spaces

Cangxia block covers an area of 10600 ㎡. In the vertical and horizontal streets and dense texture, the scheme insert public space plug-ins of different scales according to a certain density (Fig 12-17). The objects targeted by these plug-ins mainly include several main streets with a total length of 400 meters, 4 main park-squares, 3 building facades (Fig 12-18). Besides, 2 business format plug-ins are also inserted in this district (Fig 12-19).

Fig 2-17 public space plug-ins, data from www.gooood.cn

Fig 2-18 facade plug-ins, data from www.gooood.cn

Fig 2-19 format function plug-ins, data from www.gooood.cn

These small plug-ins in different nodes, while maintaining the original form of city, activate the space in different degrees, so as to provide people with more public spaces with appropriate size and diverse functions. That catalyze the regeneration of urban vitality in the whole region.

2.2.3 Other urban regeneration projects in China

2.2.3.1 Xibin South Road organic regeneration

Xibin south road is an important part of the historical features of Jinyun ancient city. For a long time, there have been a series of problems in the region, such as high density, old environment, lack of facilities, serious aging and so on.

In a total area of 60000 ㎡, the designer adopts the method of Plug-in Design to continue the old city context full of collective memory and improve the urban context and even the overall operation quality in a more gentle, gradual and accurate way (Fig 12-20).

Fig 2-20 Overall landscape environment of Xibin south road, data from www.gooood.cn

Through 5 Green Park plug-ins, 3 building reconstruction plug-ins, road reconstruction plug-ins of about 1200 meters, and the insertion of 4 small public service function plug-ins, the principle of minimum intervention is followed to improve the service

quality, cultural taste and public attributes of the city (Fig 12-21).

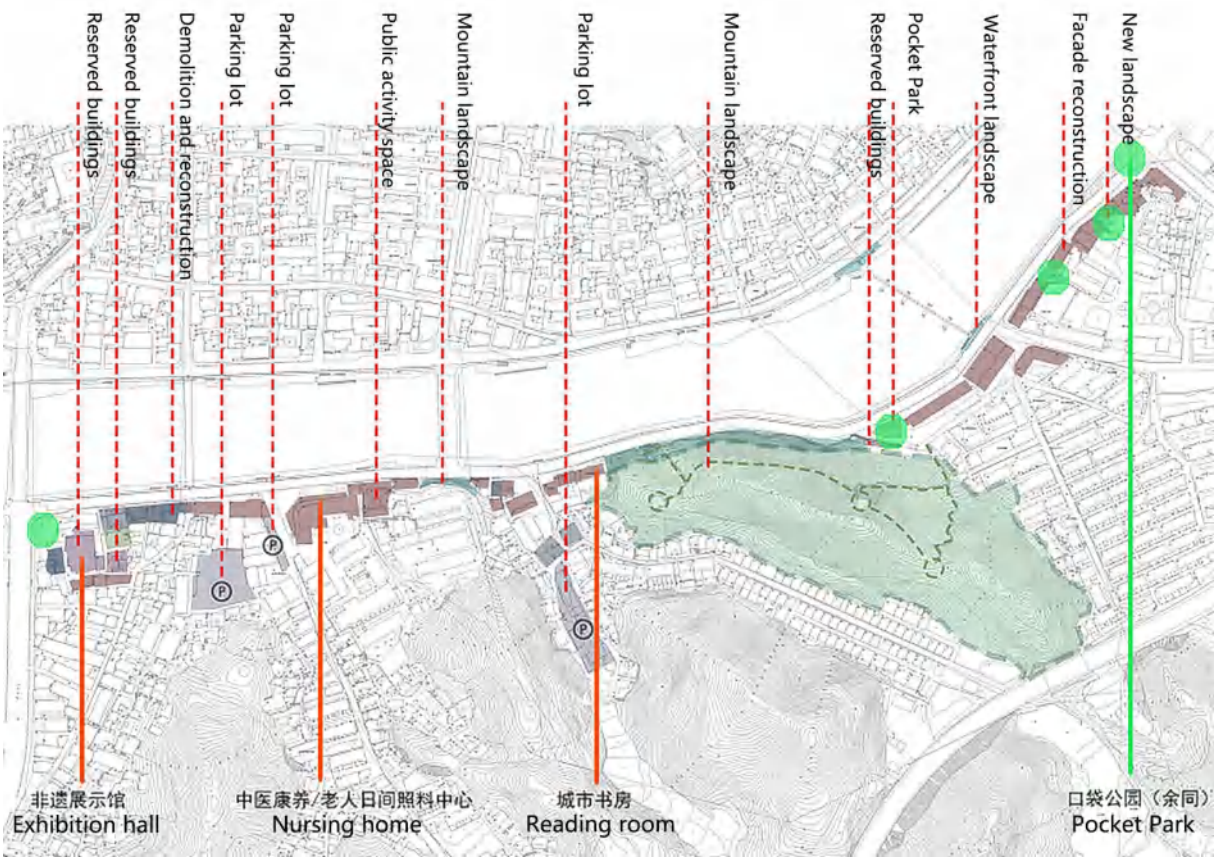


Fig 2-21 Xibin south road Plug-in Design, data from www.gooood.cn

The plug-ins in the urban texture effectively catalyze the regeneration of the old city, stimulate the vitality of the old city, and continue the context of the old city. In this case, Plug-in Design improves the urban context and even the overall quality in a more gentle, gradual and accurate way.

2.2.3.2 The transformation of a tiny house in Guangzhou

The project is located in Shangmengsheng street which is a deep alley in Mengsheng community of Haizhu District, Guangzhou. The original building was a three-and-a-half storey brick concrete building built by the owner in 1985. The single storey building area is only 22 ㎡, surrounded by dense houses.

This tiny single family residence of only more than 80 square meters is a tiny unit constituting the texture of the old city of Guangzhou. it can be seen as a Rigid Plug-in

Designd into the spatial texture of the village in the city, so as to catalyze the vitality around the building with more cautious operation (Fig 12-25).

Fig 2-22 Urban texture of Mengsheng community, data from www.gooood.cn

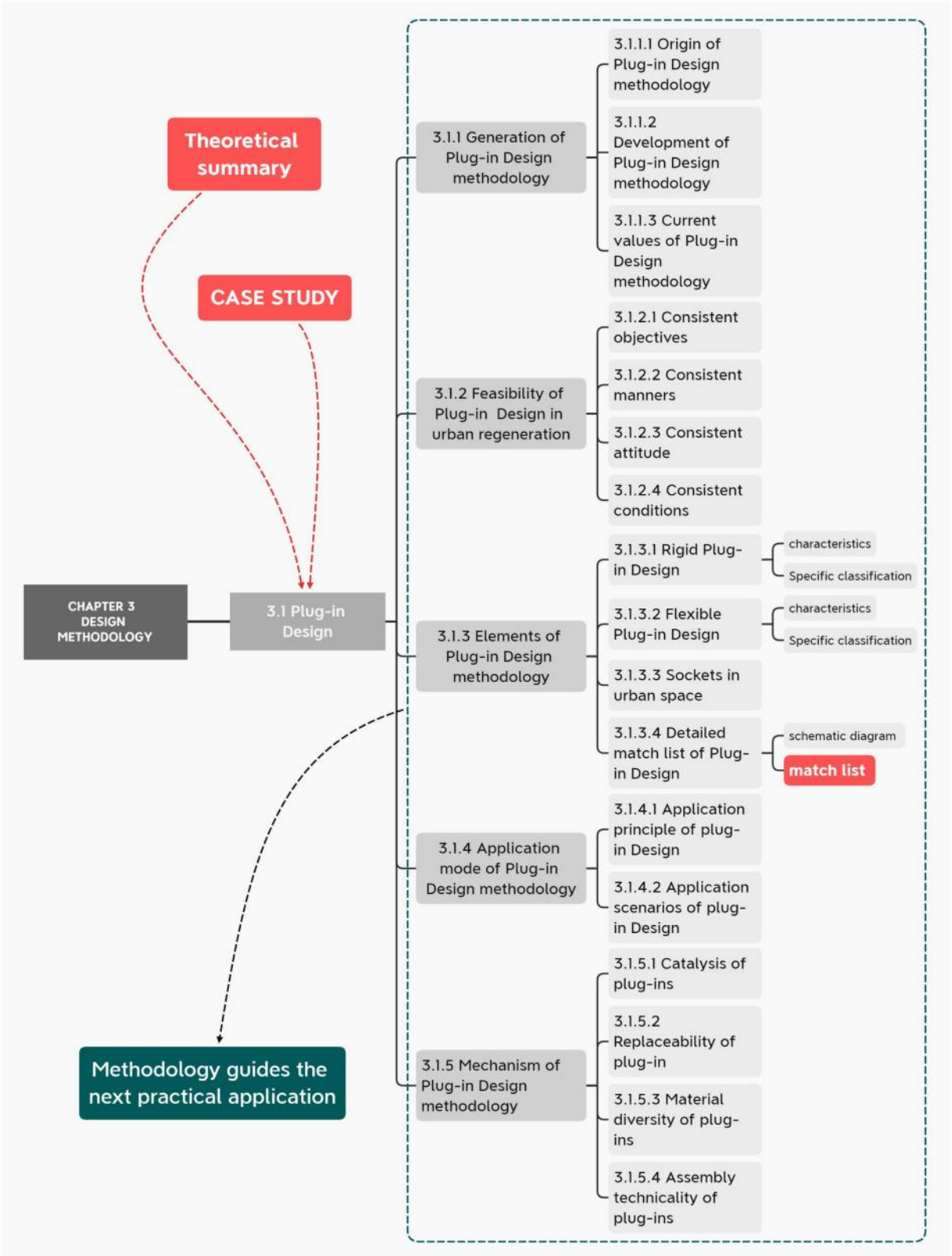
As a sample of urban micro regeneration, it has special humanistic significance for the old urban area with deep historical tradition. It is also a criticism and resistance to the old urban regeneration mode of large-scale demolition and construction (Fig 12-26).

Fig 2-23 Rigid Plug-in Design in the city, data from www.gooood.cn

2.3 Summary of chapter 2

The cases referred to in this chapter are urban regeneration design cases at home and abroad, from which some plug-in design methods can be extracted, which has reference significance for the generation of methodology. This thesis mainly analyzes and summarizes contemporary specific cases from the following two aspects: From the case of conceptual design, the author excavates ideas similar to plug-in design concepts, and summarizes and classifies them according to the characteristics of design methods. In the real project cases, the author looks for a method that can reflect the plug-in design, and further determines the scale and conditions of the application of the design method in China.

CHAPTER 3 DESIGN METHODOLOGY



3.1 Plug-in Design

The design methodology of Plug-in Design is the core of this design thesis. On the one hand, it summarizes the original theory and values, on the other hand, it explores in the field of practical application. In this chapter, it is discussed in depth from its specific definition, elements composition, action mode and mechanism. In the later project design of Xudi-Gaodijie area, it will be applied in practice.

3.1.1 Generation of Plug-in Design methodology

The generation of Plug-in Designs has traces in the history of urban regeneration. This chapter will sort out the methodology similar to Plug-in Design. It is different from the theoretical research in chapter 1. In chapter 1, the author mainly gets inspiration from the specific concepts of several theories, and combines their characteristics to generate a new methodology named Plug-in Design. These theories play a service role. However, in this chapter, The author prefer to trace back to the methodology of Plug-in Design. From the origin of Plug-in Design to the new idea of the author, it expresses the development process of some similar urban regeneration theories in history. Therefore, the chapter 1 and the chapter 3 emphasize different contents. In other words, this chapter mainly focuses on the development history of similar methodology.

3.1.1.1 Origin of Plug-in Design methodology

The insertion of "plug-in" is a methodology that causes less damage to the city, which can be traced back to Roman planning[24].

Rome is an ancient city with a history of nearly 2800 years. It has experienced a simple monarchy, an elegant Republic and a magnificent empire. It is like a magnificent historical picture, but every detail is carefully painted. Walking in Rome, you can see countless historical treasures: the Roman arena, the Pantheon, the Arc

de Triomphe, the wishing pool, the ancient Roman square, St. Peter's Cathedral... Of course, when travelers are lost in the streets, there are always delicate churches, ancient relics or historical buildings undergoing functional replacement and regeneration. The city streets, squares and churches are inserted into the medieval city texture like plug-ins. New urban layers are added on the existing urban background, so that the urban system can continue in the space-time dimension.

3.1.1.2 Development of Plug-in Design methodology

In modern times, a large number of urban design theories have emerged in the West with the development of cities. The first stage was in the 20 years after World War II. With the process of modernization, European cities underwent large-scale reconstruction and a large number of urban regeneration projects were implemented. However, as the suburbanization of the city becomes more and more obvious, there are more and more criticisms of modernism. Western urban construction has entered a post-modern period that pays more attention to urban context and humanistic care. During this period, a large number of diverse urban regeneration concepts were put forward. Peter Cook put forward the concept of "Plug-in City", and small-scale and progressive urban regeneration models such as "urban catalyst" and "urban acupuncture" are also gradually emerging. In the 1990s, "Urban Renaissance" became the slogan for the further development of urban centers in European and American countries. It is guided by the cultural strategy, and guided by the principle of preserving the urban texture and traditional style. At the same time, in China, after the industrial city construction and large-scale urban regeneration after the founding of the people's Republic of China, Mr. Wu Liangyong put forward the mode of urban organic regeneration, accompanied by the criticism of the regeneration mode of large-scale demolition and construction. Since then, the urban regeneration with multiple participation and micro regeneration modes are also slowly rising.

In 2005, based on the theories of Plug-in City and many other cases, Jon Lang, a famous Australian urban design scholar, proposed Embedded urban design.

Embedded urban design is a planning strategy focusing on the strategic construction of urban infrastructure elements. For the old urban areas, embedded urban design means that the new infrastructure elements are embedded into the original built environment, so that they can be combined into a unity. At the same time, the micro environment design of its details is controlled to improve its comfort and make it regain its competitiveness. Embedded city seems to be an exploration of the "Plug-in Design" urban regeneration model in the west, which also provides an example for our theory generation.

3.1.1.3 Current values of Plug-in Design methodology

Based on the above retrospect, this thesis further explores the historical development of the "Plug-in Design" urban regeneration model. Combined with a large number of old city regeneration cases in China and the West in recent years, this thesis re-summarizes Peter Cook's "Plug-in City" thought, re-extracts its value orientation, and forms a "Plug-in Design" methodology. For the old urban areas, Plug-in Design means that new elements are inserted into the original environment, so that they can be combined into a unity. At the same time, it catalyzes the design of its surrounding environment to improve its comfort and rejuvenate it.

The methodology of Plug-in Design is also under the design framework of "planned and prudent small-scale progressive updating", and its values mainly include the following points:

First, carry out urban regeneration with a cautious attitude. Second, keep the organic development of the city without damaging the urban infrastructure. Third, develop micro structures with flow continuity on the basis of maintaining the integrity of the main structure of the city. Fourth, integrate the old and new urban space, and activate the original urban ecosystem with new plug-ins.

The following figure shows the development of urban regeneration theory related to Plug-in Design (Fig 3-1).

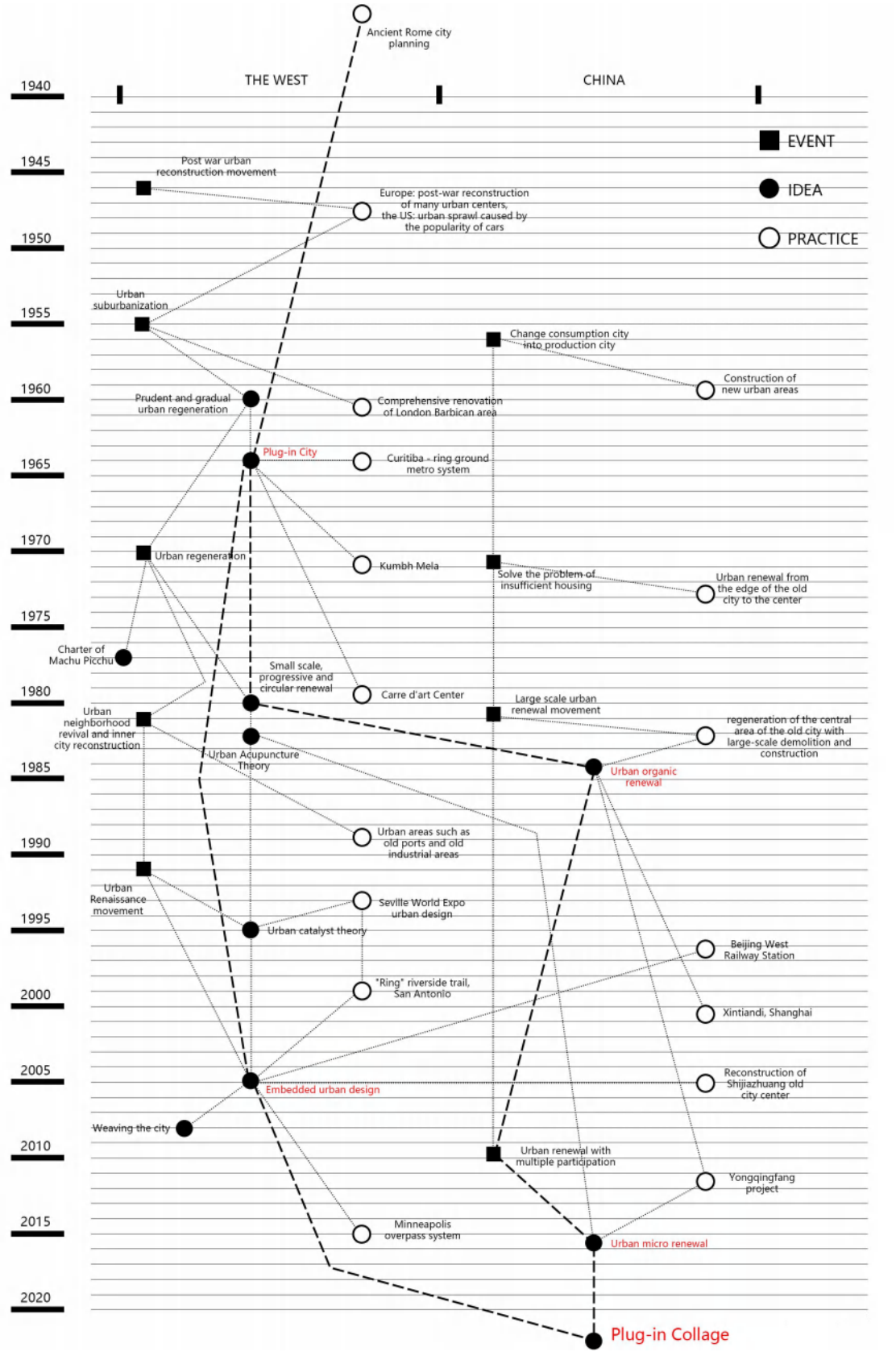


Fig 3-1 Generation of Plug-in Design methodology

3.1.2 Application feasibility of Plug-in Design in the old city regeneration in Guangzhou

3.1.2.1 Consistent objectives

The objective of the Plug-in Design just meets the needs of the regeneration of the central area of the old city of Guangzhou.

The Plug-in Design does not formulate an independent method to achieve the objective or a final blueprint for a specific region, but describes the initial necessary elements for the development and construction of a region, which can stimulate the development and construction of other projects. Its key point is that the new inserted plug-in elements can attract subsequent projects to be put together, or consider the interaction between the new plug-ins and existing elements in the urban historical area to make them a whole[33]. This is what the urban historical area of Guangzhou needs in the period of economic revival and urban construction transformation.

3.1.2.2 Consistent manners

The Plug-in Design advocates a planned, cautious and small-scale gradual regeneration, which can just make up for the deficiency of the current regeneration and transformation of the old city center in Guangzhou.

At present, in some old city regeneration projects in Guangzhou, an important problem is to take the short-term interests as the goal, ignore the overall operation system and long-term development goals of the city, and adopt a one-time regeneration operation. At a time of global economic instability, it is difficult to provide guarantee for the fund operation during the implementation of the project. The Plug-in Design method is used for urban regeneration, which has low cost, certain fault tolerance and will not cause significant economic losses. This is consistent with the old city regeneration method advocated by the current government.

3.1.2.3 Consistent attitude

Urban space with certain historical value is an important object of Plug-in Design in practice. The Plug-in Design has the value of respecting the context and makes up for the insufficient protection of the urban space of the old city center of Guangzhou during its rapid development.

Now, in the process of urban regeneration, Guangzhou is fully aware of the importance of cultural revival to economic revival. Therefore, in the process of specific regeneration, more attention should be paid to the carefully planned transformation or construction of historical buildings and public spaces, so that they can act as a catalyst to drive the development of surrounding areas. This is consistent with the values of Plug-in Design.

3.1.2.4 Consistent conditions

The old urban area of Guangzhou has rich spatial conditions. On the one hand, it retains a complete historical context and urban texture. On the other hand, these areas also need new space and business formats to enter and glow with new vitality. Within the scope of the regeneration of old cities in Guangzhou, the spatial conditions of these old cities allow the use of Plug-in Design methodology.

