专业学位硕士学位论文

Weaving as an urban design analogy:

the potential of urban leftover spaces

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论文提交日期	2023 年 2 月

Abstract

Cities always carry the wealth of human beings during the dynamic development. Containing the material elements and the spiritual ones, cities provide human beings with a good and comfortable living environment, a convenient and accessible transportation network, sufficient job opportunities, diversified and rich recreational activities to the greatest extent. In addition, Urban space always records the history of human society, contain the concentrated memory of the times, and describe the unique humanistic color. Urban land resources are precious, with the vacancy of urban development, the change of urban functions, the omission of urban space management, the complexity of land ownership and other issues, China's urbanization process has gradually shifted from incremental development to stock development. Under this background, the development of urban leftover spaces is imperative.

How to improve the urban leftover spaces with new urban functions, how to better integrate the urban context and social life into the urban leftover spaces, and how to retain its historical memory while activating its potential and rejuvenating its vitality are topics to be discussed urgently. So far, many theories have been put forward. The “Weaving” concept emphasizes the integrality, coordination, pluralism, dynamics and context of the city. The scope of it has expanded from urban spatial field which mainly focuses on the historical urban area and block to the scope of the overall urban system. Therefore, its universality has gradually improved. The “Weaving” of urban leftover space is one of the ways to redevelop urban space.

Taking urban leftover space as the research object, this paper explores the “fragmentation” of urban leftover spaces from different perspectives. Under the concept of the “Weaving”, combined with relevant methods and theories, applying with multi-level research, comprehensive analysis, literature collection, field investigation, quantitative and qualitative analysis and other methods, this paper discusses the coupling relationship between the “Weaving” and urban leftover space, injects the core design principles of the “Weaving” including coordination, diversity, dynamic, gradualism, Contextualism and humanism, into the updating of urban leftover space, summarizes and refines the urban design methodology

of “supplement - connection - growing – fusion” for urban leftover space, so as to stimulate the space potential and guide their growth, providing new ideas for urban design.

With the help of GIS technology, based on field investigation and other methods, this paper carries out quantitative or qualitative analyses on the Guangzhou Racecourse, and applies the theoretical research to it. In the research, the function, traffic system, open space, green space, spatial form, building status and context are analyzed at the hierarchical level, the potentials of different urban leftover spaces are evaluated, and different spatial reuse modes are applied, then the problems are extracted and the opportunities and challenges are analyzed. Finally, the orientation, goals and the weaving strategies of the racecourse are formulated. The purpose is to improve the integrality between the racecourse plot and the city, link the initial racecourse memory, the change and the future functional orientation, revive its vitality and continue its context.

Key words: Weaving; Urban leftover space; Urban design; Design strategies

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Chapter1 Introduction

1.1 Research background

1.1.1 The stock-based urban planning process in Chinese megacities

In the background of transformation and development at the “New Normal” stage, urban problems have emerged due to the rapid and extensive development of cities for a long time. Due to the functional duplication, dislocation, redundancy and idleness of urban spaces, urban leftover space inevitably appears. Since then, the Central Government issued corresponding policies of “Activating the stock and strictly controlling the increment” to encourage progressive and connotative development. In 2015, after the policy of “Ecological Restoration and Urban Repair” was put forward, the development further entered the stage of stock optimization. China's urbanization has entered a new period of inventory development. Urban construction is no longer limited to demolishing the old and building new ones. The focus has gradually shifted to explore how to improve urban public services, the ecological environment, the traffic systems and how to continuously promote land increment and industrial upgrading.

1.1.2 Fragmentation due to rapid urbanization in China

In the 1970s, Colin Rowe evaluated and summarized the modernist urban construction after the second world war with collage city. At the end of the 20th century, Reform and Opening up have significantly improved China’s productive forces, the urbanization process has been accelerating, industries have continued to expand, and cities have sprawled a lot. With the top-down planning, many modern urban areas have been created, which have many similarities with the rapid urbanization stage in Europe and the United States. With the development of society and the passage of time, the results of rapid development cannot match the contemporary needs, The sprawl of cities has made cities fragmented. In the 1990s, the concept of Weaving was introduced into China. How to solve the “fragmentation” problem of cities with an integrated and systematic thinking is an important proposition.

1.1.3 Urgent demand for updating urban leftover spaces

The urban problem is not only limited to the fragmentation problem. The current city is also facing challenges such as the increasing urban population, the limited urban resource capacity, the constantly encroaching on agricultural production space and the natural ecological environment. One of the reasons is the large amount of urban leftover space. Urban space

with high quality and high utilization rate is a response to the intensive use of land resources and natural resources. The reuse of urban leftover spaces can increase the utilization rate of urban land, turns urban leftover spaces into meaningful spaces, which is an effective means to improve the operation quality of urban systems and intensively utilize urban space, and an urgent demand for urban development.

1.2 Research purpose and significance

1.2.1 Purpose

Urban leftover space to some extent can stimulate the upgrading of the city, and it is also the key to enhance the vitality of the city, improve the living environment and continue the urban context. The research purpose is to analyze the leftover state of urban space, explore the coupling relationship between its upgrading mode and the “Weaving”, stimulate the potential of reutilization, supplement the mechanism of space upgrading, then, construct a “Weaving” framework of urban leftover space in terms of evaluation and implementation, and apply it to the site of Guangzhou Racecourse, trying to realize the integrated, diversified and gradual upgrading, continuing the memories of the Racecourse and inject new vitality.

1.2.2 Significance

1. Theoretical significance

The international community has a negative attitude to the sprawl of cities, opposes the large-scale demolition and construction mode in urban renewal, and emphasizes the importance of small-scale gradual renewal of and the people-oriented urban design values. However, the number of studies on urban leftover space renewal from the integrated and dynamic perspective is still small. At the same time, China's current relevant research on the “Weaving” focuses on historic cities, historic blocks and some industrial heritage areas, and less research is involved in the upgrading of ordinary urban leftover spaces, ignoring the important relationship between the “Weaving” and urban leftover space.

This study takes “Weaving” as the guiding concept and the urban leftover space as the research object, combining with the theories and methods relevant to “Weaving” methodology and space potential evaluation, explores the coupling relationship between “Weaving” and urban leftover space, which is helpful to expand the research content and provide a new perspective of urban design in the stock developing period.

2. Practical significance

With the development of China's cities, the rapid urbanization process and the concentration of resources in mega cities, urban problems, especially those in big cities, have gradually become prominent, and the urban space in the leftover state is increasing rapidly. In addition, with the transformation or upgrading of some urban functions, or the transfer of functions between different regions of the city, the reuse of urban leftover spaces is particularly important. At present, there are a great number of leftover spaces in Guangzhou, and their reuse plays a great role in improving the quality of the city, the efficiency of the various urban systems. This study selects Guangzhou Racecourse, the combination of urban leftover spaces, explores how to redevelop it under the perspective of “Weaving” with analysis, evaluation, design and implement strategies, treating it as a part of the urban skeleton promoting the growing and fusion of the whole city. It will help to solve the existing problems in the Guangzhou Racecourse, achieve the goal of integration and coordination, dynamic and graduality, continue the context and stimulate the vitality of urban life, providing a reference for the reuse of leftover spaces in other cities in terms of ideas and strategies.

1.3 Research object and scope

1.3.1 Object

In a broad sense, the research object is the urban leftover space, which is a leftover state of urban space. It is generally embedded in or adjacent to the mainstream urban space, and usually presents the characteristics of leftover, abandonment and lack of vitality. It lacks attraction to urban residents and is gradually ignored by people. Depending on the existing theories of urban leftover space, the spaces include unused and non-functional idle spaces; Abandoned spaces; Planned but undeveloped spaces. To make the definition of urban leftover space more explicit in this paper, the urban leftover spaces are defined as constructed but idle urban space in the current space-time, with redevelopment potential.

In a narrow sense, the research object of this paper is the Racecourse in Tianhe district, Guangzhou City, China. It is located on the east side of the central business district of Zhujiang New Town, overlooking the Pearl River in the south, adjacent to the west side of Guangzhou International Financial City and the south side of Wushan Higher Education district. It has undergone multiple rounds of functional replacement and is a characteristic combination of leftover spaces in the urban space of Guangzhou.

1.3.2 Scope

1. Space scope: The main design scope extends to Huangpu Avenue in the north, Huacheng Avenue in the south, Machang West Road in the West and Tancun Road in the East. In addition, in order to strengthen the connection between the racecourse and the surrounding blocks, some design suggestions are put forward for the urban leftover spaces in the east and west direction, which is west to Machang Road and east to South China expressway. (Fig 1-1)

Fig 1-1 The space scope (Source: Drawn by the author, Based map from Google Earth)

In addition, the main evaluation scope is divided into three levels: The first scale (Site-scale) is consistent with the design scope. The second scale (Block-scale) ranges from Liede Avenue in the west, Tianhe Road and Zhongshan Avenue in the north, Linjiang Avenue in the south, Tianfu Road and Yuancunerheng Road in the East. The third scale (District-scale) extends to Guangzhou Avenue in the west, Guangyuan Expressway in the north, the Pearl River in the south, and Fengye Road, Tianhe Park and Yuancunerheng road in the East, covering the southwest of Tianhe district. (Fig 1-1)

2. Time scope: Due to the diachrony of urban development and the dynamic of urban leftover spaces, from the perspective of time, the research scope starts from the first round of life cycle of Racecourse development in 1993 to today.

1.4 Research contents

This research studies the proposal, strategies and new trends of the “Weaving”, classifies and summarizes the problems of urban leftover spaces, and builds a framework for urban leftover space renewal under the “Weaving” by exploring the coupling relationship between “Weaving” methodology and the urban leftover space with the help of relevant theories, research and case

experience. In addition, the paper applies the methodology to the Guangzhou Racecourse, and a qualitative analysis carried out on the plot to extract the problems, and the space potential analysis of the leftover spaces in the racecourse was carried out in combination with the quantitative evaluation method to guide the weaving strategies.

1. Research on urban leftover space: The research includes the interpretation of the relevant concepts of urban leftover space, the discussion of the leftover state of urban space, the classification of the space in the leftover state according to the scale, spatial form, material elements and function types of surrounding area, and the analysis of the problems existing in the current urban leftover space and the problems in the reuse of the leftover space, including the "fragmentation" phenomenon, low vitality, unsustainability, lack of Genius Loci, etc.

2. Research on "Weaving" concept: Through the interpretation "Weaving" concept, this paper sorts out the development process of existing "Weaving", understands the basic principles of "Weaving" which include the Integrality and Coordination, Complexity and Diversity, Dynamics and Graduality, Historism and Humanism. To provide ideas and inspiration for the updating of urban leftover spaces, the paper interprets the "Weaving" strategies, summarizes the multi-level weaving elements contained in the city, studies the purposes and mechanism of "Weaving". In addition, to adapting "Weaving" concept into contemporary Chinese context, this part also explores the new trends of "Weaving".

3. Research on the "Weaving" framework of urban leftover spaces: Based on the first two parts, this paper seeks the coupling relationship between the "Weaving" and the concept of urban leftover space, explores the methodology of the "Weaving" in urban renewal, including analysis, evaluation, design and implementation, and considers the weaving characteristics of urban leftover spaces and their "Weaving" effect on urban space. Combined with the relevant case experience, this part builds a "Weaving" framework of urban leftover spaces which is the "Supplement – Connection – Growing - Fusion".

4. Application in the Guangzhou Racecourse: Taking Guangzhou Racecourse as the practical space, according to the "Weaving" framework formed in the third part, the basic investigation and potential evaluation of the plot were carried out. On the basis of background analysis, firstly, "Weaving" elements are invested at three levels: district scale, block scale and site scale. Secondly, this paper analyzes the problems of the Racecourse about three aspects of "Weaving" elements. Thirdly, the quantitative space potential evaluation of Racecourse is carried out with the help of Analytic Hierarchy Process and Geographical Information System.

Through qualitative and quantitative analysis, the problems of the Racecourse are extracted. Finally, through the analysis and evaluation of the current situation, the corresponding “Weaving” strategies are proposed, including the “Weaving” about function, public space, traffic system, texture, spatial form, context, etc.

1.5 Research methods and framework

1.5.1 Methods

1. Multi-level research method: The urban leftover spaces are widely distributed with many types, and the city is a complex organism with multiple elements and systems. These characteristics determine that in the research, we need to consider the relationship between various elements and use multi-level and multi angle research methods to analyze and solve the problem.

2. Comprehensive analysis method: There are many elements in the complex system of the city, involving the linkage of multiple disciplines. Therefore, this study should use the comprehensive analysis method from the perspective of multi-disciplinary to integrate the theories. And design with a holistic thinking.

3. Literature collection method: By consulting, collecting and summarizing relevant theory and research literatures on the “Weaving” concept and Urban Leftover Space, we can accumulate the theoretical development trends and achievements in this field and build a systematic knowledge framework.

4. Field investigation method: This study conducted a field survey on the research objects and collected first-hand information by taking photos and interviews, investigating the characteristics, utilization, scale and surrounding environment of different spaces in Guangzhou Racecourse to ensure the authenticity of the investigation and the objectivity of the results.

5. Qualitative and quantitative analysis

To realize the combination of qualitative and quantitative analysis. The study is based on the relevant theories of “Weaving” and Urban Leftover Space, combined with the experience of practical cases, to provide theoretical basis. The results of Internet data and field research are used as the basis for research and analysis, and relevant information is digitized and illustrated, making the research results more reasonable and intuitive.

1.5.2 Framework

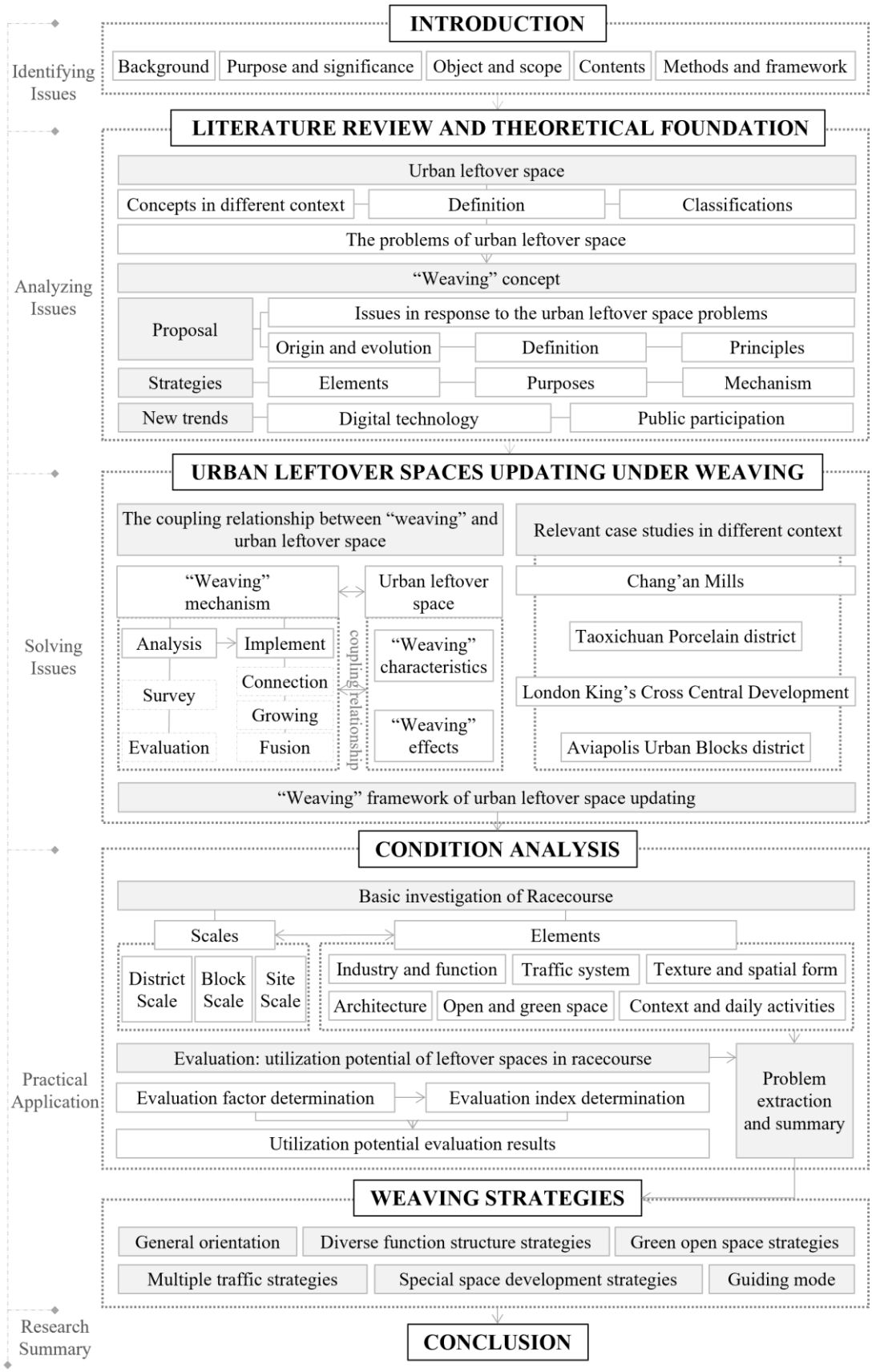


Fig 1-2 Research Framework (Source: Drawn by the author)

Chapter2 Literature review and theoretical foundation

The design and renewal of urban leftover space not only requires designers to explore the value and potential of the space, but also to inject new vitality into the space in the design process and implementation process, meet the needs of service subjects, especially urban residents, and improve the overall quality and efficiency of urban organisms.

After scholars recognized this need, many issues came into being. As a concept with holistic thinking, “Weaving” provides a redevelopment way of urban leftover spaces, and its continuous evolution provides a theoretical and strategic basis for urban design and renewal. Combined with the current new trends of urban design, the design update can be more scientific.

2.1 Urban leftover space

2.1.1 Concepts in different context

Since the end of World War II, the developed countries in Europe and America had entered a rapid post-war reconstruction period. Due to the rapid development of urbanization and the need of industrial agglomeration, the emergence of large-scale buildings, high-density residential areas, and central business districts had replaced the original human-scale urban space. Functionalism had become the mainstream of urban construction. In this context, there were a lot of leftover spaces with low utilization and long-term idle state in the city. Since then, there had been many studies on urban leftover space. (Table 2-1)

In *The Death and Life of Great American Cities*, Jane Jacobs mentioned similar concepts such as Dead Space. Most of these spaces are formed at the junction of different regions, lack of vitality. They are the edge of cities, which may further lead to the decline of surrounding areas [31].

Yoshinobu Ashihara proposed the concept of Negative Space in *Exterior Design in Architecture* and explained it with many cases and illustrations.

In 1984, Bernardo Sage, an Italian urban planner, pointed out that large voids were being formed in European cities, and believed that they were interrupted or difficult to cross. It is an eyesore, a vague transitional phenomenon that will end sooner or later [22].

Roger Trancik put forward the concept of Lost Space in *Finding Lost Space: Theories of Urban Design*, and formed the Figure-ground theory, Linkage theory and Place theory.

At first, the attitude towards urban leftover space was pessimistic. For example, Ray M. Northam emphasized the desolation of urban leftover space, Greenberg and others regarded urban leftover spaces as an urban epidemic.

With the development of the times, western cities generally reduce the speed of urbanization, the impact of urban environment on people seemed to become more and more huge, the potential of urban leftover space is gradually discovered. Loukaitou Sideris. A discussed the responsibilities of urban designers in transforming and updating the leftover spaces. Karen A. Franck and others explored how the creativity of urban residents has a positive impact on the urban leftover spaces.

In 2012, Nipesh explored the causes of urban leftover space, which can be summarized as: Wrong decision-making in urban planning; Functional degradation; Geographical features or natural disasters. Azhar and Gjerde sorted out and classified the urban leftover spaces, and formed six types to guide the spatial updating and optimization.

In addition, many countries or cities had noticed the potential of urban leftover spaces and started to update and optimize the spaces. For example, Mauel de Sola Marales formulated an urban regeneration strategy for Barcelona, making the urban leftover space a meaningful place.

Table 2-1 Relevant concepts in developed countries

Theory advocate	Year	Specific terms	Examples	Characteristics and evaluation
Jane Jacobs	1961	Dead space	Regional junction, Artificial boundary	Single use, insufficient space vitality, and may lead to the waste of surrounding areas.
Yoshinobu Ashihara	1975	Negative space	Diffusive area	It is generally a space with no plan and no clear purpose, and the opposite is a positive space.
Roger Trancik	1986	Lost space	Abandoned Waterfront, Regional junction	Underutilized and decayed space.
Greenberg	1990	TOADS (Temporarily Obsolete Abandoned Derelict Sites)	Marginal zone, Regional junction	A new urban epidemic.

Table 2-1 Relevant concepts in developed countries (Continued)

Theory advocate	Year	Specific terms	Examples	Characteristics and evaluation
Ignasi de Solà-Morales	1995	Terrain Vague	Marginal zone, Area with no activity	Fragments, Indefinite spaces, spaces with uncertain borders, spaces on hold, spaces of great potentials, poetic spaces, marginal spaces, abandoned spaces, obsolete and no productive spaces.
Loukaitou Sideris A.	1996	Crack	Space with material decay or value decay	Fracture and discontinuity encountered by cities in physical and social environment.
Groth&Corjin	2005	Intermediate space	Space between boundaries	It is in an abandoned state in terms of use function.
Crisman	2005	Sites out of sight	Spaces under the elevated road	The gap between things. And there are conflicts in scale or use.
Karen A.Franck	2007	Loose space	Space with no activity	The continuous richness of urban public life is created and maintained by people themselves, and people are encouraged to carry out various public activities in loose spaces.
Doron G.	2008	Dead zone	Abandoned industrial area, Abandoned port	Abandoned or occupied, the quality of the space is uncertain.
Carmona	2010	Residual space	Neglected community activity square	Environmental degradation due to lack of maintenance and management.
Akkerman and Cornfeld	2010	Fortuitous leftovers	The edge of the parking lot, Abandoned yard, Desolate Lane	Planned urban voids: Deliberate urban design. Mainstream urban space; Fortuitous urban voids: Outside the mainstream urban space, the unplanned space scattered in the city, sometimes regarded as abandoned space.
Kamvasinous	2011	Vacant urban land	Vacant urban land	Usually related to land use. Most of them are undeveloped idle land.
Azhar and Gjerde	2016	Leftover space	Area with Functional replacement.	Areas that have not been effectively utilized at present, such as the space with the uncoordinated development mode; These spaces are often not officially used, underutilized, or used informally.

In China, due to the difference in development stages between China and Western countries, the research on urban leftover space started late and has a certain lag. Most of scholars researched and analyzed on urban leftover space after learning from the experience of other countries. (Table 2-2) For example, In 2005, Wang Jianfeng explored the urban "Lost space" in Shanghai in *the preliminary study on the Urban Lost Space in Shanghai*, and studied the reasons and characteristics of its formation, as well as the relationship between the lost space and the urban spatial structure or the urban development stage. However, he lacked specific exploration on the renewal mode of the lost space. Li Xiaodong and Zhang Ye evaluated urban spaces again, reflected on urban space issues and urban development process from the concept of urban leftover space, and interpreted the two sides of it. Wei Chunyu interpreted

the activation of urban free space and believes that urban free space has great potential and is an activation point in urban regeneration and development [73]. Feng Ye and Wei Chunyu, in *Research on Leftover Spaces in Urban Street*, investigated and studied the leftover spaces of urban street, put forward feasible design framework and methods.

In *Residual Space – A Spatial Research Framework of Superimposed Keywords*, Liu Kenan studied the possibility of designing urban residual space from the perspectives of "Architecture Urbanism" and "Urban Architecture", made a specific exploration on the renewal methods of residual spaces.

Tian Changfeng investigated the Nanxue Street - Pingping Street block in Guancheng district of Zhengzhou City, focusing on the old streets of the city. He believed that the reason for the formation of residual space was the fragmentation of public space and the low utilization rate.

In addition, some scholars have studied the urban leftover space with the help of other theories. Huang Rui introduced the catalyst theory into the revitalization of the leftover space of old towns. Based on typology, He Wen studied the scattered urban leftover spaces and put forward the framework and strategies for fine development. Liu Qianru studied renewal of urban space with the help of Temporary Use theory. Zhu Weiqi updated and designed the urban leftover spaces from the perspective of sustainability. In the past two years, the research on urban leftover space has focused on the specific renewal and transformation mode of site urban leftover spaces. Yang Han, Jiang Shan and others have made a detailed study on the utilization of the leftover spaces under the urban three-dimensional traffic space.

Table 2-2 Relevant concepts in China

Theory advocate	Year	Specific terms	Definition
Wang Jianfeng	2005	Lost space	Urban space that has not been fully utilized. They are always negative, inevitable (the space that must exist in the city to maintain normal operation or the space that must be generated due to imperfect development), dynamic and available.
Li Xiaodong and Zhang Ye	2009	Leftover space	Belonging to the category of urban space, it is a state of urban space, rather than a specific spatial form. It belongs to the leftover and abandoned part of the city and is the secondary space in the city. To a large extent, it represents the ambiguity of perception, the lack of social relations, the loss of cultural context, the rupture of natural ecology, and the damage of urban residents' living experience. Its utilizability makes its potential very important to the city.
Tian Changfeng	2016	Residual space	The concept comes from *Complexity and Cons tradition in Architecture*, the space is always an additional space between the lining and the exterior wall.
Wei Chunyu	2017	Free space	The space that is neglected, abandoned, or left by the user, and cannot fully and reasonably play its potential value.

Through the research and summary of urban leftover space in different context, it can be found that leftover space is not a specific single term. It exists in many formal or informal fields. In countries where the study of leftover space started earlier, many theory proponents have different definitions of leftover space, but their description objects have similar characteristics. In China, the definition of leftover space is also roughly the same. Overall, the term “Urban Leftover Space” emphasizes that the space is not fully utilized, neglected or forgotten.

In general, with the continuous development of cities, more and more attention has been paid to the stock space in cities. As the product of the continuous change of urban space, urban leftover space is no longer suitable for the current urban functions or the needs of citizens. The urban leftover space usually causes some urban problems more or less because of the mismatch with the current urban functions, which is usually reflected in the problems of road traffic connectivity, non-motorized traffic environment quality, existing building quality, public space environment, matching degree of space and function. Currently, the renewal of urban leftover space is actually the improvement and solution of urban problems.

However, on the other hand, urban leftover space contains the potential to improve urban quality and system efficiency. The improvement of urban system efficiency requires a certain space carrier, which usually exists in the urban leftover space under the background of stock development. Then, the updating and renewal of urban leftover space is actually the optimization of the whole city.

2.1.2 Definition refinement

Based on the viewpoints on urban leftover space in the field of architecture or urban planning under different backgrounds, this paper believes that Urban Leftover Space is embedded in or adjacent to the mainstream urban space, which belongs to the category of urban space and is an existing state of urban space. It usually presents the characteristics of being leftover and abandoned, often accompanied by the lack of place spirit, lack of social life, poor ecological environment, and loss of context. On the other hand, although the status quo of leftover space is negative, it has a positive side. It carries the potential of urban space redevelopment, which is also its greatest value. In addition, driven by urban development, some urban leftover spaces are constantly evolving due to informal use, which to some extent also carries the memories of cities or communities.