Facing the public space in the old city of Guangzhou with rich types, Plug-in Designs can be used for streets, open spaces, activity spaces, landscape spaces, public building spaces and building exterior spaces. Insert different types of plug-ins to meet the requirements and objectives of the old city regeneration and realize the revitalization of the city.

3.1.3 Elements of Plug-in Design methodology

In order to achieve the goal that the plug-in type can be selected for urban regeneration according to the specific situation in any project, the types of Plug-in Design are complex and diverse according to the nature. Generally speaking, Plug-in

Design has two types: Rigid Plug-in Design and Flexible Plug-in Design, as well as the possibility of Multiple Plug-in Design. These plug-ins are inserted into the receiving device of urban space to meet the needs of synchronous updating of urban physical space and economic activities.

3.1.3.1 Rigid Plug-in Design

The design method of inserting entity structures, such as buildings, streets and squares into urban space is called Rigid Plug-in Design. This method has the following characteristics:

1.Build or transform urban spaces on the basis of the original structure of the city. For example, insert newly built buildings, squares, streets and other spaces into the original urban space to realize the continuation and regeneration of urban texture.

2.In terms of function, it basically continues the nature of the original space. It maintains or improves the old internal business format through new external forms or structures, and then realizes the continuation and regeneration of urban industries.

3.Because the insertion of entity structure is mainly new construction and transformation in operation, the new entity is not easy to change in a short time, that is, it has a certain rigidity, so it can be called Rigid Plug-in Design.

Specific classification:

1.Public space plug-in: By designing pocket parks, squares, sports fields and other micro nodes, supplement and improve the public spaces of the city and improve the spaces for citizens' activities. By designing the streets to improve the walkways and roadways, the overall traffic system can be activated from the micro linear structure.

2.Building plug-in: Evaluate and select some historical buildings, shops, community centers or other small public buildings as well as some residential buildings that have an important influence on the environment, then repair or transform them.

3.1.3.2 Flexible Plug-in Design

The design method of inserting new business formats into the original physical space and completing function replacement is called Flexible Plug-in Design. This method has the following characteristics:

1.Generally, there is no need to demolish, build new buildings or large-scale transformation of the original buildings and urban space. And the original spatial structure is used to continue the urban texture.

2.Reactivate the once negative urban space by relying on the participation of political or economic fields. It introduce new business formats into the physical space, and gently insert new functions into the old structure like old bottles of new wine to activate the urban vitality of the region.

3.Using the original entity insert new functional plug-in can quickly and efficiently convert from one function to another, integrate into the urban regeneration. And it is easier to change and replace in a short term. Its effect is very soft, therefore, it can be classified as Flexible Plug-in Design.

Specific classification:

(1) Policy plug-in: guide the transformation of business formats in the city by issuing specific policies and guidelines from top to bottom.

(2) Economic plug-in: drive the economic development of the area and realize urban regeneration by introducing new industries or upgrading the original industries.

(3) Cultural plug-in: guided by the culture and values of the new era, promote the improvement of the overall quality of urban life from bottom to top, and realize the self-regeneration of mass participation. For example, explore local traditional customs and activities, publicize and popularize the history and culture of the region among the public, and form a sense of cultural identity and new business formats.

3.1.3.3 Sockets in urban space

When the plug-in is inserted into the urban space, an existing physical space

receiving device is needed as a carrier to accept the plug-in insertion.

Different space conditions will determine the type of plug-in and where the plug-in should be inserted. There are many open spaces, streets, buildings and other public spaces in a historical block, and their respective situations are different. If they are regarded as design nodes, the plug-in has a corresponding receiving device, namely socket.

For example, a large open space with dense crowds can be inserted into the square plug-in as a socket; The small abandoned space can be used as a socket to insert the plug-in of pocket park, and the building of commercial street can be used as a socket to insert the economic plug-in. Only when the socket in the urban space is determined can the plug-in be inserted or replaced further.

3.1.3.4 Detailed match list of Plug-in Design

On the basis of the above simple classification, the author can continue to classify in detail according to the functions, list the schematic diagrams (Fig 3-2, 3-3) .

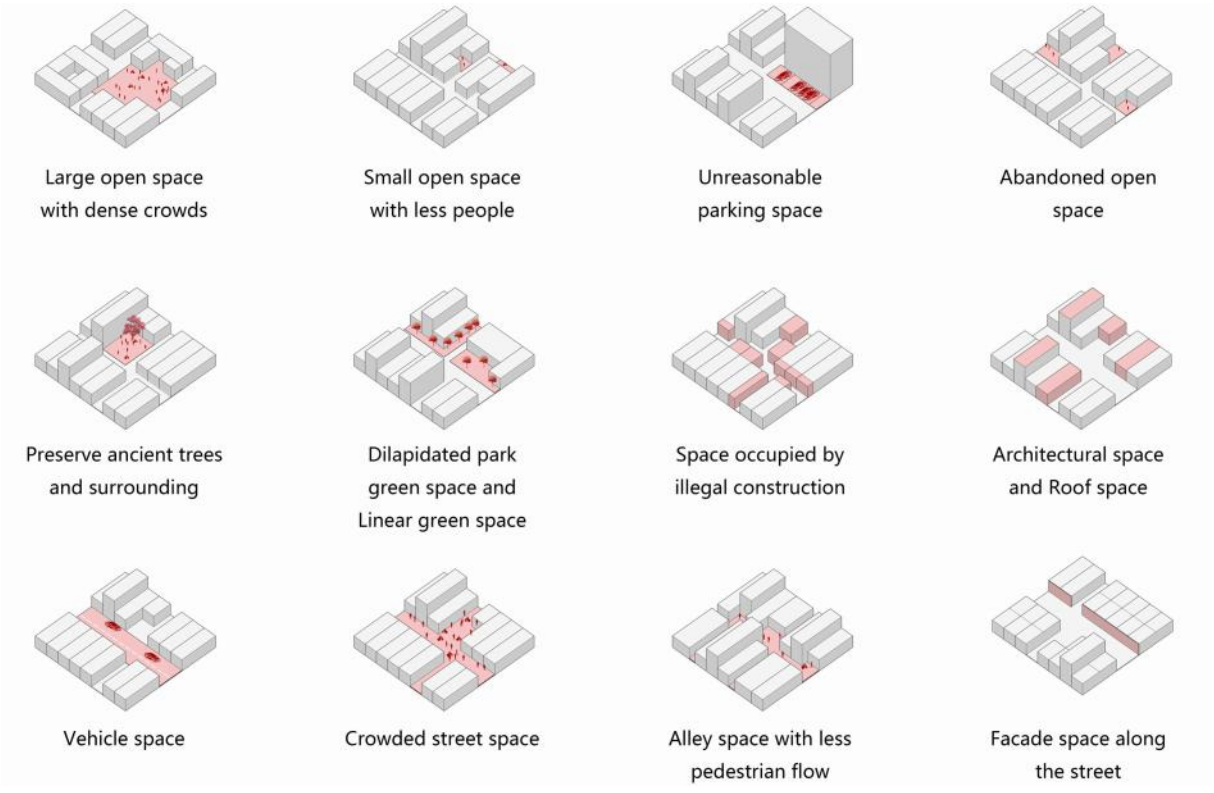


Fig 3-2 Socket schematic diagram

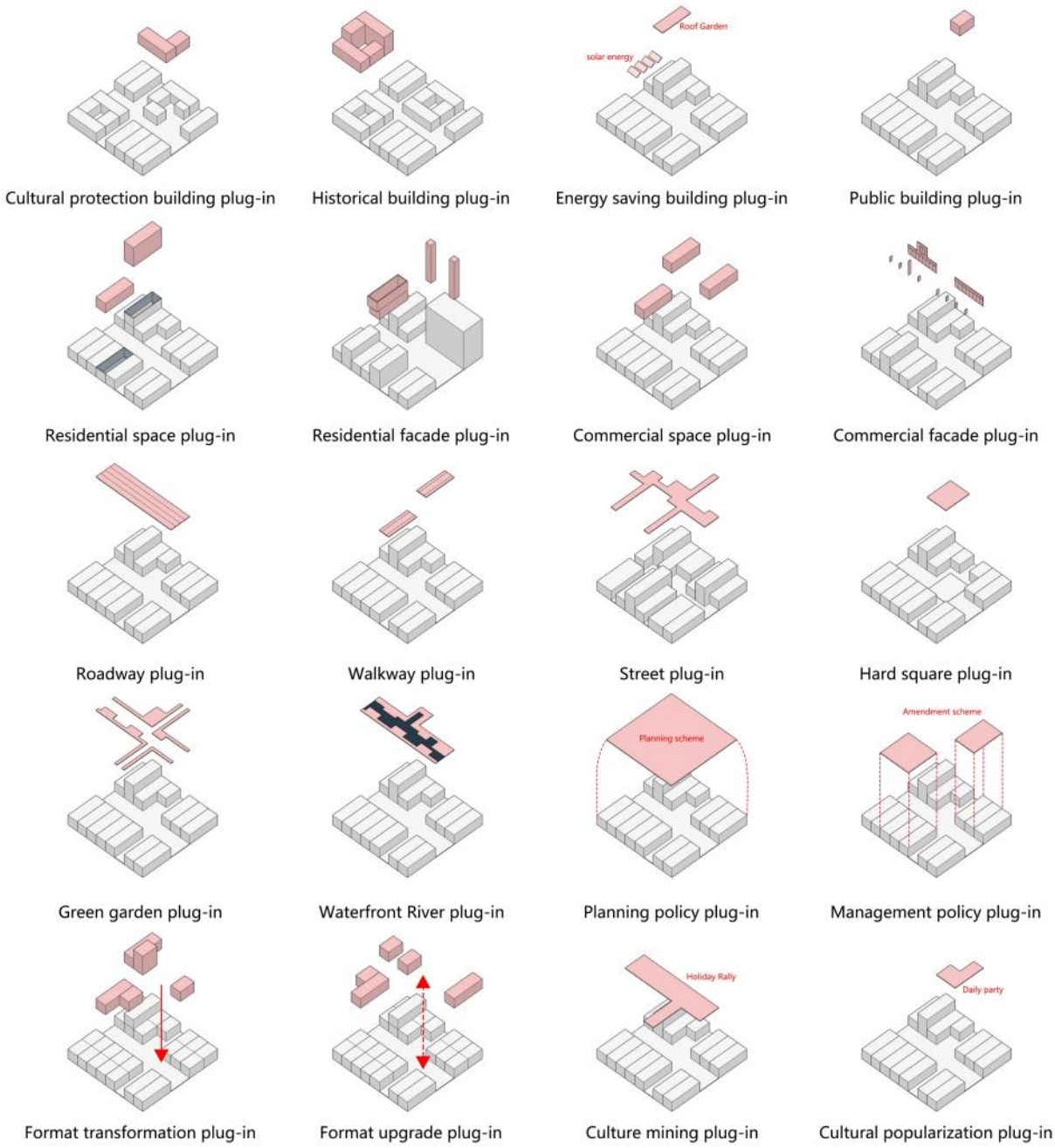


Fig 3-3 Plug-in schematic diagram

Finally, a detailed matching list can also be summarized(Fig 3-4, 3-5). After having such a set of matching list, in the future urban design practice, designers can follow the specific categories in the list, adhere to the universal matching principles, and select specific plug-ins for combination, use or replacement in different design projects(Fig 3-6).

For example, in the next research of the Xudi-Gaudijie area, the author will select some specific rigid and flexible plug-ins for the design of its public spaces to complete the urban regeneration of the whole region.

Classification			Selection principle	Scale
Socket (space receiving device)	Block space	Large open space with dense crowds	Located at the flow of people node, the function is fuzzy	> 300㎡
		Small open space with less people	It has the potential to improve the spatial quality of the region	≤300㎡
		Unreasonable parking space	There are major problems in parking in the site	> 300㎡
		Abandoned open space	Dirty and messy spare	≤300㎡
		Dilapidated park green space	Park green space in disrepair or poor quality	≤300㎡
		Preserve ancient trees and surrounding open spaces	Can form public space nodes	≤200㎡
		Space occupied by illegal construction	Public space occupied by private illegal construction	≤200㎡
		architectural space	Buildings with public property rights or private buildings with renewal permission	≤200㎡
		Roof space	Potential for technological transformation	≤100㎡
	Linear space	Vehicle space	The mixed flow of people and vehicles is serious	≤500m
		Crowded street space	Important mobile public space	≤200m
		Alley space with less pedestrian flow	Alley with local characteristics	≤50m
		Facade space along the street	It has the potential to improve the business atmosphere	≤200m
		Linear green space	It has the potential to improve the greening environment	≤200m

Fig 3-4 Socket match list

Classification			Principle	Object	Scale	Update frequency
Rigid Plug-in	Building plug-in	Cultural protection building plug-in	Protect the current situation of buildings and catalyze the continuation of regional historical context	Carry out structural reinforcement and maintenance of cultural protection buildings	≤300㎡	Once every 5 years
		Historical building plug-in	Transform valuable historical buildings and catalyze the integration of new and old buildings in the region	Transformation of the structure and space of historical buildings	≤300㎡	Once every 5 years
		Energy saving building plug-in	Reduce building energy consumption and catalyze the formation of energy-saving communities	The building is equipped with roof garden, rainwater collection system, solar energy, etc	≤100㎡	Once every 3 years
		Public building plug-in	Insert small public buildings to catalyze the activity of the region	Community service center, public toilet	≤100㎡	Once every 5 years
		Residential space plug-in	Transform the old residential space and catalyze the living quality in the region	Interior decoration and house type transformation	≤100㎡	Once every 5 years
		Residential facade plug-in	Repair the facade of dilapidated residential buildings, and catalyze the feeling of street space in the region	Install elevator, thermal insulation and waterproof layer and facade painting decoration	≤100㎡	Once every 5 years
		Commercial space plug-in	Insert small commercial stores to catalyze the popularity of the region	Clothing store, cultural and creative store	≤200㎡	Once every 5 years
		Commercial facade plug-in	Repair the old and poor commercial facade, and catalyze the regional commercial atmosphere	Facade restoration and advertisement signboard design of characteristic Commercial Street	≤200㎡	Once every 3 years
	Public space plug-in	Roadway plug-in	Separation of people and vehicles, catalyzing driving accessibility in the region	Road shared by people and vehicles	W≤10m	Once every 5 years
		Walkway plug-in	Set up in important pedestrian routes to catalyze the walking experience in the region	Main pedestrian road	W≤7m	Once every 3 years
		Street plug-in	Connect public space nodes, impassable roads, and catalyze pedestrian accessibility in the region	Small roadway in the block	W≤4m	Once every 5 years
		Hard square plug-in	Set at the pedestrian flow node to catalyze the number of public spaces in the region	Fitness square and playground	≤200㎡	Once every 5 years
		Green park plug-in	Improve the green space rate and catalyze the regional environmental quality	Green Garden	≤200㎡	Once every 5 years
		Waterfront landscape plug-in	Increase waterscape and catalyze regional water quality and environment	Waterfront Park and river restoration	W≤10m	Once every 5 years
Flexible Plug-in	Policy plug-in	Planning policy plug-in	Set up long-term and stable planning policies to catalyze the long-term and continuous regeneration of the region	Urban planning documents/Urban regeneration guidelines	≤10000㎡	Once every 3 years
		Management policy plug-in	Set up management regulations or policy adjustments to catalyze short-term rapid regeneration in the region	Amendments and management measures	≤1000㎡	Once a year
	Economic plug-in	Format transformation plug-in	Put in the new type of business functions, and catalyze the comprehensive renewal of regional business types	Replacement of old and new business forms, such as the transformation from warehousing to tourism	≤10000㎡	Once every 5 years
		Format upgrade plug-in	Upgrade the functions of the original business types and catalyze the partial renewal of business types in the region	Upgrade the original business type, such as upgrading the wholesale industry to the retail industry	≤10000㎡	Once every 3 years
	Cultural plug-in	Cultural Renaissance plug-in	Revive declining cultural activities and catalyze the continuation of regional context	Residents' traditional festivals and customs	≤1000㎡	Once a year
		Cultural popularization plug-in	Publicize typical local cultural activities and catalyze the continuation of regional context	Daily life customs of residents	≤1000㎡	Twice a year

Fig 3-5 Plug-in match list

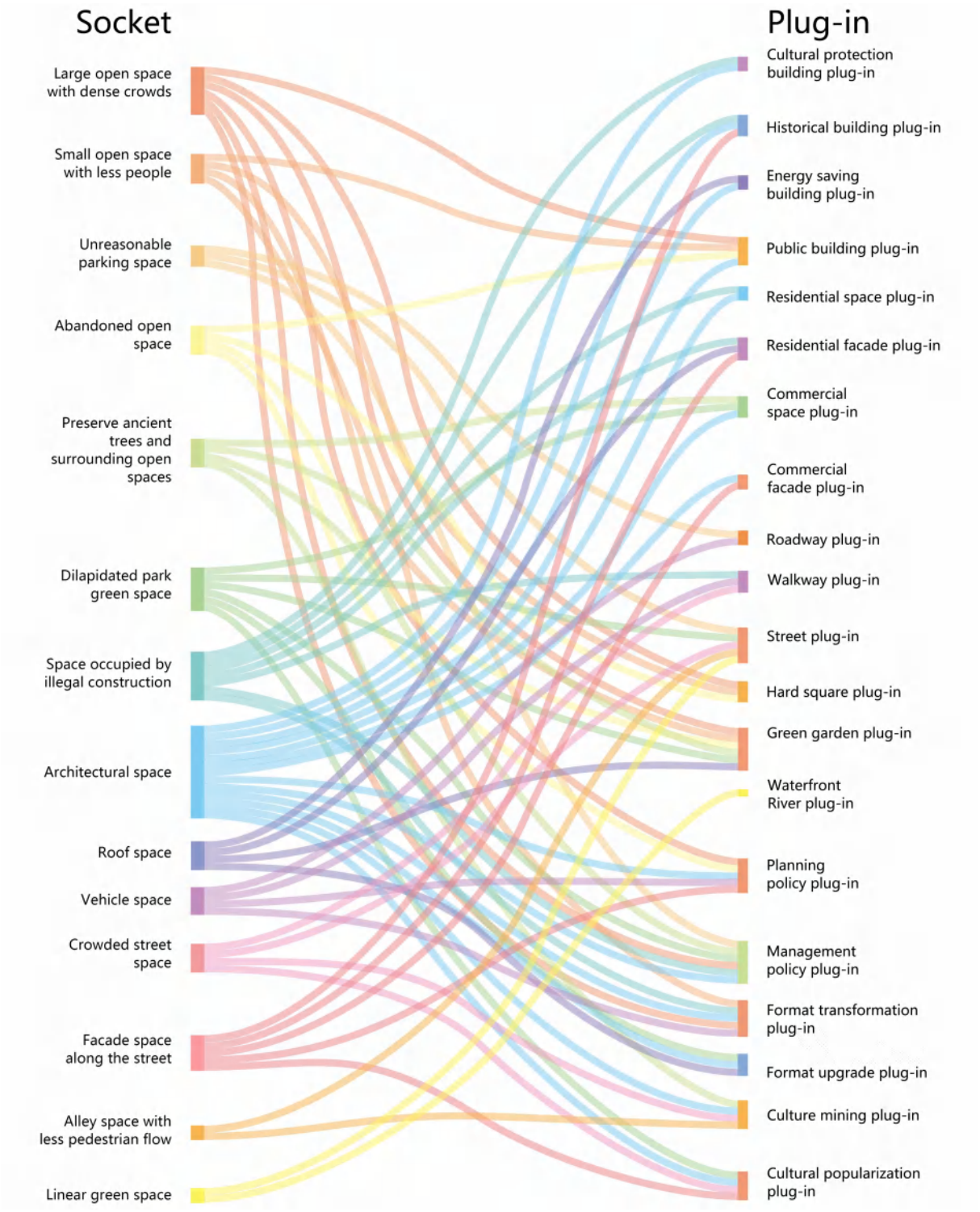


Fig 3-6 Connection between socket and plug-in

In the match list, the author explains in detail the classifications, action principles and objects of various plug-ins and sockets. In view of the differences between Rigid Plug-ins and Flexible Plug-ins, the scale of Rigid Plug-ins and Flexible Plug-ins are also quite different, but they both play a role in catalyzing the regeneration of the

whole area. Due to the replaceability of plug-ins, the update frequency is kept from once a year to once every five years. In this way, the attributes of plug-ins can be adjusted within the update period as much as possible to comply with the development of the times.

3.1.4 Application mode of Plug-in Design methodology

The application of Plug-in Design methodology in urban regeneration aims at how to control and strengthen the urban texture that embodies the spirit of place. This can be achieved in four ways: the first is to preserve the texture. The second is to strengthen the loose texture. The third is to repair the lost texture. The fourth is to create a new texture for the block and give it a new order.

3.1.4.1 Application principle of Plug-in Design

1. Understand the context and spirit of the area.

Consider in detail whether the individual characteristics of the plug-in are consistent with it. Each urban space has its own characteristics, and plug-in design cannot assume equality.

2. the function of the plug-in can be controlled.

Its influence should be controlled in the direction of conforming to the context of the block, rather than destroying the texture and spirit of the block.

3. based on the controllability of plug-ins, the design of plug-ins is strategic.

The revival of historical blocks does not come from simple intervention, but through step-by-step prudent strategies to affect the future state of the blocks, including the targeted policy economic strategy, functional strategy, building reconstruction strategy and so on.

4. The impact of plug-ins can be predicted.

There is no single formula that can be applied to all street environmental conditions.

The plug-in strategy adapted to local conditions can predict the targeted impact results.

5. The insertion of each plug-in is based on the revival premise of the whole historical district.

That is, the overall effect of the block is the first, rather than the renovation of a single space. Therefore, the revival goal of each Plug-in Design is to create a whole block that exceeds the sum of all plug-ins, rather than a simple addition of isolated fragments.

3.1.4.2 Application scenarios of Plug-in Design

In practice, Rigid Plug-ins and Flexible Plug-ins may also be combined or used alternately. In other words, a node of urban regeneration may not only need to insert Rigid Plug-ins to regenerate the form of the city, but also need to insert Flexible Plug-ins to update the business formats to drive the economic and social vitality of the surrounding blocks.

Due to the expected existence and use time of Rigid Plug-ins are relatively longer, the new Flexible Plug-ins could be inserted in Rigid Plug-ins as time goes on. And Flexible Plug-ins may also be replaced with Rigid Plug-ins with the change of people's living needs and the aging of external structures. This replaceable organic update feature makes the fault tolerance rate of plug-ins higher and more sustainable.

There needs to be a process of observation after the plug-in is inserted. When the role of the plug-in does not meet the expectations, owing to the scale of the plug-in modules are smaller, design solutions could not only become more realistic, but also their implementation less risky—if a newly tried module failed its intended purposes, consequences would be less damaging, and reversing the change much easier and less costly.

3.1.5 Mechanism of Plug-in Design methodology

In the design process of urban regeneration, with the insertion of modular elements such as plug-ins, their own mechanism will also be reflected in the overall regeneration. First of all, the plug-in itself has a certain catalytic property, which makes the whole region be regenerated under the catalysis of the plug-in[4]. Secondly, the plug-in also reflects the diversity of materials in the specific design, making it integrated into the urban texture. Finally, as an avantgarde high-tech concept, plug-in technology can improve its efficiency during construction[33]. This mechanism is different from the previous urban design methodology.

3.1.5.1 Catalysis of plug-ins

The concept of plug-in is similar to the catalyst in chemistry, which has certain catalysis. the scholars generally call this kind of material as urban catalyst[23]. Wayne Atton and Donn Logan defined "urban catalysts" as strategically inserting new elements to stimulate urban vitality and bring sustainable development around the project. "Urban catalyst" is not a single final product, but a kind of spatial elements that can trigger or guide subsequent development, promoting the continuous evolution of urban structure in the direction of meeting the needs of social development[24].

Plug-ins are elements shaped by adapting to the urban environment, which in turn shapes the urban environment. Plug-in is not a single final product, but an element that can stimulate and guide subsequent development[7]. The methodology of Plug-in Design does not plan a specific goal, a final form or a better visual characteristic for all urban areas, but describes the essential element of a city's development: the power that can arouse other functions[1].

With its own catalytic effect, the plug-in attracts new business formats and people into the block, promotes urban regeneration from point to area[3] (Fig 3-7). The plug-in itself will not cause great damage and interference to the urban spatial structure, so

the "plug-in" technology is a method with less damage to the city.

Fig 3-7 Catalysis of plug-ins

3.1.5.2 Replaceability of plug-ins

Plug-in is replaceable in urban regeneration. A plug-in is not static after it is inserted into a node. With the change of time, the business formats and context in the area have also changed, which will directly affect whether the catalytic effect of plug-ins meets the conditions of the times. Therefore, the period for the plug-in to play a catalytic role is limited. In the future, the type of a plug-in may not be applicable to a node space in this area, so the plug-in needs to be replaced. This reflects the replaceability of plug-in types (Fig 3-8).

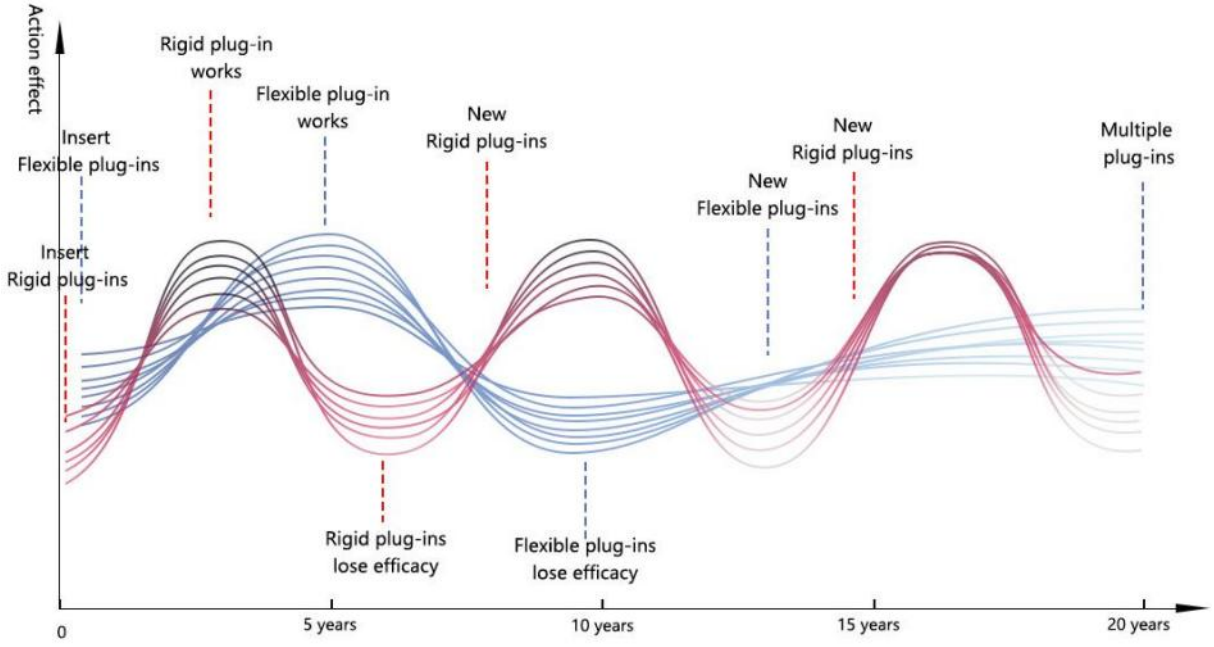


Fig 3-8 Replaceability of plug-ins

There are two modes of this replaceability: one is to add new plug-ins to the original and expired plug-ins, so that the new plug-ins can play a role in the original plug-ins, and restore the update and catalytic role of plug-ins. The other is to directly pull out the original plug-ins and insert new plug-ins to solve new urban problems. Either way, the original plug-ins will be replaced by other types of plug-ins to follow the development of the times, solve new problems and meet new needs.

3.1.5.3 Material diversity of plug-ins

Every era has its own urban public space structure, which embodies different spirit of the times. Time provides the public space structure with special charm. Broken bricks and tiles, rusty steel, decaying wooden columns, etc. naturally produce extraordinary material texture while showing its vicissitudes of history. Nowadays, steel, wood and glass are widely used in urban construction. Some new materials, such as carbon fiber sheet, have excellent properties such as high strength, light weight, corrosion resistance and aging resistance. They are an ideal new material for the reconstruction and reinforcement of existing public spaces and buildings.

When the plug-in is injected in a specific urban space, it needs to consider the surrounding environment[31]. Some historical buildings' plug-ins continue the original materials and maintain the old form. Some new buildings' plug-ins make innovations in materials and integrate old and new materials.

3.1.5.4 Assembly technicality of plug-ins

When designers use traditional methods to design single space, they often judge the performance only by subjective experience or simple design. Therefore, their judgments often appear uncertainties or errors, which affect the construction efficiency. Under the BIM Technology Environment, the plug-in has the assembly technicality. By simulating and analyzing the performance of urban space, such as sunshine environment analysis, thermal environment analysis, wind environment analysis, etc., combined with modular rapid prefabrication, the accuracy of design and construction efficiency can be improved.

Plug-in Design pays enough attention to the concept of energy saving and "people first". Plug-in catalyses the re-circulation of urban space life cycle, which is a way of resource saving. In the life cycle of urban space, the plug-in provides users with a comfortable and healthy atmosphere, saves resources and protects the environment, and advocates the catalysis of the "quality" of the environment in the design. (Fig 3-9).

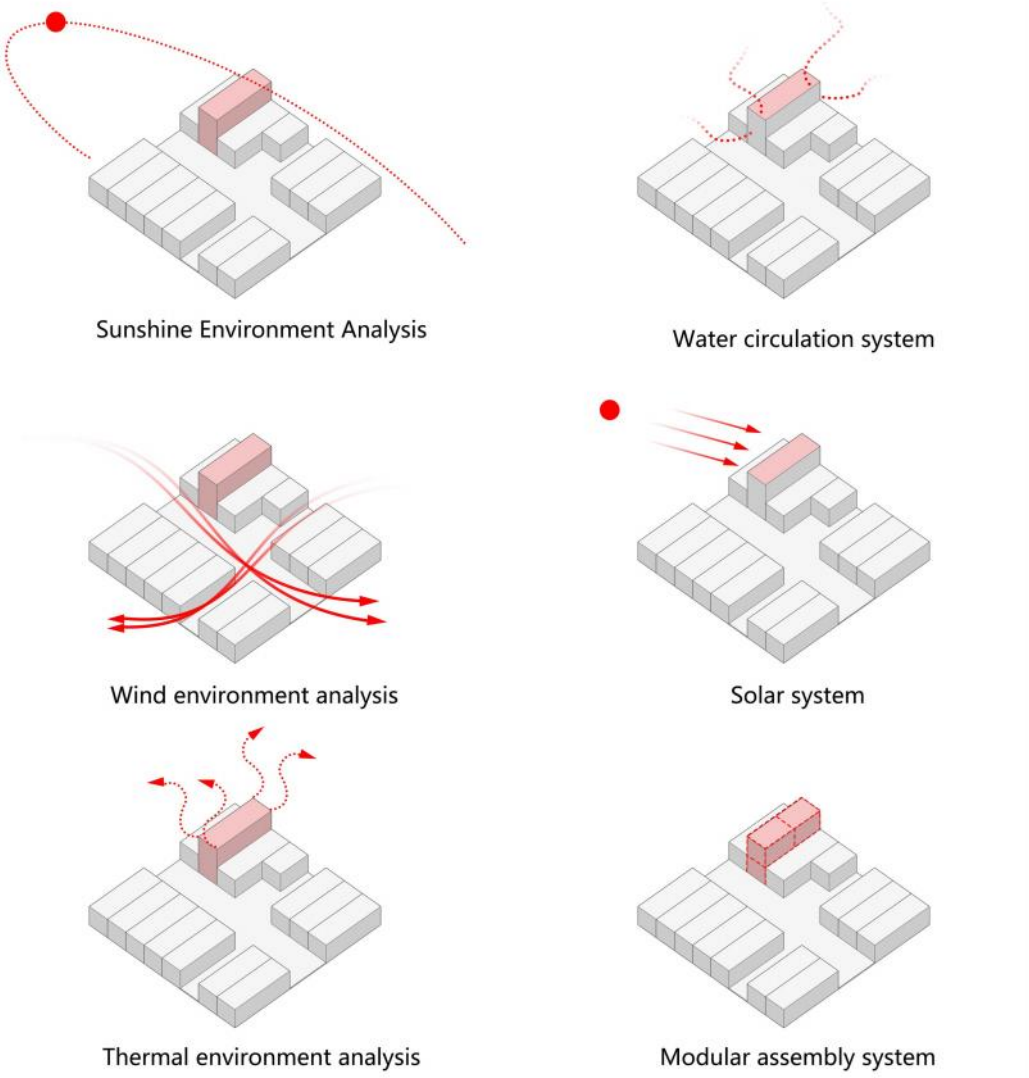
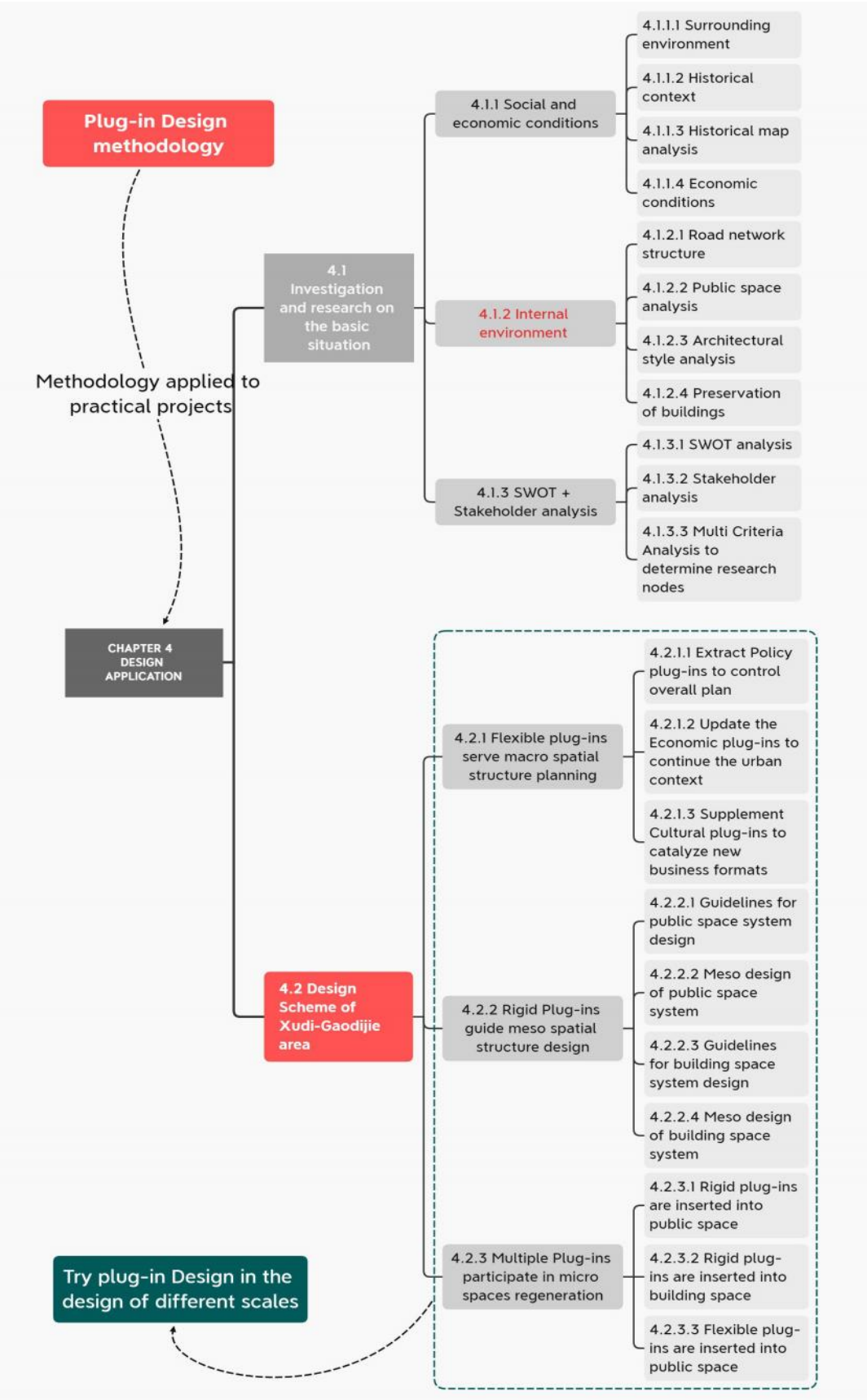


Fig 3-9 BIM Technology and green energy-saving design

3.2 Summary of chapter 3

The design methodology of Plug-in Design is the core of this design thesis. On the one hand, it summarizes the original theory and values, on the other hand, it explores in the field of practical application. In this chapter, it is discussed in depth from its specific definition, elements composition, action mode and mechanism. In the later project design of Xudi-Gaodijie area, it will be applied in practice.

CHAPTER 4 DESIGN APPLICATION



4.1 Investigation and research on the basic situation

The main goal of this thesis is to explore and solve practical problems through the methodology of Plug-in Design. Before the design application, It is needed to do a survey on the basic situation of the target site to provide a basis for our subsequent design.

4.1.1 Social and economic conditions

The analysis of social and economic conditions helps us to have a comprehensive understanding of the basic situation of the land used in Xudi-Gaodijie area. By investigating its surrounding environment, historical context, business type and economic development, we can roughly draw the advantages, potential and current macro problems of the plot.

4.1.1.1 Surrounding environment

Xudi-Gaodijie covers an area of about 78000 square meters and is the site for the practical application of this design thesis. The reason why the author choose Xudi-Gaodijie area as our research site is mainly due to its current situation: long but unsustainable historical context, diverse but damaged texture， once brilliant but declining business formats. It seems that these problems can be explored and solved by methodology of Plug-in Design.

Xudi-Gaodijie area is located in Yuexiu District, Guangzhou (Fig 4-1). It is located on the old central axis of Guangzhou, with superior geographical location and good surrounding supporting facilities. It is close to Beijing Road commercial pedestrian block in the northeast and Haizhu Square in the southwest. Within 1km, there are Pearl River night tour wharf, Shishi sacred Heart Church, Liurong temple, people's Park and other tourist attractions. They are all crowded lively places. These nodes make the business and tourism atmosphere in Xudi-Gaodijie area very strong.

The people driven by the old central axis of Guangzhou gather here (Fig 4-2). Around Xudi-Gaodijie area, there are several large commercial nodes, such as Tianhe City and Haiyinbinbin square. The flow of people in these nodes is an important resource to stimulate the vitality of the area in the future. By regenerating the form of Xudi-Gaodijie area through urban design, the people will be attracted to the site and promote the upgrading of business formats in the area[35].