2.1.3 Classification

The dynamic and inevitability of urban leftover space determines that its classification can be time dimension, while its availability and negativity determine that its classification can be space dimension. Based on the reference system classification of Liu Kenan and the spatial dimension analysis method of Zhu Weiqi, this paper classifies and expounds the urban leftover space in terms of time and space. (Fig 2-1)

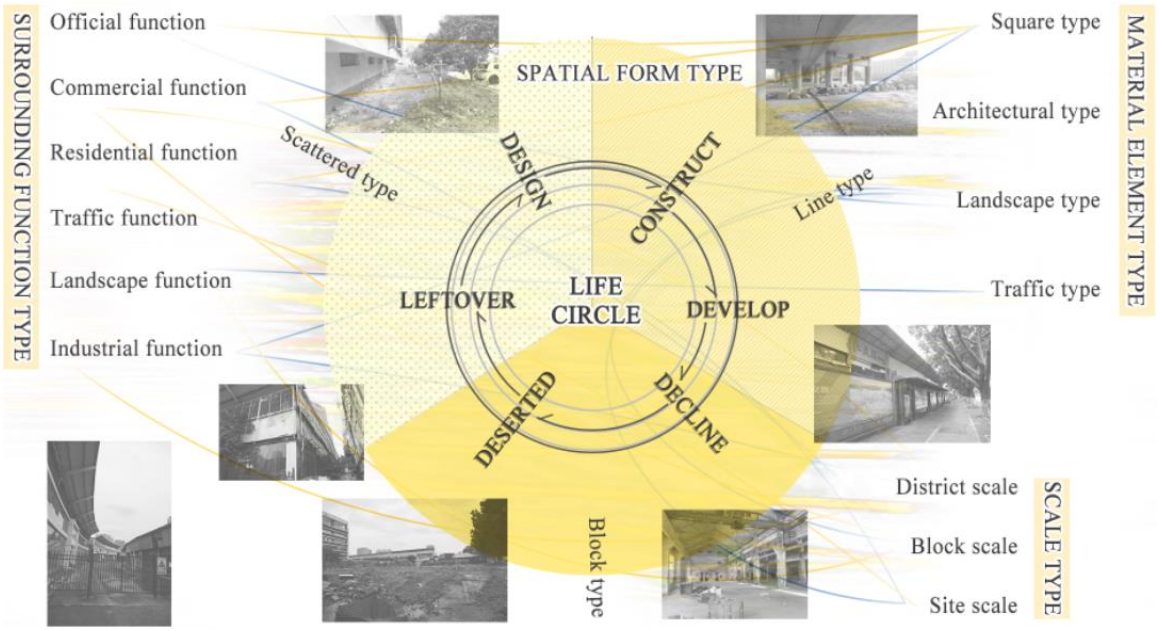


Fig 2-1 The classifications of urban leftover spaces (Source: Drawn by the author)

The development mode of a city is a collage type development. The development in different time and space will cause poor coordination and integrality between different regions, and such urban space will become the urban leftover space. In addition, each area of the city itself will slowly become leftover space with the passage of time and the development of the city or change from urban leftover space to use space. The definition of "Leftover" has obvious space-time and dynamic color, and its leftover states are difficult to be unified from the same time dimension. Both urban architecture and urban space are experiencing the cycle of “blank – design – construction – growth – decline – deserted...” all the time. While the leftover space stage is a stage in a spatial cycle, it is also a great opportunity to reuse, supplement the urban skeleton and improve various urban elements.

If it is necessary to upgrade and optimize the urban leftover spaces at the urban design level, the classification and elaboration of the spatial dimension is essential. The classification of urban leftover space can be carried out in terms of scale type, material element type and surrounding function type:

Table 2-3 The classifications of urban leftover spaces

Spatial form type	Characteristics	Material element type	Examples	Characteristics
Scattered type	The spatial area of this type is small and distributed in a dot shape.	**Square type**	community squares, open spaces in front of the building	Poor activity conditions, low utilization rate, poor landscape environment, lack of facilities, and outdated facilities due to lack of management.
		Architectural type	abandoned buildings, building roofs, spaces beside the buildings	Abandonment of building space due to functional decline or replacement; In addition, it also includes the building roof, the building's public space or the narrow area around the building.
		Landscape type	vest-pocket parks, sight furniture groups	The community level landscape is in a state of low utilization and waste due to problems such as location and landscape quality.
		Traffic type	small parking lots	With tidal characteristics, the space is vacant in some periods of a day due to the function of the surrounding area.
Line type	The spatial area of this type is narrow and linear	**Traffic type**	alleys, abandoned roads, spaces under overpasses, spaces on both sides of rail	The idle state caused by the lack of reasonable utilization means and unreasonable distribution of street rights. Their walking or cycling experience is generally poor.
		Landscape type	dike, river beach and greenway	Most of them are natural or man-made landscapes around the water system, which are idle and abandoned due to lack of reasonable design or lack of maintenance and management.
Block type	The spatial area of this type is large and occupies more urban space	**Square type**	city level squares, squares in front of the building, large outdoor sports grounds	There are no good activity conditions, with lack of reasonable design, poor landscape environment or poor facilities, and the space is idle and abandoned due to function decline or replacement.
		Architectural type	industrial buildings, large factories, large sports buildings	Most of them are in industrial areas and old urban areas. Due to the development of the times, the changes of urban functions and the decline of their own functions, the building space is idle or decayed.
		Traffic type	large ground parking lots	With tidal characteristics, the space is vacant in some periods of a day due to the function of the surrounding area. It is large in scale and has a great impact on the ground environment.

1. Spatial form type: As for the spatial form types, they can be divided into Scattered type, Line type and Block type. Scattered type urban leftover spaces are usually attached to other architectural spaces and closely related to people's daily life. This type usually has a large number in cities with small characteristic, generally due to the fragmentation of public open space organization. Line type urban leftover spaces are often accompanied by water system and linear transportation infrastructure, including some abandoned alleys, whose distribution characteristics in the city are obvious, and their locations are always uncertain. However, the length of two vertical directions of the Line type space has a large drop, which is usually used as a passage through the space. The existence of block type in cities is usually due to the decline and abandonment of the original planned functions, such as abandoned factory land, large-scale commercial facilities with backward functions, large-scale sports facilities, etc. Urban leftover spaces of Block type usually cover a large area, have obvious characteristics, and carry the memories of a certain group in the city. (Fig 2-2)

a) Scattered type b) Line type c) Block type

Fig 2-2 Urban leftover spaces of different spatial form types (Source: Baidu image)

2. Scale type: It can be divided into district, block and site scale types. The district scale generally includes a large area of abandoned land or vacant land in the city, such as abandoned industrial areas, abandoned developed lands, urban spaces to be developed, etc. The block scale generally includes a medium area of idle land or abandoned land, such as the square in front of the building, the spaces at the bottom of the elevated, the deserted waterfront spaces, etc. The site scale generally includes small-area dot spaces and linear spaces, such as deserted street spaces, inter building space, deserted lane, etc. (Fig 2-3)

a) district scale b) block scale c) site scale

Fig 2-3 Urban leftover spaces of different scale types (Source: Baidu image)

3. Material elements type: According to the material elements that are easy to become urban leftover space in the city, it can be divided into square type, building type, landscape type and traffic type. The square type usually includes city level, community level squares and squares in front of buildings. The building type usually includes abandoned buildings, abandoned building roofs, and spaces adjacent to buildings. Landscape type usually includes abandoned spaces in natural or artificial landscapes. The traffic type usually includes the surrounding of large-scale traffic infrastructure such as wide roads, rail transit, urban viaducts, or deserted lanes and lanes. (Fig 2-4)

a) square type b) building type c) landscape type d) traffic type

Fig 2-4 Urban leftover spaces of different material element types (Source: Baidu image)

4. Surrounding function type: due to the mode of functional zoning in the rapid urbanization stage, the existing urban leftover spaces are usually located in an urban area with a dominant function, and its urban vitality, community relations, land rent value and other characteristics are significantly different. It usually includes industrial area, office area, residential area, commercial area, landscape area, etc. However, different regional function types cannot completely dominate the vitality of the plot and community relations. Therefore, this type is used as a secondary classification method in this study.

2.1.4 The problems of urban leftover space

1. Urban “fragmentation”

The urban leftover spaces, especially the block type space, because they always cover a large area and are in the decline or deserted stage of the space life cycle, their spatial organization generally do not adapt to the needs of the current era, most of them have damaged the integrality of the city and caused the “Fragmentation” phenomenon. To a certain extent it usually causes problems such as splitting the urban road traffic network, disconnecting the urban ecological landscape, and affecting the coordination of urban scape. In addition, it also causes the fracture of non-motorized traffic paths and the degradation of the quality of living environment.

2. Lack of urban space vitality due to lack of function or single function

Urban leftover spaces usually exist in cities in a state of decline and idleness. On the one hand, they cause a waste of urban space resources. On the other hand, their use value, economic value, ecological value and cultural value cannot be developed. Generally, the spaces without function only have the attribute of “existence”, and the space without bearing function always accompanied by “zero urban vitality”. There are also some spaces with a single function, which gradually decline due to the demand of the city for functional diversification, and a large part of them have become parking lots. In addition, these urban spaces will give birth to some informal activities and functions. These activities and functions also have a strong dual nature. On the one hand, they can reflect the current social activities and functional needs. On the other hand, due to their informal nature, the lack of supervision makes these informal urban spaces have some hidden dangers.

3. Poor living environment quality due to lack of property management and maintenance

Because of the lack of capital investment and the confusion of governance rights and responsibilities, the urban leftover spaces usually have a lack of management and maintenance, which have caused the problems of overgrown weeds, dilapidated buildings and other environmental deterioration to varying degrees, and further caused the consequences of low attention, falling into a vicious cycle.

4. Poor city scape and spatial image caused by decline

Due to the lack of management and maintenance of urban leftover spaces for a long time, they have a great impact on the image and scape of the city, especially in the densely populated places in the core area of the city, whether from the perspective of architectural space or open space. Because of the problems of land property rights and other factors accumulated over the years, there are many problems such as the setting of private fences and passage obstacles, which also have a negative impact on the urban street interface. In addition, due to the addition of informal functions, such urban leftover spaces have problems of illegal reconstruction, addition and expansion to a certain extent, and lack strict control due to its decline.

5. The lack of Genius loci caused by the backwardness of space publicity

The shared public space in the city is an important carrier for the daily public life of urban residents. The existence of urban leftover spaces has to a large extent led to the lack of public space that can provide good daily activities and social contact. At the spiritual and cultural level, the backwardness of space publicity has led to the lack of place culture, affecting the

historical context of the city and the diversity of urban life. On the other hand, due to the abandoned state of the urban leftover space and the lack of social bond based on public activities, urban residents can not develop a sense of identity and belonging to the urban space, causing a lack of unique memory of the space. Finally, it will lead to the spiritual loss of the Space Center

2.2 Proposal of "Weaving"

2.2.1 Issues in response to the urban leftover space problems

After the 1940s, due to the rapid urbanization of modern cities and the sweeping of functional urban planning, many problems of urban fragmentation had arisen. With the passage of time, people with insight in various fields had realized that cities were not cold machines, but emotional organisms. The optimization of urban built environment had become the research focus. The demand of urban residents for the urban environment had been upgraded from material demand to spiritual demand, more and more consideration should be given to the urban context and urban life.

In order to alleviate the problems of urban "fragmentation", low spatial vitality, poor living environment, decline of city scape, and loss of urban context, scholars had been studying in the issues about urban problems, urban development values, and urban revitalization paths since the 1960s.

In 1961, Jane Jacobs criticized the large-scale and mechanized urban construction mode, believing that such mode would make the dynamic buildings, blocks, urban space and urban culture disappear and form a fragmented city. She believed that cities need diversity and complexity and put forward three urban renewal strategies from the perspective of Sociology: (1). Ensure the mixing of two or more functions; (2). Integrate into the original spatial texture of the city; (3). Ensure the diversity of buildings and make new and old buildings coexist.

In 1967, American architect John Portman's "Urban Weaving" theory put forward that urban renewal was to implant new elements into the old urban texture, to make the old and new buildings coexist. From the standpoint of whole city, the theory pays attention to weave the relationship between the form, scale, texture, materials and other elements of the architectural group, so as to make it have internal unity and thus create an integrated organic city [42].

In the 1970s, Barcelona's industrial industry was declining, and the central area of the city had problems such as environmental pollution, anti-urbanization, and the surge of unemployment.

In 1976, Barcelona proposed the “City restart plan”. A series of small-scale public space renovation projects, such as small parks and squares, were included in the government-led urban renovation and renovation. Through this series of projects, the vitality of Barcelona had been reinvigorated. Against this background, Manuel de Sola Morales, a Spanish architect and urban research expert, put forward the Urban Acupuncture in 1982. He believed that the surface of the city was like a layer of skin, which would be affected by intervention and strategies. In Urban Acupuncture, determining the sensitive points was the first step. In addition, Urban Acupuncture focused on the strategic, systematic and relevance of the city. Urban Acupuncture regards the city as an organic whole, emphasizing that site-intervention can bring a positive effect on the whole urban organism, and that the superposition of various site-intervention measures can produce a more effective comprehensive result. Its object can be a building, a landscape, or events and activities contained in the urban space. The ultimate goal is to regulate the metabolism of urban organisms through “Acupuncture”, including urban structure, spatial texture, social economy, history and culture, etc.

In 1975, Colin Rowe wrote in *Collage City* that collage is a kind of coexistence or combination, which is a mode of understanding, thinking or an operation method, “Collage” is “A proposal for constructive dis-illusion, it is simultaneously an appeal for order and disorder, for the simple and the complex, for the joint existence of permanent reference and random happening, of the private and the public, of innovation and tradition, of both the retrospective and the prophetic gesture.” [58]. To the field of architecture and urban design, “Collage” is a modified architectural language. He used “Hedgehog” and “Fox” to describe the design attitudes of architecture and urban design, proposing to carry out urban renewal and construction relying on “Collage”, explore the use of contextualism to weave the city, understand the western city as a combination of small harmonious environments composed of some building blocks and the intentions of different buildings often conflict with each other, which forms the final picture.

The concept of Urban Catalyst was first put forward in *American Urban Architecture - catalysts in the design of cities* published by American scholars Wayne Atton and Donn Logan in 1989. They believed that the European design concepts in the United States at that time lacked regional characteristics. They introduced the concept of “Catalyst” in chemistry into architecture for the first time, put forward the Urban Catalyst Theory. They believed that reviving the urban center with the help of new elements would not completely change the original elements but could sustainably reform the context with respecting of the urban

history.

The role of Urban Catalyst is to stimulate the driving force of continuous reaction through the access of certain specific elements, promote the interaction between new factors and existing factors, which can impact on the whole city. This impact can enhance the value of existing urban elements, make them shift to a more beneficial direction, and the impact of the catalyst can be controlled without damaging the connotation of its environmental context. In the middle and late stages of the catalyst reaction, the catalyst points are continuously combined with the surrounding urban space to produce a chain reaction, reviving the declining space in the city, and finally form a catalyst network to realize the activation of the city.

Urban Catalyst Theory has great inspiration in the redevelopment of the urban leftover space. It emphasizes the overall linkage between elements, the gradual process of catalyst reaction and action from part to the whole, the difference between various catalysts, the diversity and multi-level of the overall catalyst network, and the respect of the catalyst for the original context. The four methods of “preservation”, “enhancement”, “repair” and “creation” can be used to stimulate the catalyst reaction.

In 1987, Kisho Kurokawa elaborated the symbiosis philosophy and thinking in detail in *Philosophy of Symbiosis*, dug out the rationality and necessity of symbiosis of the multiple existences, and advocated the pursuit of symbiosis in different regional, natural cultures, etc. After the 1990s, Kisho Kurokawa developed this idea into Symbiosis Theory, which includes: the symbiosis of history and future, the symbiosis of heterogeneous culture, the symbiosis of part and whole, the symbiosis of internal and external, the symbiosis of reason and sensibility, the symbiosis of economy and culture, the symbiosis of human and nature, etc. It covers all fields of society and life, linking cities, buildings and life principles, emphasizing the symbiosis of part and whole. In urban design or regeneration, we should pay equal attention to the whole and the part, grasp the relationships in urban space with the symbiosis urban view, and promote the individuality of the city. In the urban leftover spaces, Symbiosis Theory can guide the logic of design and help grasp the symbiotic relationship of various urban elements. The redevelopment of urban leftover spaces also needs to pay attention to different systems in the city and the coupling relationship between different urban spaces. In the research stage of urban leftover space, the urban elements can be sorted out with the relationship between the local and the overall situation.

In 1986, Roger Trancik pointed out that the influence of modern movement in automobile,

architectural design, urban renewal and zoning policy, the domination of private to public interests and the change of land use in the city center had led to the loss of value and significance traditionally associated with urban open space. He also studied Gothenburg in Sweden, Washington in the United States and Byker area of Newcastle in England, and finally put forward the overall urban design principles and some key concepts of weaving up broken urban space such as orderly connected activities; Continuity of edges; Indoor and outdoor integration; Axis and perspective; Integrated bridges and others [65].

C. Alexander divided cities into Artificial City and Natural City. The former is a tree, and the latter is a semi-lattice. When the city needs complex, interlaced and fine organization. His Weaving strategy is to build a semi-lattice city and recover the vitality of the city [3]. In *The Ovegon Experience*, the principle of piecewise architecture and urban development was proposed, which approves of the value of the original buildings and denies the urban renewal method that directly erases the past [2].

Since the 21st century, some Chinese scholars have begun to realize the role and significance of the redevelopment of urban space, have studied relevant theories and concepts, and have made beneficial attempts and explorations in urban space. In 2000, in the design of Xidan Cultural Square, Shao Weiping hoped to solve the problems of isolated buildings, poor traffic, urban fragmentation, and insufficient public space in the commercial district through the repair of urban landscape, effective connection of public transport, and the stitching of urban space. In 2005, Jia Jing studied the historical value, cultural emotional value and material function value of industrial relics, and discussed the regeneration design of industrial relics. In 2015, the concept of "Double Urban Repairs" was put forward. With the vigorous promotion of the Chinese government, the research on the redevelopment of urban space showed explosive growth.

2.2.2 Origin and evolution of “Weaving”

The “Weaving” was born in the Western countries in 1960s after the criticism on the problems caused by the large-scale transformation of the United States put forward by Jane Jacobs.

By 1976, Colin Rowe, in *Collage City*, proposed to solve the problem of fragmentation in modern cities basing on contextualism and introduced the urban design method of “collage”. In the early 1990s, when East and West Berlin merged, the concept of “Weaving” was introduced for the first time to solve the fragmentation of urban environmental facilities. Until 2000, when Paris applied to host the Olympic Games, it took “Weaving City” as the slogan,

and “Weaving” gradually spread to the world and was widely used for urban renewal. Up to now, the main application fields of the “Weaving” concept have been expanding, which can be divided into four stages:

1. Transformation of urban renewal mode: In the 1960s, the budding stage of the concept of “Weaving” was actually a criticism of the urban demolition and large-scale construction mode. The diversity of the city is its essential feature, while the extensive expansion is the destruction of the city's essence. At that stage, the concept of “Weaving” was mainly used as a value of urban development, which believed that urban development should follow the essential characteristics of its diversity and guide its benign development.
2. “Weaving” of urban space texture: In the early stage of the birth of the concept of “Weaving”, its main goal was to solve the problem of urban texture and spatial form. Taking Colin Rowe as the representative, he believed that modern cities were full of contradictions and conflicts between “texture” and “entity”. More and more building entities were put into the traditional urban texture, eroding the urban organic system. In addition, John Portman believed that “Weaving city” was actually the integration of the spatial texture and spatial form of the new and old urban space. On the other hand, the “Weaving” of urban texture and spatial form also reflected the value of “people-oriented” to a certain extent, paying attention to people's spatial feeling.
3. “Weaving” of urban context: With the gradual recognition of historical and cultural protection in urban central areas, “Weaving” for urban historical context gradually began to emerge and received great support. There are many movements and manifestoes on the “Weaving” of urban context. For example, the movement advocated the revival of neighborhood blocks in the United States in 1974 ended the urban renewal act of large-scale transformation. In 1976, the *Recommendation Concerning the Safeguarding and Contemporary Role of Historic Areas* in Nairobi proposed to put historic cities under the world heritage list and protect them. In 1987, the *Charter for the Conservation of Historic Towns and Urban Areas (Washington charter)* proposed to incorporate the protection of the historic areas into urban planning. They all considered about the urban context and promoted the context weaving of cities.
4. “Weaving” of urban life: In early 1990s, the concept of Weaving was introduced into urban design in the Berlin IBA (Internationale Bauausstellung) to rebuild Berlin. That was an improvement of the living environment of urban residents. The “Weaving” was mainly

aimed at the problem of the lack of urban infrastructure.

In China, due to the different stages of social development, the study of “Weaving” began late, almost in the end of 20st century, involving architecture, urban design, landscape and so on. Zhang Jie put forward the viewpoint that “Weaving City” mainly refers to weaving life and weaving lifestyle. He proposed that “Weaving” should not be limited to architecture, landscape and other aspects, but rather a systematic weaving of the whole social life, which is weaving city [93, 96]. In addition, he proposed to look at the city from the perspective of urban residents, pointing out the “Weaving” role of urban green space for the city. Zang Jiaming et al. Studied the renewal of urban large-scale transport infrastructure and put forward the weaving strategy of embedded renewal method. Xue min summarized the elements, contents, principles and methods of weaving. Shen Ling put forward the principles and theoretical methods of weaving from the perspective of landscape. In 2015, the policy of “Ecological Restoration and Urban Repair” accelerated the pace of urban renewal, and the research related to the theory of “Weaving” increased. At present, more scholars focus their research on urban residents and apply the concept of “Weaving” to improve the quality of urban living environment based on the residents' demand.

From the development and evolution of the “Weaving”, it can be found that “weaving” focused on the respect for architecture and the traditional historical culture of the city at the beginning, and used the collage of historical architectural symbols or architectural morphology to enable the urban form to respect the past and reshape the urban context at the spatial level. The use of “weaving” was also mostly concentrated in the spaces born in the urban development process from the bottom to the top, mainly including historical cities, historical blocks, etc. With the spread and expansion of the “Weaving”, the influence has gradually expanded. After 2000, “Weaving” has changed from space weaving aspect to a mechanism or values of urban development, which is no longer limited to historical heritage space, but has expanded to include all levels of spaces in different urban contexts, which emphasizes the organic coordination of the past, the future and the present, extracts the weaving elements from the interdependent urban structure, translates and connects them, to achieve the retaining of characteristics and the enhancement of harmony, guiding the continuous interweaving and integration of new and old elements in a dynamic and progressive perspective.

The “Weaving” has gradually expanded from the field of urban spatial morphology to various

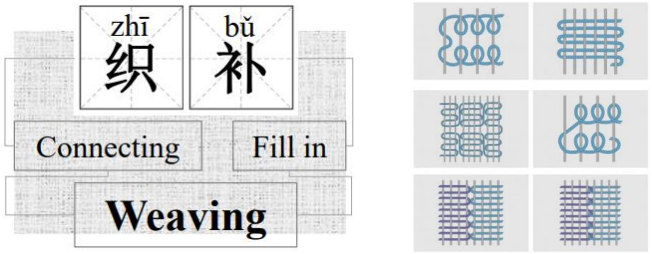
urban systems, and its research scope has also gradually expanded from the historical ancient city, historical blocks to contemporary urban regions and even the whole city. The “Weaving” not only pays attention to the weaving of urban spatial form, but also pays attention to the integration and coordination of new and old urban elements and promotes the overall urban function with its principles of integrality, coordination, graduality and dynamics.

The current urban development is seeking for more comprehensive urban renewal and urban recycling ways. The progressive design method of urban structure has been adopted by more and more urban planning and urban design projects, and the urban design strategies under the “Weaving” is an open and progressive way to solve urban problems, which are conform to the overall values.

2.2.3 Definition of “Weaving”

Weaving is interpreted as a method of textile production in which two distinct sets of yarns or threads are interlaced at right angles to form a fabric or cloth in *Wikipedia*. In Chinese, the term “Weaving” can be translated into “织补”, interpreted as “According to the original law of warp and weft interweave of fabric, repairing by yarn, thread and other materials.”. “Weaving”, Which can be separated into “Connecting” and “Fill in”, similar to the definition of weaving in English. (Fig 2-5-a)

As shown in the figure 2-5-b, different weaving methods can be selected according to the current characteristics of different original fabrics to achieve overall balance and coordination.



a) Definition b) Illustration

Fig 2-5 Connotation of Weaving (Source: Drawn by the author)

To urban design, “Weaving” is a method that advocates a holistic view and respects the existing spatial form, social groups and urban context, etc. It regards the city as an organism and weaves urban functions, transportation, public space, ecological landscape and other systems by adopting a holistic, coordinated and systematic approach to provide a flexible

optimization for urban development and change.

The “Weaving” of urban leftover spaces is to use “Weaving” as a analogy, take urban leftover spaces as the damaged parts of the fabric that needs to be repaired, select appropriate weaving techniques from a holistic perspective, implant contemporary urban development needs and citizens’ needs on the basis of respecting the original development context and history, weaving the past, present and future, making urban development traceable, and such traces can be tangible or intangible.

2.2.4 Principles of “Weaving”

1. Integrality and Coordination

The development mode of a city should be integrated and coordinated. In the process of urban renewal and urban construction, we should first make overall control over the development direction of the city at the district scale and take it as the framework of Weaving. Secondly, from the block scale, to update urban areas with fragmented characteristics, should take the development direction of the whole city as the premise, pay attention to the coordination with the surrounding urban environment, and connect various elements in the process of weaving. From a site perspective, the urban plots that need to be weaved not only need the optimizing of each weaving element, but also need the overall view, so that an orderly operating state and a coordinated spatial organization can be formed.

2. Complexity and Diversity

Complexity and Diversity are the keys to maintain the vitality of a city. In the study of postmodern urban development theories, cities should be pluralistic. This Diversity is reflected in the mixing of functions in three-dimensional space, the coexistence of blocks with different scales, the mixing of different traffic modes, the coexistence of new and old buildings, and the respect for different urban activities. The Weaving space should not only coordinate with the urban environment to weave urban functions and spaces, but also need the attention to the mixing of positive related functions, the design of buildings, road networks and public open spaces that are compatible with functions, the evaluation, analysis and disposal of existing buildings, spatial functions and the original activities, so that the new and the old elements can coexist and stimulate the vitality of urban space simultaneously.

3. Dynamics and Graduality

The development of a city is a dynamic process, and urban weaving should also be dynamic

and gradual. In the renewal activities of a city, it is important to regard the current city as a stage of urban development and attach attention to the sustainability of urban development. The dynamics and graduality determine that urban weaving needs to replace large-scale reconstruction activities with a gradual renewal model, and it is always a continuous process. With the development of city state and stage, its contents and methods should be changed accordingly.

4. Contextualism and Humanism

Contextualism and Humanism are mainly embodied in urban context and culture, city life and urban ecology which can satisfy the material needs and spiritual needs of urban residents. The historic context of a city contains great value, which reflects the city spirit and plays a great role in enhancing the cohesion and sense of belonging of urban residents. It always accompanies with historic heritages and spaces with special meanings. Thus, weaving should also continue the memories and stories of the city through the analysis and renewal. The weaving of the ecological environment also helps to improve the health level and happiness index of urban residents, including advocating green travel, creating a good urban green space system and open space system. In addition, urban culture is also reflected in the cultural activities. The process of weaving should pay attention to the diversity of daily activities of urban residents and respect the rights of different social groups.

2.3 Strategies of "Weaving"

2.3.1 Elements

Since the city is an organism composed of multiple systems and the goal of "Weaving" is to weave the whole city, the urban system involved is multi-level and multi-system. To some extent, the weaving elements are various elements of the city. Urban elements can be classified into material elements and immaterial elements according to their materiality. From the perspective of urban system, it can be divided into Urban Texture and Urban Scape, Landscape Environment, Urban Function, Traffic System, Historic context, City Life and other factors, each category can be layered from the district, block and site perspectives. (Table 2-4) In addition, due to the complexity of the city, there are also inextricable links among the various elements of the Weaving elements, which also requires the consideration of links between the various elements in the hierarchical Weaving network.