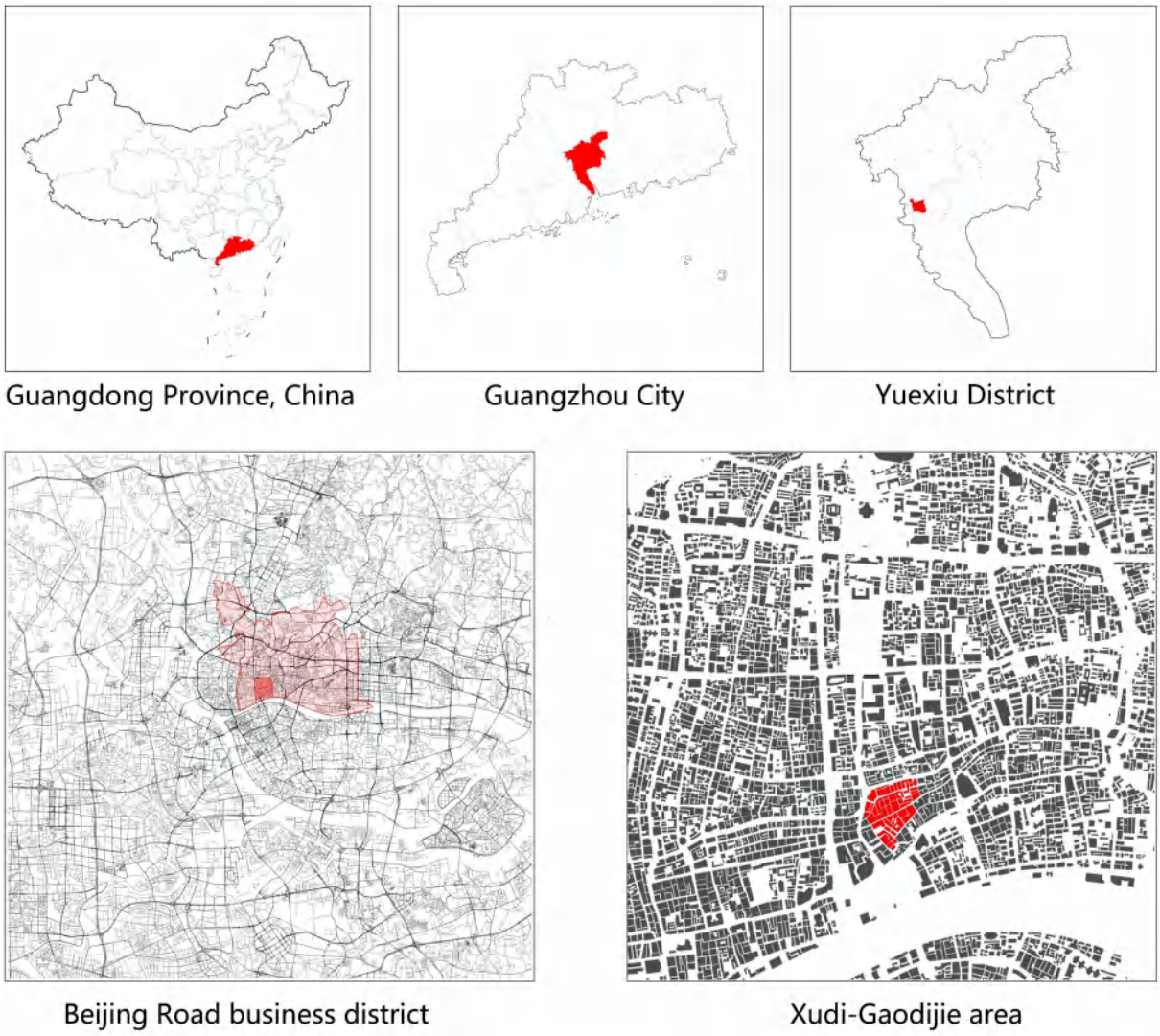


Fig 4-1 Location analysis of Xudi-Gaodijie area

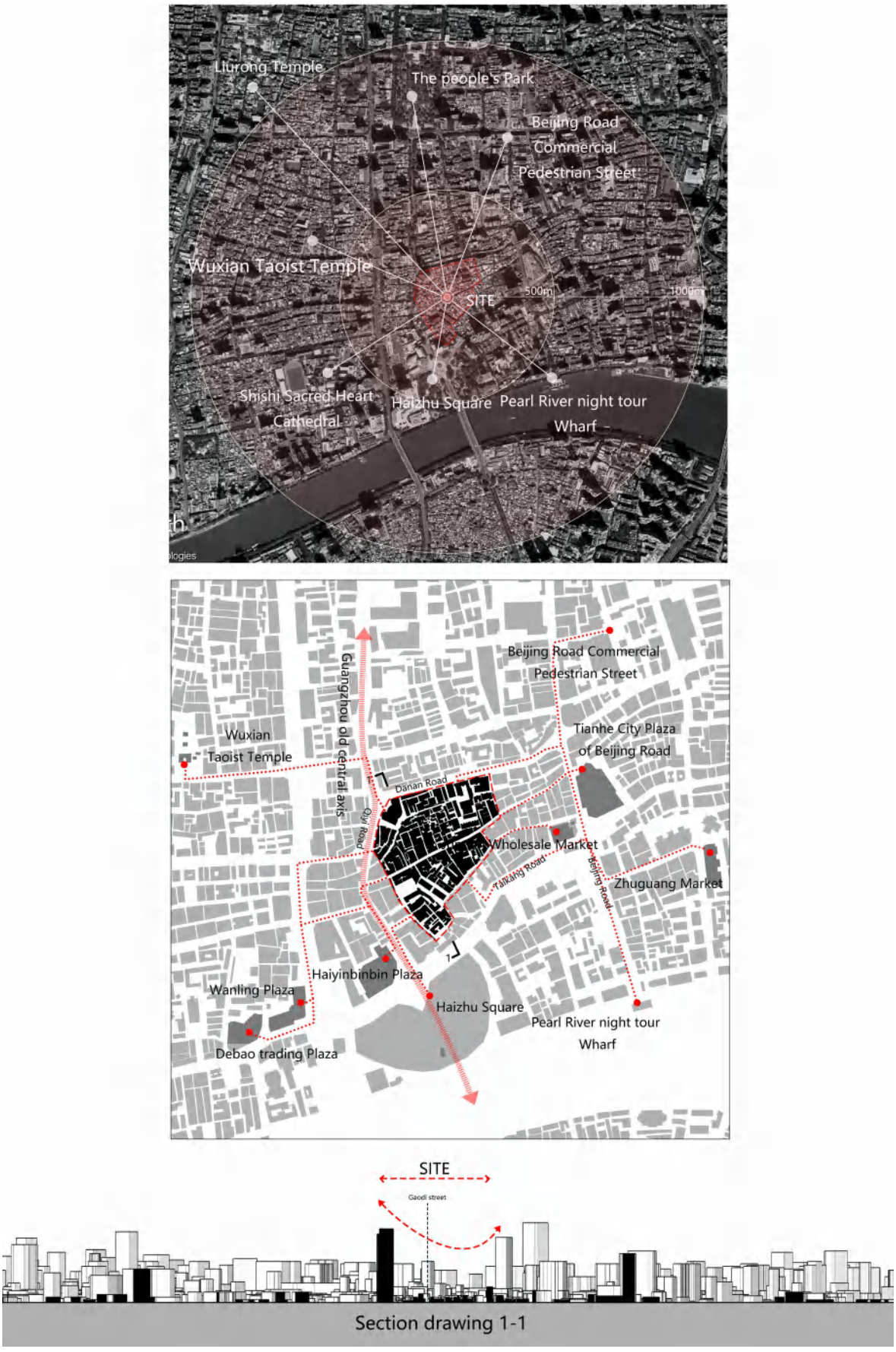


Fig 4-2 Surrounding area analysis of Xudi-Gaodijie area

4.1.1.2 Historical context

Xudi-Gaodijie area is located in the core of the old urban area of Yuexiu district, Guangzhou. The block retains a large number of historical context of the old city of Guangzhou, and there are a large number of historical buildings and cultural protection units. Guangzhou's commercial culture has lasted for thousands of years, while Gaodi street has enjoyed a commercial prosperity for nearly a thousand years since the Song Dynasty. In the late Qing Dynasty and the early Republic of China, many celebrities of the Xu family represented by Xu Guangping once lived in Xudi residential area, adding a revolutionary color to the region. These contexts carry the long commercial history since the Song Dynasty and revolutionary history in modern, and reflect the changes of Guangzhou.

In terms of cultural heritage, Gaodi street, as a prosperous commercial street in history, has a large number of time-honored brands. Famous time-honored brands include "Jiutongzhang" and "Sanduoxuan". These time-honored brands are important cultural spaces for the inheritance and expression of commercial culture and traditional handicraft skills in the block, and are of great significance for maintaining the historical memory of Xudi-Gaodijie area[30].

4.1.1.3 Historical map analysis

During the Song Dynasty, with the development of Guangzhou City and the convenient transportation in Yudaihao river, the Commerce here gradually rose and Gaodi street gradually formed from scratch[38]. The land on both sides of the main street of Gaodi street is densely occupied by merchants, forming a unique street texture (Fig 4-3).

During the Ming Dynasty, the Yudaihao river area became a prosperous area comparable to the Qinhuai River in Nanjing[38]. However, with the development of the city, the land around Yudaihao river is merged, and some river sections are narrowed due to filling the land, gradually losing their regional traffic advantages, and the commercial development trend is stagnant.

Fig 4-3 City map of Guangzhou in Song Dynasty

During the Qing Dynasty, with the increase of population, Gaodi street became an important transportation channel, which once again promoted the development of Commerce. Gaodi street also became a treasure land for rich businessmen to settle down in peace. One of them is Xudi residential area, where the famous Xu family in modern Guangzhou is located. Several Xu family figures represented by Xu Guangping participated in the transformation of the times in various ways in the late Qing Dynasty and the Republic of China (Fig 4-4).

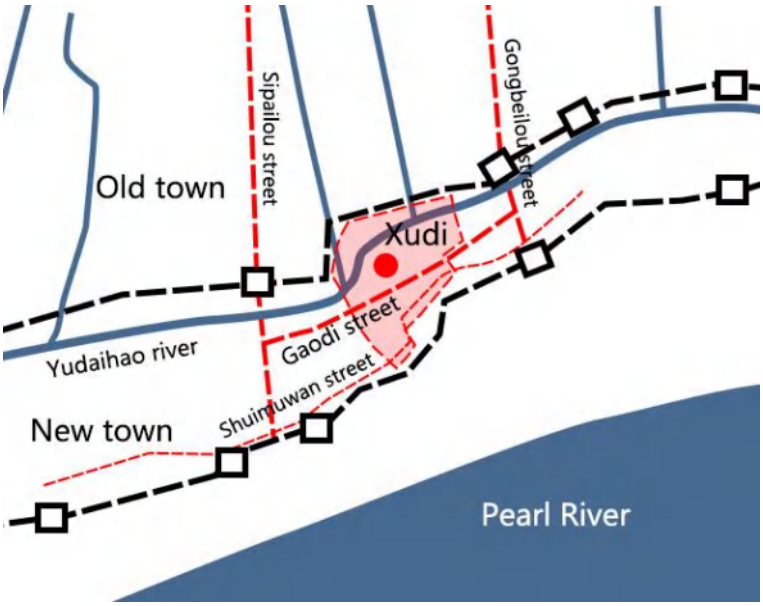


Fig 4-4 City map of Guangzhou in Qing Dynasty

During the period of the Republic of China, urban expansion and new construction had a great impact on Xudi-Gaodijie area. The new road divides Gaodijie into East and West sections, and the street is shortened to 600 meters in the east section. Later, Xudi-Gaodijie was gradually surrounded by roads, shops began to move along the road, and the internal streets and alleys also extended to the road. In addition, large-scale real estate development has emerged in the block, and various styles of collective houses and foreign houses have been built, which has brought new texture to the block originally dominated by traditional buildings and bamboo tube houses (Fig 4-5).

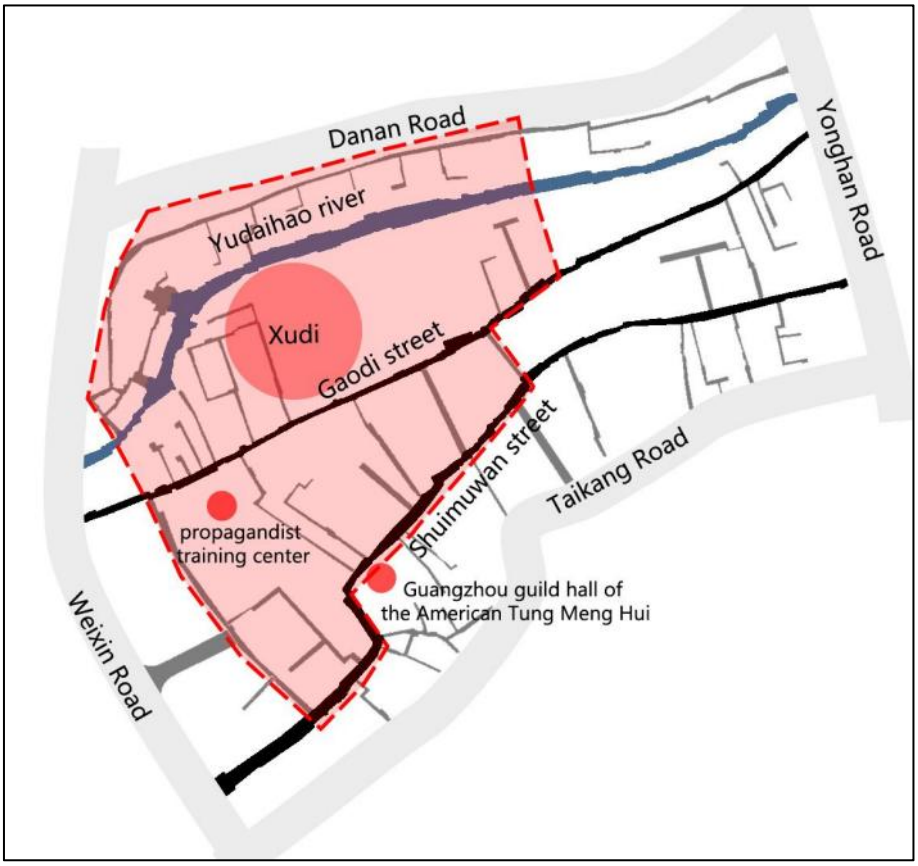


Fig 4-5 City map of Guangzhou in Qing Dynasty

With the change of the times, Shuimuwan street in the block have become the gathering places of modern revolutionary activities. The Guangzhou guild hall of the American Tung Meng Hui was set up at No. 21, Shuimuwan, and the "propagandist training center" run by the Guangdong Provincial Education Committee led by Chen Duxiu is located at No. 30, Suboxiang (now the small red building in the 10th middle

school in Guangzhou).

After the founding of the people's Republic of China, Gaodijie street has keep the function of commercial street. In the early days of the founding of the people's Republic of China, it operated daily necessities. In 1952, Yudaihao river was transformed into an underground canal, which no longer exists. Only the existing street names record the former prosperity. Xudi historical block was forgotten, the house was wantonly demolished and rebuilt, and gradually submerged in high-rise buildings. After the reform and opening up in the 1980s, Xudi-Gaodijie area became a self-employed market. Around 2000, Xudi-Gaodijie area gradually became a wholesale market and continued its commercial function (Fig 4-6).

Fig 4-6 City map of Guangzhou in 2000

After 2000, Xudi-Gaodijie gradually became a wholesale and retail market and continued its commercial function. In the past 20 years, the wholesale and retail industry in Xudi-Gaodijie area has become a major industry, and the residential function has been gradually replaced by the warehousing function[38].

At present, the texture of Xudi-Gaodijie area is seriously damaged. The public space is arbitrarily occupied, and the illegal construction has caused serious influences to the style of buildings and blocks. On the general plan, the urban texture of the ancient buildings was damaged by additional buildings built later. The materials and sloping roofs of the original buildings have also been replaced by new materials and flat roofs (Fig 4-7).

Fig 4-7 City map of Guangzhou in 2022

4.1.1.4 Economic conditions

Nowadays, the land within the site has various functions, mainly including commerce, warehouse and residence (Fig 4-8). Gaodi street and Danan road are the distribution areas of the main commercial types in the area. As many warehousing functions are changed from residential functions, warehousing functions and residential functions are distributed and mixed in a chaotic manner in the area, without obvious zoning.

Fig 4-8 Land use and function analysis of Xudi-Gaodijie area

As an area with a strong commercial atmosphere and a long history of Commerce and trade, the commerce of Xudi-Gaodijie area has not become the industrial support for its development, but has gradually withered. In order to learn about the problems existing in its commercial formats, the author conducted further research and statistics on the commercial type composition of Xudi-Gaodijie area. In the business formats structure of Xudi-Gaodijie area, retail business accounts for 70%, catering and life service functions account for 20%, and other types of businesses account for the remaining 10%. It can be seen from the chart that the main commercial types in the

area are wholesale and retail business (Fig 4-9). How to improve the service quality and space quality of these commercial stores is one of the tasks that designers should complete.

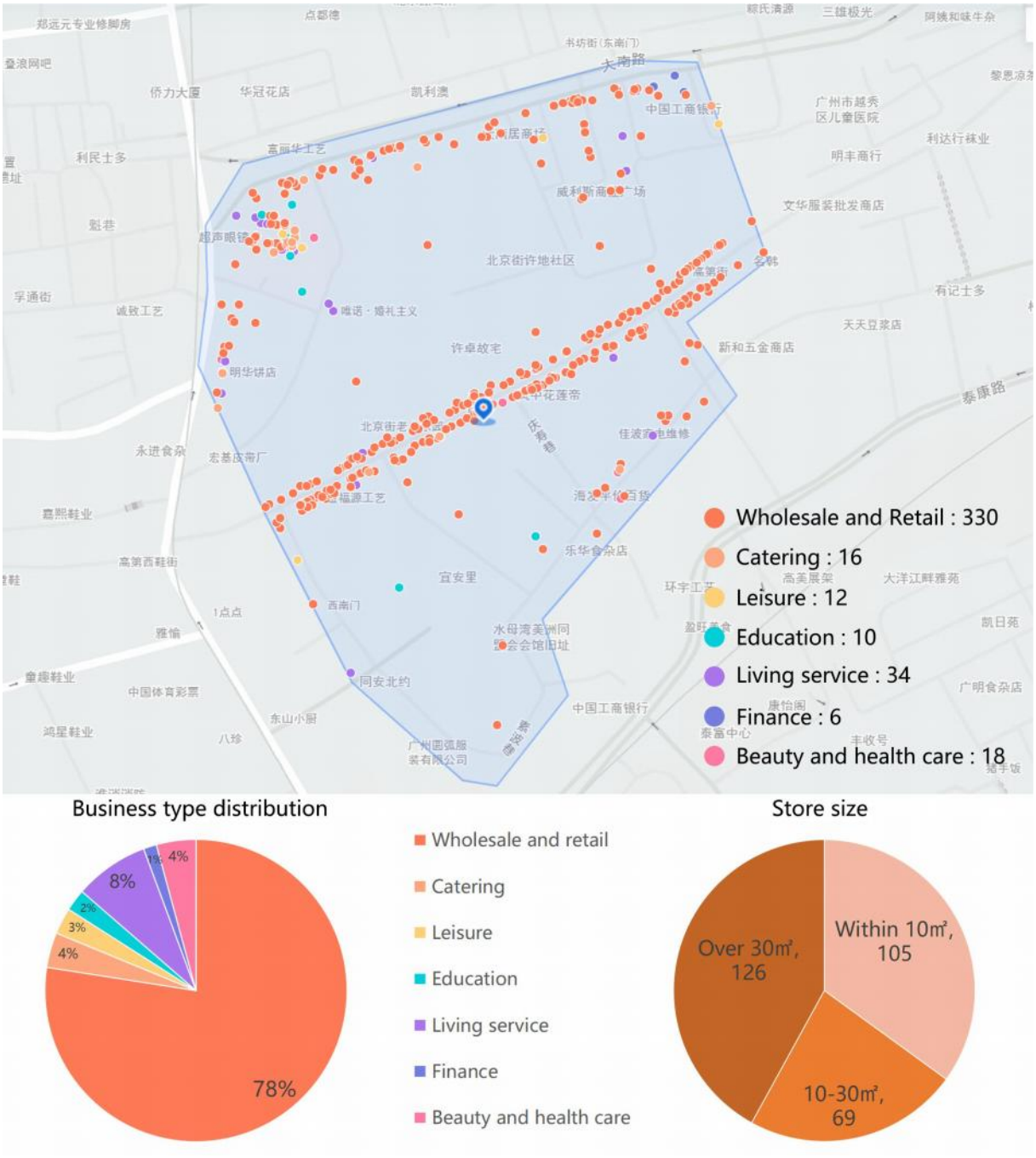


Fig 4-9 Distribution of business types of Xudi-Gaodijie area

According to the internal environment investigated, the land use functions of Xudi-Gaodijie area and its surrounding blocks are mainly commerce, warehouse and residence. The decline of Xudi-Gaodijie area makes the phenomenon of changing

housing to warehouse serious, which affects the daily life of existing residents. The warehouse is transformed from folk houses, which has caused serious erosion to the residential function.

The building area of the wholesale shop on Gaodi street is about 10000 square meters. According to the 1:4 ratio between the building area of general wholesale stores and that of warehouses, the building area of warehouses required by the underwear wholesale market on Gaodi street is about 40000 square meters. The warehouse building area in the block is about 60000 square meters, which is higher than the expected warehouse reserves in the block.

The self-employed wholesale and retail business is relatively low-end and has a low contribution to the social economy. It can not effectively create famous brand and attract popularity like the high-end consumer industry, and can not be combined with the urban historical and cultural landscape to enhance the regional identity of local residents and tourists. As a part of Beijing Road pedestrian block, the noise, clutter, congestion and low-end business formats brought by its wholesale and retail industry are incompatible with the historical commercial atmosphere of Beijing road.

At the same time, the transportation and storage of goods have brought noise, pollution, congestion, fire hazard, health and public security problems to Xudi-Gaodijie area, resulting in a serious decline in the quality of life of the block. Local residents have moved out, and the population loss is serious. The total population of Xudi community and Gaodijie community is about 7000, and the total number of households is about 2200. Among them, there are 2800 empty hanging population and 1500 empty hanging households, with an empty hanging rate of 68%. The real population is 2300 and the floating population is 2100, basically reaching the ratio of 1:1. The neighborhood committee said that the overall development trend of the population in Xudi-Gaodijie area is still that a large number of local residents have moved out, and the number of immigrants is increasing. Under the background of a large number of local people moving out of Xudi-Gaodijie area, the population aging phenomenon of this area is becoming more and more serious. Among the total

population of Xudi community and Gaodijie community, there are about 1500 people over 60 years old, accounting for 65% of the real population.

It can be seen that the key to solving the local economy decline is to improve the style and features of urban spaces in Xudi-Gaodijie area and regenerate its business formats. These problems require us to pay attention to business format regeneration in the follow-up design. The proportion of wholesale trade and warehousing should be gradually reduced to restore the original business style of the block, improve the living environment of xudi Gaodi street, and attract more residents to live here.

4.1.2 Internal environment

4.1.2.1 Road network structure

The internal road network of the site is complex, mainly taking Gaodi street, Yudaihao street and Shuimuwan street as the basic structure (Fig 4-10).Gaudi street is the main commercial street. The road has the widest cross section, with more than 7 meters, and can be opened to traffic. Therefore, the problem of people and vehicles merging is relatively serious. On both sides of the street are bamboo tube house with 2-3 floors. Shuimuwan street is located in the residential area in the south of the area. The road is more than 5 meters wide. The people on the streets are mainly local residents. Most of the surrounding buildings are of the type of 1990s. Yudaihao street is located on the former site of the original Yudaihao river. The cross section of the road is the narrowest. Yudaihao river is now an underground canal. There are many historical buildings around it, with rich historical context.

many small streets and alleys extend internally (Fig 4-11). Most of these roads are only about two meters wide and can not be opened to traffic, mainly pedestrian and non motor vehicle traffic, but the mixed flow of commercial logistics is serious.