Table 2-4 Classifications of "Weaving" elements

	Element Type	Origin	Scale Type	Essential Element Subitem	Contents of Element
Material Element	**Urban texture and Urban Scape**	Jane Jacobs, John Portman, Colin Rowe, Zhang Jie	district scale	Road network form	The overall layout of urban road network, consider the impact of urban road traffic on urban form.
				City color	The overall color selection and layout mode of the city.
				Development intensity	Selection and layout of development intensity in different areas of the city, and zoning control of building height.
				Skyline	The skyline control of the main urban scape display belt and the skyline guidance of ordinary urban areas.
			Block scale	Block Scale	Proper block size road traffic division.
				Development intensity of block	Distribution mode of different development intensity zones in different urban regions.
			Site scale	Architectural scale	Guidance and control of building height and volume in different urban environments.
				Spatial organization	The organization mode of building clusters in urban blocks and the combination mode of buildings in clusters.
	Landscape environment	Roger Trancik, Zhang Jie, Shen Ling	district scale	Structure of urban green space system	Including urban ecological corridors, water systems, etc.
				Structure of urban open space system	Including urban ventilation corridor, etc.
			Block scale	Green land of block	Connectivity and hierarchical distribution mode of green spaces.
				Open space of block	Connectivity and hierarchical distribution mode of open spaces.
			Site scale	Parks	Environment quality of green landscape, etc.
				Squares	Environment quality of squares or specific activity areas, etc.
	Urban function	C. Alexander, Jane Jacobs, Zhang Jie	district scale	Land use	Overall urban land use layout.
				Industrial Structure	Layout of primary and secondary industries in different regions of the city.
				Industrial Distribution	Different industrial ratios in different regions of the city.
			Block scale	Land use	Including the main function of urban land, the functional combination and spatial matching mode of urban land.
				Structure of industrial and business types	The main industrial functions of different urban blocks, the proportion of business forms and the layout mode in three-dimensional space.
			Site scale	Architectural use	Function layout of different buildings.
				External space use	Function layout of external spaces.

Table 2-4 Classifications of "Weaving" elements (Continued)

	Element Type	Origin	Scale Type	Essential Element Subitem	Contents of Element
Material Element	**Traffic system**	Roger Trancik, Jane Jacobs, Zhang Jie, Zhang Jiaming	district scale	Overall traffic structure	Including the external traffic structure of cities such as railways, airlines and expressways, the internal traffic structure, and the connection between external traffic and internal structure.
				Road traffic structure	The structure of main road networks (expressways and trunk roads).
				Public traffic structure	The structure of main public transport networks (Urban Rail Transit, Bus Rapid Transit)
			Block scale	Road density	Road network density suitable for design road traffic speed.
				Road capacity	Suitable road capacity in different city regions.
				Static traffic	The distribution of parking lots or public transit stations.
				Public transit	Bus routes, locations of public transportation stations, etc.
				Non-motorized traffic structure	The connection of non-motorized traffic spaces in different blocks.
			Site scale	Road section	Right distribution, Space distribution, etc.
				Parking lot	Including ground parking lot, roadside parking, underground parking lot, parking building, etc.
				Public transport station	Friendly station design.
				Walking and cycling environment	Safety and environment quality of walking and cycling environment, etc.
	Historical context	Jane Jacobs, Colin Rowe, C. Alexander, Nairobi Recommendation, Washington charter	district scale	Historic urban structure	Urban spatial structure of the old city.
			Block scale	Historic urban areas	Urban spatial forms and road structure of the historic urban areas.
			Site scale	Historic architecture	Protection, repair, regeneration and reuse of historic buildings.
Immaterial Element	**Historical context**	Zhang Jie, Wang Peng	district scale	City Spirit and culture	The main spiritual and cultural characteristics of the city and the development context of the city.
			Block scale	Regional development context and culture	The main spiritual and cultural characteristics of different city regions and the development context of them.
			Site scale	Intangible cultural heritage	Cultural heritages, historical legends and Folktales, etc.
	City life	Zhang Jie	district scale	City level public activities	Sports and leisure activities, cultural activities, large-scale public activities, etc.
			Block scale	Community public activities	Sports and leisure activities, cultural activities, neighborhood performances, etc.
				Community bonding	Social relationships and contacts.
			Site scale	Daily activities	Basic daily activities according to different social groups.

When applying the “Weaving” to Urban Planning, the above-mentioned elements should be fully considered, and the Weaving elements should be analyzed in different situations, so that the city can develop comprehensively and emphatically. This study focuses on urban design, including the urban texture and urban scape, landscape environment, traffic system, urban function, historic context and city life at the block and site scale, and involves some district scale elements.

2.3.2 Purposes

1. Integrating the urban elements

The connotation of urban element integration is to connect the original fragmented urban elements with a certain medium and a certain method, so as to make the links between urban elements closer, enhance the resource synergy of the urban system, and make the city a highly efficient organism.

Due to the difference of construction period, the diachronic nature of urban planning, there are certain differences in the overall construction logics of urban planning and urban design in different periods. The difference of construction logics has caused the fragmentation of urban space and the conflict of cultural context to a large extent. As an urban design model with a holistic view, Weaving is to reconcile the contradictions between urban plannings in different periods, and to weave the logic of urban construction. Starting from the holistic view of the city, Weaving promotes the diversity and hierarchy of urban development, softens the boundaries between different urban elements, and enhances the systematicness and integrality of the city.

2. Continuing the urban context

The city spirit is usually born from history, context, and memory, where the sense of belonging of citizens to the city is also growing. The continuation of the context means the protection of the city spirit and respect for the city history. In weaving, the memory of urban context can be abstracted into the texture of the original fabric. If the original texture and material are abandoned and the damaged fabric is rewoven, the weaving results may become nondescript. For the city, it is also necessary to retain and continue the cultural memory.

If the origin and the history of a city is nowhere to be found, the spiritual context of the city is easy to perish. As the background and basis of human life, urban context can give citizens a sense of security and belonging. The urban context is not only contained in historical cities,

historical blocks and other areas with a long history, but also hidden in the traces of contemporary life, where the authenticity and integrality of the urban context lies. The urban context and development imprint contained in the place is a major focus of the weaving.

On the one hand, urban context is reflected in the tangible elements of urban space. As the container and foundation of the construction of Genius Loci, the location, scale, road structure, spatial characteristics of space all contain urban context. On the other hand, the intangible elements contained in urban space are also important parts of urban context, including urban experience, urban activities, historical functions, etc. They can arouse people's perception and memory of urban spaces.

The purpose of the “Weaving” is to analyze all aspects of urban life carefully and meticulously. On the one hand, it is necessary to pay attention to the weaving of the space carrier containing the urban context, and it is also necessary to sort out and connect the social life context and urban development context, making the material environment characteristics and urban life connotation continue, to recall people's memory of urban space and strengthen urban residents' recognition of the living environment.

3. Supporting future development

The “Weaving” not only requires the continuation of the past and the integration of the current urban elements, but also need to connect the past, the present and the future, studies and judges the future development direction of the city and should provide the impetus for the sustainable development of the city. The weaving emphasizes the gradualness of urban development, studies the current and future development needs according to the context of urban development, integrates urban needs into urban space through specific weaving means, coordinates the spaces with the original urban context and various elements, and supplements and supports the future development from a gradual and dynamic perspective.

2.3.3 Mechanism

1. Analysis

(1) Investigation: Fully understand the “Weaving” object

Cities are multi-layered and multi-dimensional. Weaving always regards urban functions as weaving elements to solve urban problems. The systematic nature of weaving determines that the problems at all levels of the city need to be treated and handled separately, and the relationship between different weaving elements also need to be clarified. The weaving

methodology should first investigate the elements in detail to obtain authentic and objective information. The weaving objects should be well-known from the aspects of urban functions, land use, green space, public space, transportation, etc., and the development context and cultural spirit of the objects should be excavated in detail. The study of urban space from a multi-dimensional and holistic perspective provides a good information basis for the follow-up steps, which is conducive to focusing on the overall situation, grasping the key points, and plays a great role in supporting the scientific nature and integrality of weaving.

(2) Evaluation: Assessment of space potential

Weaving pays attention to the coordination between the object and the surrounding urban space and always recognizes the value of the object itself. The weaving process will integrate the potential of objects into the whole city, achieve a better solution of spatial renewal, providing the city with the greatest positive effect. In order to fully and objectively understand the potential of the weaving objects, different evaluation methods can be chosen, and a suitable evaluation framework can be framed according to different potential, finally, the objective and quantitative space potential evaluation can be carried out for the weaving objects.

(3) Export Results: Guide design and Implementation

According to the results of the investigation and evaluation, the weaving objects should be summarized by different levels, including the judgment of the qualitative investigation content and the judgment of the qualitative evaluation results. First, the perspective of judgment should be multiple and holistic, which can make the weaving process more systematic. Secondly, we need to extract the main problems of the weaving objects, consider the spatial potential of it, and make a reasonable summary, so as to provide an overall guidance for the design and implementation.

2. Design and implementation

(1) Connection: Strengthen the urban skeleton

Integrality is the primary principle of the weaving concept, and “Connection”, as the most critical link in the weaving mechanism, is an organic link between different elements in the city. Weaving objects should be a supplement to the urban skeleton through the method of “Connection”, so that the urban organism will have a more indestructible skeleton support. According to the content of the weaving element, “Connection” should not only be the links of the city’s material elements, but also the link of the immaterial elements. The early

weaving concept emphasized the connection of urban fragments with public space and urban streets, paying attention to the material elements. With the development of theory, Weaving further emphasized the protection of spatial texture and urban context, which is the connection between the past and the present. Today, Weaving should consider not only the spatial and spiritual aspects, but also the connection of urban functions and social relations. Weaving should follow the principles of integrality and coordination, dialectically treat the urban organism, look for the "fragments" of the city, and repair the "cracks".

The "Connection" emphasizes integrality and coordination and looks at the development of the city from a holistic perspective. The purpose of "Connection" is to supplement and integrate new woven materials on the basic texture of the original damaged fabric, and make the fabric more strongly connected. For cities, due to their dynamic development, "damaged areas" and "fragmented areas" that need to be supplemented will constantly appear in urban space, and these areas need to be connected with new urban elements.

(2) Growing: Perfecting the network of weaving elements

"Growing" is the improving process of each weaving element based on connection improving and the urban skeleton strengthening. In addition, "Growing" is a gradual process. The original fabric and the new weaving material gradually form a new whole through close interweaving. Different from the direct pasting of patches, the weaving is dynamic, and the Weaving process is adjustable. This is important for the ever-changing process of urban development. The dynamic development concept inherited by the "Weaving" is consistent with the urban development path, which can refine the urban development direction, aiming to make urban development more scientific.

The process of "Growing" not only needs to improve all kinds of Weaving elements from multiple angles and levels, but also needs to treat the process from a dynamic and progressive perspective. In the "Growth" process of the weaving objects, appropriate strategies should be implemented for the weaving elements contained in the objects. For the objects with different scales and different degrees of importance, the time required for the "Growing" process and the precision of the strategy are also different. In large-scale weaving objects, "Growing" can be carried out in time stage, and a schedule can be made according to the development potential and updating urgency of the space. To the objects with higher importance, the strategies of "Growing" need more detail designs to guide the implementation of the weaving scheme.

(3) Fusion: Achieving reconfiguration and re stabilization

In the process of “Weaving”, the old fabric and the new fabric materials need to be knitted through the matching degree of elements and different techniques. The “Weaving” works between the new and old elements, strengthens the coupling between them, makes the new elements blend into the old environment, makes the old elements generate new vitality because of the adding of new elements.

Cities need some time to adapt to the “Weaving” result. “Fusion” is the city’s acceptance of “Weaving” and the integrating process of the old and the new. The renewal of urban functions, ecological networks and other elements has certain instability at first, which will be stable again in the process of urban development. Under the premise, the diversity and complexity are particularly important. An appropriate degree of mixing is conducive to the integration of “Weaving” objects in cities. On the other hand, “Fusion” is the osmosis process of the cultural spirit, context and so on contained in the “Weaving” objects. Therefore, the memory of urban residents on the objects will be clearer and more concrete. In this process, the cohesion of the community and even the city will be increased, and citizens will get a sense of belonging.

2.4 New trends of “Weaving”

2.4.1 Application of digital technology in “Weaving”

In the face of increasingly complex urban space, traditional urban design analysis and expression methods gradually show the limitations of subjective assumptions and understanding bias. The use of analysis tools is an essential practice of urban design digitization. At present, GIS platform is the most widely used. Niu Xinyi comprehensively described the application method of GIS in the whole cycle of urban design. Fu Juan used GIS analysis tools to study the spatial form of villages. Dingwo applied GIS to the analysis of block morphology. MIT Sensible City Lab has been focused on the spatial distribution of urban population and combined social behavior with urban spatial research with GIS.

When digital technology was used in different fields, the subjects are different, the evaluation criteria are different. For example, in 2015, Xiong Ya carried out quantitative analysis on the renewal of urban industrial land based on GIS, combining qualitative and quantitative research, providing a reliable basis for the redevelopment of the stock land in urban renewal.

In 2017, Deng Yuanyuan and others tried to introduce a self-organization perspective, with the goal of potential evaluation reflecting the compliance with the internal development laws of

the city, and with the help of GIS and Spatial Syntax, to study the theoretical basis and technical methods of potential evaluation. The evaluation factors are mainly considered from the perspective of sustainable development in economic, ecological and social aspects, including Floor area ratio, vacancy rate, land function, etc.

In 2018, Sheng Qiang, based on multiple data sources such as open data, UAV aerial photography, field survey, etc., used digital means to analyze these data in the preliminary conceptual design stage and the deepening stage, and applied the conclusions to the auxiliary design work such as potential evaluation, scheme optimization, etc., to carry out urban renewal of Sanyang Road in Wushan.

In 2020, Dai Shujian made a quantitative evaluation of the space potential of abandoned railways, based on the regeneration value, and established a regeneration potential evaluation system for the space of urban abandoned railways oriented by ecological regeneration, transportation regeneration, cultural regeneration, own space, and connection value.

The digitalization of “Weaving” is the inevitable result. Applying city-related data and information to the “Weaving” process can make it more scientific. However, digital technology is used to correct the deviation of subjective decision and increase the rationality of design, rather than leading the “Weaving” process. From the perspective of “Weaving” analysis, digital technology can be mainly used in the qualitatively and quantitatively analysis stage of “Weaving”. Besides, the evaluation factors mainly include protection project, building quality, ecological environment, function, traffic accessibility, development intensity, regeneration guidance, etc.

Potential evaluation is always based on specific subject needs. In the analysis and evaluation, first, a comprehensive analysis of the object is essential. Secondly, it is necessary to combine the research in relevant fields to form a specific oriented evaluation principle, and the evaluation system should be based on the evaluation principle, with qualitative and quantitative combination.

2.4.2 Public participation in “Weaving"

Since the 1960s, with the global prevalence of liberalism and the development of “civil society”, western public participation concept had been fully developed. At the same time, based on the “bottom-up” planning perspective, many public participation practices based on community governance units had emerged, such as the “community planning” proposed by the British government, and the “traditional neighborhood mode” of the United States. The

public participation concept was introduced into China in the 1990s and the early 21st century.

Since 2000, the practical value of relevant research in this field has been gradually increasing. In 2013, Zhu Chunmin proposed that urban planning work should build a collaborative work mechanism and systematically integrate multidisciplinary resources. In 2017, Liu Yang and Xu Suning proposed the necessity of changing the design model and discussed the path of integrating public participation into urban design. In 2019, Jin Yunfeng and others believed that bottom-up public participation was an effective supplement to urban planning.

Since 2015, in the field of urban renewal and urban design, many urban design practices with public participation have been carried out. Among them, in the regeneration of the historical and cultural block of Enning Road in Guangzhou, the practice was led by the government, with the participation of the media, society, experts and other subjects. The process of public participation formed a consultation organization composed of multiple subjects. The government was supervised by the media, and finally the Enning Road was included into the historical protection area. In 2017, during the regeneration of Taoxichuan Porcelain district, all parties involved achieved creative ideas and feedback through the DIBO platform, while the implementing entities could directly connect with the designers on the platform. The practice process integrated and allocated resources from the aspects of consulting design, implementation construction, management and operation. The government and DIBO jointly entrusts the design agency to implement the whole process guidance and control from project planning to construction control. In the urban design of Pazhou West district, the chief designer, the owner and the design team jointly discussed the architectural design scheme with the core of urban public space development.

The introduction of public participation in “Weaving” is conducive to the realization of diversified interests. From the perspective of various stakeholders, the “Weaving” of various elements in the city can also “Weaving” the social and public life to a certain extent.

2.5 Summary

This chapter starts with the “urban leftover space”, defines the concept of “urban leftover space” in this paper, and clarifies the current situation and problems of it. By expounding the birth, development, strategies and new trend of the “Weaving” concept, this paper clarifies its feasibility in urban design, summarizes its advantages, and provides a reference for the updating method of urban leftover space under “Weaving”.

Chapter3 Urban leftover spaces updating under “Weaving”

Different urban leftover spaces have different problems and potentials, so that new development directions and paths need to be formed through multi-level investigation and research. However, different urban leftover spaces have something in common. They can be abstracted into the damaged space of the original urban fabric, causing a series of urban problems. The “Weaving” can provide a deep and systematic understanding of the urban leftover space from the research stage, treat the updating of the urban leftover space from the overall perspective, use a coordinated, diversified and progressive way to weave the city, take into account the urban functional structure, transportation system, public space, texture and other element.

This chapter looks at the characteristics of urban leftover space from the perspective of “Weaving”, discusses the “Weaving” effects of urban leftover space in the city, explores their coupling relationship, and summarizes the strategic experience through four relevant cases of urban leftover space to build a “Weaving” framework for urban leftover space redevelopment.

3.1 “Weaving” characteristics of urban leftover space

3.1.1 The potential

1. Holistic potential

Urban leftover space is a rare resource in urban space and a major driving force for urban inventory development. The leftover space is always available, and its negativity can be transformed into a positive one to a large extent, feeding back to the city in a positive way. The renewal and reuse of leftover space means the rebirth of space and the redefinition of its own value. The definition can be the carrier of urban composite functions, the catalyst for activating urban space vitality, the booster for urban ecological environment optimization, and the creator of a good living environment. On the other hand, the potential of urban leftover space is not only limited to the value of space itself, but also reflected in the positive impact on the urban system, which include:

(1). Through the renewal of urban leftover space, the problem of city “fragmentation” can be alleviated to a certain extent, and the integrality and coordination of the urban system can be strengthened.

(2). In view of the low vitality of the urban area where the urban leftover space is located,

through the implantation of composite functions and the mutual support of urban elements, urban space can be diversified, urban system complexity can be increased, and the functional resilience of the city can be improved to a certain extent.

(3). The potential of urban leftover space is also shown in its ability to provide a gradual upgrading power in a relatively stable urban system. According to the needs of the city, the leftover space is updated and reused in a framework sequentially. For example, in the Catalyst theory, the catalyst point is first used to drive the regeneration of the spatial vitality around, and different renewal strategies are proposed gradually and dynamically according to the development of the city.

(4). Urban leftover space is usually in the state of being leftover due to the cycle of its own life or the conditions that do not match urban development. But before the leftover state, it often witnessed the development of the city, containing a certain urban memory to some extent.

2. Potential of different space types

The different types of urban leftover spaces determine the different directions of their spatial potential. The exploration of their potentials can provide a variety of personalized urban renewal modes and strategies.

From the scale type of urban leftover space, with the increase of space scale, the main potential direction of space also changes.

(1). The site-scale leftover spaces characterized by wide distribution, large quantity and small area. They often exist in the spaces for residential, working and leisure activities, and are closely related to the daily life of citizens. There potential direction is mainly to satisfy the daily public activities and social communications of the public, and to promote the urban living environment in a catalytic manner.

For example, on a deserted roof in Urban Village, Shenzhen, the designers reused it as “The Green House” (Fig 3-1), taking bamboo as the wall and set up different activity areas in the bamboo forest, including glass “box” space for performing or sharing activities, gym, trampoline, swing, teahouse, interactive stage, large "chessboard" and rest area, which gave the building and even the surrounding urban village sustainability, cool temperature and diversified social and leisure space.

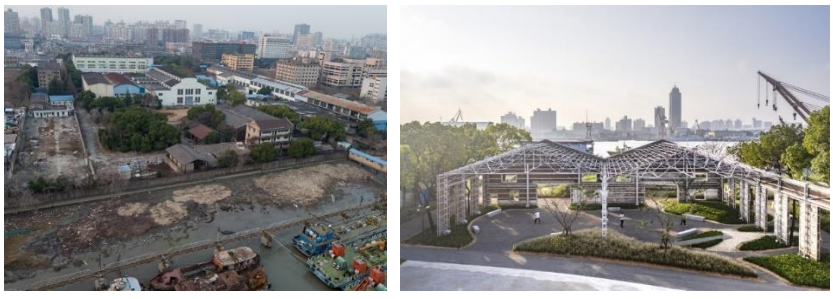
a) aerial view b) functional analysis

Fig 3-1 “The Green House” reusing roof space

(Source: MVRDV’s official website - https://www.mvrdv.nl/projects/436/idea-factory)

(2). The number of urban leftover space in block-scale is reduced compared with those in site-scale. They can usually be observed by the scale of blocks and be measured from the perspective of people. As one or several blocks in the urban space in leftover state, their connection to surrounding blocks, supplement and improvement of functions are their main potential directions, usually showing the supports to urban green space, public services, transportation networks, etc. In addition, by shaping their vitality, they can form new block centers and radiate the surrounding blocks

For example, in a project located in the original “Yangshupu industrial belt” (Fig 3-2), the designers designed a public space around a section of 300-500m industrial plant in a state of leftover, to retain the authenticity of the wharf with minimal artificial intervention. The project preserved the original camphor trees and transformed a warehouse to form an open structure integrated to the natural space. The designers excavated the spatial context of the site, introduced a slow path, created ecological pools, memory gardens and other nodes, making the site an interesting riverside space.



a) leftover stage b) riverside park

Fig 3-2 Renewal of Shanghai Yangpu Riverfront space

(Source: Atelier Liu Yuyang Architects’ official website)

(3). Due to the large scale, the district-scale leftover spaces usually need to be developed from the perspective of the whole city. As a large space in the leftover state, they can undertake more functions and responsibilities in the urban system. However, the stock of district-scale

spaces is relatively small compared with the other two types, and the development of their spatial potential is usually carried out at the city level. In district scale, the driving forces for the upgrading of the urban system is huge, and they may form a new vitality center of the urban area, radiating a certain urban area or even the whole city.

For example, in the Hangang district, Handan, Hebei Province, due to the change of the industrial development direction of the resource-based city, a large number of urban industrial space gradually declined, becoming the leftover space of large cities. Taking “Transition · Memory · Renaissance” as the design route, the designers carried out conceptual planning for the 8.66 square kilometer space, aiming to create an important part of the comprehensive service center in the old city of Handan and improve the existing urban functions. Through the exploration of land plots and urban cultural context, the study and judgment of the city's natural pattern, the discussion of the city's required functions, and the evaluation and analysis of the original conditions, the project formed urban design strategies to promote the vitality and function optimization of urban areas, including the implanting of new industries to form composite functions with potential, activating industrial heritage, continuing the city's memory, building a comprehensive transportation system connecting other urban space, and optimizing the urban ecological pattern, creating a vibrant and healthy community, and finally revitalizing the urban area and reshaping the spatial potential. (Fig 3-3)

a) location b) evaluation c) general plan d) aerial view

Fig 3-3 Regeneration of Hangang district

(Source: International masters invited competition of urban design for Hangang area – Team academician Wang Jianguo)

From the perspective of spatial type, the functions are also different due to different spatial forms.

(1). Scattered urban leftover spaces are generally on the site scale, and their spatial potential is basically the same as that of site-scape types. The key is to create rich activity space, improve public service facilities, increase site landscapes, renew them from the perspective of urban residents’ daily life activities.

In the “Pixeland” project (Fig3-4), designers increased the types of public activities in the space between buildings, combined different outdoor activity facilities in a space in a modular manner of “Functional Pixels”, solved the problems of leftover spaces beside the landscape edge, pedestrian circulation edge, landscape edge, and formed a multi-functional public space.

Fig 3-4 Abundant functions in the “Pixeland”
(Source: Official website of 100architects https://100architects.com/zh-hans/project/pixeland/)

Shekou school square in Shenzhen is a street corner square in a high-density community. It was introverted and closed. Due to the barrier of walls and unused publicity board, the function of the space was single and negative. The project placed waiting space, game space and shared leisure space in the square, respecting the function of the original site, reshaping the order of the space. Thus, the project made the original urban leftover space more dynamic and interesting. (Fig 3-5)

a) leftover state of Shekou school square

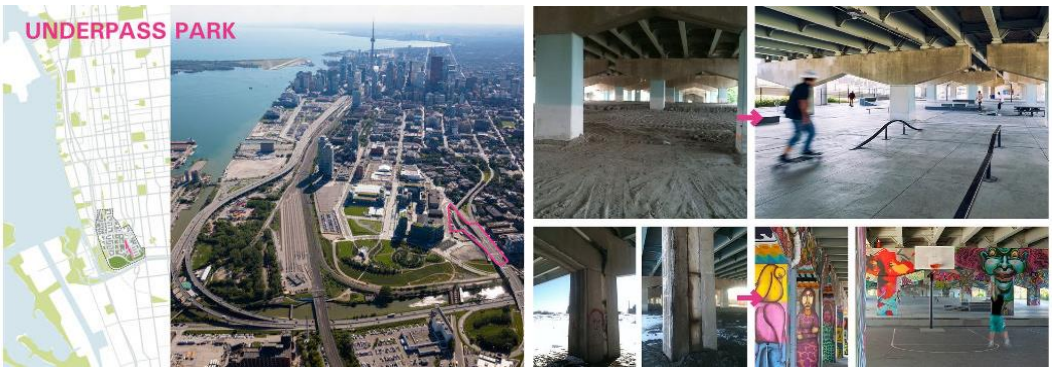
b) axonometric view (designing) c) activities

Fig 3-5 the renewal of Shekou school square
(Source: Official website of ZIZU studio https://www.zzkj.pro/skxx)

(2). The characteristics of the line-type leftover spaces are that the scale in one direction is much larger than that in the other direction. They are generally distributed in the vicinity of the urban traffic network or water system and is usually adversely affected by traffic conditions, air pollution and other aspects. Their spatial potential is generally built on the

premise of safety, to improve the composite utilization efficiency and accessibility of spaces, and to embed functions that are positively related to the surrounding area, weaving the cracks in urban space:

Located under an overpass in downtown Toronto, Toronto Underpass Park is an important community connection point. However, due to its spatial location, the original state of the space was abandoned and dangerous, and the space was used for informal parking function and illegal activities. In the design, the part covered by the bridge deck is used as the space for activity facilities, and the space not covered is used as the green space, which plays role of a spatial transition. The diversified activities combined with the new landscape make the original urban leftover space become the public property of the community, making it a truly dynamic and vibrant community connection point. (Fig 3-6)



a) location b) transformation of space

Fig 3-6 Toronto Underpass Park(Source: Designed by PFS Studio and The Planning Partnership Official website of ASLA https://www.asla.org/2016awards/165332.html)

In the center of Rotterdam, a 400m pedestrian overpass connects the Pompenburg Park, roof garden of Hofplein railway station and important commercial public spaces and buildings by using the leftover space beside the city's large transport infrastructure. The project improved the continuity of the space, increased the level and interest of the space, and made the area a better whole. (Fig 3-7)

a) plan b) aerial view

Fig 3-7 Luchtsingel pedestrian bridge
(Source: Official website of ZUS https://zus.cc/projects/luchtsingel-rotterdam)

(3). The block-type leftover spaces mainly include the outdated functions that are not compatible with the times, such as abandoned factories, industrial docks, large urban public facilities, etc. They always cover a large area and have a lot of urban memories. They have witnessed a period of urban development and usually contains a memory of an era. Therefore, their spatial potential is not only the promotion of urban material elements, but also the continuation of immaterial elements such as urban context. They can usually be redeveloped from the aspects of urban function structure, traffic system, green space system and cultural spirit, etc.:

For example, Qijiang Park in Zhongshan City (Fig 3-8), Guangdong Province, China, formerly known as Yuezhong shipyard, is located on the east bank of the Qijiang river. The shipyard was a representative urban space in the history of local industrial development from 1953 to 1999. However, due to the decline of function, its space was gradually leftover. With the help of the postindustrial landscape reconstruction idea of ecological restoration and reuse, the designers transformed the shipyard into a city park, supplemented the urban green space system, and continued its memory as a city's industrial heritage.

a) leftover state b) aerial view

Fig 3-8 Qijiang Park in Zhongshan

(Source: Designed by TURENSCAPE https://www.turenscape.com/home/index.html)

Tonsley Industrial Park originally belonged to Mitsubishi car factory. Due to the recession of Australian manufacturing economy, it had become a block-type urban leftover space, which had a negative impact on the whole city, but it also contained huge space potential. The original space was transformed into a knowledge park, carrying clean technology, sustainable industry, advanced manufacturing, education and scientific research activities. The project symbolized Adelaide's transition from a manufacturing economy to a knowledge-based economy, broke all kinds of restrictions between the industrial zone and the community, accommodated a variety of activities, reshaped the vitality of the site and successfully activated the potential of the space. (Fig 3-9)

a) leftover state b) internal space c) external space

Fig 3-9 Tonsley Park Redevelopment

(Source: Designed by Woods Bagot, Photos taken by Sam Noonan)

In addition, from the function types of the areas surrounding urban leftover spaces, the potential of spaces can be determined by the surrounding areas to a certain extent. However, due to the uncertainty of the vitality and function saturation of the surrounding areas, the determination of the spatial potential direction requires a comprehensive study and analysis of them.