Fig 4-10 Main road analysis of Xudi-Gaodijie area

Fig 4-11 Streets and lanes analysis of Xudi-Gaodijie area

Due to the restriction of the internal street and lane scale of Xudi-Gaodijie area, the goods flow in the wholesale market almost all depends on manpower. The main street and most of the branch lanes of Gaodi Street are used as the channels for goods transportation between stores and warehouses. The narrow streets and lanes are

mixed with a variety of flow lines, including the passenger flow of customers, the freight flow of freight workers, and the flow of people generated by the daily life of local residents. The interweaving of various streamlines brings huge traffic hazards. The phenomenon of private building and disorderly construction caused by the expansion of storage demand in the block has led to the poor connection of some streets and lanes, further increasing the traffic burden of the block. These linear spaces will be used as sockets to receive the insertion of plug-ins in the design.

4.1.2.2 Public space analysis

The existing public spaces in Xudi-Gaodijie area are mostly linear public spaces such as streets and alleys, and block public spaces such as large-scale parking lots, school playground and open spaces between buildings. There is a lack of pocket parks and small green land squares to supplement the activity spaces (Fig 4-12).

Fig 4-12 Analysis of existing public space

The streets and alleys of Xudi-Gaodijie are an important part of public spaces, reflecting the original trend of streets in history. They are winding and irregular, resulting in uneven boundaries and different sizes of streets. The interior of the plot is divided by alleys, reflecting the texture differences caused by different times and land properties such as commerce and residence.

During the investigation, the author also found that there is a lot of lost spaces in Xudi-Gaodijie area (Fig 4-13). They are mainly distributed in the declining Xudi area and near Shuimuwan street, at the end or intersection of streets and alleys, close to historical buildings or crowded points. These lost spaces have not been fully utilized and are public spaces with great development potential. These block spaces will be used as sockets to receive the insertion of plug-ins in the design.

Fig 4-13 Analysis of lost space

4.1.2.3 Architectural style analysis

Xudi-Gaodijie area and its surrounding blocks are rich in architectural relics, including many cultural relics protection units, historical buildings and a large number of traditional buildings. The buildings in the block are mainly divided into four types (Fig 4-14):

①The traditional buildings of the Qing Dynasty represented by Xudi architectures;

② Street houses (bamboo tube houses) / arcades / collective houses from the late Qing Dynasty to the Republic of China;

③ Small foreign buildings in the period of the Republic of China;

④ Modern housing.

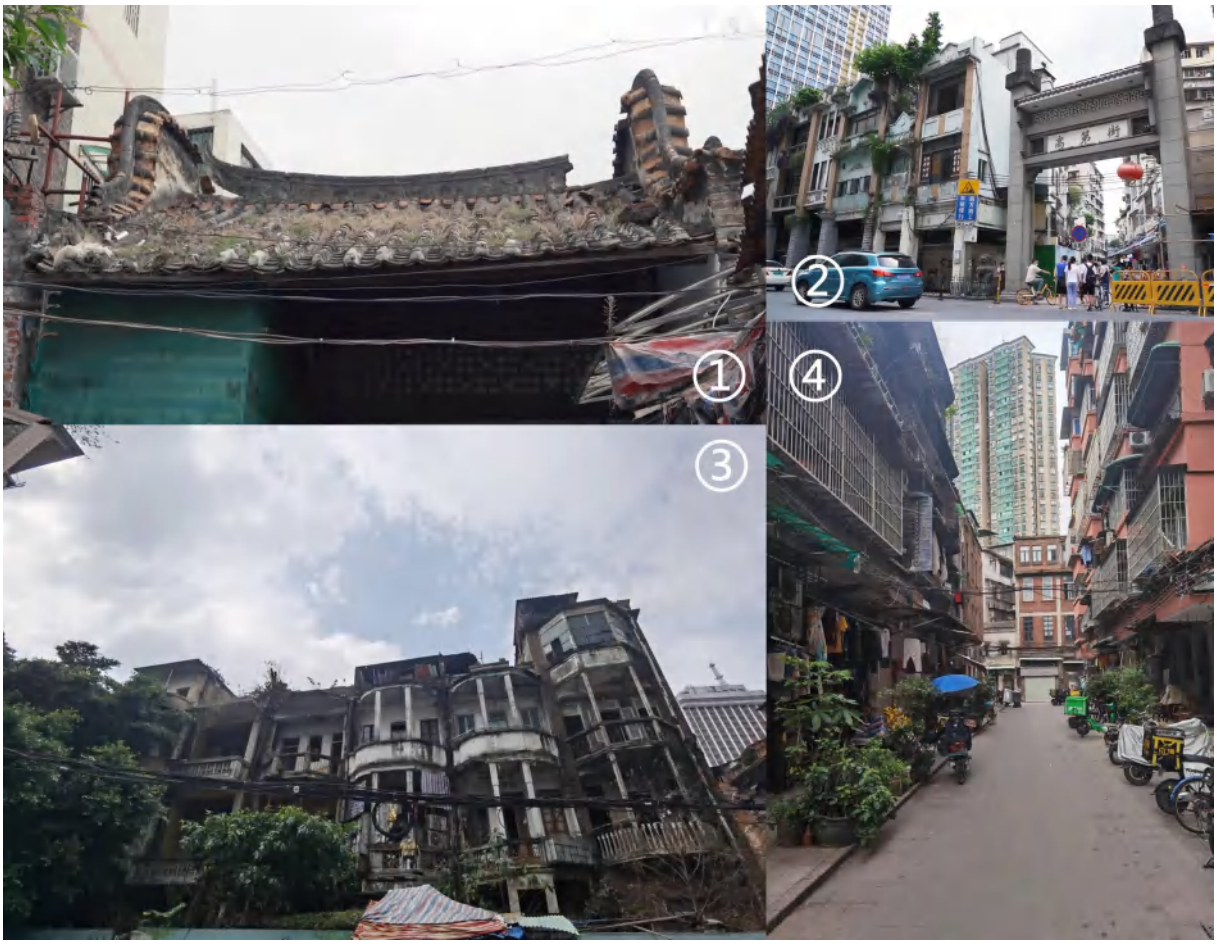


Fig 4-14 Analysis of architectural style

The architectural features of Xudi-Gaodijie area the embodiment of the traditional urban texture of Guangzhou. The functional pattern of buildings in the block is clear,

and there are many historical buildings and cultural protection units, which are of great protection value. But at the same time, some buildings are not in harmony with the historical features and may need to be transformed (Fig 4-15). At the same time, the building materials in different periods makes the street space facade of Xudi-Gaodijie complex and diverse (Fig 4-16).

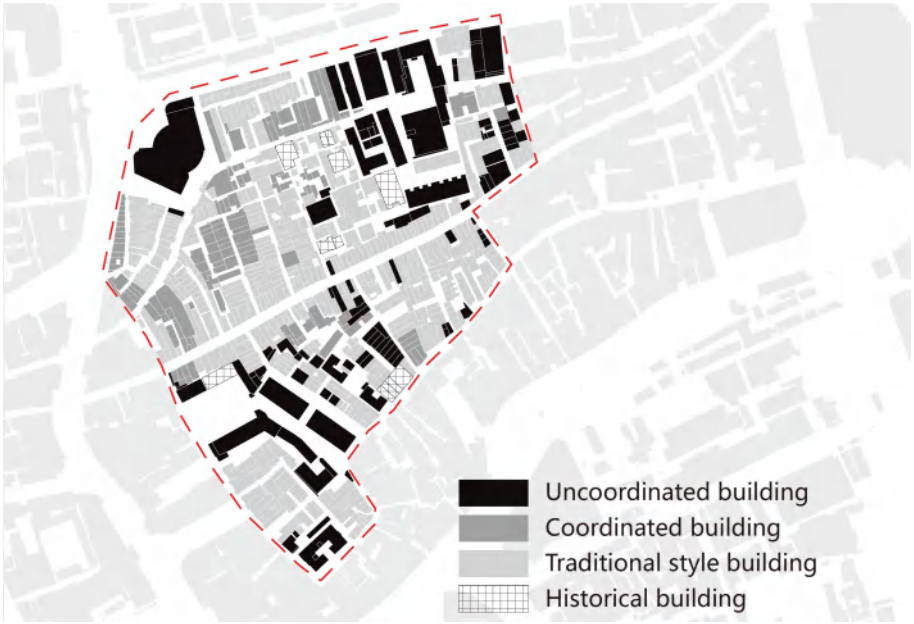


Fig 4-15 Analysis of architectural style coordination

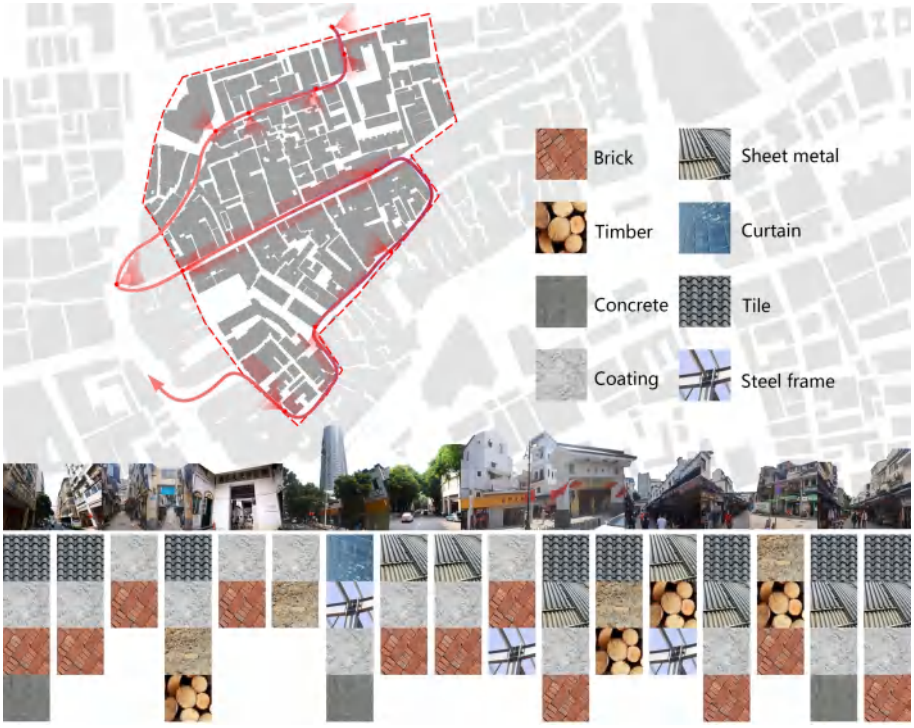


Fig 4-16 Facade materials

4.1.2.4 Preservation of buildings

There are only a few high-rise buildings in the northwest, northeast and southwest corners of the area. Due to the large number of historical buildings and old buildings in the site, the building storey height is generally 1-3 floors (Fig 4-17). Since most of the buildings in the area were built in the last century, the preservation status is relatively general. Some buildings in disrepair for a long time are poorly preserved and can be demolished (Fig 4-18).

Fig 4-17 Storey height analysis of Xudi-Gaodijie area

Fig 4-18 Analysis of architectural preservation of Xudi-Gaodijie area

4.1.3 SWOT + Stakeholder analysis

The specific design strategy includes two stages. First of all, after collecting and sorting out the information in the research stage, conduct multi standard analysis such as SWOT analysis and Stakeholder analysis on the information to determine the main contradictions to be solved and the design nodes of the project. Then, in the design stage, the methodology of "Plug-in Design" is used to design nodes of different scales.

Through the above research, the author can conduct SWOT analysis and stakeholder analysis on Xudi-Gaodijie area. The comprehensive comparative analysis of the two can determine the public space nodes that the author need to design.

4.1.3.1 SWOT analysis

SWOT analysis is a technology to reasonably analyze the planning selection of the decision-making process. This technology is attributed to the research of American economist Albert Humphrey. Since the 1980s, SWOT analysis has been used to analyze the development options of the public sector. Today, the use of this technology has been extended to territorial analysis, regional planning and programme evaluation.

SWOT is the abbreviation of four English words: strengths, weaknesses, opportunities and threats. SWOT analysis will ultimately determine the strengths, weaknesses, opportunities and threats of a plan or project. Through SWOT analysis, the author can select the goals to be implemented in the plan and project, the problems to be solved urgently and the corresponding strategies.

This design thesis classifies and analyzes the factors affecting the urban space of Xudi-Gaodijie area from six aspects: architecture, green space square, street, policy, economy and social culture(Fig 4-19). Through these analyses, it is not difficult to see that the lack of public space and the decline of functional formats are the main reasons why Xudi-Gaodijie area falls behind the times.

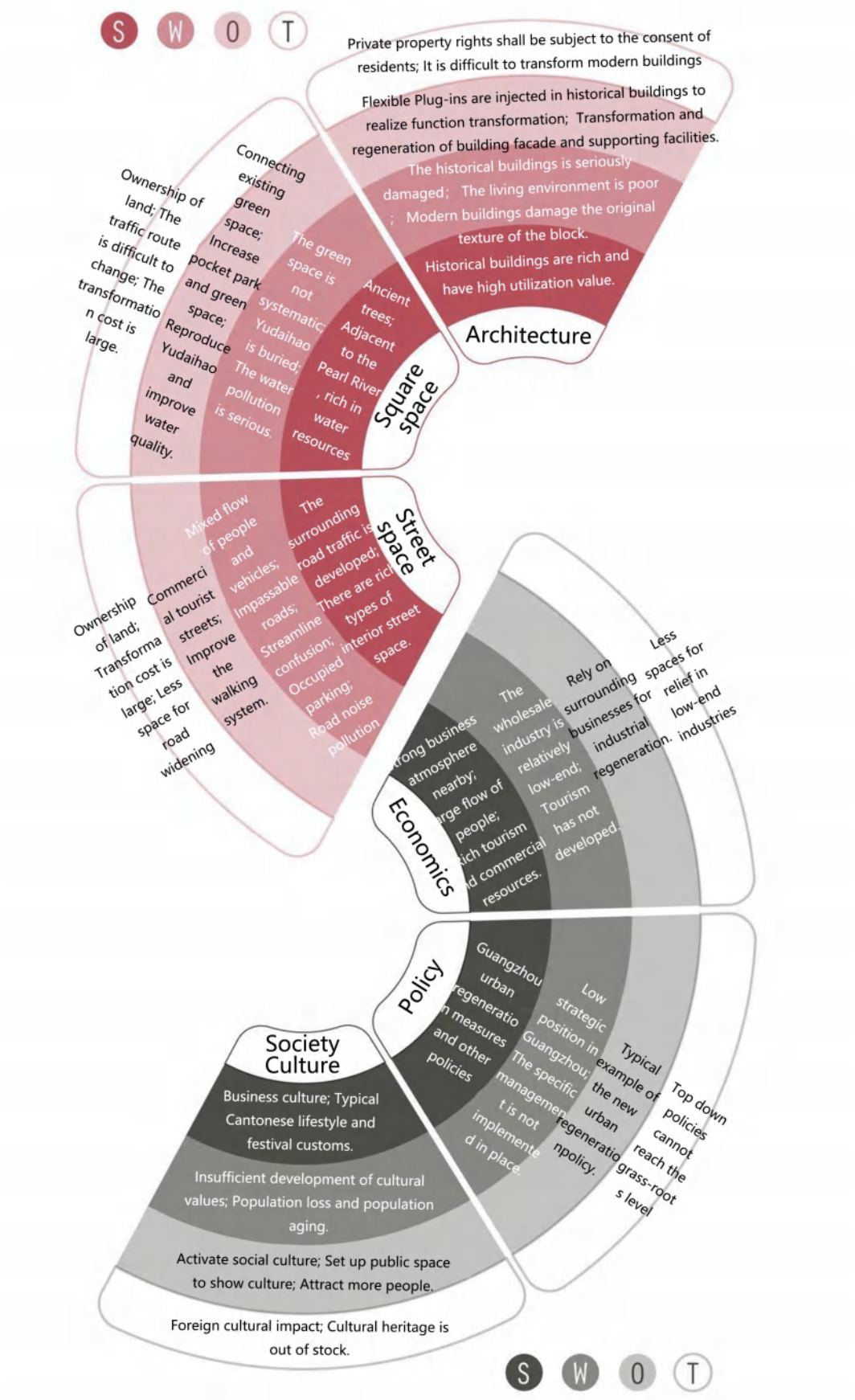


Fig 4-19 SWOT analysis of Xudi-Gaodijie area

4.1.3.2 Stakeholder analysis

Stakeholder analysis is a process or method to support decision-making. The first step in solving the problem is to identify the actors involved. In order to understand what happened or could happen in the decision-making process, the author must understand who contributed to the development and results of the project by taking relevant actions. The people involved in this process are named stakeholder. They can act after making a decision, resulting in consequences for the projects.

In urban design projects, stakeholder analysis is very important to sort out the exact participants. Stakeholder analysis provides important information and quantifies the interaction of different dimensions, which may be important variables more suitable for explaining or predicting decision results. It provides a new analysis tool for analysts. In the process of stakeholder analysis, the author generally divide it into two steps:

1.Establish power / interest matrix

Based on the power and interests of the stakeholders, a "matrix" can be generated for each stakeholder to get the priority list of the stakeholder. The power / interest matrix helps urban designers lock in the people they want to serve and the stakeholders who need to be taken into account in the design process.

Through the interview and investigation, the author can get the stakeholder analysis of Xudi-Gaodijie area (Fig 4-20). The matrix shows that local residents and government are the core groups that designers need to serve. Therefore, how to improve the quality of life of residents and promote the construction and development of the city is the fundamental goal of the project.

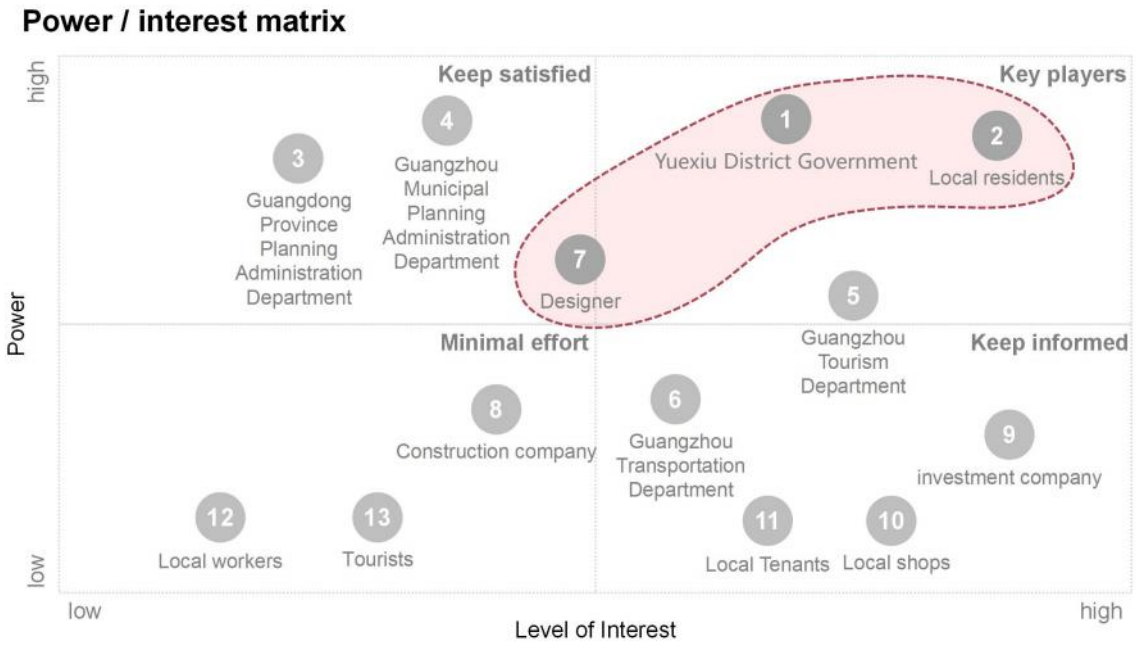


Fig 4-20 The power / interest matrix of Xudi-Gaodijie area

2.Conduct social network analysis

SNA theory is an interdisciplinary research. It evolved from sociology and Anthropology and attracted people's attention in social and behavioral aspects. The SNA concept emphasizes everyone's connection with others and pays attention to the relationship between stakeholders in the network (Fig 4-21).

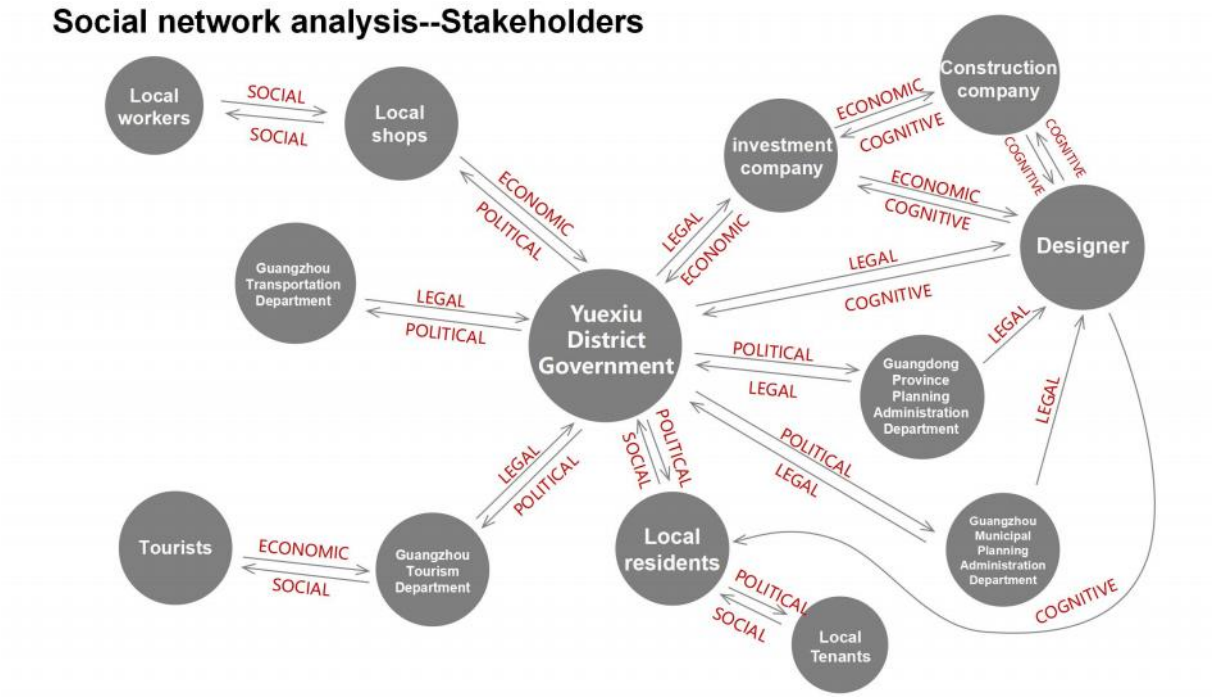


Fig 4-21 Social network analysis of Xudi-Gaodijie area

Through the analysis of SNA, the author can accurately get which node's actors are important and closely related participants.Social network analysis once again reminds designers that local governments and residents need to focus on services in the design process, while maintaining contact with other stakeholders.

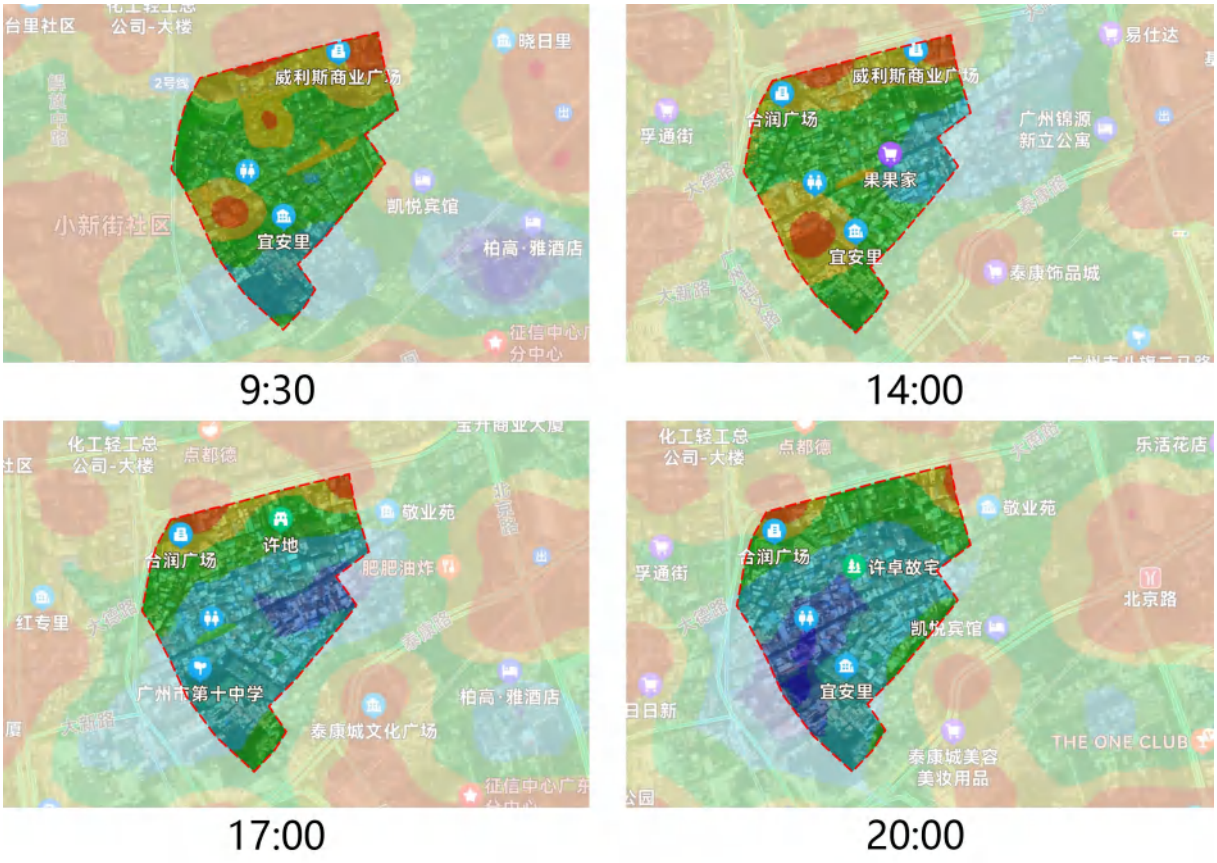
This also enlightens the author on whether the expression of the relationship between stakeholders can be transformed into the expression of the relationship between nodes in the area. Therefore, next, the author tries to determine the design nodes of Xudi-Gaodijie area by using the logic of Stakeholder analysis.

4.1.3.3 Multi Criteria Analysis to determine research nodes

Multiple Criteria Analysis is used to compare and evaluate projects. Multi Criteria Analysis allows decision makers to consider different criteria at the same time, so as to collect all the elements of a project and all the views of actors involved in the process, and therefore have a rational basis to make a decision on a complex problem.

The evaluation of urban regeneration scheme is a complex decision-making process, which needs to consider different aspects at the same time, including both technical factors based on empirical observation and non-technical factors based on social vision, preference and emotion. Through the MCA Method, the author can integrate the Stakeholders analysis and thermal map of human flow activities, and accurately find out which spaces in the city are important activation nodes, so as to select the space for design.

Combining the stakeholder analysis with the thermal diagram, It can be seen that in this site, Gaodijie street and Xudi community are the two most important nodes of stream of people, and they are also the public space nodes that serve the local government and residents in the design (Fig 4-22). These nodes may include commercial street space, community activity space and community public service buildings, etc.



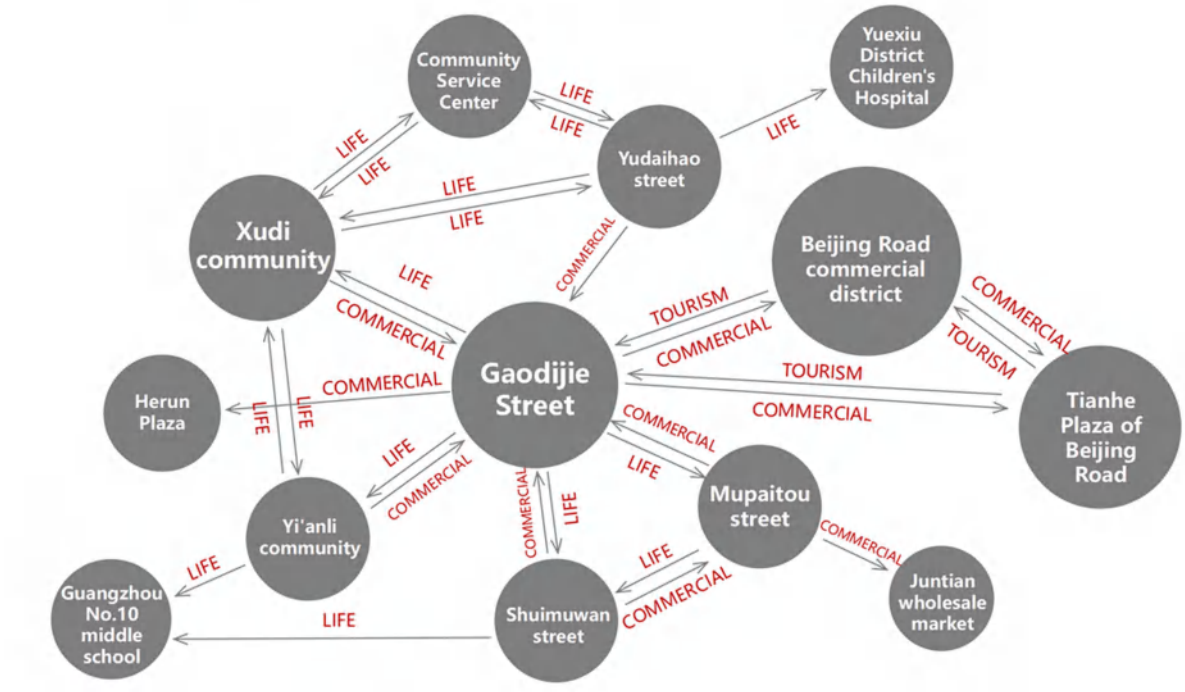


Fig 4-22 The power / interest matrix of Xudi-Gaodijie area

Based on the above analysis, the author can accurately determine the nodes to be designed next. These design nodes take Xudi community and Gaodi street as the two core areas, Shuimuwan community and other small blocks as the secondary areas.

After inserting various plug-ins, Xudi-Gaodijie area will complete the public space system update. Finally, the old city regeneration mode of point to area will be formed (Fig 4-23).

Fig 4-23 Select design nodes

4.2 Design Scheme of Xudi-Gaodijie area

Through investigation, the author have determined the research nodes and direction. Next, The Plug-in Design methodology will be used to design these public space nodes. The purpose of using plug-ins in different dimensions is also different. Because the scale of Rigid Plug-ins is generally small, giant structures cannot be inserted into the sockets of macro dimension, the author rely more on Flexible Plug-ins to serve urban overall development. In terms of micro structure, because the catalysis of plug-ins can be brought into full play, the author rely more on the multiple design of Rigid Plug-ins and Flexible Plug-ins to realize urban regeneration.

4.2.1 Flexible plug-ins serve macro spatial structure planning

In macro urban design, Flexible Plug-ins play a role of service. They mainly serve the overall planning of the local government. These plug-ins are not created out of thin air, but are obtained by extracting complex and comprehensive planning policy documents. These plug-ins have a better understanding of the economic and cultural background of the area than the original plans and regulations, and can more accurately formulate the policy, economic and cultural planning positioning of the region. Therefore, these Flexible Plug-ins will catalyze the improvement of government service quality.

4.2.1.1 Extract Policy plug-ins to control overall plan

By summarizing the superior planning, the author gets the strategic development positioning of Xudi-Gaodijie area, extracts the relevant Flexible Plug-ins of Policy. And these planning policy plug-ins can realize the purpose of catalyzing the whole block at the macro dimension.

The planning policy plug-in 1 comes from the 14th five year plan of Yuexiu District, Guangzhou[2] (Fig 4-24). The plug-in constructs the industrial spatial layout of "one

axis, three belts and six clusters". Xudi-Gaodijie area will be protected and regenerated, the business formats of the whole area will be transformed and activated.

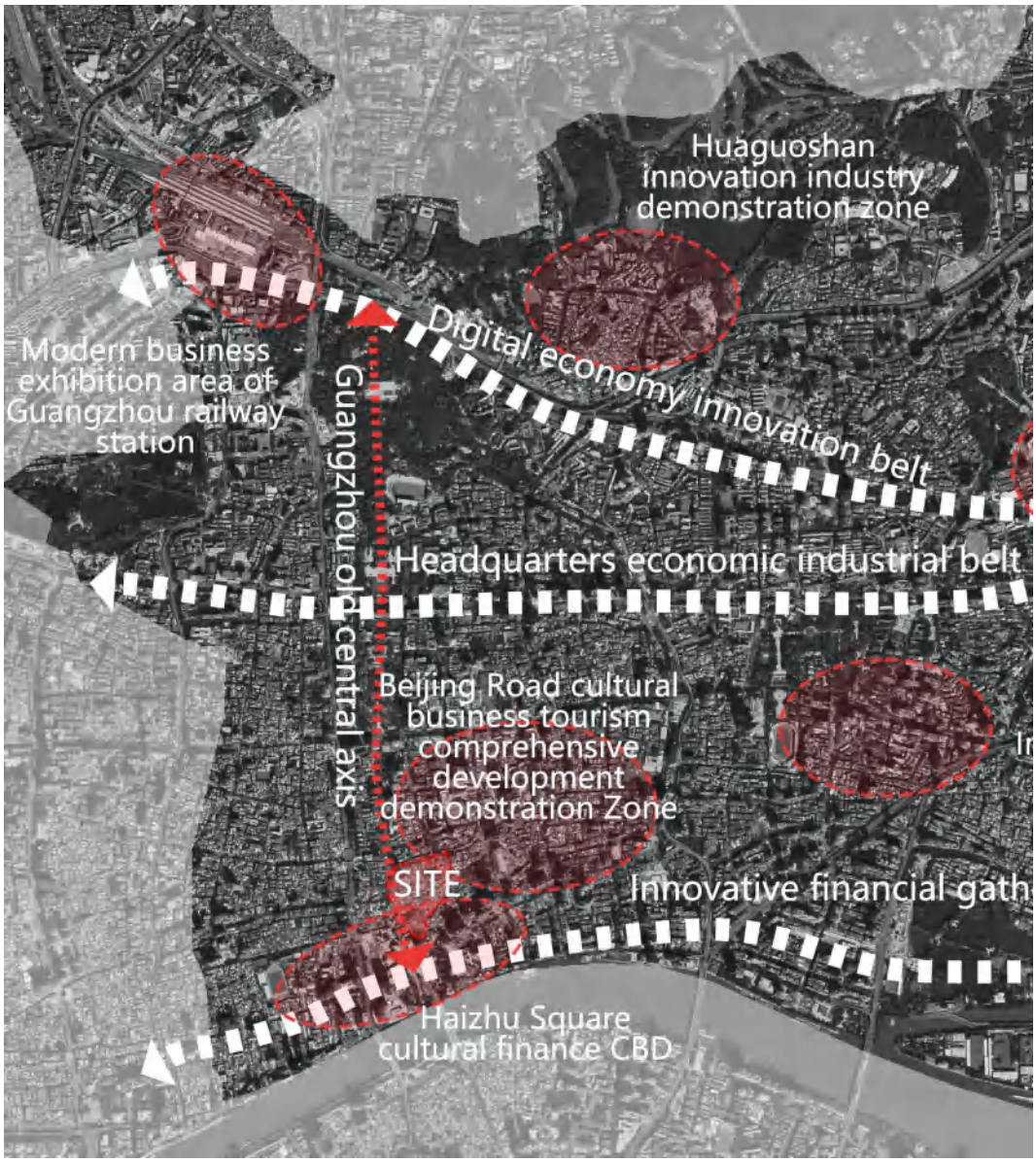


Fig 4-24 Policy plug-in: the 14th five year plan of Yuexiu District

The planning policy plug-in 2 comes from the second batch of "national demonstration pedestrian street[5]" documents of the Ministry of Commerce (Fig 4-25). The plug-in will create the Beijing Road area including Xudi-Gaodijie area as a national demonstration pedestrian block. The cultural tourism industry here will be activated under the action of plug-ins.

Fig 4-25 Policy plug-in: national demonstration pedestrian street

Through the above two policy plug-ins, the overall development direction of Xudi-Gaodijie area will be controlled, and the meso and micro design will be further promoted under this framework.

4.2.1.2 Update the Economic plug-ins to continue the urban context

The Flexible Plug-in of Economic - land function distribution is extracted from the regulatory plan of Yuexiu District (Fig 4-26). According to the plan, the land use nature of this plot is commercial land compatible with commercial land[6]. It can be found that the existing regulatory plan ignores the protection and continuation of traditional texture, especially in road planning. In addition, there is no detailed transformation or upgrading of internal business formats, and there is a lack of understanding of the actual situation. This kind of planning is not in line with the values of Urban Repair and Micro Regeneration. A Format upgrade a transformation plug-in need to be designed to update Flexible Plug-ins of Economy in the area.

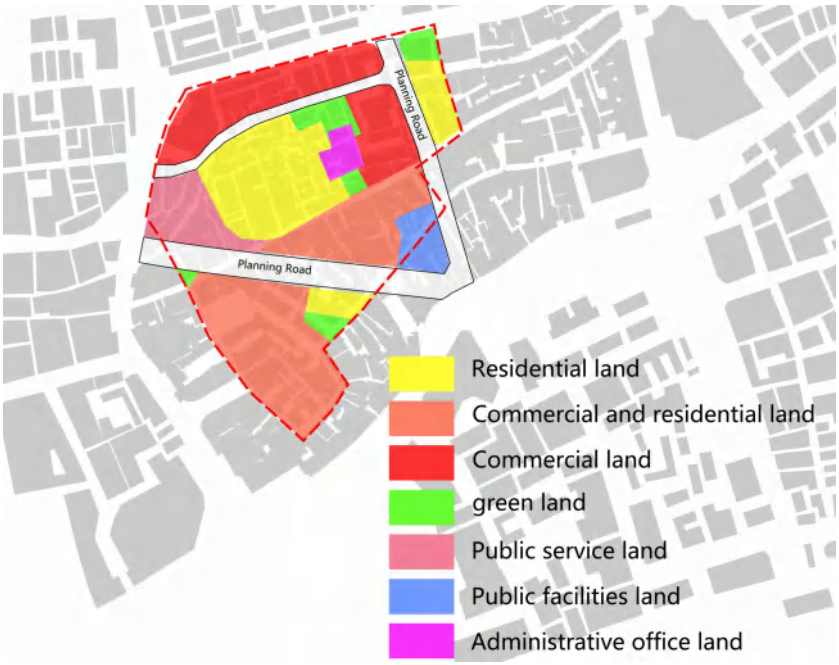


Fig 4-26 regulatory plan of Yuexiu District

The updated plug-in retains the layout of the existing economic plug-in on its economic planning and continues the original functions and business formats (Fig 4-27). The land in the whole site is mainly commercial land, residential land and commercial and residential land, with a height of 18 meters. The road network continues the urban texture, avoiding the damage of urban space. In the further micro design, the updated Economic plug-in will guide the thesis to comb the specific design of the functional business forms in the area.

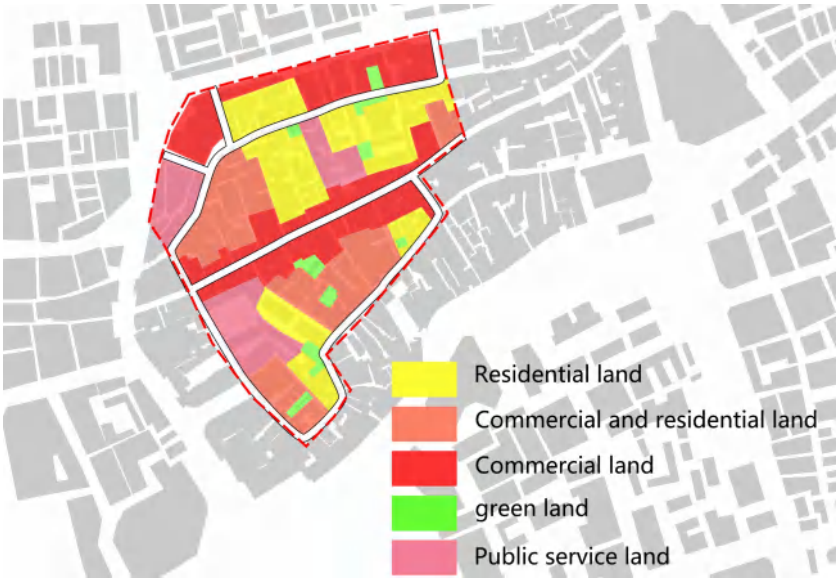


Fig 4-27 New Flexible Plug-in of economy

4.2.1.3 Supplement Cultural plug-ins to catalyze new business formats

Through the above Flexible plug-ins, the strategic positioning and land use function of Xudi-Gaodijie area are basically determined. These plug-ins have guiding significance for the design of macro structure. However, the above Flexible plug-ins are all top-down planning. Therefore, more cultural plug-ins need to be considered in the design to promote residents to spontaneously participate in urban regeneration, protect and continue the texture and context of the plot, and improve the overall appearance and vitality of the plot. The newly added cultural plug-in not only catalyzes local residents to participate in public activities to form new business formats, but also catalyzes the inheritance and protection of historical context..