3. Potential of different material element types

(1). Square type

The urban leftover space of the square type usually appears with other functions, and gradually fades out of the residents’ sight due to the passage of time, neglect of repair and other reasons. However, due to its original stay function, as a part of the public open space, it has a greater impact on the surrounding environment. Its renewal and reconstruction are generally combined with the surrounding building space to form a space with better environmental quality and connectivity. The re-combination of square and surrounding buildings is a potential of this kind of urban leftover space.

For example, in the project “Old Market Folk Culture Block_Phase I” (Fig 3-10), the part of the existing market transformed from the industrial building was completely reserved. On the one hand, laws and regulations and the limited funds of the investors do not allow large-scale demolition and construction. More importantly, the project hopes to maintain the balance of the existing market and the new functions on the basis of existing communities. The square in front of the original building was combined with the stuffy and closed hall to form a new whole, which has been transformed into an open square with steps; The steps not only guide the flow of people into the upper space, but also become a stage for public life in the market and a new catalyst point in the old community.

a) original square with the old market

b) square as a catalyst for the community

Fig 3-10 Old Market Folk Culture Block_Phase I

(Source: Designed by Bounds Plan, images from https://www.boundsplan.com/cover)

(2). Building type

The building type urban leftover spaces are usually caused by the decline of functions and the aging of buildings. Different buildings have different characteristics of memories, quality attributes, and the construction era, so we need to get the disposal methods through detailed research and analysis. The methods generally include demolition and reconstruction, partial demolition, addition, reconstruction, retention, and repair. Their potentials are mainly reflected in the continuation of urban memory, the reuse of the original building structure, the preservation of architectural features and Genius Loci.

a) original building type space b) building as an exhibition space

Fig 3-11 Beijing 798 old building regeneration

(Source: Designed by Linjian Design, images from https://www.gooood.cn/g-m-gallery-by-linjian-design-studio.htm)

For example, in an old building design and reconstruction project in the core area of Beijing 798 Art district, the original two-story building was added and designed to retain the original space intention of growing. New functions were injected into the original building, and the space finally became a distinctive building in the art district. (Fig 3-11)

(3). Landscape type

The landscape type urban leftover spaces are usually caused by environmental pollution, lack of management and other reasons. They usually have the problems of dilapidated environment, overgrown weeds and poor water quality, etc. However, due to its original landscape attributes, the design can improve the environment and optimize the landscape, thus making it a high-quality urban landscape.

a) original environment b) ecological corridor

c) construction process

Fig 3-12 Ningbo Ecological Corridor

(Source: Designed by SWA, images from https://www.swagroup.cn/projects/ningbo-east-new-town-eco-corridor/)

For example, in the Ningbo Ecological Corridor project (Fig 3-12), the original landscape was dilapidated, and the sanitary environment was worrying. As a polluted land, no one wanted to get close to it. Since ancient times, the project site had crisscross rivers and vast land covered by riverine forests, reed marshes and farmland. However, under the pressure of rapid urbanization development, the original canal had been converted to industrial use, and at the

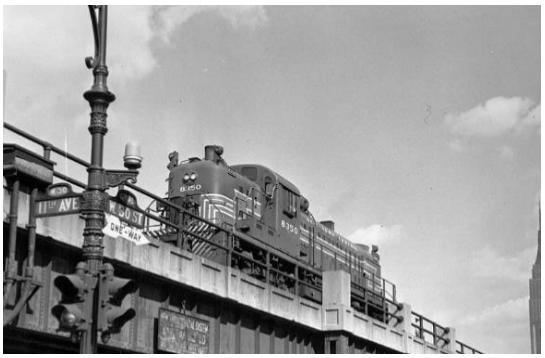
same time, it lacked effective zoning and pollution control. Combined with various factors, its water quality had seriously deteriorated.

The project integrates the characteristics of local topography, hydrology and vegetation to transform the uninhabitable land into a linear “living filter”. Ningbo Ecological Corridor has created a place for native animals and plants to live and reproduce, improved the quality of public health, brought public places with good landscape quality, and stimulated the landscape potential of the original natural environment.

(4). Traffic type

The traffic type urban leftover spaces are usually caused by the decline of large-scale transport infrastructure. Due to the development and expansion of the city, the negative impact of the original transportation infrastructure on urban space has gradually become greater. On the other hand, due to the upgrading and diversion of transportation infrastructure, the existing large-scale transportation facilities may be abandoned. This kind of urban leftover spaces usually contains many urban memories and can improve the overall urban environment on the basis of the original space.

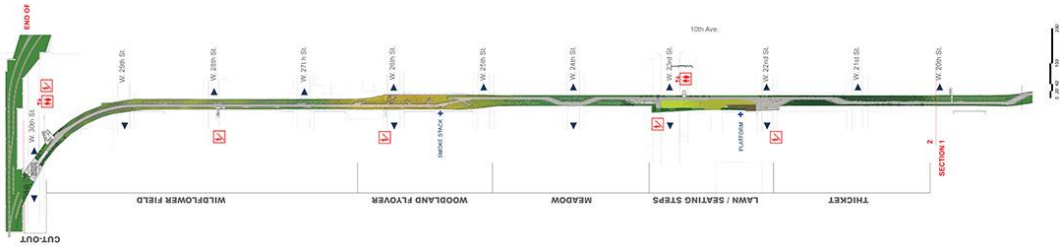
For example, The High Line Park in New York is an urban public space transformed by an abandoned elevated railway. (Fig 3-13) The High Line connects the blocks, provides a new landscape green space for the city, and makes the city and green space better integrated. It cuts into the changeable urban landscape in an uninterrupted manner. The connection between the High Line and different types of buildings has improved the quality of the original public open space, leading the line of sight to the Hudson River, landmark city monuments, etc., bringing people a rich experience of daily life. (Fig 3-14)



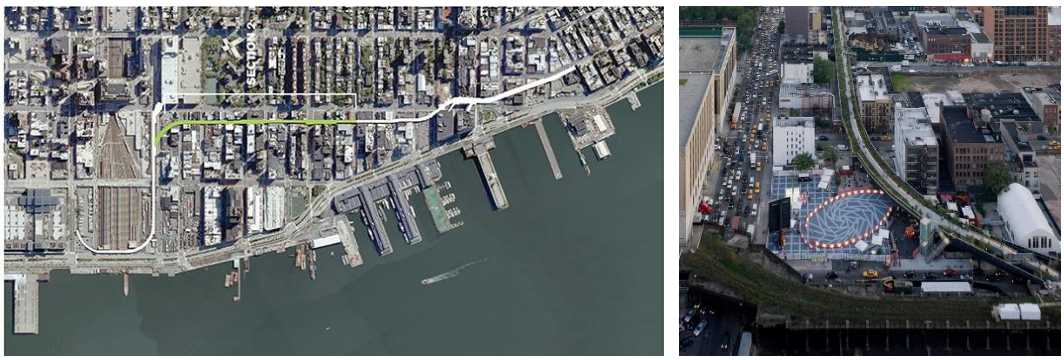
a) original function

b) new urban landscape

Fig 3-13 Comparison of the original and present High Line
(Source: Designed by James Corner Field Operations, images from https://www.gooood.cn/high-line-park-section2.htm)



a) Different connections with the surrounding environment



b) aerial view of High Line Park

Fig 3-14 High Line Park in New York

(Source: Designed by James Corner Field Operations, images from https://www.gooood.cn/high-line-park-section2.htm)

3.1.2 The upgrading depending on existing urban elements

If the urban leftover spaces want to give full play to its weaving characteristics, the basis should be first clarified for the upgrading and reconstruction of the urban leftover space. By exploring the current urban space, taking advantage of the existing resources, the urban leftover space can used to weave the city, so as to maximize the synergistic benefits between the leftover spaces and the city to achieve a win-win situation.

1. Urban functional structure

The renewal of urban leftover space is based on the original function structure of the city. In the process of renewal, it is necessary to conduct in-depth research on the current function structure of the city and the function status of surrounding urban areas, extract the urban functions that are lacking in the urban area and the whole city, then, select and arrange the functions in combination with the characteristics of the leftover spaces themselves. They can often be used as supplements to urban functions and provide the city space resources. The updated functions can also feedback the city to a certain extent, making the urban system operate more efficiently and with quality.

2. Urban green system

In general, urban leftover spaces always have an adverse impact on urban space and urban

green system due to its negativity. The urban green system is an important urban system that integrates the urban artificial environment and the natural environment and provides the urban residents with a more natural and high-quality living environment. As the leftover spaces in the city, they can supplement and perfect the urban green system. The supplement is multi-layered, and the level is mostly related to the scale of urban spaces, including protecting the urban environment, regulating the site climate in the city, the protection of species diversity, the establishment of ecological corridors and the repair of ecological barriers to form a more reasonable ecological structure, which is more conducive to urban resilience. If a urban leftover space can be used as a node in the structure of the urban ecological landscape system or a natural patch in the city, it can improve the urban ecosystem.

3. Urban open space system

A large part of the urban leftover spaces are external spaces, which have the potential to become a part of the urban open space system. Urban public space mainly includes parks, squares, streets and alleys. It is the main place for urban residents to carry out outdoor activities. Urban leftover spaces can be the supplement to improve the accessibility of public space according to their geographical location and surrounding open public spaces. We can also identify whether urban residents lack public space nodes and improve the urban public open space system through the supplement of urban leftover space, improving the urban open space system.

4. Urban texture and spatial form

As a part of urban space, the renewal and reuse of urban leftover spaces should be based on the existing urban texture and spatial form, coordinated with the overall space, and guided and controlled by the overall urban spatial form plan. On the other hand, because they are in a leftover state, their original texture and spatial form are also part of the characteristics of the urban space, and the consideration of their own texture and spatial form is also the respect for the overall urban space to a certain extent.

5. Urban traffic system

Urban traffic system includes urban external transport system, road system, public transit system, static traffic and non-motorized traffic system. Due to the urban traffic system, the urban leftover spaces usually accompany the appearance of large-scale transportation infrastructure. In addition, some block-scale and district-scale leftover spaces have a certain blocking effect on the urban road system. And a certain negative impact acts on the continuity

of the urban non-motorized traffic system due to the existence of some site-scale and block-scale urban leftover spaces. In addition, urban spaces can easily become a supplement to urban static traffic in their leftover stage. When the urban leftover spaces are close to the public transport station, their space development value will be improved accordingly. The urban leftover space can be used to weave the urban “fragmentation” caused by the urban traffic system according to the surrounding functional conditions. In the process of renewal, the leftover spaces can be used to dredge urban road traffic and non-motorized traffic, improving urban traffic efficiency and humanize the non-motorized traffic environment. On the other hand, in the renewal of the leftover spaces, their parking function also needs to be considered, and the parking volume required by the city can be supplemented through the development of underground space.

6. Urban context and cultural spirit

The context of a city usually covers the development context, historical memory and social spirit of the city. At the material level, it usually exists in the historic relics of the city, and at the immaterial level, it is an important support for the spirit of the city, and a key for citizens to have a sense of belonging and cohesion. Urban leftover spaces are usually in the later stage of the life cycle, which have been built and used, and may contain the memory of a generation, because part of the urban leftover spaces once served as an important part of the urban functions and declined and deserted with the passing of time. In the renewal of urban leftover spaces, it is necessary to explore their development context and cultural core. By reshaping their cultural spirit, they can provide strong support for the urban context and retain a part of the memory for citizens.

3.1.3 Redevelopment paths

Under the district blueprint of the stock planning now, many urban renewal projects for urban repair and ecological restoration have been successfully implemented, have played a positive role in the existing urban space and the ecological environment of the city. Policies or projects such as “15-minute Community Living Circle”, “See the green in five minutes and the garden in ten minutes”, “pocket park” and “industrial heritage regeneration” have developed the potential of urban leftover spaces to a large extent. However, there is still some room for improvement in the current urban leftover space reuse mode.

1. Improve integrality, systematization and coordination

Most of the upgrading models of the current urban leftover spaces are designed around

specific space or focus on a certain design object and design dimension, lack of consideration for the integrality, systematization and coordination of the city. As a dynamic urban space widely distributed in the city, the urban leftover space needs an overall evaluation and design. If not, its transformation mode is very likely to fall into another dilemma of incongruity. In the upgrading of urban leftover spaces, they should be considered as a part of the overall framework of the city on the basis of adapting measures to local conditions. The relationship between different urban leftover spaces should be considered as much as possible, so as to form a systematic network.

2. Pay more attention to sustainable development

The current mode of updating the existing urban leftover space has taken the sustainable development into account, such as the ecological consideration in “sponge cities”. However, most of the modes are one-sided, and it is difficult to achieve the sustainability of ecological sustainability, economic sustainability, social development sustainability and the continuity of the spirit of the place. The current mode mainly considers the current needs. In addition, at the level of urban system, the transformation of leftover spaces is difficult to build a link with other urban spaces as a part of the existing urban system framework, so as to supplement the urban ecosystem and urban functions.

3. Improve the diversity of spatial functions

The space utilization ratio depends on the diversity and mixing degree of urban spatial functions to a large extent. In the utilization of urban leftover space, composite functions are more conducive to activating the vitality of space. On the contrary, if a single function is placed in the urban leftover space, it will change from the original “urban leftover space” to another “urban leftover space” from the perspective of space-time utilization, so that the potential of the space can not be better developed. For example, in many cases, the original urban leftover spaces are transformed into parking lots, sports grounds, etc., but their function lacks contact with the surrounding areas and the functional complexity are poor, then, The change of spatial vitality will be similar to the tidal effect.

4. Pay more attention to the inheritance of context and the diversification of social life

Urban leftover space is a kind of leftover state of urban space. Part of them has experienced one or more cycles of “blank – design – construction – growth – decline – deserted...”, and its development stage bears the stories and memories of the city at that time to a certain extent. In the reuse of urban leftover spaces, if we strengthen the tracing and exploration of its

development context and implant it into the space, we can greatly help the inheritance of urban context. In addition, in terms of social life, it is inadvisable to simply create the “Internet celebrity”, if the old, present and future social life types can be integrated into the spaces and the activities of various social groups can be respected more, the social life will be diversified, and the urban culture will be more abundant.

5. Strengthen the sorting of the reusing mode of urban leftover spaces

The reusing mode of the current urban leftover spaces mainly focuses on the cultural and creative transformation of industrial heritage, the pocket park design of abandoned open spaces and the reuse of the surrounding space of buildings or structures. The reusing mode is single, and the reusing objects are largely related to key policies. The exploration of urban leftover spaces reusing lacks a relatively complete and systematic framework and methodological guidance. From the overall level of the city, the reusing of the current urban leftover space mainly focus on the upgrading of scattered points and single blocks, and it is difficult to form an integral reusing network from point to area.

6. Strengthen maintenance and management

If there is no maintenance and management, the time for urban space to enter the decline stage will be shortened. The long-term lack of maintenance will lead to the decline of the environment quality, thus making the space enter the “leftover space” stage again. Therefore, all urban spaces need daily maintenance and management after the design and construction is completed, and gradually increase the sense of identity and belonging of urban residents, so as to prevent it from becoming urban leftover space again.

3.2 Coupling relationship between “Weaving” and urban leftover space

3.2.1 Coupling of elements

Urban leftover space is an important spatial resource in the urban inventory development, and Weaving is a means of updating urban inventory space. From the perspective of purpose, urban leftover spaces and weaving elements are highly coupled. In the research and conclusion of the theory, the paper defines the weaving elements and expounds the dependence of urban leftover spaces on the city. The coupling of the two is mainly reflected in the five parts including urban function, ecology, traffic, space and historical context. The concept of Weaving can guide the renewal of urban leftover spaces, complete the renewal, and promote the better development of the city. (Fig 3-15)

3.2.2 Coupling of mechanisms

From the perspective of the relationship between the potentials of the urban leftover spaces and the advantages of “Weaving”, it is suitable for the urban leftover spaces to use the “Weaving” in the updating and reuse process. The overall potential of urban leftover space can be better explored by virtue of the advantages of “Weaving”. Due to the difference in the key direction of updating and reuse of different types of urban leftover spaces, the "overall consideration of various urban elements" of “Weaving” can conduct research on different types of spaces from simple to deep, different urban leftover spaces and the surrounding urban environment should be well integrated to form a better overall urban area. Therefore, there is always a coupling relationship between the potentials of the urban leftover spaces and the advantages of “Weaving”.

From the perspective of the relationship between problems of the urban leftover spaces and purpose of “Weaving”, the principle of integrality and coordination in the “Weaving” is applicable to solving and mitigating the urban fragmentation caused by urban leftover spaces. The principles of complexity and pluralism can be used to enhance the vitality of urban leftover spaces and solve the problem of low vitality of them. The dynamic and progressive principles are helpful to solve the unsustainable problems in the development of urban leftover spaces. In addition, the inheritance of the “Weaving” to contextualism and humanism can better shape the Genius Loci lacking in the leftover space of the city.

The characteristics of renewal objectives according to the relevant problems about urban leftover spaces are basically the same as the principle of “Weaving”. They coincide with the urban problems to be solved in urban renewal process, so the overall objectives of urban leftover space renewal and the weaving mechanism are the same. In addition, from the classification of the weaving elements and the urban leftover spaces, their dimensions and perspectives are similar. In urban space renewal, the concept of weaving emphasizes a comprehensive understanding of the objects. In the mechanism of urban upgrading and renewal, it is also necessary to evaluate and analyze the space from multiple levels and perspectives. To a large extent, the multiple spatial potential directions of urban leftover space are coupled with the “Weaving” mechanism. (Fig 3-15)

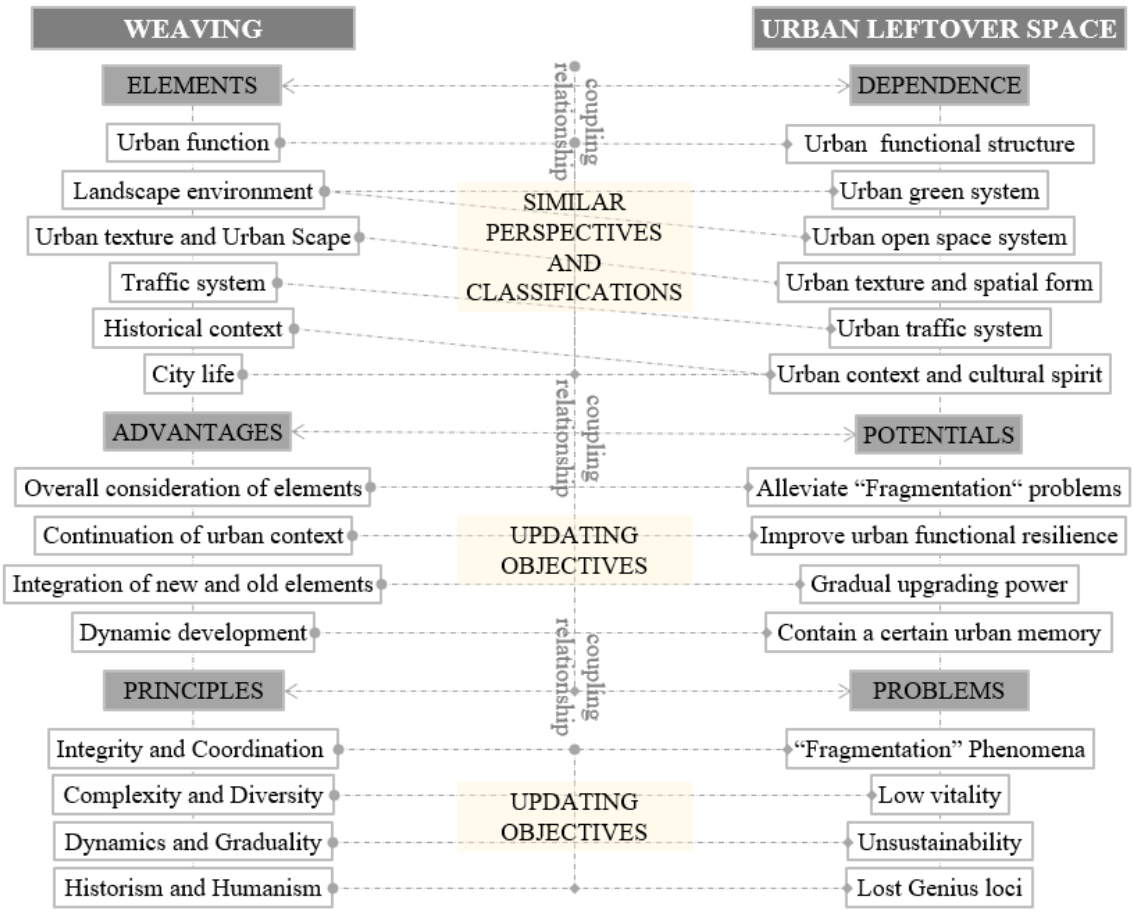


Fig 3-15 The coupling relationship between Weaving and Urban leftover space
(Source: Drawn by the author)

3.3 “Weaving” effect of urban leftover space

The “Weaving” can guide the renewal and reuse of the leftover space in the city. Under the guidance of the Weaving mechanism, the leftover space in the city plays the role of “Supplement”, “connection”, “growing”, and “fusion”, so as to enhance the integrality and diversity of the city, realize a dynamic and progressive urban development mode, continue the city’s context and condense the city's spiritual culture.

3.3.1 Supplement

For urban leftover spaces, as the stock space in the city, they can provide urban space to carry the functions required by the city development and adjust the original urban system through the leftover spaces. The first weaving effect of urban leftover space is “Supplement”. The “Supplement” includes new demands for urban industry, urban public service facilities, urban green space and public space, urban transportation, urban culture and spirit, etc., which comes

from the demand of upper planning, or from bottom-up public feedback and participation. The urban leftover space can be designed and redeveloped according to its own advantages and opportunities and in line with the new needs of the city.

3.3.2 Connection

"Connection" is the primary role of urban leftover spaces in the process of weaving the city, which runs through the whole process of renewal. Different renewal strategies are used for different urban systems to supplement and strengthen the overall structure of the city.

1. "Connection" to urban functions:

At the urban level, it is the undertaking of industries and functions required by the city; From the perspective of urban area, it is a supplement to the urban functions and services lacking in the area; From the perspective of communities, it is always a supplement to the public service function closely related to daily life. In the function connection process, we also need to pay attention to the consideration of its own characteristics, improving the function diversity.

2. "Connection" to urban green space

It is mainly reflected in the improvement and shaping of the overall ecological and landscape structure of the city, in which way, the connectivity of green space in the city can be strengthened, the green space rate of urban blocks can be improved, a continuous green space system can be create, citizens will be provided with a better natural ecological environment, and the stability of urban climate conditions will be improved.

3. "Connection" to open space

It mainly focuses on the improvement of the connectivity in different scattered open spaces, which makes the urban open space more continuous, the open space system more hierarchical, and satisfies the needs of different urban functions with the urban leftover space as the medium.

4. "Connection" to urban texture and spatial form

The coordination is particularly important, including the coordination of building scale, the smoothness of urban skyline, and the continuity of street interface. In "connection", it is also necessary to preserve the individuality of the space and reshape the space to achieve a balance between individuality and coordination.

5. "Connection" urban traffic

From the perspective of the city, it is mainly reflected in improving the overall traffic structure

of the city, opening up the urban road network, and reasonably arranging urban public transit nodes; From the perspective of urban areas or communities, it is essential to improve urban traffic sitecirculation, connect urban non-motorized traffic networks, better connect public transit system and non-motorized traffic system, thus, choices of convenient and low-carbon travel mode can be provided for citizens.

6. “Connection” to urban context

It is mainly embodied in the continuation and inheritance of the development context and the cultural connotation contained in the urban leftover spaces, and the combination with the urban spiritual culture, to form a richer cultural connotation. The “Connection” includes the protection and retention of historic relics, the reusing of the space with the historical memory of the city, the provision of a place for the spread of intangible culture, the friendliness strengthening of space to social exchanges, to promote the urban cultural construction and reshape the urban characteristics.

3.3.3 Growing

The “Growing” of urban leftover space represents the gradual improvement of network of urban elements. The updating mode is generally continuous, phased and multilaterally negotiated. In the process of its construction, it is also necessary to adjust the existing design framework and design strategies to dynamically achieve the updating objectives. Different types of urban leftover spaces represent different spatial potentials, and different spatial potentials require different implementation time, different number of stages, different implementation sequences, and different implementation accuracy. Formulating different implementation plans according to different objects is crucial to weaving cities, coordinating with the design in the implementation process.

3.3.4 Fusion

The “Fusion” of urban leftover space is generally embodied in the middle and later stages of renewal implementation. The general structure of renewal object has been established. Through the necessity and diversity of its existing functions, it can be more quickly integrated into the urban environment, so that it can reach a stable state faster, thus providing new vitality to the city. On the other hand, the “Fusion” of urban leftover space can promote its own cultural context to achieve osmosis effects, reshape community relations, better supplement the space for social communities, and enhance citizens’ memory.

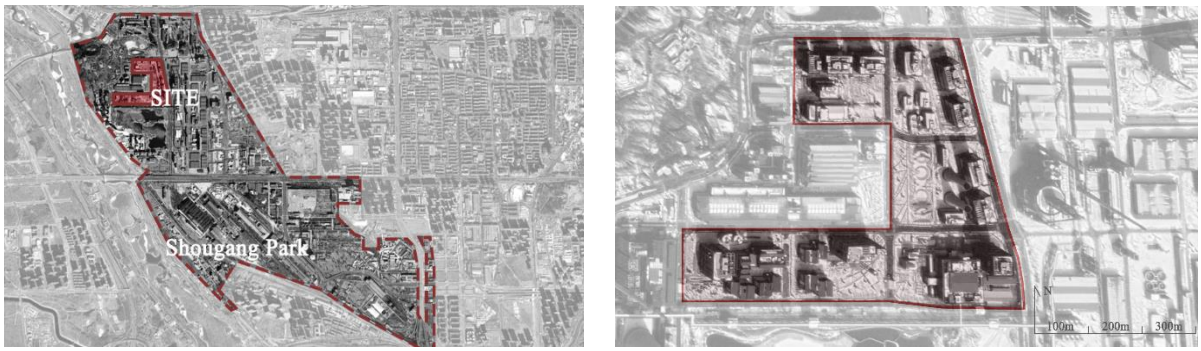
3.4 Case studies

Many practical cases of Weaving concept have important significance for proposing the urban design strategy of this paper. This paper selects four relevant practical cases as references to study from excellent experience.