Specifically, the Cultural popularization plug-in can promote the popularization of some daily business and leisure activities of residents in Xudi-Gaodijie area, and catalyze the continuation of community memory in this area. The Cultural Renaissance plug-in can also excavate the traditional festivals and customs of residents in Xudi-Gaodijie area, and catalyze the continuation of the historical context of the area. And eventually form the group memory of the region, catalyzing new commercial or cultural formats.

4.2.2 Rigid Plug-ins guide meso spatial structure design

At the level of meso design, the type of socket will be combed and inserted into rigid plug-ins to play a catalytic role. These plug-ins guide the urban structure design and put forward the design guidelines, so that the Xudi-Gaodijie area can be activated at multiple points to complete the urban regeneration. At the same time, the meso level design plays a guiding role in the micro level design. The following figure shows the master plan of the meso level (Fig 4-28).

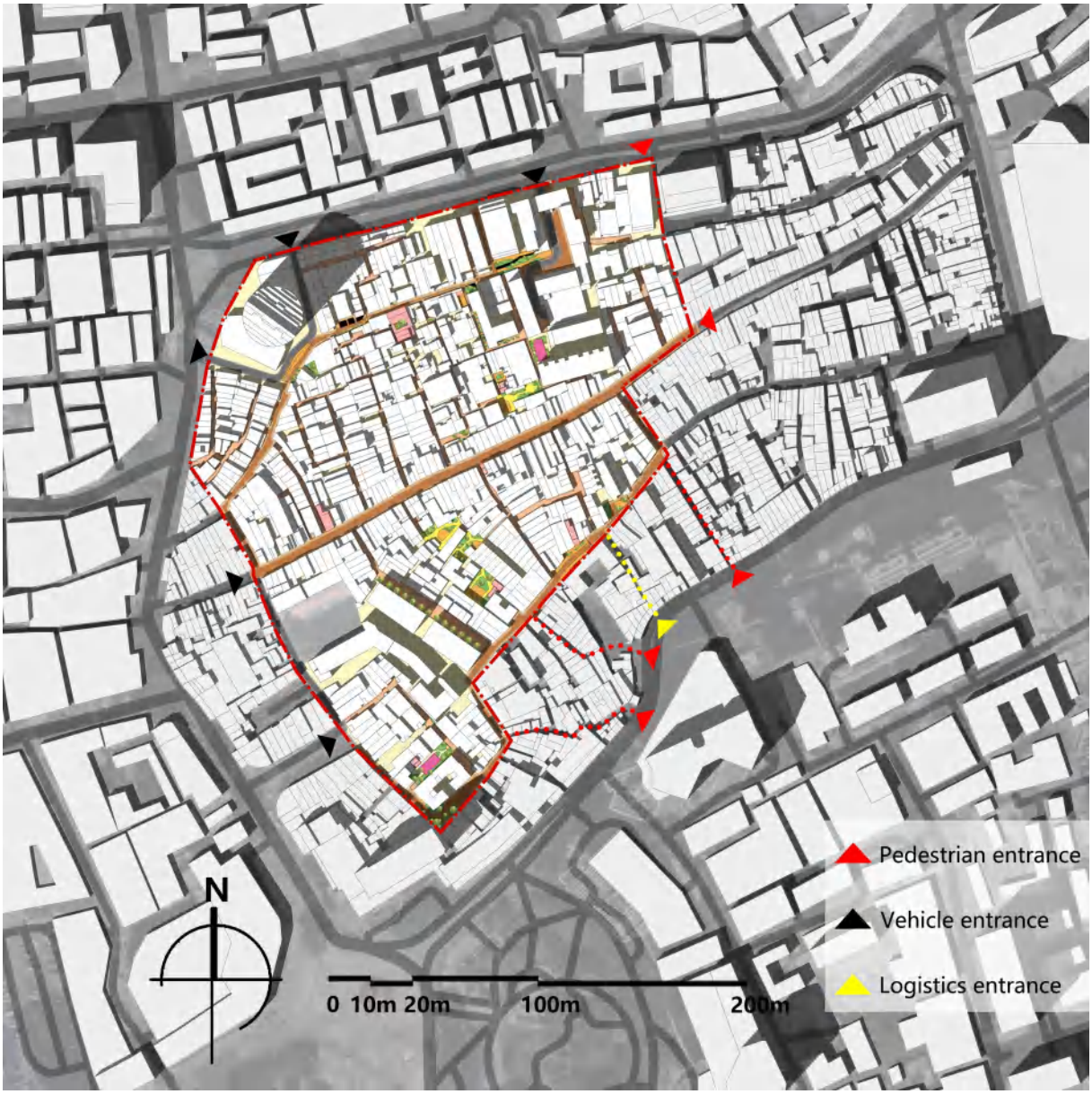


Fig 4-28 Master plan

The meso level design of Xudi-Gaodijie area is mainly aimed at the overall structure of the block public space system. On the one hand, the existing public space system will be sorted out and transformed. The socket type in the matching list can be selected correspondingly. On the other hand, new public space is added to the socket to solve the problem of insufficient activity space in the site (Fig 4-29).

Fig 4-29 Meso level design scheme

Under the guidance of this design, the types of plug-ins used in Plug-in Design can be divided into plug-ins that catalyze the regeneration of public space system and plug-ins that catalyze the regeneration of building space system. These plug-ins that guide meso design are rigid plug-ins which will be inserted into the sockets of this area.

4.2.2.1 Guidelines for public space system design

In the design process of public space system, the safety, identity and comfort of public space should be considered. Therefore, there are the following Guidelines:

1. Ensure the quality, smoothness, comfort and safety of the ground. If the ground is uneven, the elderly will pay special attention to the ground and ignore the surrounding environment.

2. Lighting will have a great impact on vision, so it should be used with caution and

should not produce glare or dark shadow.

3. Use landscape and buildings to control microclimate.

4. The outdoor rest area shall be set up in a place that can be seen from the indoor or easily accessible.

5. Children's entertainment area shall be separated from residential quarters, private spaces and quiet areas. Benches should be set up in the children's recreation area so that the parents accompanying the children here have a rest area where they can exchange feelings with each other. Walking paths and benches can also be arranged not far away to provide surrounding residents with access to the children's entertainment area.

6. In the design of public space, special attention should be paid to the barrier free detail design, so that people with inconvenient actions can reach all places in the living space, so that they can also feel the care and scenery of the community.

7. Existing plant resources should be preserved as much as possible, which are an important part of the historical development and cultural accumulation of the community.

8. Build a 10 minute community life service circle, use the Internet and other systems to create an intelligent community and stimulate community vitality.

9. Retain the original landmark landscape node with historical culture and integrate it with the reconstructed landscape.

10. The insertion of public space plug-ins is a long-term dynamic change process, and the types of plug-ins in different space states are different. The plug-in needs observation and feedback before and after insertion.

For example, blocky public spaces use plug-ins such as squares and parks. The linear space uses plug-ins such as streets and waterfront landscape. If the existing business type does not conform to the overall plan, the business format transformation plug-in shall be adopted. Adopt business upgrade plug-ins for public spaces with backward existing business formats. When there are valuable cultural

activities in the public space, the cultural popularization plug-in is adopted. When the cultural activities in the public space have declined, the culture mining plug-in is used.

4.2.2.2 Meso design of public space system

The public space plug-in of the Xudi-Gaodijie area project has a catalytic effect on the activation and regeneration of public space in this area. It plays a catalytic role in two types of socket: Linear public space and Block public space[14].

Firstly, the public space plug-in catalyzes the road network system in this area by being inserted into linear space receiving device(Fig 4-30). These roads will be connected, their fire passages will be increased, and the separation of people and vehicles will be realized. The design of road network system will further catalyze the improvement of public facilities and attract people to enter the area.

Fig 4-30 Road network system

Secondly, the public space plug-in catalyzes the public space system in this area by being inserted into block and linear space receiving device(Figure 4-31). The public space plug-in promotes the increase in the number and quality of public spaces in the block, and connects the isolated public spaces. It further catalyzes the improvement of residents' quality of life.

Fig 4-31 Public space system

4.2.2.3 Guidelines for building space system design

In the design process of building space system, the form and scale of architectural space should be considered. Therefore, there are the following principles:

1. The external space of the buildings should conform to the scale of the human body, and create an active street space for people through flexible layout.

2. Respect the existing surrounding buildings and strengthen the existing

transportation system and public space form.

3. Strictly control the building retreat to ensure the continuity of street space and form an open space on the ground. The bottom of the building serves the urban life and is the main interface to form the urban public space.

4. The design of the building shall be meticulous and coordinated, and the building shall conform to the historical context through the treatment of the texture of the facing materials, architectural texture and other architectural details.

5. The relationship between adjacent buildings must be considered in facade treatment to ensure the continuity and coordination between buildings.

6. The entrance space of the building needs to be focused on, so as to create rich and vivid street space and integrate the public activities inside the building into urban life.

7. The roof space of the building serves the skyline of the city, and the building height is controlled within 18 meters.

8. Stone, brick and paint are encouraged to be used for building exterior wall materials. The materials shall keep the color coordinated with the surrounding buildings, and soft neutral color metal materials shall be used locally; It is forbidden to use large-area specular reflection glass

9. Consider other elements of the building, such as Lingnan characteristics.

4.2.2.4 Meso design of building space system

The building space system plug-in in Xudi-Gaodijie area is mainly aimed at public buildings, historical buildings and private houses allowed to be transformed. Its main function is to catalyze the completion of demolition, transformation or new construction of building space system. After insertion, the texture of the city will be improved (Fig 4-32).

The building plug-in promotes the building form in the block. Xudi-Gaodijie area will become an urban block with historical and cultural atmosphere and modern commercial atmosphere. The regenerated buildings attract more residents, more

businesses and more tourists.

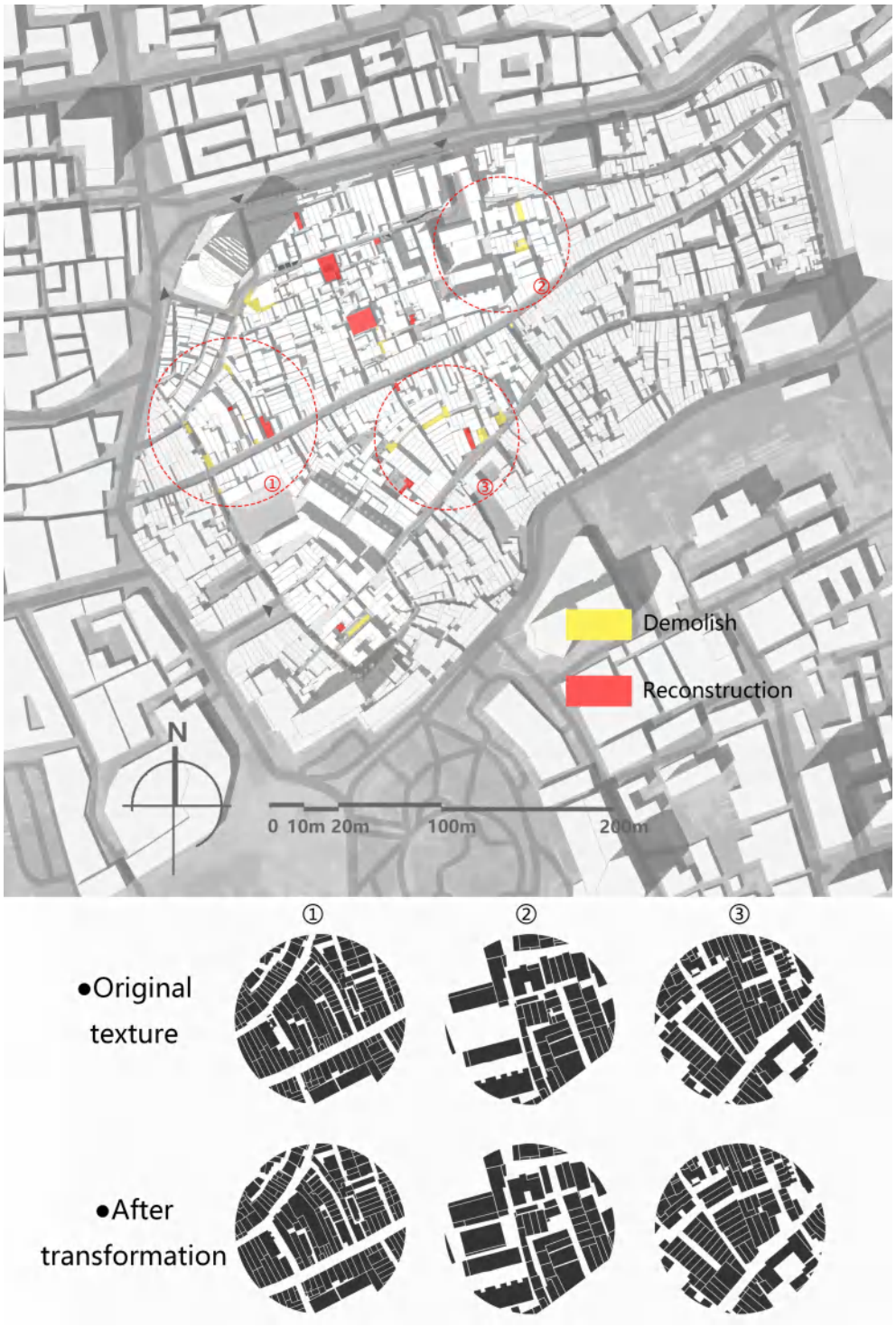


Fig 4-32 Building space system

4.2.3 Multiple Plug-ins participate in micro spaces regeneration

In the micro structure design of Xudi-Gaodijie area, the plug-in with small-scale

characteristics will play a greater role. Whether it is a Rigid Plug-in or a Flexible Plug-in, the design of micro structure is essential. Firstly, the rigid plug-in will play its role in both public space and building space. Secondly, the citizen culture and business transformation in the block need the participation of flexible plug-ins. The participation of Multiple Plug-ins jointly catalyzes the urban regeneration of the block.

4.2.3.1 Rigid plug-ins are inserted into public space sockets

The micro level design of Xudi-Gaodijie area is mainly aimed at the specific public space socket in the block. It can use the single plug-in that catalyzes the regeneration of public space and the single plug-in that catalyzes the regeneration of buildings. For the plug-ins that catalyze the regeneration of public space, the plug-ins of road or the plug-ins of public activity space can be selected according to different space types. The plug-ins used for these spaces are rigid plug-ins.

For specific street regeneration, their function positioning is also different according to the width of the street socket. Roadway plug-ins, walkway plug-ins and street plug-ins play different catalytic role in the regeneration of these streets. The following figure shows the Walkway plug-ins injected in the three main streets of the Xudi-Gaodijie area (Fig 4-33).

Street cross-section is an important factor to reflect how different plug-ins catalyze the regeneration of regional road network system. In the three main streets of Gaodi street, Yudaihao and Shuimuwan, the cross-section forms of streets with different characteristics are designed according to their business planning. The street plug-in of Gaodi Street will catalyze the street space with more commercial atmosphere (Fig 4-34). The street plug-in of Yudaihao will catalyse the recovery of historical context and reproduce the waterscape of yudaihao river (Fig 4-35). The street plug-in of Shuimuwan will catalyze the formation of leisure life corridors in the community (Fig 4-36).

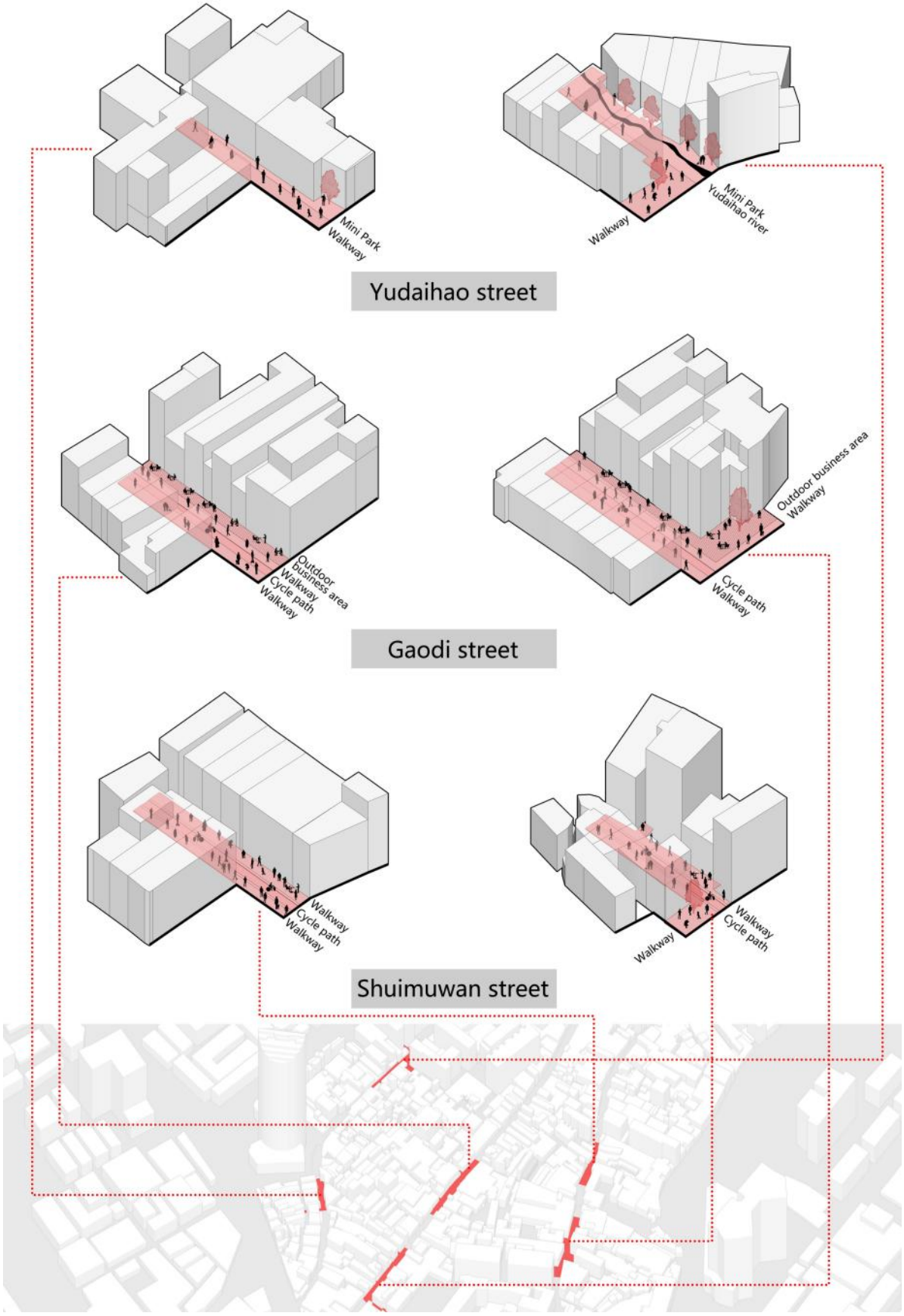


Fig 4-33 Plug-ins for main streets

Fig 4-34 Gaudi street cross section

Fig 4-35 Yudaihao street cross section

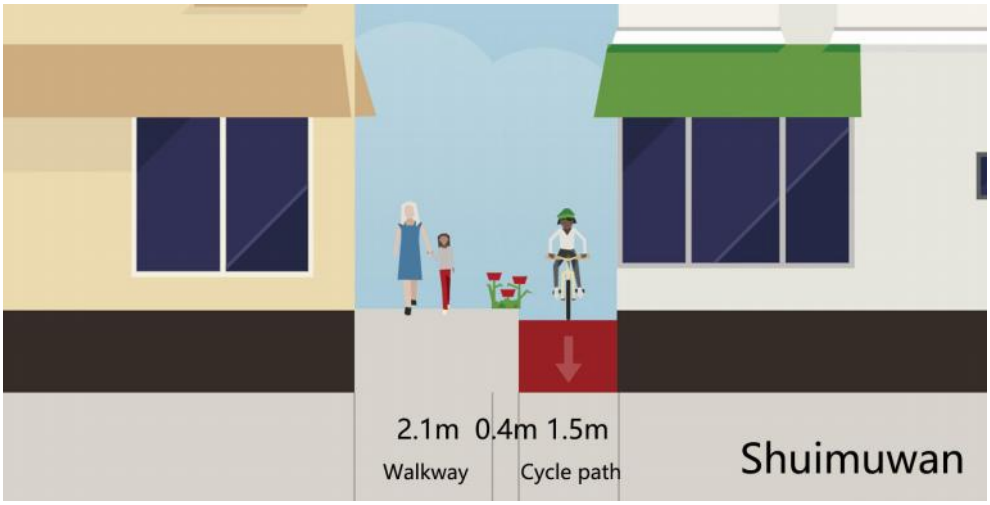


Fig 4-36 Shuimuwan street cross section

For the regeneration of some public activity spaces, some hard square plug-ins, green park plug-ins and waterfront landscape plug-ins are inserted according to different functions of public space sockets, such as pocket parks, squares, playgrounds and

Yudaihao Waterfront park. These rigid plug-ins will catalyze the improvement of the quality of the artificial environment in the region (Fig 4-37).