3.4.1 Chang'an Mills

1. Overview

Chang'an Mills is in the core plot of north district of Beijing Shougang Industrial Park, surrounding by abundant natural resources. The site is located at the foot of Shijingshan Mountain, between Xiu Lake and Qunming Lake, and adjacent to Qunming Lake Street in the east. The project covers an area of 13.2 hectares, presenting a U-shaped structure. The old industrial zone of Shougang where the project is located is a super large enterprise that once had one sixth of the industrial workers in Beijing, covering an area of about 7 square kilometers. In 2005, due to the adjustment of Beijing's urban functional structure in the master plan of Beijing (2004-2020), the old industrial zone was gradually relocated, and all steel related productive activities were stopped at the end of 2010. Since then, it has become the leftover space in the city and the site is at the north of it, where the original power plant was located. (Fig 3-16)



a) location b) design scope

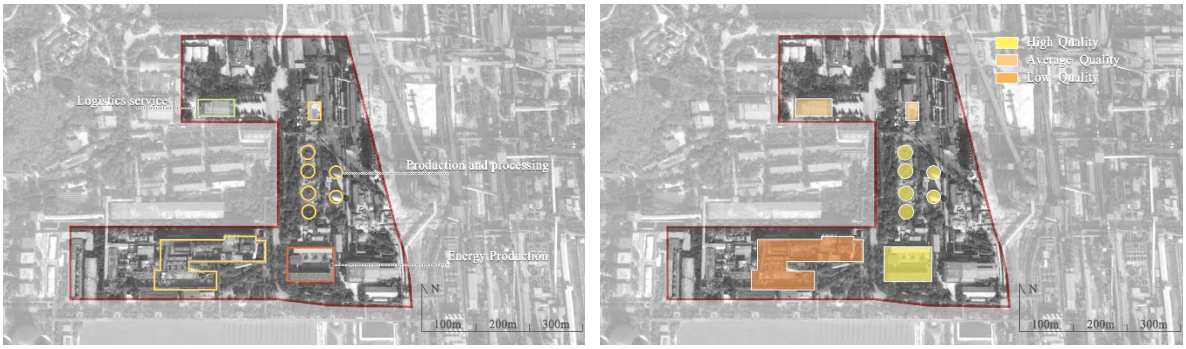
Fig 3-16 Location in Shougang Park

(Source: Drawn by the author, Base map from Google Earth)

2. Design Strategies

(1). Targeted evaluation: The project is located in Shougang Park, Beijing. The original base is the industrial heritage of the city, which contains many memories of the heavy industry period in the city and gathers the sweat and hard work of a generation. Continuing the context is one of the tasks. However, due to the requirements of urban renewal for new functions, the

original industrial buildings can not be completely preserved. Therefore, the project evaluated the buildings in the site at the investigation and research stage, classified the original functions of buildings and evaluated the building quality, so as to guide the subsequent disposal mode of the spaces. (Fig 3-17)



a) function analysis b) quality evaluation

Fig 3-17 Analysis of industrial relics

(Source: Drawn by the author, Base map from Google Earth)

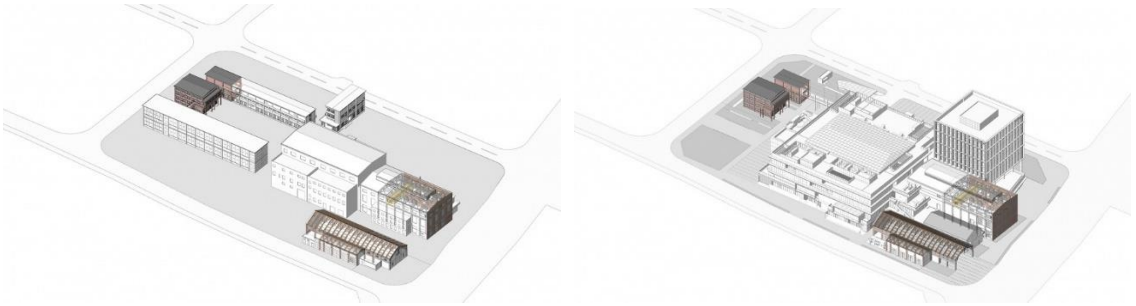
(2). Multi-level open space connection: The project gives the site a hierarchical public space structure, connects the two lakes through green space and landscape, forming an ecological corridor and connecting multiple square areas. And through the connection of view corridors, the city's cultural heritage and vitality nodes can be better displayed to the public. (Fig 3-18)

Fig 3-18 Analysis of the open space connection

(Source: CCTN Architectural Design)

(3). Continuity of texture: Due to the importance of its development context, the treatment of the original buildings is particularly important. The design uses spatial topology and reserves the original site texture. By planting a new courtyard in the center of the site, two existing courtyards are connected in series to form a courtyard space where the old and the new integrate. In the east of the site, the entrance of the commercial center will be built around the historical relics, while in the west, the historical buildings will be preserved. Combined with the original Figure-Ground relationship, a new commercial center and a Sports Themed

courtyard are formed. (Fig 3-19)



a) the preserved part of the old building b) The coexistence of old and new buildings

Fig 3-19 Analysis of the texture reshaping (Source: CCTN Architectural Design)

(4). Reuse of buildings: Because of the age, the original buildings have been seriously damaged, which cannot meet the current use, and the structure has also been significantly outward. This paper selects two buildings to illustrate. One of the buildings called No.2 pump station has left the most distinctive wooden structure through repair, and some of the exterior walls are decorated with glass and dark aluminum profiles as the entrance of the commercial center, integrating the old with the new. (Fig 3-20)

a) previous view b) the east entrance plaza

Fig 3-20 Renewal of “No.2 pump station” (Source: CCTN Architectural Design)

a) previous view b) the new business space

Fig 3-21 Renewal of the “7000 wind room” (Source: CCTN Architectural Design)

In the renovation of another building called the “7000 wind room”, the original construction method was mostly adopted, and the requirements of energy conservation were embedded. The visual effect of the original external window was retained to the maximum extent, and the

original color of the wall was continued, so that the new functional space can be full of historical details. (Fig 3-21)

3.4.2 Taoxichuan Porcelain district

1. Overview

The project is a demonstration area under the overall planning of Grand Taoxichuan, covering an area of 11.2 hectares. Taoxichuan is located in Jingdezhen, Jiangxi Province, China. Jingdezhen is the famous “Capital of Porcelain”, one of the starting points of China's Silk Road, and also the prosperous place of porcelain industry in Chinese history. The Cosmos Porcelain Factory, where the project is located, was the first state-owned mechanized porcelain factory in Jingdezhen in 1958. It has a glorious history, but it was severely damaged in the reform of state-owned enterprises in the 1990s, and the porcelain factories gradually declined and abandoned. The project aims to promote urban industrial upgrading through the regeneration of old factory areas. (Fig 3-22)

a) location b) pictures of the historical memory

Fig 3-22 Overview of Taoxichuan Porcelain district (Source: Bibliography [92,95])

2. Design Strategies

(1). Improving the overall layout of urban space: the overall layout of the Taoxichuan Porcelain district is based on the urban design of the Grand Taoxichuan. In the regeneration process, the Taoxichuan Porcelain district is studied from the perspective of the whole, and the whole is improved by the Porcelain district in turn. So that the Porcelain district and the surrounding urban space can be better integrated. (Fig3-23)

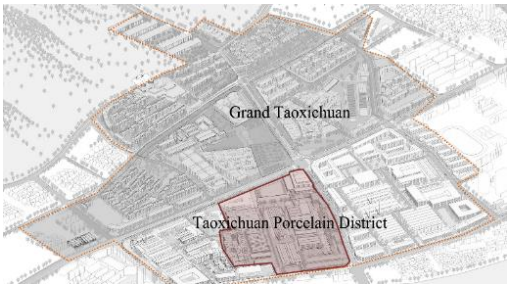
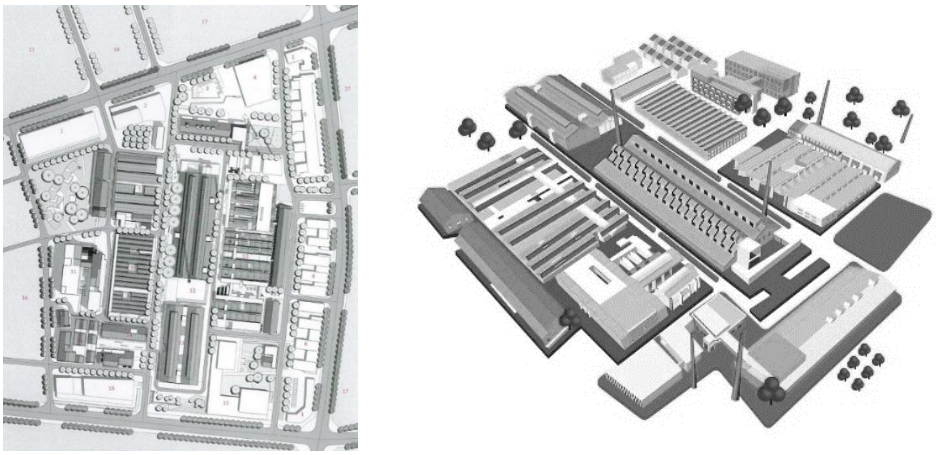


Fig 3-23 Porcelain district in Grand Taoxichuan (Source: Redrawn according to Bibliography [88])

(2). Continuation of history and preservation of Relics: In Porcelain district, the main objective is to continue the historic context and to exhibit the art and culture. Thus, the renewal method of historical relics is “repairing the old as before”, emphasizing that building materials can restore the characteristics of the times and the original site space should be preserved. In the design process, special elements such as production space, industrial structures and big trees are reserved to protect the cultural authenticity. (Fig 3-24)



a) general plan b) preserved historical relics

Fig 3-24 Preservation of the Porcelain factory (Source: Bibliography [95])

(3). Create pleasant open space: It is essential to reexamine the role of pleasant environment and recognize the importance of open space. In Porcelain district, the design scheme relies on Industrial Relics to create a public space with historical flavor and cultural characteristics. All the big trees are preserved, and other plants are supplemented owing to the environment, and the waterscape is implanted into the open space to optimize the site climate. It provides high-quality open space, increases the comfort of open-air activities, promotes social communication and improves community cohesion. (Fig 3-25)

Fig 3-25 Images of the open space (Source: Bibliography [88])

(4). Mixed business types: In order to avoid the problem of homogenization of business types

in the district, the project screened the settled merchants and enterprises and focused on the ceramic industry. The functions involve hotels, restaurants, commercial offices, multi-functional exhibitions, retailing, youth apartments, master studios, etc., forming a comprehensive art park with diversified business types. There are 135 independent business types, 27 catering business types. The proportion of art and culture business types is high, and the artistic atmosphere is strong. (Fig 3-26)

Fig 3-26 Function analysis (Source: Bibliography [58])

(5). DIBO-The implementation method of heritage activation system: The design, investment, building and operation of cultural heritage are coordinated by adopting refined management at the block scale. The project is led by the design team, which mobilizes the strength of the government, the proprietor and the community to achieve wider public participation, dynamically optimizing the scheme. The government's support at the decision-making level can avoid the destruction of industrial heritage by the real estate; At the same time, the proprietor is the main body of construction, who plays an important role in financial support and community liaison. This method enables the proprietor of the community to participate in the design and management, providing suggestions for community development.

3.4.3 London King’s Cross Central Development

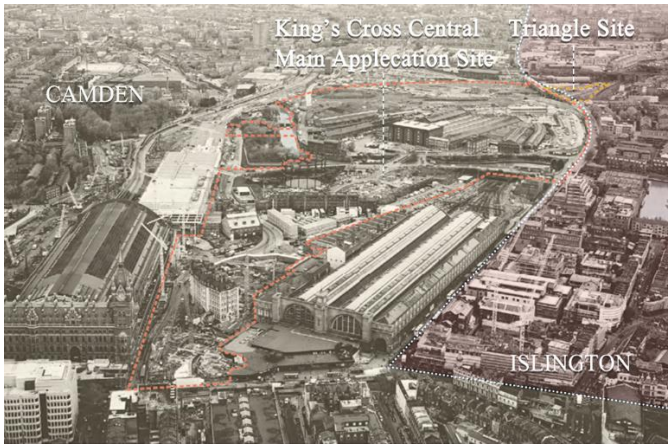
1. Overview

King’s Cross Central is located in the north of London Mid Town, at the junction of Camden and Islington, taking King's Cross station in 1852 and St Pancras station in 1868 as the centers. (Fig 3-27-a) King’s Cross Central was an important transportation hub in Britain from the Victorian era to World War II. After the World War II, with the decline of British industry, the factories in this area gradually withdrew from the historical stage, and the urban space

gradually became leftover. (Fig 3-27-b) Besides, King's Cross Central is located at the junction of two administrative regions, which is the gray area of urban management. With a high crime rate, it gradually became one of the slums in London. In the 1980s, the discussion on the deserted King's Cross Central was mainly focused on urban problems such as the poor population and economic situation, the underutilized transportation hub, the nonfunctional historical sites, the regional population congestion, housing difficulty, poor environment and other problems. On the other hand, in the London Plan, King's Cross Central is regarded as one of the five central areas margin key opportunities, which represented its spatial potential was huge for the whole city.

The planning of King's Cross Central began in 2000, and the first round of construction also began with the expansion of St Pancras station in 2000, and the regeneration was planned to be completed around 2020. The total area of the site is 27 hectares, sandwiched between the Regent's Canal and the boundary of railway lines. The site is divided into two by the canal. The development objective of King's Cross Central is to build it into a mixed functional area of employment, residence, education and leisure, and the project promised to improve the public space, planned to build 50 new buildings, 20 new streets, 10 major public buildings, 10.5 hectares of public space, protection and renovation of 19 historical buildings, 315,871m^2 of office facilities and 46,452m^2 of education facilities. Due to its positioning as a comprehensive transportation hub, King's Cross Central must meet the needs of high density and strong circulation as well. (Fig 3-27)

a) location



b) previous aerial view

c) spatial development from 1766 to 2007

Fig 3-27 Overview of King's Cross Central (Source: King's Cross Central Urban Design Statement)

2. Design Strategies

(1). Comprehensive evaluation and participation of multiple parties: To change the situation of the boundary and land fragmentation of the area itself, the project needs to conduct a comprehensive investigation and evaluation of the site about the surrounding blocks, urban barriers, historical relics, vision corridor, railway status, important nodes, etc. so as to have a deep understanding of the area from a multi-level and overall perspective. (Fig 3-28)

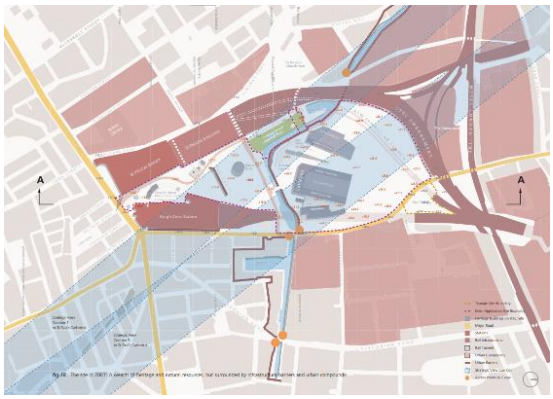


Fig 3-28 Overall evaluation (Source: King’s Cross Central Urban Design Statement)

In addition, due to the importance of the project and the complexity of interest groups, the government would carry out a lot of consultation work before the start of the regeneration project, emphasizing public participation. Every breakthrough in urban regeneration needs public participation in decision-making. Although it seems that a lot of time has been spent in the formulation stage, the open and transparent multi-dimensional negotiation mechanism integrates multi-party consensus into the strategies, reducing the resistance in the implementation stage. (Table 3-1)

Table 3-1 Appeals of different stakeholders in three phases

Renewal phase	Name of interest group	stakeholders	Appeals
First phase	LRC	Developer\investor	Increase office building development and focus on profit return.
	EXEL	Landowner	Pursue return on short-term capital investment and extract land funds.
	KXRLG	Community residents	Increase indemnificatory housing.
Second phase	LCR	Railway and Station construction companies	Pursue return on short-term capital investment and extract land funds.
	DHL	Landowner	Pursue return on short-term capital investment and extract land funds.
	CRG	Community residents	Profit from existing properties.
	KXCAAC	Historical heritage protection organization	Preserve the existing historic relics.
Third phase (including the stakeholders in the second phase)	ARGENT	Developer\Asset management company	Long term capital investment, focusing on profit return.
	KXBF	Local assets\business partners of Camden district	Improve production efficiency and sales

(2) Comprehensive development mode of multi-function mixing: The project aims to provide a dynamic planning mode of multi-element integration, so that both the business and the community can obtain the maximum benefits. In the overall planning stage, to provide jobs, office dominates the whole function structure, accounting for 56%, residential area for 24%, retail business for 11%, and other service facilities for 9%. The project defines the functions of large blocks, and there are certain overlaps between the different function blocks. Various functions in each block are developed comprehensively in different proportions. In addition, the planning also requires that a certain area of undetermined functions should be reserved to maintain flexibility. (Fig3-29)

a) general function zones b) mixed functions

Fig 3-29 Multi-function mixing (Source: King's Cross Central Urban Design Statement)

(3). Road network weaving: The original traffic on the site is blocked by the canal, and the density of roads inside the site is low, which has little effect on the easing of urban traffic. Secondly, due to the huge potential of this space, it plays a great role in activating the vitality of the city, thus, its requirements for traffic volume also increase. On the basis of respecting the original texture of the site, the project adds East-West roads and connects north-south roads to improve the operation efficiency of the urban road traffic system. (Fig 3-30)

a) previous b) renewal

Fig 3-30 Reformation of the road network (Source: King's Cross Central Urban Design Statement)

(4). Connection between public transport and non-motorized traffic: Through the prediction of the future travel mode in the area and the city's advocacy of low-carbon travel, the project will combine the original traffic stations to form a variety of urban public transit modes, a variety of public transport routes and evenly distributed public transit stations. In addition, in King's Cross Central, pedestrian space accounts for the main part. Pedestrian space is designed in combination with public space nodes and leads to the central part of the site. (Fig 3-31) Hierarchical pedestrian routes and public spaces bring good public activity experience and high-quality living environment for citizens. The combination of green space and different open-air activity spaces makes people closer to nature and provides flexibility and interest for public spaces. (Fig3-32)

a) public transport route and interchange b) pedestrian and cycle routes

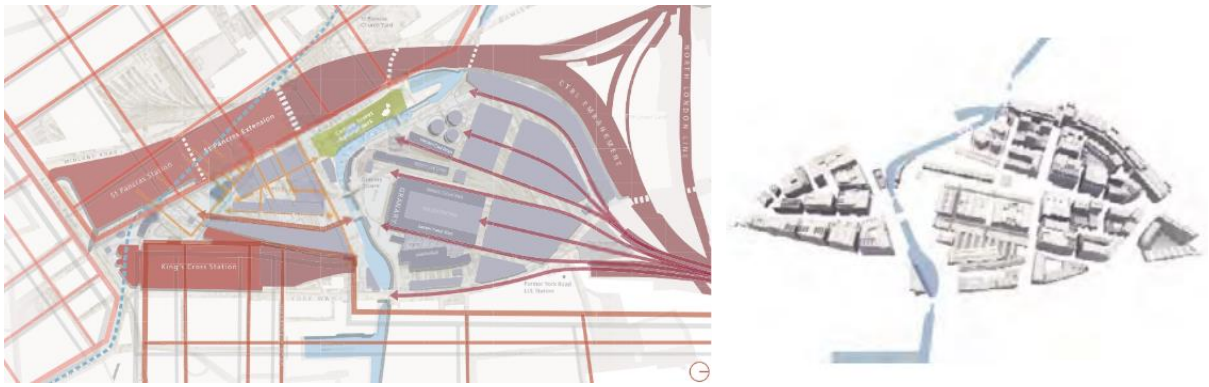
Fig 3-31 Public transport and non-motorized traffic (Source: King’s Cross Central Urban Design Statement)

a) hierarchical open space system b) long park

Fig 3-32 Open space with good environment (Source: King’s Cross Central Urban Design Statement)

(5). Integrating the texture and spatial form of the site and its surroundings: The project

extracts its own teapot like spatial texture from north to south, combines the grid like texture of surrounding cities, melts huge site into the urban area, and contains its original spatial context, finding integration in coordination and characteristics. In the three-dimensional space form, the development intensity is analyzed, and a space form suitable for the required functions is formed with high development intensity on the north and south sides and low development intensity in the middle, and the viewing corridor is considered to reasonably control the building forms. Finally, King's Cross Central will possess a texture and spatial form that is coordinated with the city and has personality. (Fig 3-33)



a) texture b) spatial form

Fig 3-33 Integrated texture and spatial form (Source: King's Cross Central Urban Design Statement)

(6). Catalyst for Change and Connection: "The full regeneration of the wider area around King's Cross relies on more than just the realization of King's Cross Central. King's Cross Central however would set the conditions and provide the catalyst for change on all fronts." .The project not only pays attention to its own development and construction, but also makes predictions and suggestions on the development of surrounding urban space, which better promotes the fusion of the urban area. (Fig 3-34)

Fig 3-34 Developing guidance for the surrounding areas
(Source: King's Cross Central Urban Design Statement)

As a catalyst, the project is expected to become a vitality center to drive the development of surrounding areas, seeking for surrounding blocks with regeneration potential, and make suggestions on the connection of pedestrian routes and the adding of public spaces around, so as to facilitate the follow-up urban regeneration projects.

3.4.4 Aviapolis Urban Blocks district

1. Overview

The project is located in Aviapolis, Vantaa, Finland, near Helsinki International Airport, with a land area of 15.6 hectares. It is not a fully utilized urban space. The airport hub will bring more urban vitality and more cultural exchanges to Vantaa. As a gateway from Finland to the world, Aviapolis needs to create pluralistic and shared urban blocks to carry the acceptance of more people in the region, aiming to form an integrated social space network to support the diverse activities of the city, connect the world and local residents, and provide a model for the construction of subsequent blocks. (Fig 3-35)

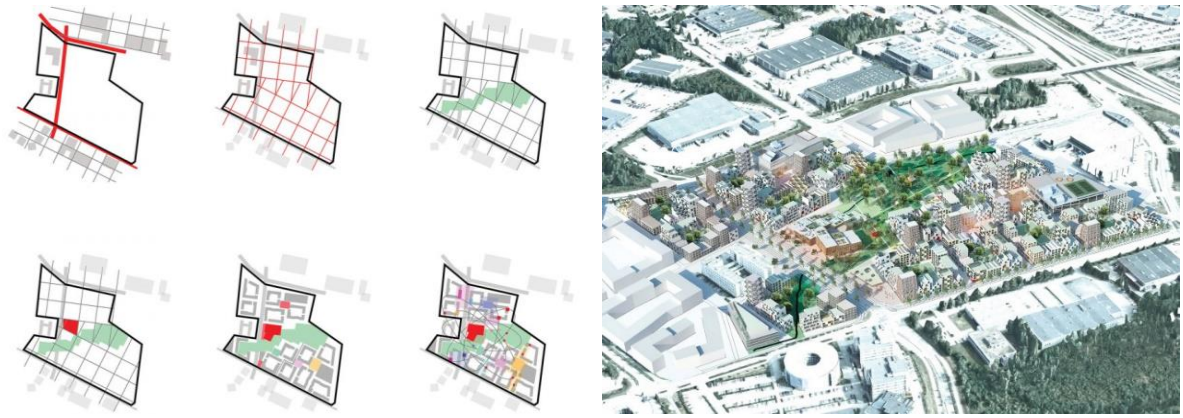
a) location b) scope

Fig 3-35 Location and scope of the site

(Source: Drawn by the author, Based map from Google Earth)

2. Design Strategies

(1). Grid connecting the city: The overall morphological structure of Aviapolis is a highly dense grid, but due to the large scale of the urban grid, it basically does not conform to the human body scale. The project continues the urban spatial context, makes more detailed division of the structure, forms a pedestrian friendly road network, retains the existing green and water space in the center of the site, creates an open and dynamic community center, and activates the vitality of the site by using the central educational facilities and social pockets as the block catalyst points. (Fig 3-36)



a) forming process b) aerial view

Fig 3-36 Grid structure

(Source: The official website of MASSLAB http://www.masslab.pt/portfolio/aviapolis-urban-blocks/)

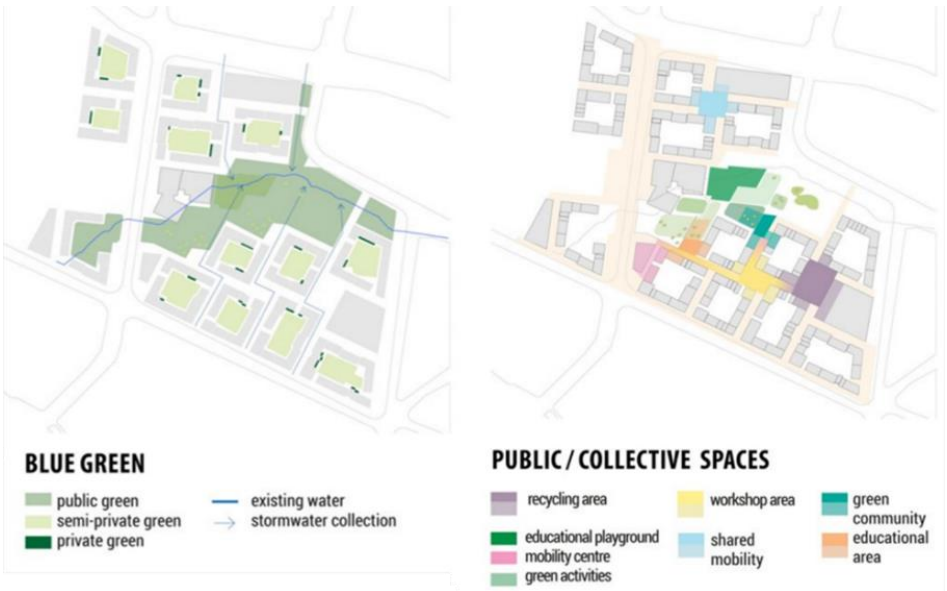
(2). Growing grid: The project will be gradually implemented in phases. In the first phase, the cultural and educational facilities in the center of the district will be used as the community center to promote the vitality of the whole block. Each phase includes residential, office and mobility hubs (for cars and bicycles). Finally, the block will form 1500 residential units and adequate community supporting services. (Fig 3-37)

Fig 3-37 Three phases of the project

(Source: The official website of MASSLAB http://www.masslab.pt/portfolio/aviapolis-urban-blocks/)

(3). Diverse activities with Green: The project forms a three-level green space system, including the public green space in the center of the block, the semi-open green space in the building cluster and some private green spaces close to the buildings. The main green spaces create a friendly public space to the surrounding urban areas. In addition, a variety of daily activity spaces are embedded in the public space of the block, including education square,

shared space for studio, green communication space, etc., leading to a better living environment. (Fig 3-38)



a) hierarchical green system b) activities in public spaces

Fig 3-38 Analysis of green and public spaces

(Source: The official website of MASSLAB http://www.masslab.pt/portfolio/aviapolis-urban-blocks/)

3.4.5 Summary of “Weaving” strategies

1. Targeted evaluation strategies

In the four cases of weaving, the investigation, research, analysis, and evaluation of urban leftover spaces have clear objectives, including the investigation and analysis of the origin and change of the functions, the evaluation and summary of the space quality, and the evaluation and analysis of the external space quality. The direction of evaluation and assessment is determined through preliminary investigation, and then combined with qualitative and quantitative analysis and assessment methods, the subjective and objective assessment and research on the elements of the leftover spaces are carried out to better guide the update and design.

2. Consideration of overall urban layout

The consideration of the overall urban layout where the urban leftover space is located exists in four cases, especially in the Taoxichuan Porcelain district project. As a part of the whole city, the leftover space should be weaved on the basis of the overall layout, combining its own spatial characteristics. This holistic view can better enhance the integrality of the city and increase the coordination between the urban leftover space and the surrounding space.

3. Flexible function mixing mode

The mixture of functions is particularly important in the renewal of urban leftover space. This mixture is flexible and three-dimensional. The function mixing shall be carried out according to the functional layout of the surrounding urban space, its own original functions and the adaptability to new functions. Variable multi-function space shall be reserved to better cope with the change of functions. Each function should have a strong positive correlation to enhance the integrality of the functional structure in the space.

4. Interweaving of public transport and non-motorized traffic

In London King's Cross Central Development, in addition to improving the connectivity of the original road network, the optimization of public transport environment is also indispensable because modern cities generally advocate low-carbon travel. One of the strategies to improve the low-carbon travel rate is to improve the non-motorized traffic system and improve the comfort of the non-motorized traffic environment. The connection between public transport and non-motorized traffic shall be strengthened to interweave public transport and non-motorized traffic.

5. Hierarchical public open space system

The four cases all emphasize the design of public open space system. The leftover urban space should connect with the surrounding public open space system and provide more public outdoor activity space for citizens. In weaving, the public open space should be multi-level and three-dimensional and can improve the space quality of other urban elements, Connecting and optimizing the public open space in the urban region.

6. Continuity and reshape of texture and special form

Through the reservation of buildings or structures, the extraction of original texture and spatial forms in the leftover urban spaces, and the respect to surrounding urban space texture, the Weaving will continue and reshape the urban texture and spatial form. The strategies include the "layering", "inlaying" and "compounding" of the old and new textures. According to the urban context and memories that the original space contains, the texture and spatial form can be continued and reshaped through different strategies.

The "layering" strategy needs to retain more original buildings, establish new space texture through different layers, and overlay different element subsystems, emphasizing the superposition of space elements. The "inlaying" strategy embeds the new street texture into the old street texture, so that the two different space textures can be better integrated and

reshaped. The “compounding” strategy aims to integrate different levels of architectural space, based on the original space elements, respect the original texture characteristics and spatial order, and transform the conflict between the old and new space elements into the “unity of experiences”, which requires more sensitivity of architects and planners to urban space.

7. Progressive construction mode

The Aviapolis Urban Blocks district project and London King’s Cross Central Development both emphasize the gradual and dynamic perspective on urban development and urban construction. The Aviapolis Urban Blocks district construction process is divided into three phases according to the necessity and urgency of the functions, starting from the public service function, and constantly integrating green space function and residential function. London King’s Cross Central Development, as an urban regeneration project, has a long construction period. At different stages of construction, the project has gradually developed various weaving elements, and made certain adjustments according to the opinions of the government, community residents, investors, etc. at different stages of development, but such adjustments must follow the overall weaving framework.

8. As a catalyst to affect the surrounding urban space

At the later stage of the weaving process or after the weaving, the urban leftover space gradually changes from the forgotten state broken away from the mainstream urban space to the urban vitality space. The generated vitality space, as a new urban catalyst, feeds back and supports the surrounding urban environment. In the weaving, it is necessary to consider the location of the catalyst point and the construction periods, so as to better work on the overall urban space.

3.5 “Weaving” framework of urban leftover space updating

Through the demonstration of the coupling relationship between the “Weaving” and the urban leftover space concept, it is basically shown that under the guidance of the “Weaving”, urban leftover spaces have the ability to weave the city, which lays a theoretical foundation for the practice of the urban leftover space weaving mechanism. The updating mechanism of urban leftover spaces under the “Weaving” is a personalized extension of the weaving framework, which combines the weaving framework, the characteristics of urban leftover spaces and reference to case experiences. The updating mechanism starts from the analysis of the dependence on the existing urban environment, the characteristics and conditions of the leftover spaces themselves. Through qualitative and quantitative evaluation, the problems of

the leftover spaces themselves and their spatial potentials are judged to determine the orientation and general objectives of urban renewal and urban design. In the design and implementation stage, the overall strategy of "Supplement, Connection, Growing and Fusion" in the weaving mechanism is used, and the phased construction mode, dynamic strategies and multi stakeholder negotiation mode are also used according to the elements, creating an urban space with integration, coordination, diversity, complexity, dynamic and progressive development, and upholding Contextualism and Humanism. (Fig 3-39)

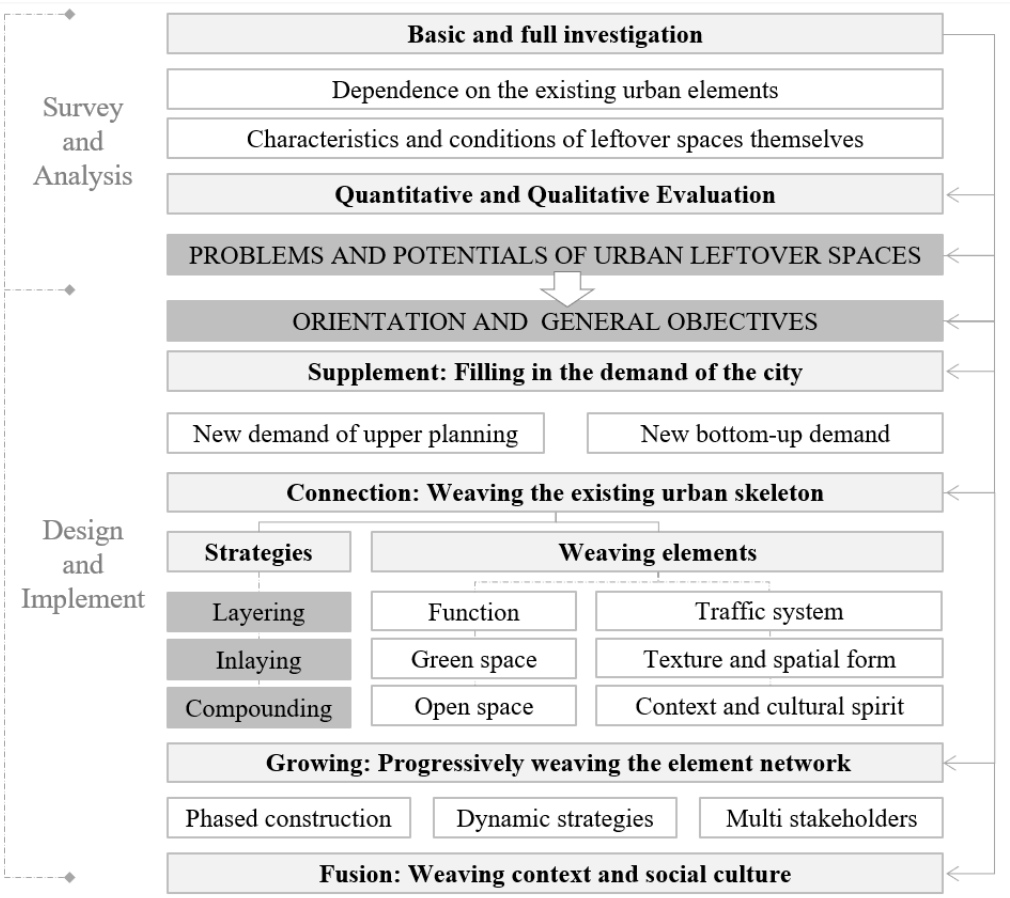


Fig 3-39 "Weaving" framework of urban leftover space updating
(Source: Drawn by the author)

Chapter4 Investigation and evaluation of the Racecourse

The analysis and evaluation of space is an indispensable step in the process of urban design, and it should be carried out under the framework of the urban leftover space weaving. This chapter discusses the "Weaving" elements of the racecourse, forms a comprehensive understanding, and takes the urban public life orientation based on space sociality, the connectivity orientation based on holistic thinking, and the TOR development mode orientation based on space value as the potential evaluation orientations, and forms a qualitative-quantitative analysis and evaluation framework to guide further urban design.

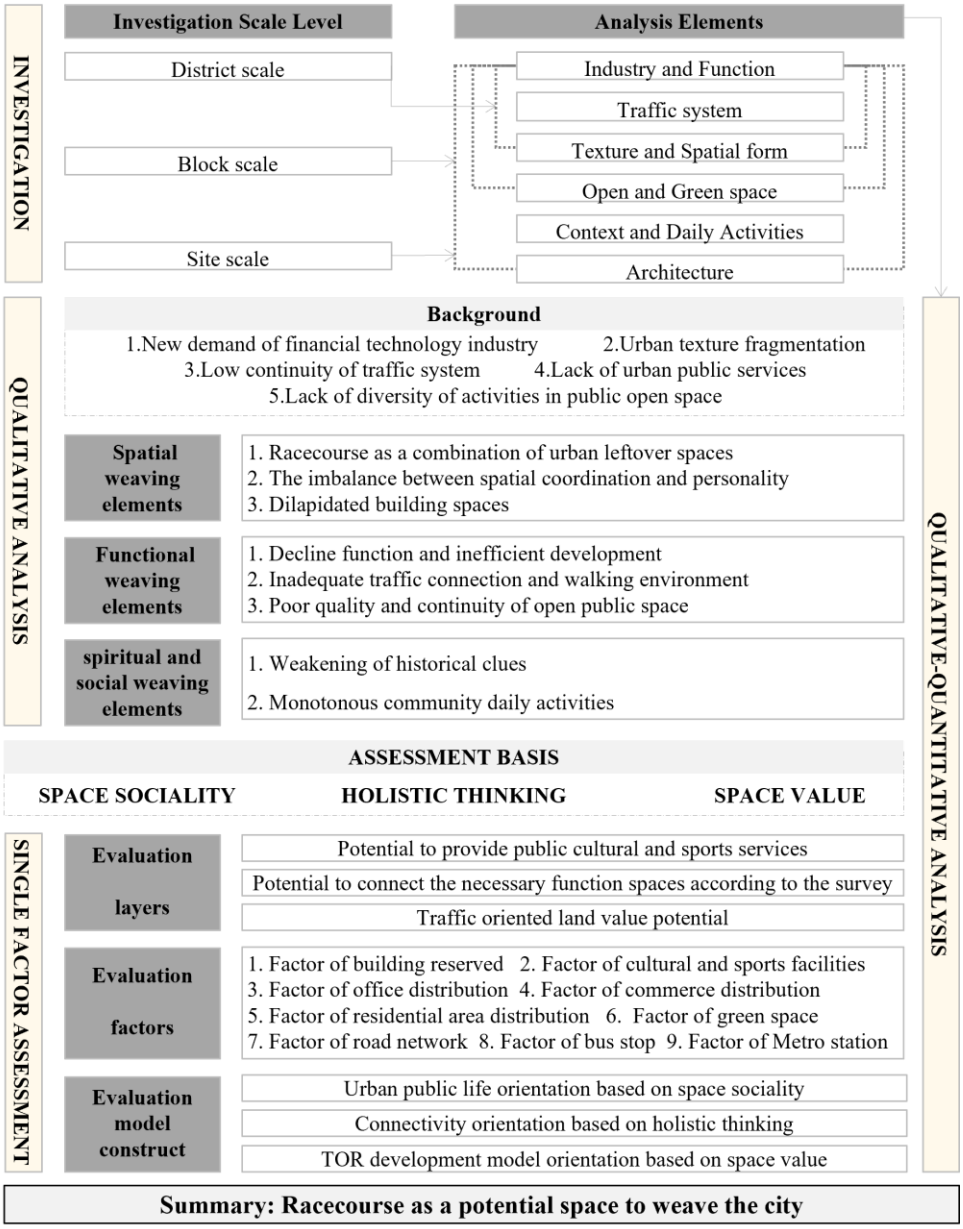


Fig 4-1 Qualitative-quantitative analysis and evaluation framework
(Source: Drawn by the author)

4.1 Background: Racecourse as a junction of three urban function areas

The racecourse is located at the easternmost side of the Zhujiang New Town, and the west side is close to the new central axis of Guangzhou. (Fig 4-2) According to *the Fourteenth Five Year Plan of Tianhe district*, its spatial location is close to the Wushan Higher Education Area in the north, close to the Guangzhou International Financial City in the east, overlooking the Pearl River in the south. It is located at the junction of the three regions in urban development and is an important urban node. Therefore, it is necessary to investigate and study it at the scale of urban region.

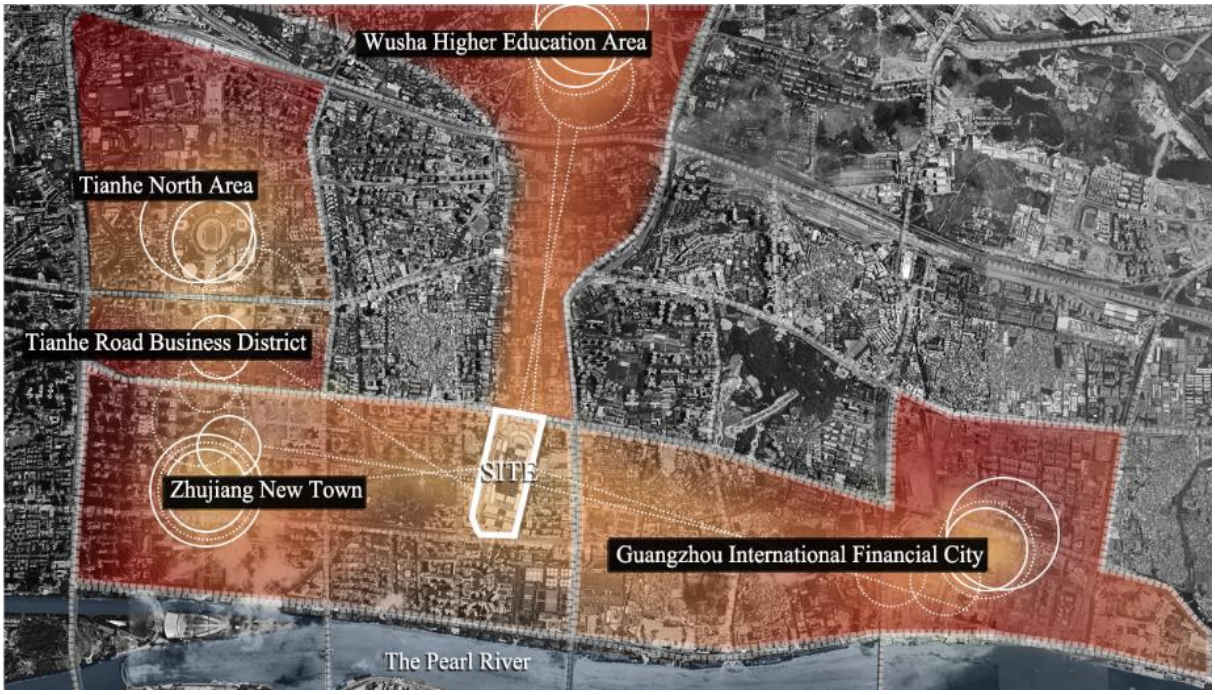


Fig 4-2 Racecourse at the junction of three urban zones
(Source: Drawn by the author, Based map from Google Earth)

4.1.1 New demand of financial technology industry

The research on the industry type will help to determine the new functions of the racecourse. Based on the *Tianhe Yearbook* and *Guangzhou Statistical Bulletin of National Economic and Social Development*, this paper analyzes the annual growth value of the four leading industries in Tianhe district, their proportion in the GDP of Tianhe district. The financial industry is the core industry among the four leading industries, followed by the new generation of information technology industry. (Fig 4-3)

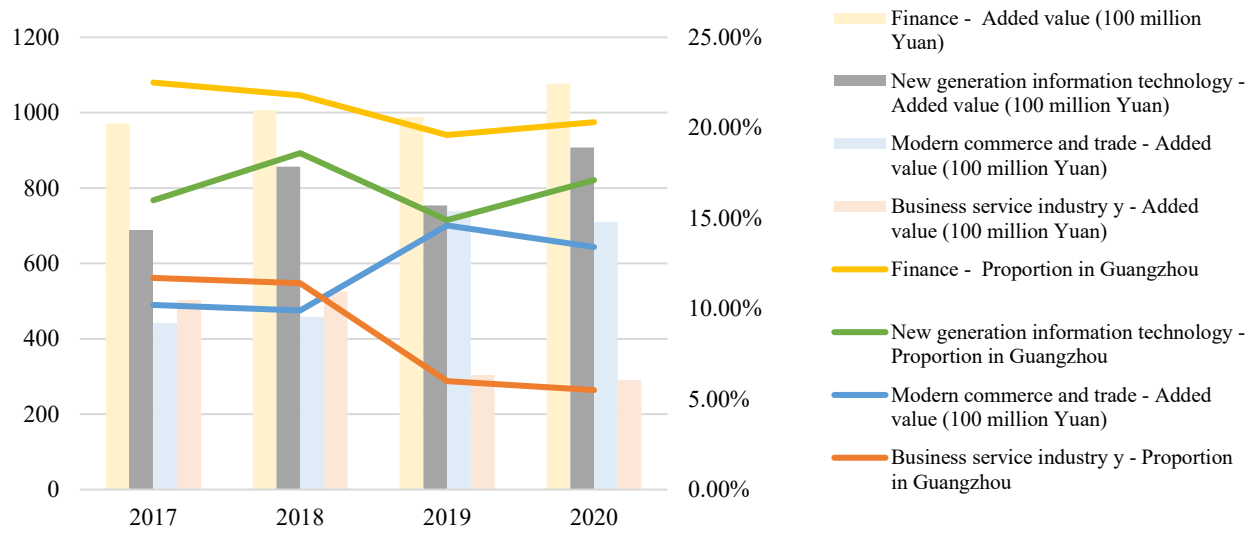


Fig 4-3 Development of four predominant industries in Tianhe district, Guangzhou
(Source: Drawn by the author, data from Guangzhou Yearbook)

In terms of the development of the financial industry in Tianhe district, its growth has increased year by year. Although there was a small decline in 2019, it returned to the original level in 2020. On the whole, the financial industry has an unshakable position in the proportion of GDP in Tianhe district. (Fig 4-4)

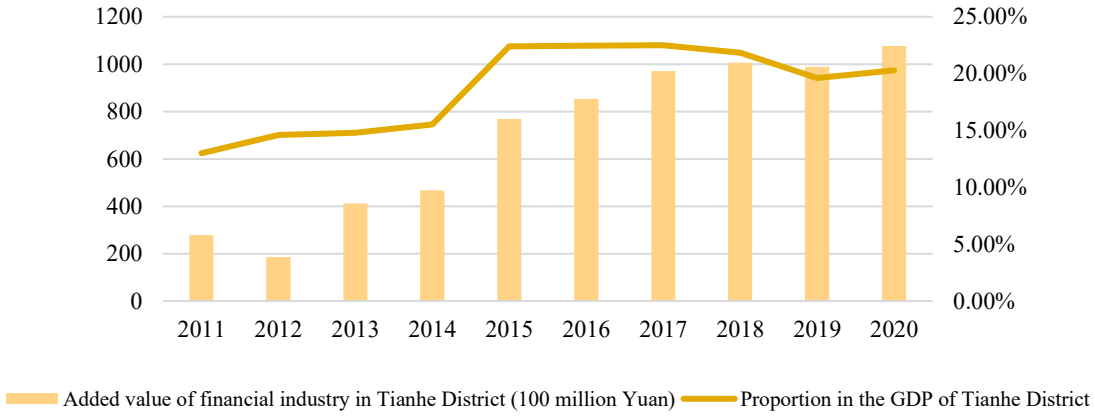


Fig 4-4 Added value of financial industry in Tianhe district, Guangzhou
(Source: Drawn by the author, data from Guangzhou Yearbook)

From the perspective of the number of financial institutions, the number of Tianhe district accounts for 70% of the number of Guangzhou. The financial industry in Tianhe district has formed an agglomeration effect, and the number of traditional financial institutions in Tianhe district has tended to balance. How to take advantage of Tianhe district's predominant industry and form a differentiated development path is a problem that needs to be considered for the

racecourse. (Fig 4-5)

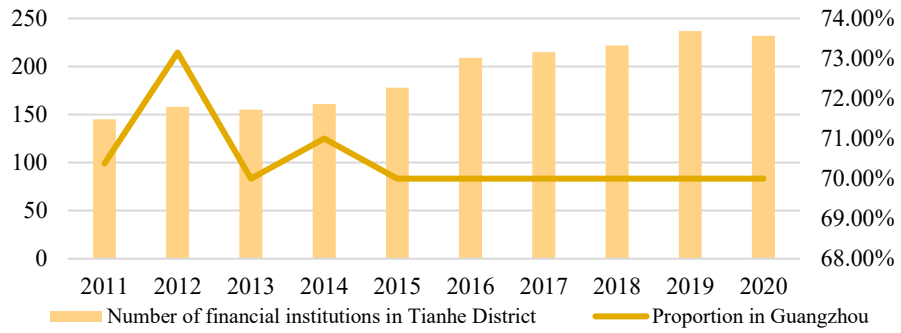
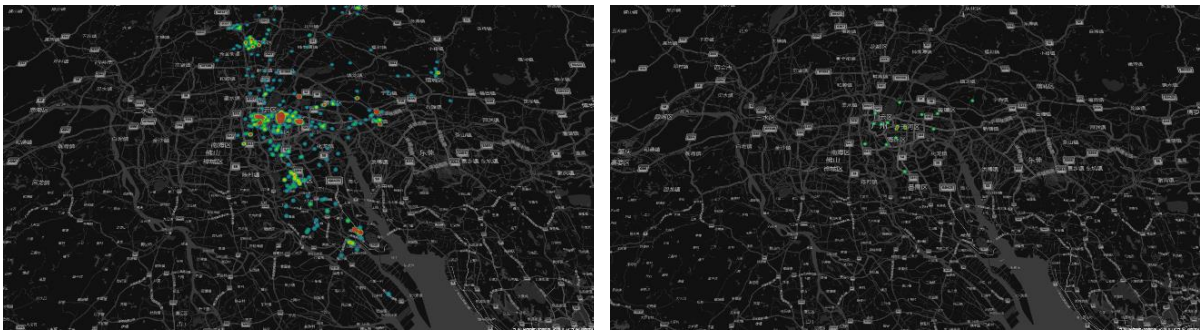
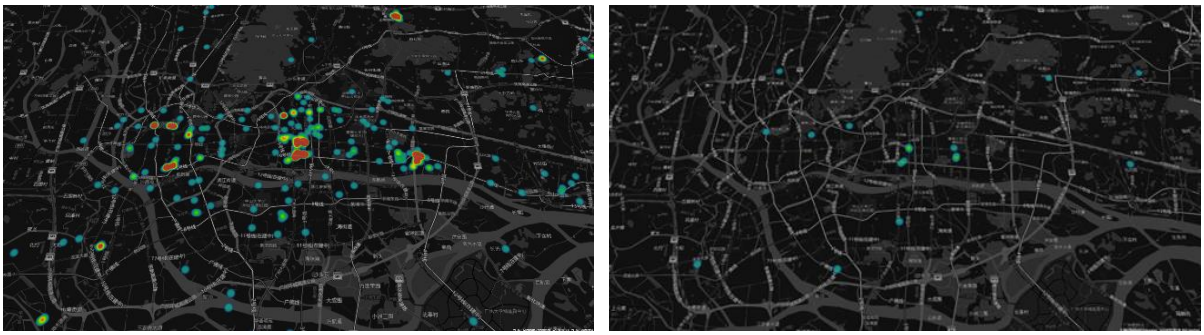


Fig 4-5 Development of financial institutions in Tianhe district, Guangzhou
(Source: Drawn by the author, data from Guangzhou Yearbook)

This study uses big data and extract the location of financial institutions, financial technology institutions, financial institutions in Tianhe district, and financial technology institutions in Tianhe district. Through kernel density analysis, it is found that financial institutions are mainly concentrated in Tianhe district, especially in the central area of Zhujiang New Town and the starting area of Guangzhou International Financial City. However, the number of financial technology institutions is small, and their distribution is relatively uniform, which is still in the initial stage. (Fig 4-6)



a) financial institutions in Guangzhou b) fin-tech institutions in Guangzhou



a) financial institutions in Tianhe district b) fin-tech institutions in Tianhe district

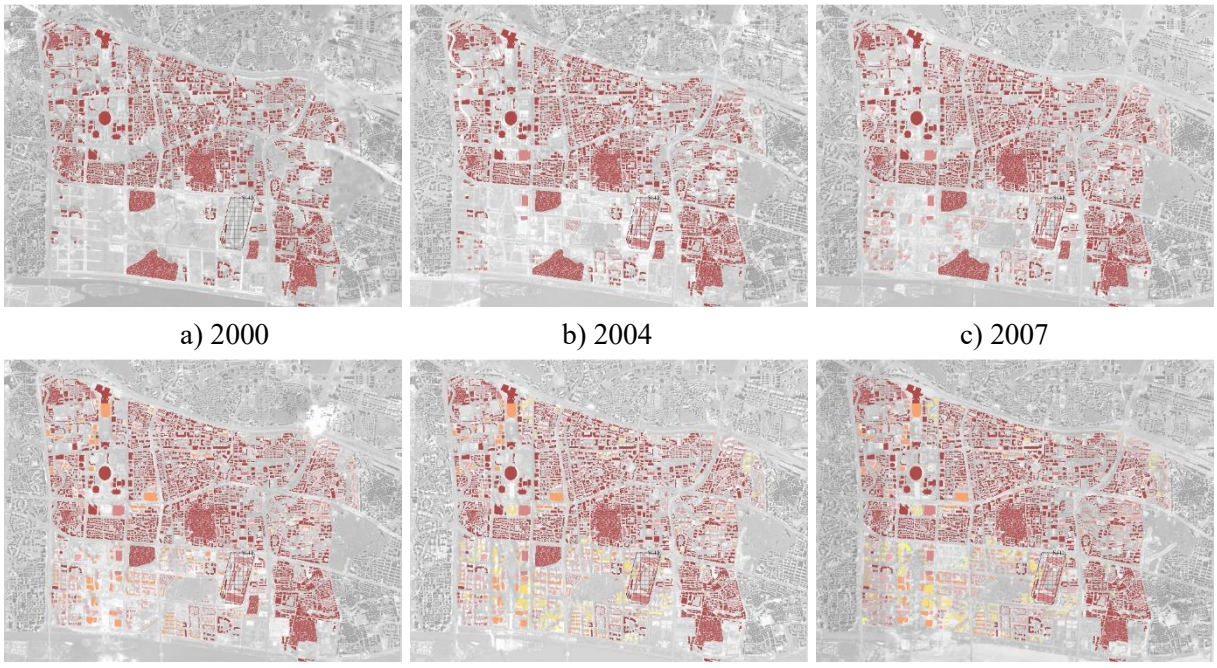
Fig 4-6 The kernel density of financial and fin-tech institutions in Guangzhou and Tianhe district
(Source: Drawn by the author, data from Gaode Map API)

Combining the financial industry with the new generation of information technology industry, the industrial development path can rely on the original two predominant industries in Tianhe district and use the industrial agglomeration effect to form a new industrial model, which can enable the two industries to integrate to a certain extent.