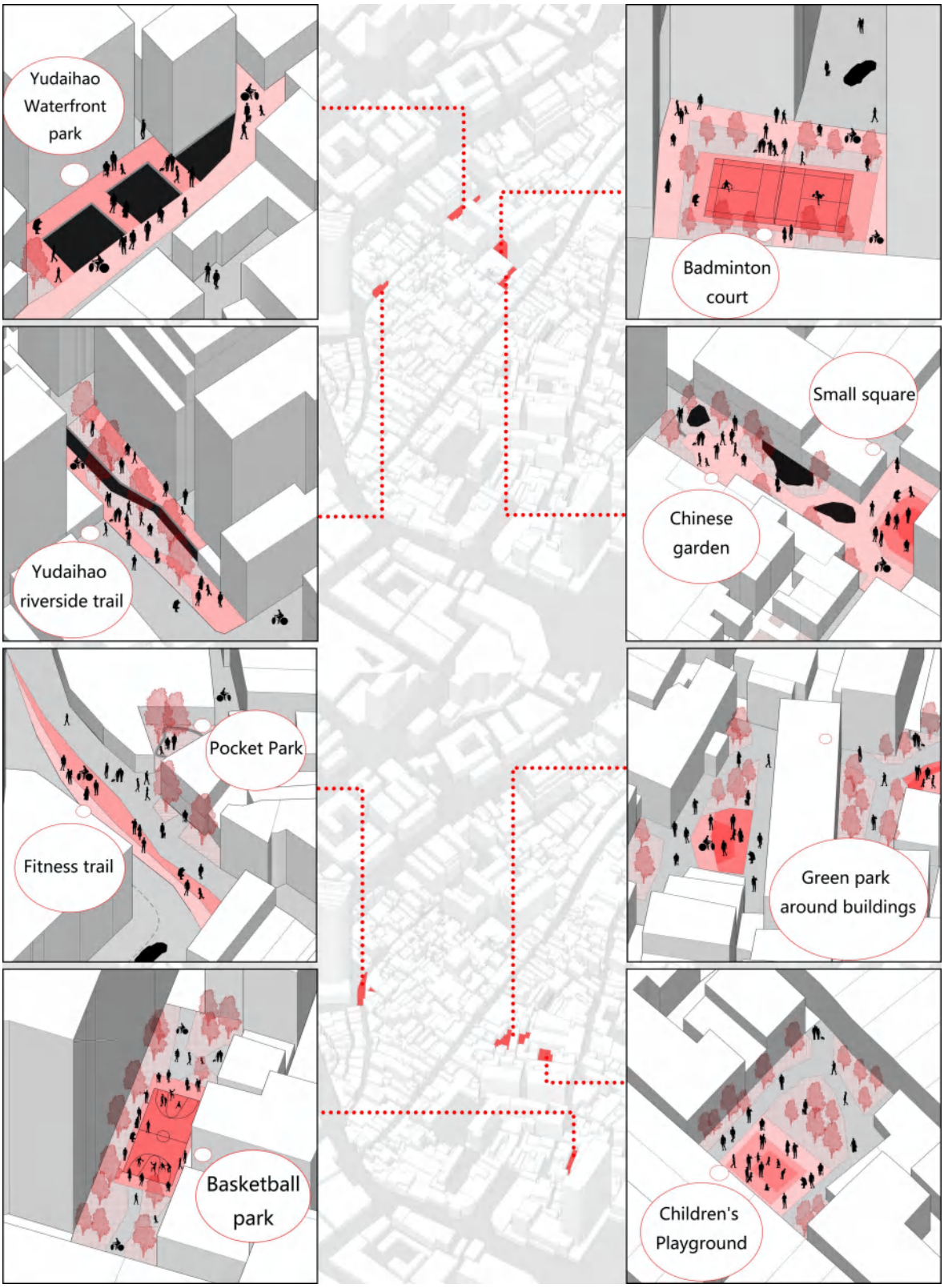


Fig 4-37 Plug-ins for main public activity spaces

4.2.3.2 Rigid plug-ins are inserted into building space sockets

For the buildings regeneration，it can be inserted some building plug-ins (Fig 4-38).

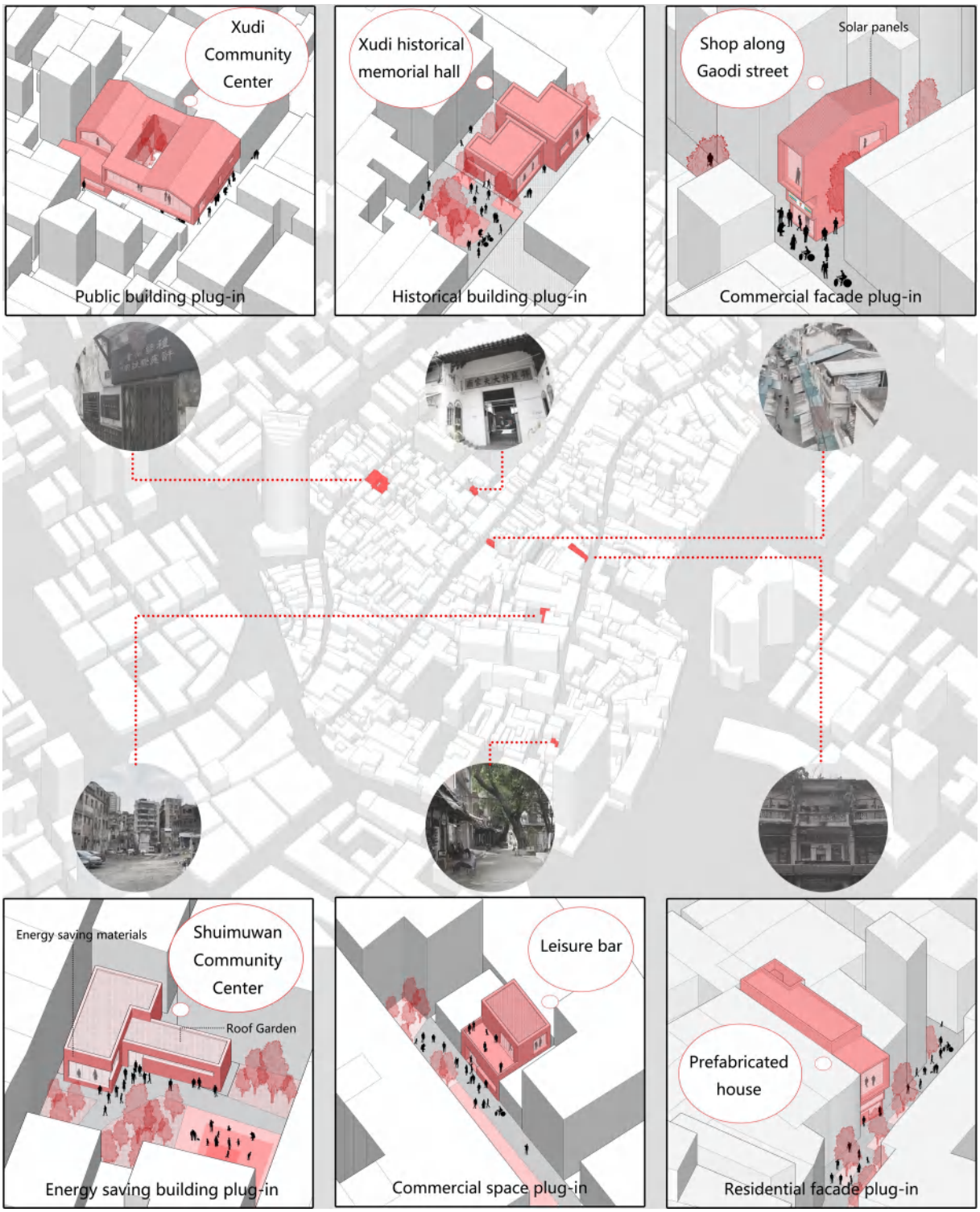


Fig 4-38 Building plug-ins

These building plug-ins can catalyze the development of urban space in the area and continue the original urban texture by being inserted into building sockets. The main

building plug-ins include historical building plug-ins, public building plug-ins, commercial facade plug-ins, residential facade plug-ins, etc. Because housing involves private property rights, when inserting plug-ins into private buildings such as housing, residents' permission is required.

The building plug-in has certain technicality. Taking the prefabricated house as an example, the prefabrication and energy saving of the plug-in are fully considered in the design process. The new housing module will become a new model for living in the community and gradually catalyze the regeneration and transformation of other old houses (Fig 4-39).

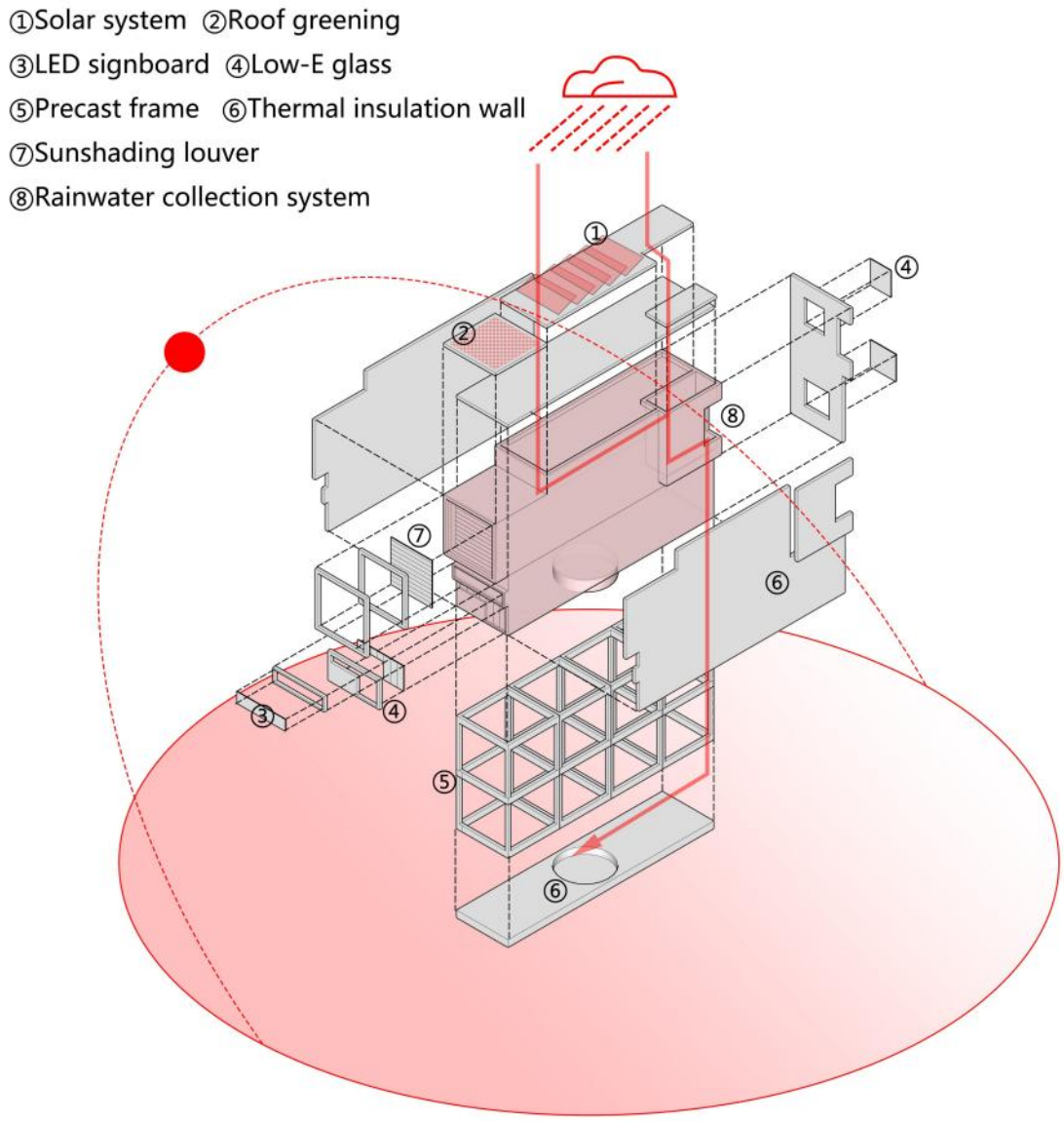


Fig 4-39 Technical analysis of building plug-in

4.2.3.3 Flexible plug-ins are inserted into public space sockets

At the micro level, in addition to inserting Rigid Plug-ins to catalyze the regeneration of urban spaces, Flexible Plug-ins can also be inserted to catalyze the regeneration of urban formats and context (Fig 4-40).

Fig 4-40 Flexible Plug-ins

Flexible plug-ins not only provide the structure and functions of people's lives, but also make cities more dynamic. It turns the city into a collective space full of cultural activities and ideology - the space of citizen identity. Psychologist Maslow's famous theory holds that in cities, people have the opportunity to exert their creativity, which is

the last and highest demand in the demand pyramid[3]. This highest demand is met by Flexible Plug-ins, and cultural life or people's creativity is brought to the city.

By inserting cultural plug-ins into the space receiving device, it can catalyze the popularization of local cultural customs and the continuation of historical memory. Specifically, cultural activity plug-ins can be inserted in combination with local cultural entities such as theatres, morning tea shops, gourmet shops and time-honored stores to catalyze new cultural industries[36].

By inserting the economic plug-ins, it can catalyze the regeneration of the functional formats of the whole block, and gradually eliminate the phenomenon of economic decline and the gap between the rich and the poor. Specifically, it can replace the original low-end warehousing and wholesale functions and insert emerging industries such as commerce, tourism, exhibition industry and elderly care industry.

Finally, Xudi-Gaodijie area will be built into a business and leisure area through these flexible plug-ins.

4.3 Summary of chapter 4

The main goal of this thesis is to explore and solve practical problems through the methodology of Plug-in Design. Before the design application, It is needed to do a survey on the basic situation of the target site to provide a basis for our subsequent design.

Through investigation, the author have determined the research nodes and direction. Next, The Plug-in Design methodology will be used to design these public space nodes. The purpose of using plug-ins in different dimensions is also different. Because the scale of Rigid Plug-ins is generally small, giant structures cannot be inserted into the sockets of macro dimension, the author rely more on Flexible Plug-ins to serve urban overall development. In terms of micro structure, because the catalysis of plug-ins can be brought into full play, the author rely more on the multiple design of Rigid Plug-ins and Flexible Plug-ins to realize urban regeneration.

CONCLUSION

How will "Plug-in Design" change the mode of urban regeneration? With the development of technology and urban design concept, the application of "Plug-in Design" began to become more feasible.

A successful old city block will eventually lead to the overall revival of material, function, economy and society. The old city block in Guangzhou has its unique sense of history, which has affinity and appeal to the local residents. But the change of the times is inevitable. In those places where the old buildings have been swept away, the continuity of the place has died. And people often lose their original sense of belonging and security. Therefore, it is necessary to preserve the traces of the times and the historical urban spaces of various styles in various periods, so that most of them can be changed to make the past serve the present. At the same time, it can also bring visual pleasure and intimacy to tourists, residents or just pedestrians. The application of Plug-in Design methodology in Guangzhou urban regeneration is to maintain this sense of history and create this sense of affinity[23].

Innovation points

The methodology of "Plug-in Design" proposed in this thesis takes the public space in Xudi-Gaodijie area as the design starting point. Its innovation effectively complements the old city regeneration model of Guangzhou.

First of all, Plug-in Design uses a set of more general toolset. Through summary and research, this thesis combs the classification of Plug-in Design according to rigidity, flexibility and space receiving device, which is more detailed and universal. The plug-ins that are inserted into sockets catalyze the urban regeneration of the whole area by their different attributes. This makes it possible for the methodology to be widely used and complementary to the existing urban regeneration methods in Guangzhou, such as urban acupuncture and micro regeneration.

Secondly, Plug-in Design combines the advantages of plug-ins with the concept of urban repair and micro regeneration to form a new methodology. In the design of Xudi-Gaodijie area, the urban space and context of a Guangzhou block with a very declining industry are reorganized from macro to micro. Through the application of Plug-in Design, this representative old city block of Guangzhou starts from the public space sockets, is inserted into rigid and flexible plug-ins, and finally the whole area has been revitalized (Fig 5-1).

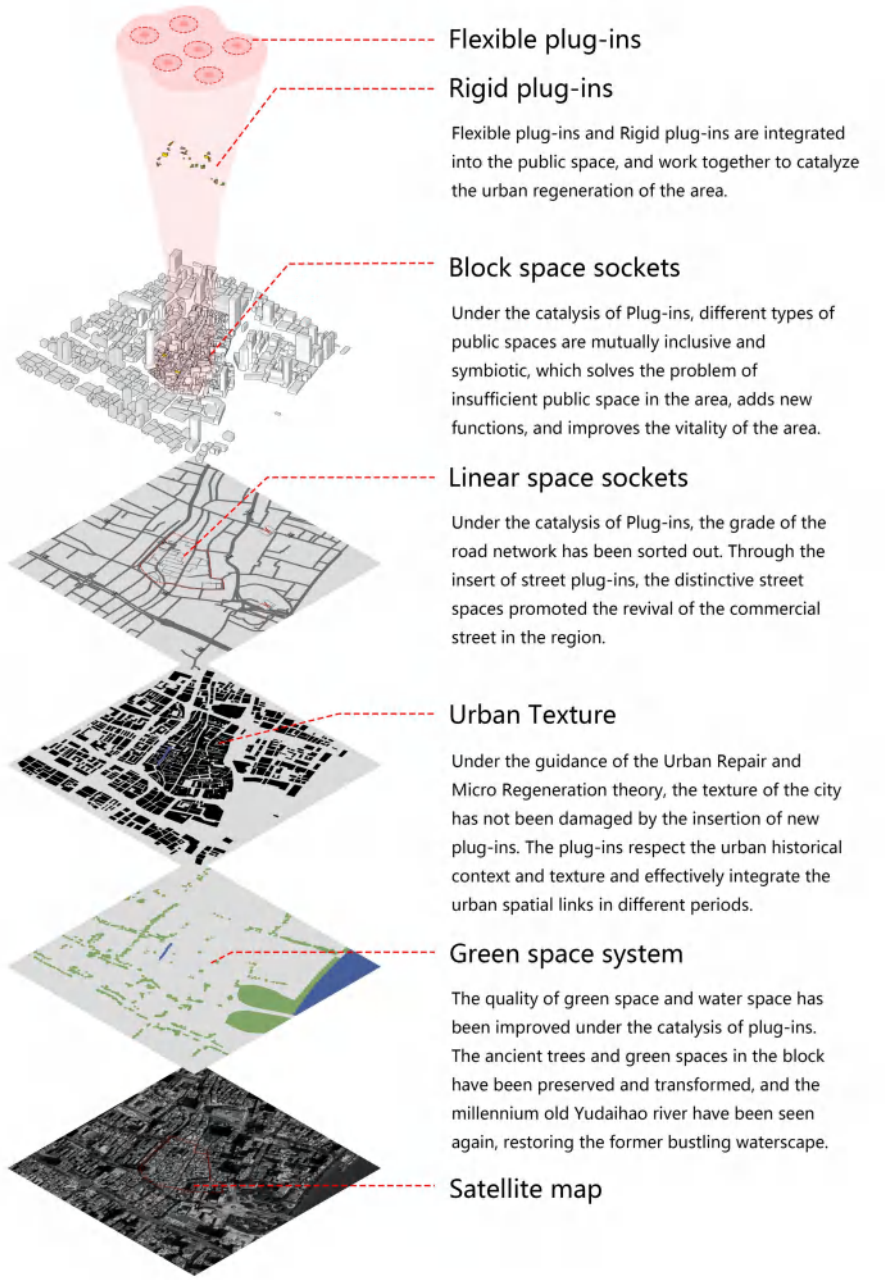


Fig 5-1 Explosion analysis diagram of Plug-in Design

Thirdly, the methodology combines multiple analysis. From the perspective of stakeholder analysis, "Plug-in Design" seems to provide new work and life opportunities for local residents, improve living conditions, narrow the gap between the rich and the poor and prevent population loss. Meanwhile, local government can also benefit from this, increase fiscal revenue and supplement governance means.

Fourthly, the plug-in is updated with time, ensuring the integration of urban space in different times. As we all know, urban regeneration is not an invariable problem. As time goes on, the space and context of the city will change. The replaceable plug-ins adopt a regeneration mode from point to area. The modular design simplifies the complexity of the process, so that it can be replaced in time at a small cost and realize organic regeneration[34]. Therefore, this methodology has the significance of survival and development in the regeneration of the old city in Guangzhou.

Shortcomings

Due to the COVID-19, some survey data of Xudi-Gaodijie area in this thesis are partly from references, and there is a lack of interviews with local residents in the field survey. In addition, the project tends to conceptual design and lacks practical feedback. The scheme needs to be improved in further practice.

The purpose of this design thesis is not to provide a solution, but to express the vision of future urban regeneration in Guangzhou by providing a "Plug-in Design" thinking. It is hoped that in the future urban regeneration, designers can make use of the progress of science and technology, pay more attention to the protection of historical context, and realize people-oriented urban regeneration.

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