4.1.2 Urban texture fragmentation

1. Construction dominated by incremental development

At the beginning of 1990s, Guangzhou's economy developed rapidly, and the urban spatial structure had undergone tremendous changes. With Tianhe Sports Center as the core, Guangzhou has promoted the urban center to move eastward. At the same time, Guangzhou Municipal Government believed that Guangzhou should continue to improve its status as a central city, and to develop the tertiary industry in a large-scale and high standard way with the goal of building an international metropolis. In 1993, the development of Zhujiang New Town was officially launched.



a) 2000 b) 2004 c) 2007

d) 2010 e) 2015 f) 2020

Fig 4-7 The spatial development at the district-scale

(Source: Drawn by the author, Based map from Google Earth)

Before 2000, a relatively complete urban construction had been formed near the north side of Huangpu Avenue and the east side of South China Expressway. The urban space was mainly composed of the sports center area, the higher education district, the gated residential area, and the villages in the city. The west and east sides of the Pearl River New Town also formed sporadic construction. At the same time, there were steel three large-scale villages in the city

in the Zhujiang New Town. (Fig 4-7-a)

From 2000 to 2004, the construction of Zhujiang New Town was still centered on the west and east. During this period, the racecourse plot gradually became the Guangzhou Motown, forming a building cluster based on the original texture of the racecourse. In the areas outside the Zhujiang New Town, the construction is mainly about the urban renewal, the leftover land in the area had been developed, but the renewal and construction speed is slow. (Fig 4-7-b)

From 2005 to 2007, the construction of the Zhujiang New Town gradually shifted to the central area, and the construction speed gradually increased, entering the comprehensive construction stage. During this period, the opening of Metro Line 3 and the maturity of the completed residential areas had driven the continued development of the central area, the eastern and western regional space. The construction volume of the areas outside the Zhujiang New Town was small, still sporadically developed. Zhengjia Square was completed during this period, and the sports center business circle gradually formed. (Fig 4-7-c)

From 2007 to 2010, the spatial rudiment of the Zhujiang New Town was basically formed. The village in the south of the area was demolished, leaving only some historical buildings such as ancestral temples. The related facilities in the central area of the city were gradually improved. The completion of landmark buildings on both sides of the new central city axis led to a gradual gathering of urban vitality. During this time, the development of the surrounding areas of the racecourse was gradually slowed down. The renewal of urban areas outside the Zhujiang New Town has been gradually accelerated. The construction of One Link Walk, Taikoo Hui and other urban complexes around the Guangzhou Sports Center had been completed. The business district has developed in full swing, forming an important business center in the city. (Fig 4-7-d)

From 2010 to 2015, the construction of the region entered a mature phase. Large cultural facilities around the central axis of the Zhujiang New Town were gradually completed. More commercial office buildings rose from the ground. The village in the city on the east side of the racecourse was demolished. The region-level business circle around the Happy Valley was gradually built, and the construction space in the region was gradually reduced. The establishment of the Tianhuan Complex on the south side of Guangzhou Sports Center had become a new booster for the sports center, and the vitality of Guangzhou's new city axis had been enhanced to a new stage. (Fig 4-7-e)

From 2015 to 2020, the construction mode in the region gradually shifted from incremental

mode to inventory mode. Xian Village, on the east side of the central axis of Zhujiang New Town, had entered the stage of comprehensive reconstruction. In addition to the historical relics containing many urban memories, a large area of Xian Village had been demolished to meet the needs of current urban development as much as possible. Construction outside the Zhujiang New Town had basically stopped. Since then, the focus on the construction and development of this urban area had gradually turned to the Racecourse. (Fig 4-7-f)

2. Texture fragmentation

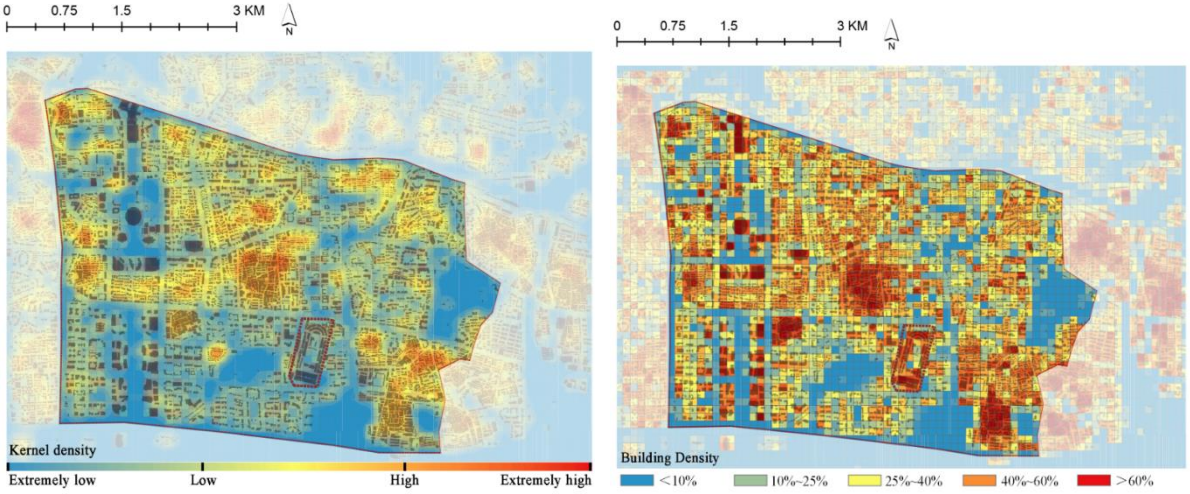
In the late 20th century, China's development model advocated taking the automobile as the main travel method. The construction was always accompanied by a large scale of urban blocks, and used to use the closed mode in the construction of urban residential areas and university campuses. Many large-scale blocks composed of residential areas and campus space were formed in the northeast. Since 2010, the development model of "small blocks, dense road network" has gradually become the mainstream of urban development, so the block scale of the space constructed later in the urban area is small.

On the whole, the block scale of this urban area is small in the southwest, large in the east and northeast. From the point of view of the racecourse, due to its initial function, its block size is kept in a large state, resulting in problems such as discontinuous roads and poor walking friendliness. (Fig 4-8)

Fig 4-8 The block texture (Source: Drawn by the author, Based map from Google Earth)

Combined with the kernel density analysis of buildings and the building density analysis, it can be found that the urban texture is collage. Due to the different functions and construction periods, the urban texture has great differences, which is also an inevitable problem in urban development. The designers need to comprehend the diversity of urban texture in the urban

renewal and establish a new balance. (Fig 4-9)



a) the kernel density of building points b) the building density of 10*10m unit

Fig 4-9 The analysis of the architecture texture

(Source: Drawn by the author, data from Gaode Map API)

With the Figure-Ground analysis, it is obvious that the urban building texture is small and dense in the northeast and large and sparse in the southwest. On the one hand, it is because of the differences in the architectural functions it carries, and on the other hand, it is because of the differences in the construction period. The southwest side is mainly large cultural facilities, commercial facilities and high-rise office buildings built later, mainly including the block-type and tower-type buildings. The northeast side is mainly the university area and residential area constructed earlier, which is low in height and mainly presents a determinant layout. There are still two villages in this urban region, with dense urban texture. (Fig 4-10)

Fig 4-10 The building texture (Source: Drawn by the author, data from Gaode Map API)

The racecourse is located at the junction of urban texture changes, and its own texture is

mainly in an enclosed state. The building scale is large, and the morphological characteristics of the original racecourse can be clearly observed. How to balance the individuality and coordination of the racecourse space texture is a problem that must be considered in urban design.

4.1.3 Low continuity of traffic system

The road network of the racecourse area is dense and there are many levels of roads. However, due to the differences in the construction period, the road network density is uneven. The road density around Huacheng Square in the southwest is high. The road density drops suddenly in the area with large block size, which is easy to form congestion in places with large traffic flow. There are some problems in the continuity of main roads and secondary roads, which aggravates the congestion of road intersections. (Fig 4-11)

South China Expressway passes through this urban area, adjacent to the east of the racecourse. It has caused “fragmentation” of the city to a large extent. Due to its existence, road traffic and non-motorized traffic are greatly affected on both sides. Problems caused by “fragmentation” requires some strategies conducive to mitigation.

If we observe the area around the racecourse, we will find that the site of racecourse has also caused fragmentation of urban traffic, reducing the continuity of the road network, especially blocking the east west Jinsui Road, further reducing the operating efficiency of the urban road system.

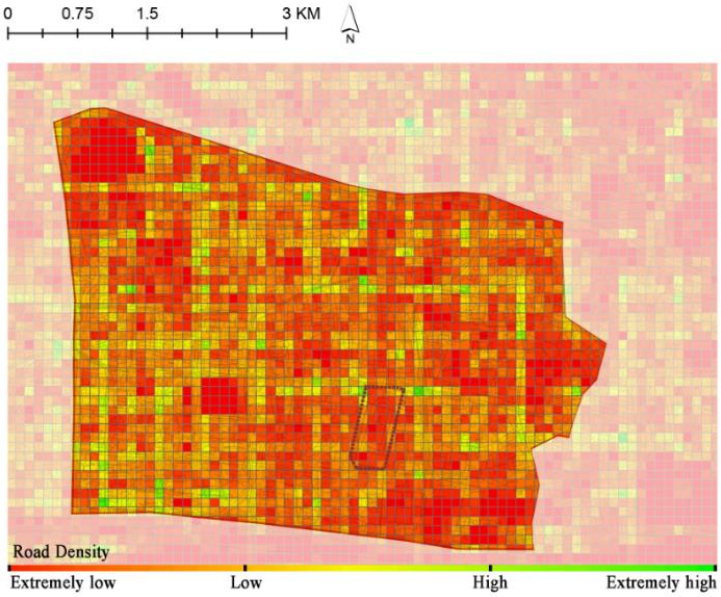


Fig 4-11 The road density (Source: Drawn by the author, data from OpenStreetMap)

From the perspective of Metro transit, the subway lines are concentrated in the west and northwest of the area. Metro Line 5 passes Tancun Metro Station along Huacheng Avenue, in the south of the racecourse. In addition, Line 13 is being built on the north side of the racecourse, and station will also be set on the racecourse plot. (Fig 4-12)

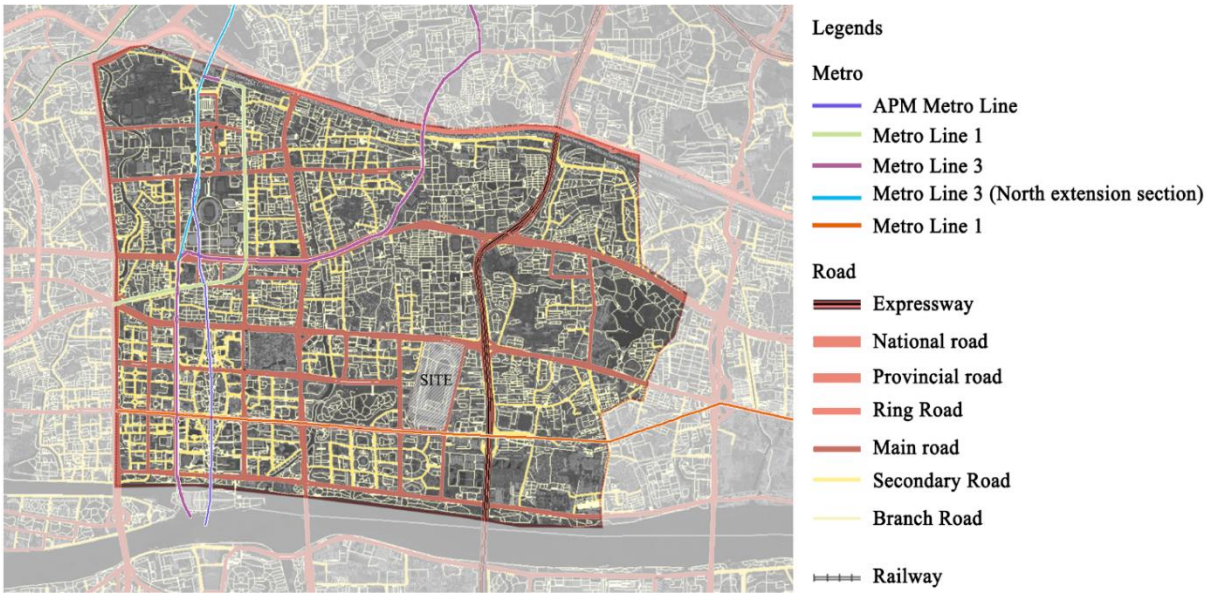


Fig 4-12 The traffic system (Source: Drawn by the author, data from OpenStreetMap)

4.1.4 Lack of urban public services

In terms of urban service functions, the urban area has relatively complete public facilities due to its early development period. This paper captures the data of urban interest points on the Gaode map platform, and selects commercial and leisure interest points, sports interest points, education interest points, and medical interest points for kernel density analysis to study the agglomeration degree of various service facilities in the city.

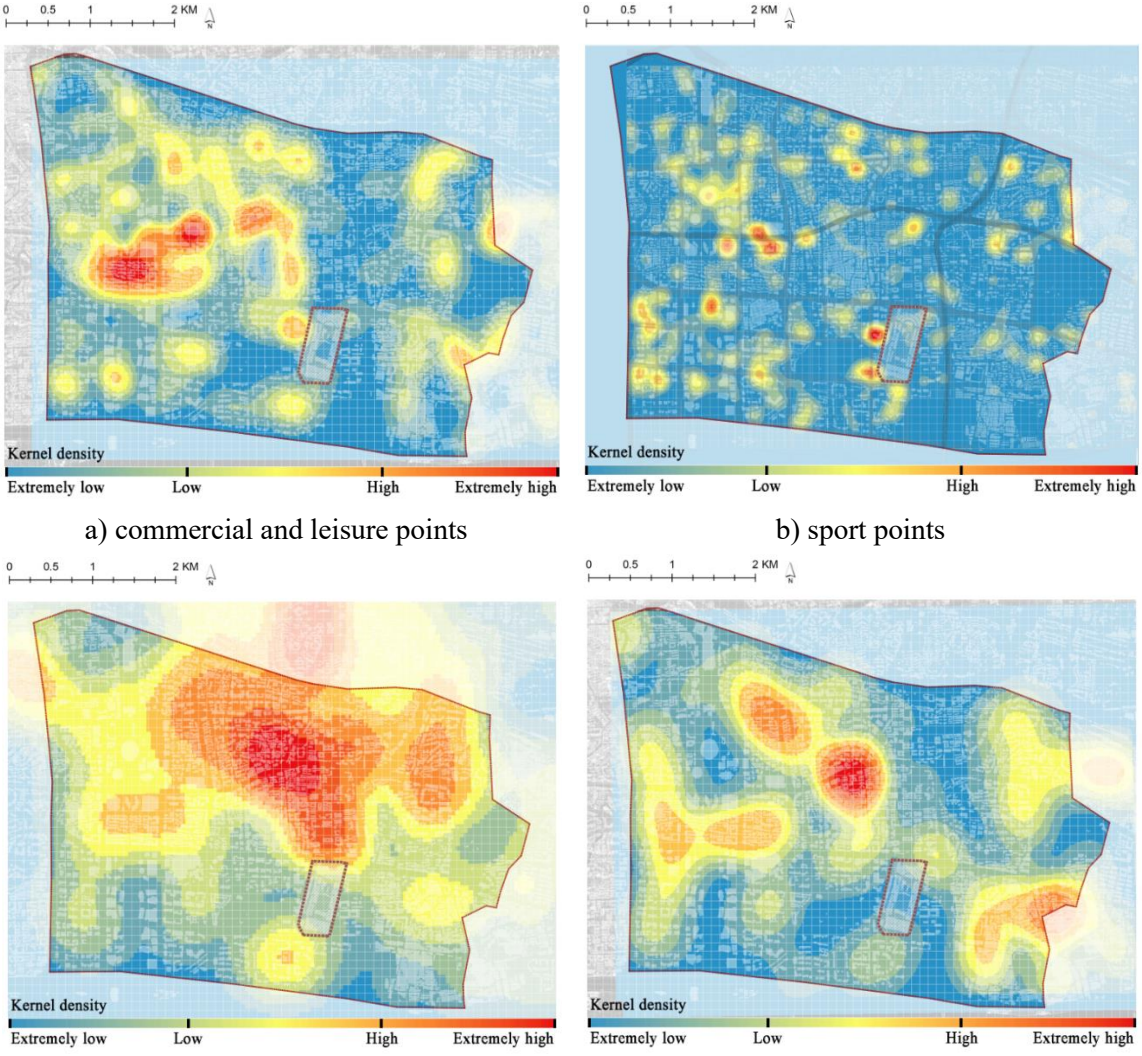
Among them, commercial and leisure services are mainly concentrated in Tianhe Road Business district, and widely distributed in the northwest part of the region. There is a gathering point of commercial and leisure facilities in the west of racecourse, with the Sun New World Mall as the gathering center. The business agglomeration effect on both sides of the South China Expressway is relatively low, and the distribution of interest points is extremely sparse. It can be considered to put commercial and leisure functions in the racecourse space, and strengthen the connection on both sides of the South China Expressway to form a district scale Trading Area. (Fig 4-13-a)

Sports facilities are distributed evenly, but they are mainly concentrated in the sports center. Sports interest points are also concentrated on the west side of the racecourse. According to

the attribute of the points, they mainly belong to private business, mostly for physical education courses. The racecourse area lacks public sports facilities, so public sports facilities can be implanted in the design phase. (Fig 4-13-b)

From the perspective of educational facilities, this urban area has abundant educational facilities, mainly concentrated in the north of the urban area, which basically covers the residential area, possessing rich educational resources. (Fig 4-13-c)

From the perspective of medical facilities, the medical facilities are mainly concentrated near Gangding Metro Station, but the medical resources are relatively rich and the service radius covers a large area. However, due to the existence of South China Expressway, the medical facilities on both sides are less distributed. (Fig 4-13-d)



a) commercial and leisure points

b) sport points

c) education points

d) medical points

Fig 4-13 The kernel density of different points of interest
(Source: Drawn by the author, data from Gaode Map API)

From the perspective of urban land use, in addition to urban road land, residential area accounts for 38.8%, commercial land accounts for 8.1%, business and office land accounts for 7.1%, park area accounts for 5.6%, primary and secondary school land accounts for 4.4%, and scientific research and education land accounts for 9.1%, which conforms to the requirements for the "commercial and residential" nature of the site in the upper planning. However, the area is extremely short of land for sports and public cultural facilities. Commercial and business land has formed a certain concentration on the west side of the racecourse. (Fig 4-14)

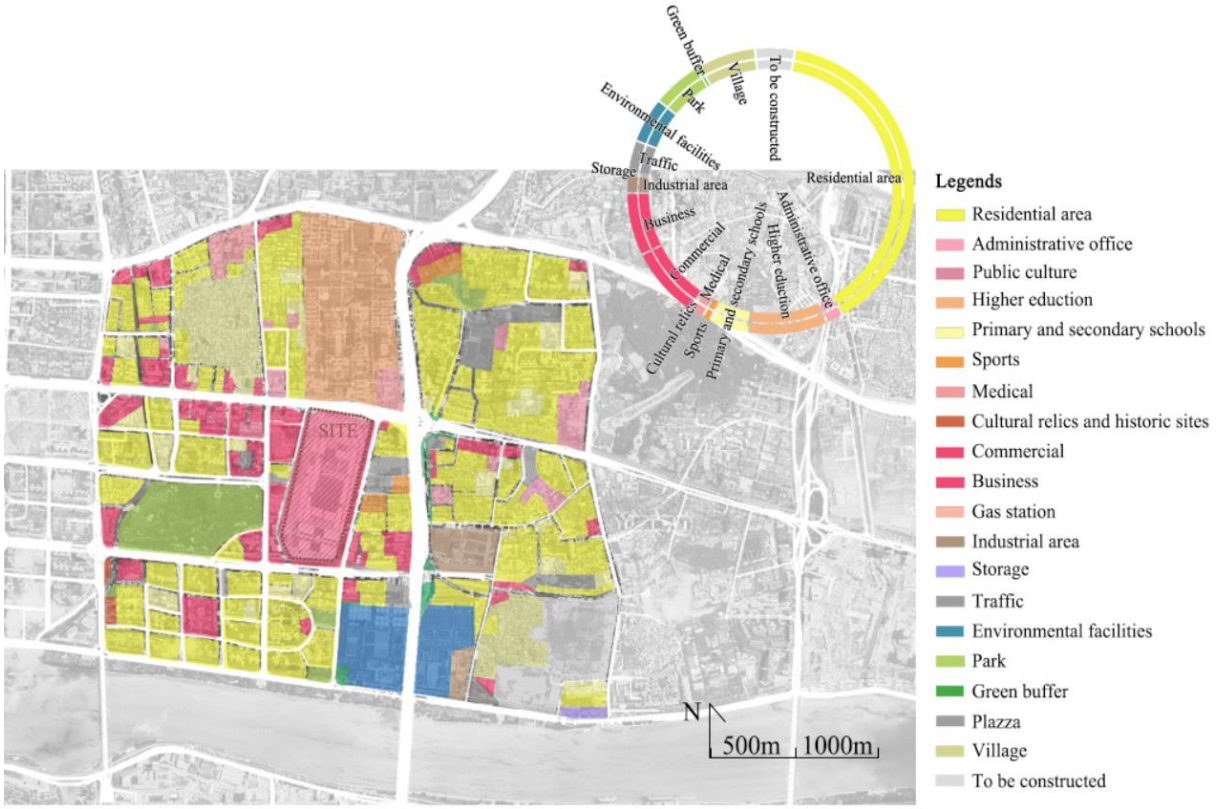


Fig 4-14 Land use analysis (Source: Drawn by the author, Based map from Google Earth)

As the center of the region, the racecourse can further gather with the central business and commercial cluster, provide cultural, sports and other facilities for the surrounding blocks, and supplement diverse commercial and business formats. In addition, the green space with multiple functions can be formed by relying on Tianhe Park in the west and combining other functions, to create a multi-level and interesting urban leisure green space.

4.1.5 Lack of diversity of activities in public open space

The urban green space and public space in this area mainly include Zhujiang Park, green space in golf clubs in the racecourse, and green space in Ji'nan University. The space is concentrated, the distribution is uneven, and it is always closed with poor continuity.

The green space system and urban public space system can be weaved in the renewal of the racecourse site, improving the hierarchy, connectivity and publicity of urban open space by improving the green space rate and building a more complete urban public space network. (Fig4-15)

Fig 4-15 Green and public space analysis
(Source: Drawn by the author, Based map from Google Earth)

4.2 Analysis of spatial weaving elements

4.2.1 Racecourse as a combination of urban leftover spaces

Analyzing the racecourse from a site perspective is conducive to grasping the spatial elements, finding its spatial development context, evaluating and analyzing the original available resources, and implementing the weaving at this scale. The site scale scope mainly includes the racecourse site, extending to the racecourse road and South China Expressway through the other urban leftover spaces in the east and west.

According to the heatmap obtained from the analysis of the population density based on Baidu big data, the population flow of the racecourse site and the urban space in the middle of the west and east is small, and the population density is mainly concentrated in the northwest, northeast, southwest and southeast corners of the racecourse. The population density is similar to that of the Zhujiang Park, but according to their specific functions, the racecourse site, as a commercial and leisure plot, is extremely low in popularity, It is gradually leftover by urban residents. (Fig 4-16)

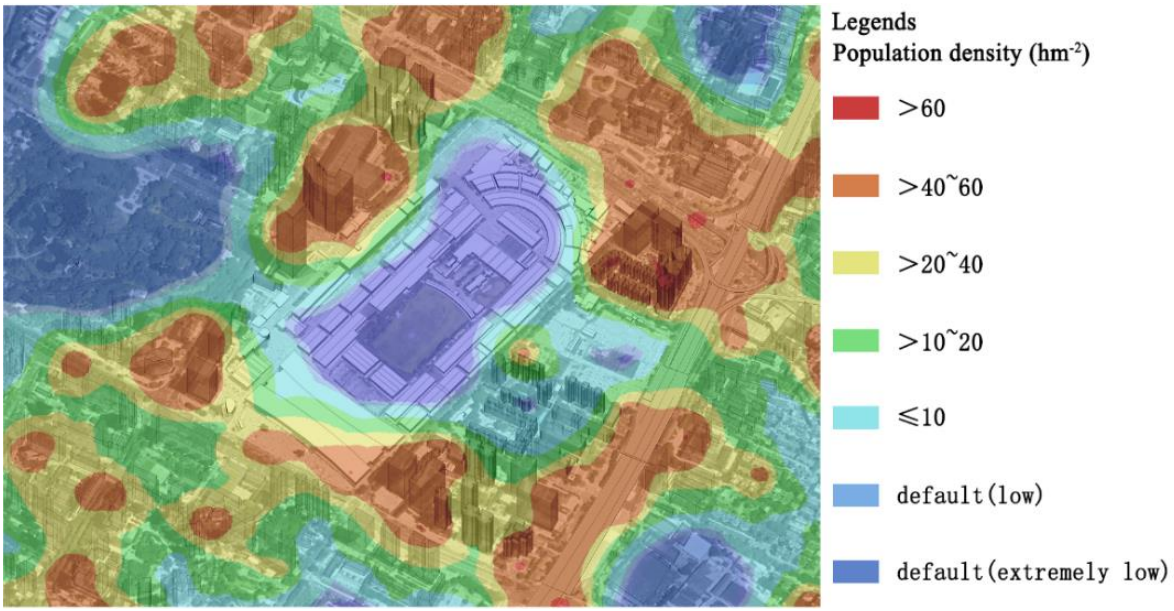


Fig 4-16 Heatmap of racecourse
(Source: Drawn by the author, Data from Baidu Map, Based map from Google Earth)

According to the field investigation, analysis and summary, there are many urban obstacles distributed on the racecourse site and its east and west sides, including barriers such as fences, closed and abandoned street shops, and South China Expressway on the easternmost side. There are few entrances to the site, which greatly reduces the continuity and integrality of the urban system. The space of the racecourse is like an island of a city, which is gradually left by the city and becomes a leftover space. (Fig 4-17)

Fig 4-17 boundaries of racecourse (Source: Drawn by the author, Based map from Google Earth)

The whole racecourse plot is in a state of being forgotten. If we look at the leftover space s of the site scale in the space of the racecourse separately, we can find that the racecourse is a combination of the urban leftover spaces, which includes the leftover architectural space and external space, as well as the informal architectural space and external space. The boundary of external space is vague, which is mainly used for temporary parking and other traffic functions. The informal use function is mainly located in the center and west of the site. From the perspective of weaving, the design of a collection of leftover spaces in the racecourse, is more in line with its spatial development logic, and can promote the “Connection, growing, and fusion” in the city, making the relationship between the racecourse site and the surrounding urban space more harmonious. (Fig 4-18)

Fig 4-18 Space classification of racecourse
(Source: Drawn by the author, Based map from Google Earth)

4.2.2 The imbalance between spatial coordination and personality

In the urban area, there are dense urban textures in the east and north, with large-scale buildings distributed in the south and west. In terms of the building height, the height difference of buildings in the southwest corner is large, with Zhujiang Park and racecourse as height valleys, high-rise residential buildings and business buildings as peaks. The north and east areas of the racecourse have a relatively gentle height change due to the early construction mode and space requirement of higher education function. In the development of the racecourse site, the three-dimensional space form of the city should be weaved according to the requirements of its development intensity, to form a well arranged, smooth and

appropriate urban skyline. (Fig 4-19)

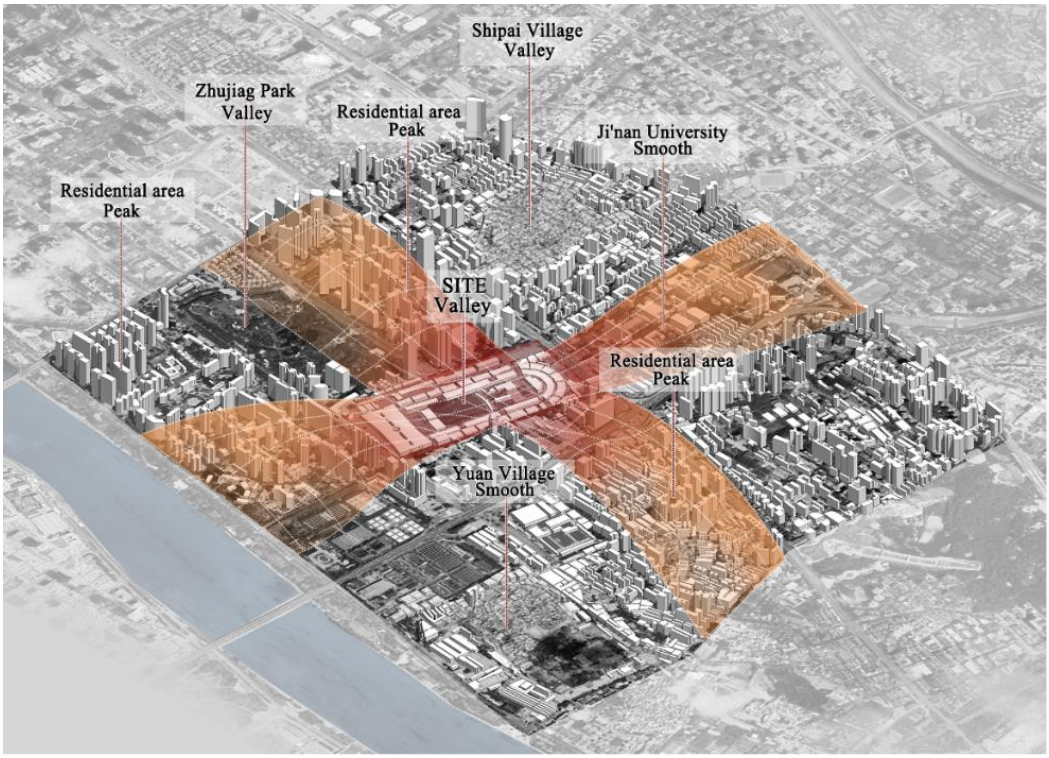
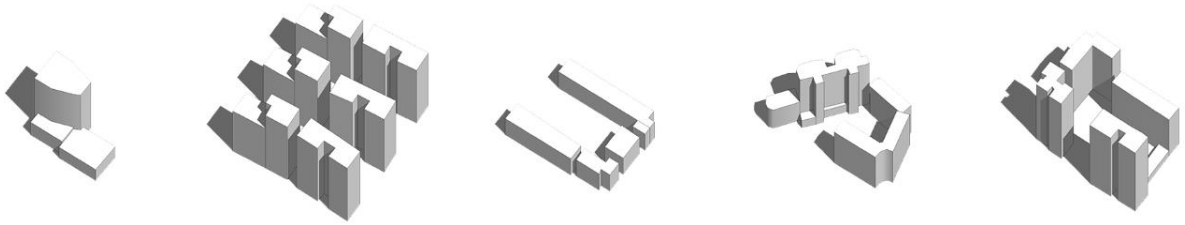


Fig 4-19 General spatial form analysis
(Source: Drawn by the author, Based map from Google Earth)

This study has extracted the common building cluster models in this range, including tower and block type buildings, row and column type buildings, semi-closure type buildings, partially open courtyard type buildings, closure type buildings. (Fig 4-20)

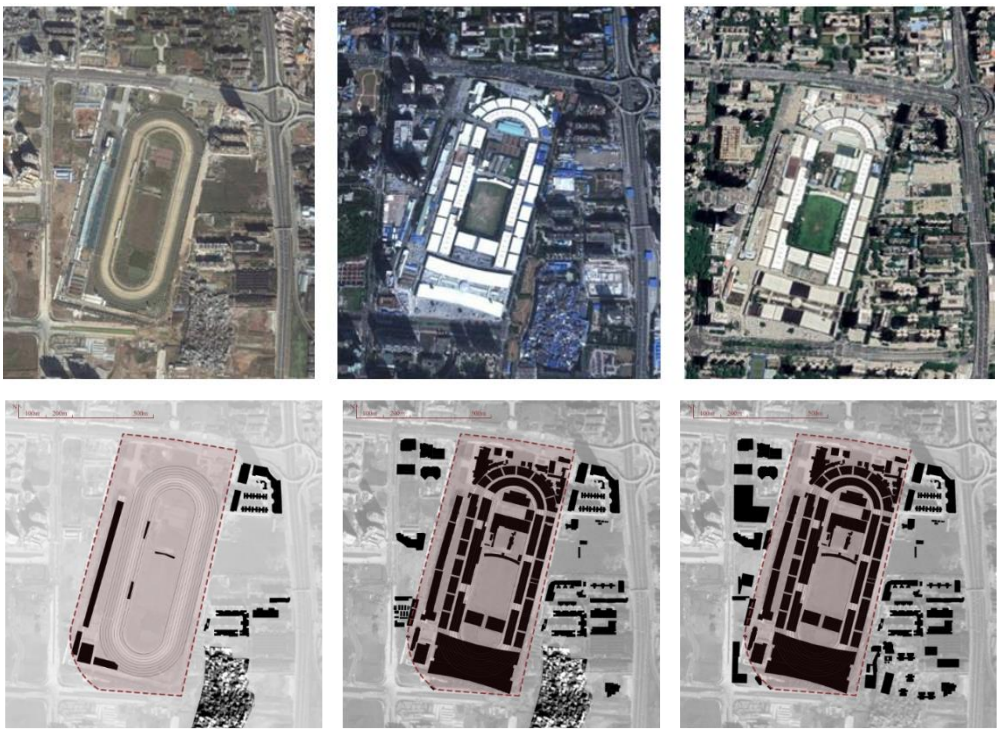


a) tower &block b) row and column c) semi-closure d) partially open courtyards e) closure
Fig 4-20 Building group spatial form analysis (Source: Drawn by the author)

including tower and block type buildings with large single volume mainly consisting of commercial office buildings and urban commercial complexes, which were always built late, and row and column distribution models mainly consisting of residential areas. In addition, enclosed distribution mode building clusters are mainly distributed in residential areas, higher education school areas, and early built commercial areas. The degree of openness of enclosed building clusters is determined by their functions. Building clusters with high publicity are

generally more open, while building clusters with high privacy are generally less open. In the subsequent urban renewal and design, a characteristic and coordinated urban space can be formed according to the clues in the current building cluster and the functional characteristics.

The spatial development of the racecourse is traceable in its texture and spatial form. Before 2000, the plot of the racecourse still had the attribute of horse racing function. The stands, scoreboards, stables and other facilities were clearly visible. At this time, the villages in the southeast still existed, and the shape of the racecourse could be clearly perceived from the satellite map. After 2003, the Motown transformed from the racecourse retained most of the racetrack shape and built a large area of Mahui Furniture Center building in the south. It can be seen from the texture changes at different stages that the development of the racecourse has preserved and renovated some scoreboards, the southern section of the grandstand and the stables. In the design of the racecourse site, through the exploration and reconstruction of its original characteristic texture, the memory of the racecourse can be extended to a certain extent, and the development context of this site can be told to citizens through the material spatial elements. (Fig 4-21)



a) racecourse period b) Motown period c) at present

Fig 4-21 Spatial change of racecourse

(Source: Drawn by the author, Based map from Google Earth)

In addition, if the street interfaces on four sides of the racecourse are observed, it can be found that the north side of the racecourse is mainly composed of the original green belt and the

obstacles during the construction of Metro Line 13. The street interface is closed, and the building is hidden in the green belt. The opposite side is the main gate of Ji'nan University. The street interface is mainly composed of fences and green spaces, which is highly closed.

From the south side of the racecourse, the street interface is mainly occupied by the parking lot. The Mahui Furniture Center, a huge building, is located in the north side of the parking lot and forms an angle with the street. The building interface is smooth and continuous but monotonous and relatively closed. The opposite side is the high-rise building area and the supporting primary and secondary school area of the residential area. The street interface is mainly composed of fences and green belts, which is highly private and difficult to achieve the continuation of the public space. (Fig 4-22)

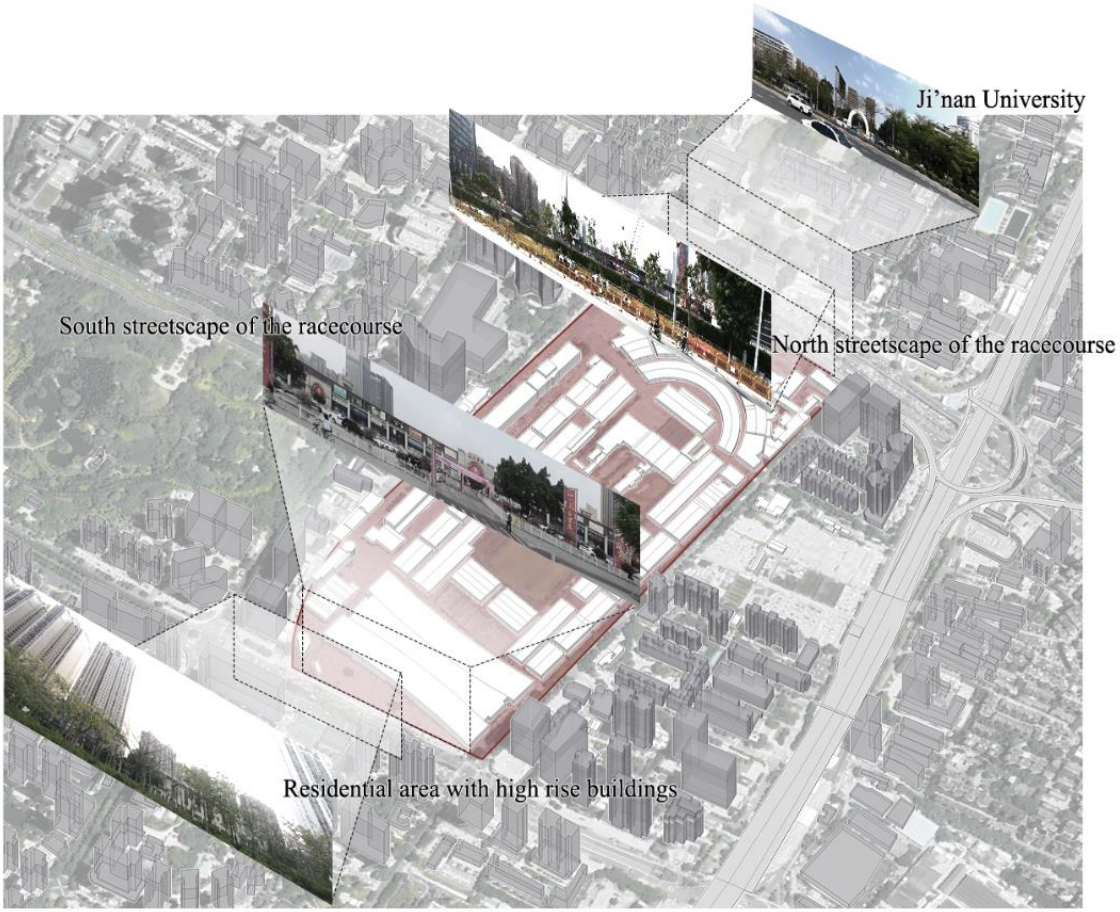


Fig 4-22 North and south side interfaces of racecourse
(Source: Drawn by the author, Based map from Google Earth)

From the east side of the racecourse, the north section of the east side is mainly composed of closed shops and an independent office yard. The middle section is mainly surrounded by walls. The south side is the east facade of the Mahui Furniture Center building. Some shops are still in operation. The street interface on the opposite side is also divided into three

sections. The north section is a high-rise residential building area, and the middle section is the urban leftover space being used informally. The street interface is composed of a wall. The north section is a glass high-rise building and a newly built supporting commercial block. The style is relatively modern, and the street interface is continuous with some changes. In the east direction, the open space of the racecourse space can be continued, and the continuity of the street can be grown and integrated to a certain extent. (Fig 4-23)

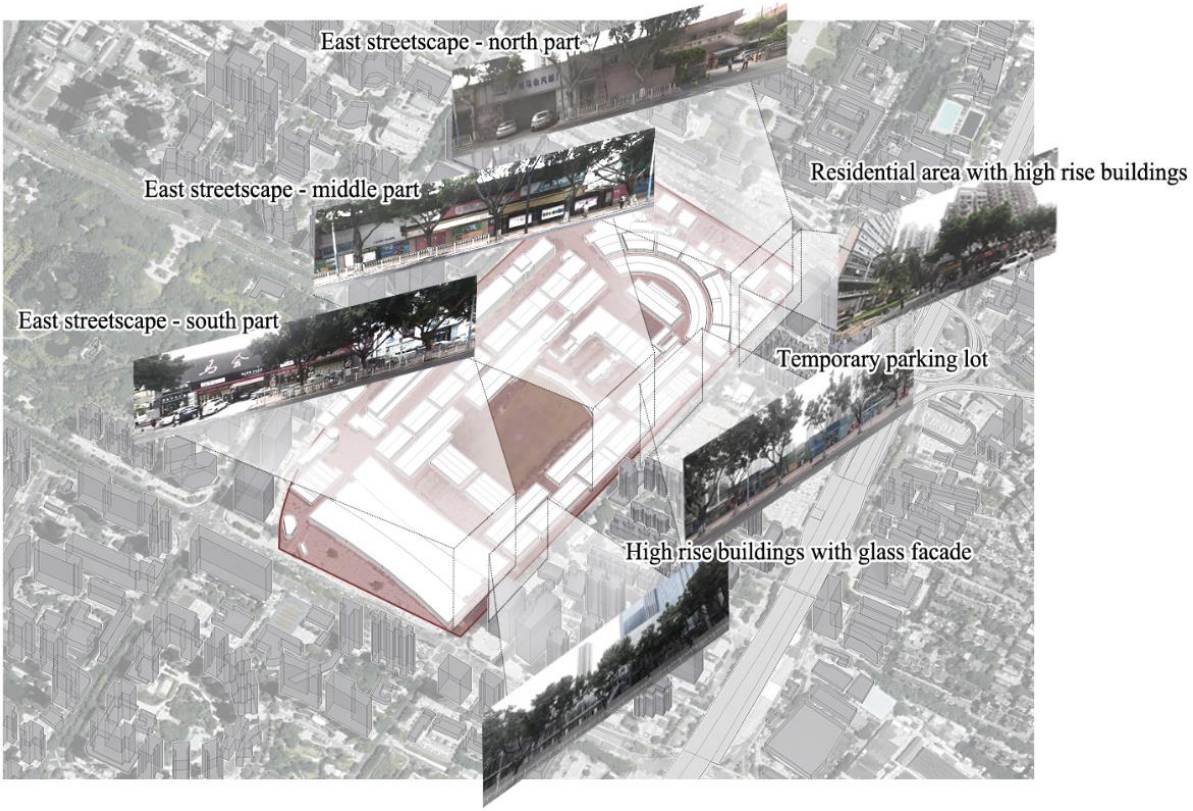


Fig 4-23 East side interfaces of racecourse
(Source: Drawn by the author, Based map from Google Earth)

On the west side of the racecourse, the street interface of the north section is mainly a fence. Behind the fence is another traffic space and a five-story high continuous building. The street interface of the south section is mainly some unofficial shop space behind the stands. The space is flexible and has certain characteristics, but the street on the west side is not continuous. The north section and the south section are distributed on both sides of a fence. The north section on the opposite side is an apartment area dominated by high-rise buildings. The middle and south sections are mainly composed of tower and block type buildings. The street interface is mostly made of glass and other materials. The building interface is relatively open with low continuity. In addition, there is also a urban leftover space, which can be used as a catalyst to connect the racecourse site with the Zhujiang Park, and optimize the overall

street space interface. (Fig 4-24)

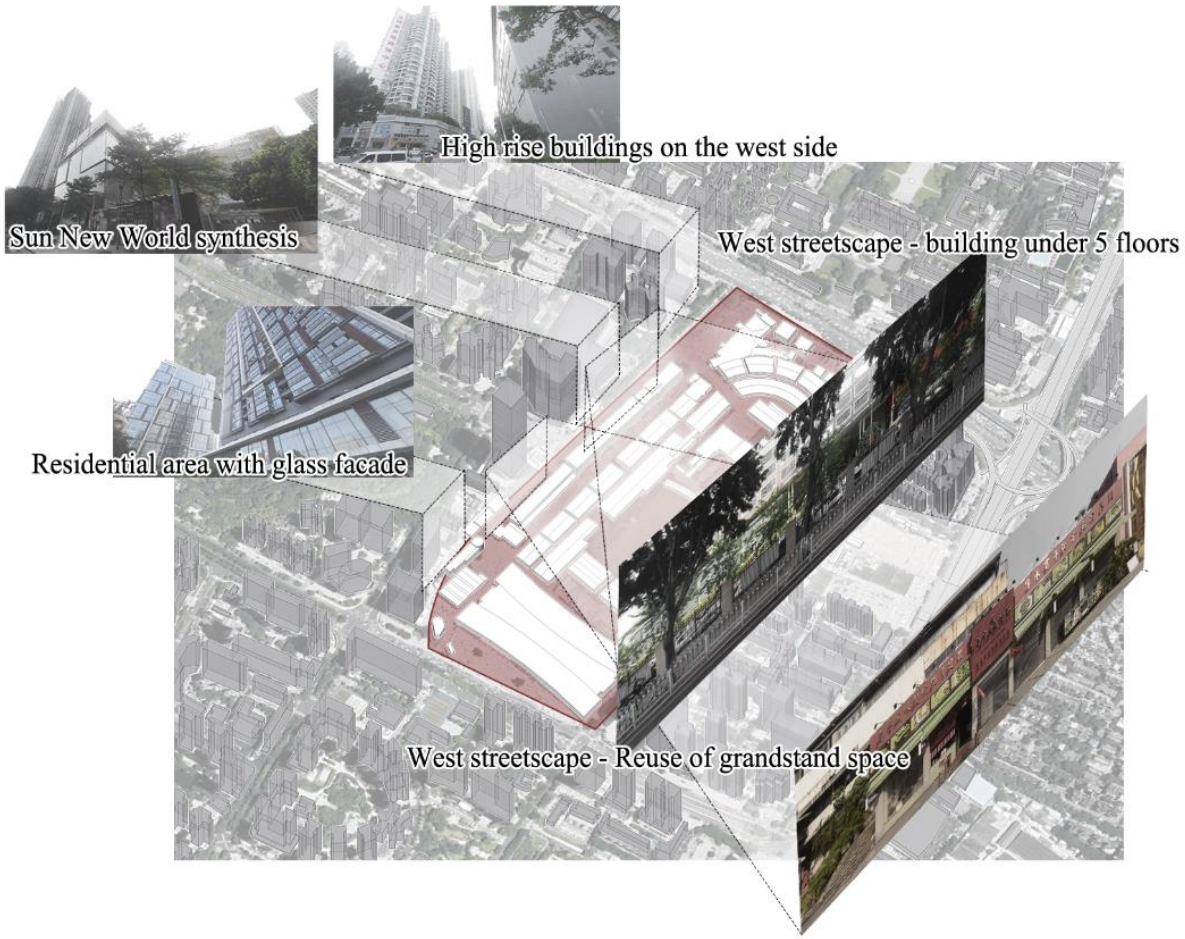


Fig 4-24 West side interfaces of racecourse
(Source: Drawn by the author, Based map from Google Earth)

4.2.3 Dilapidated building spaces

The research on the current situation of buildings is conducive to sorting out the age and quality of buildings. The historical memory of buildings and the availability of buildings can be analyzed at the evaluation stage, and the buildings with the imprint of the times can be preserved and the available buildings can be reconstructed. According to the field investigation on the buildings of the racecourse site, most of them are of poor quality and have become dilapidated buildings. The quality of buildings in informal use has been slightly improved, but the quality is still not good. In addition, the quality of the frame structure of the Mahui Furniture Center in the south, the five-story building in the west and the buildings in the late construction period in the north is ordinary. From the perspective of the age of building construction, the west grandstand, stables, and scoreboard structures at both ends of the middle of the racecourse are products of the horse racing period, with strong historical

memory. Most of the buildings were built at the beginning of the Motown period in 2004, and some buildings were attached to the grandstand construction. According to the evaluation, most of the buildings have a blocking effect on the continuity of the overall urban system or have poor quality, which need to be demolished in the urban renewal. However, the buildings with historical memory or those have good quality can be preserved and reused through reconstruction. (Fig 4-25)

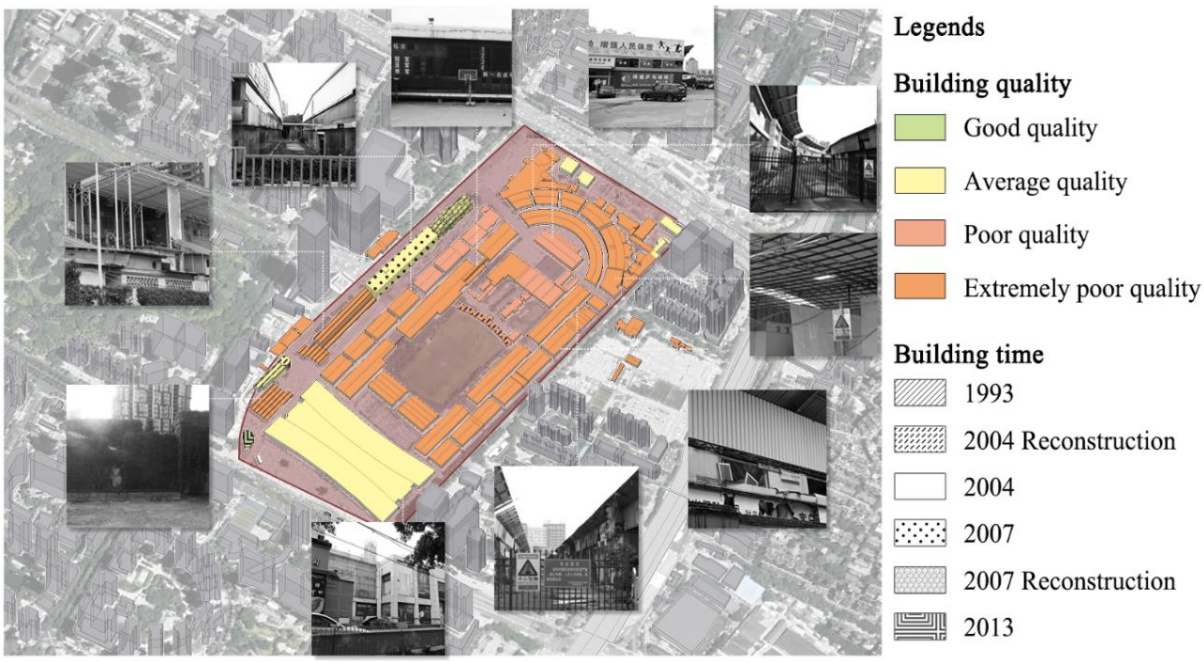


Fig 4-25 Building condition analysis
(Source: Drawn by the author, Based map from Google Earth, Photographed by the author)

According to the investigation on the current conditions of the buildings in the racecourse site, part of the buildings constructed in the racecourse period still remain on the west side, including the entrance building of the racecourse, part of racecourse stands, stable, two scoreboards and an auxiliary building. Among them, the entrance building of the racecourse was renovated in 2007, which only vaguely shows the overall shape of the initial state after the renovation; The additional construction of the racecourse stand has formed an informal restaurant function, and the current function is in good condition; The stable on the south side have been totally abandoned, and the outer walls were covered with plants; The scoreboards are partially covered by new buildings built during the Mo-Town period. In general, the buildings of the racecourse period have survived in the urban construction, but they are hidden in the urban space, attached to other buildings, and are being forgotten by the citizens. In the process of weaving the leftover spaces of the racecourse, it is necessary to preserve and regenerate the buildings in the racecourse period, integrate them into the urban open public

space, and activate the urban memory. In addition, there is a building with good quality in the southwest corner of the racecourse site, and its existence has a weak impact on urban systems such as transportation. This paper adopts the retention treatment for it. As for the Racecourse furniture center on the south side of the site, according to the discussion on traffic in the previous paper, its existence has a greater impact on traffic facilitation, and its development intensity needs to be considered, with little significance for reservation. (Fig 4-26)

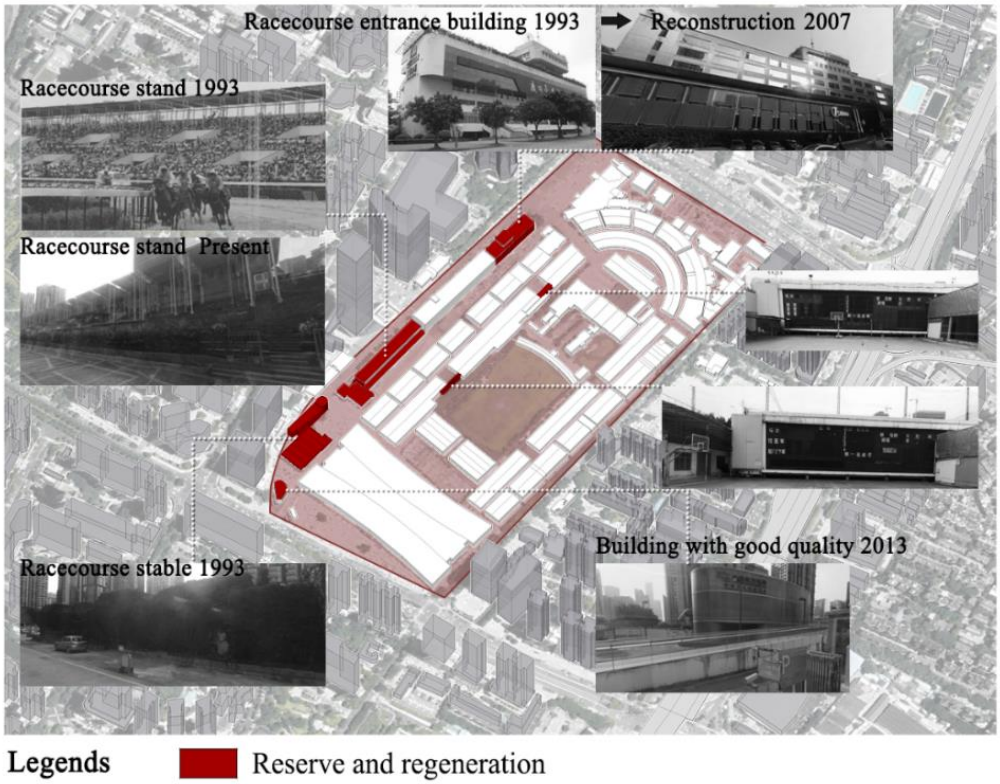


Fig 4-26 Determination of reserved buildings
(Source: Drawn by the author, Based map from Google Earth, Image from Baidu Image)

4.3 Analysis of functional weaving elements

4.3.1 Decline function and inefficient development

In combination with field investigation and big data, this paper first makes statistics on the business forms of the Racecourse, Sun New World on the west side and One Mall Commercial Street on the east side, of which catering accounts for 34%, clothing and other department stores retail accounts for 39%, supermarket and other life services account for 11%, children related business forms account for 13%, and leisure and entertainment business forms only account for 3%. There are few leisure and entertainment formats, and more diversified commercial formats can be implanted in the subsequent design and update of the

racecourse. (Fig 4-27)

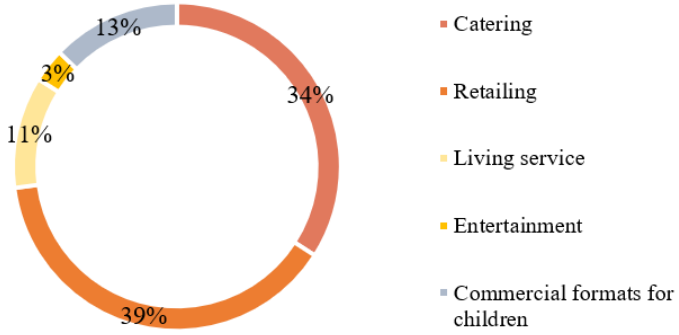


Fig 4-27 Industry type analysis of the trading area
(Source: Drawn by the author, Data from Win Data)

The current functions of the racecourse space can also reflect the development of the racecourse space to a certain extent. According to the modeling and statistics of the current situation of the racecourse, it currently has the functions of car sales, sports, furniture sales, catering, hotels, leisure and entertainment, and office. (Fig 4-28) Among them, the functions of car sales, catering, furniture sales are the witness of the space transformation of the racecourse, which bears not only the current functional formats, but also the history of space function changes.

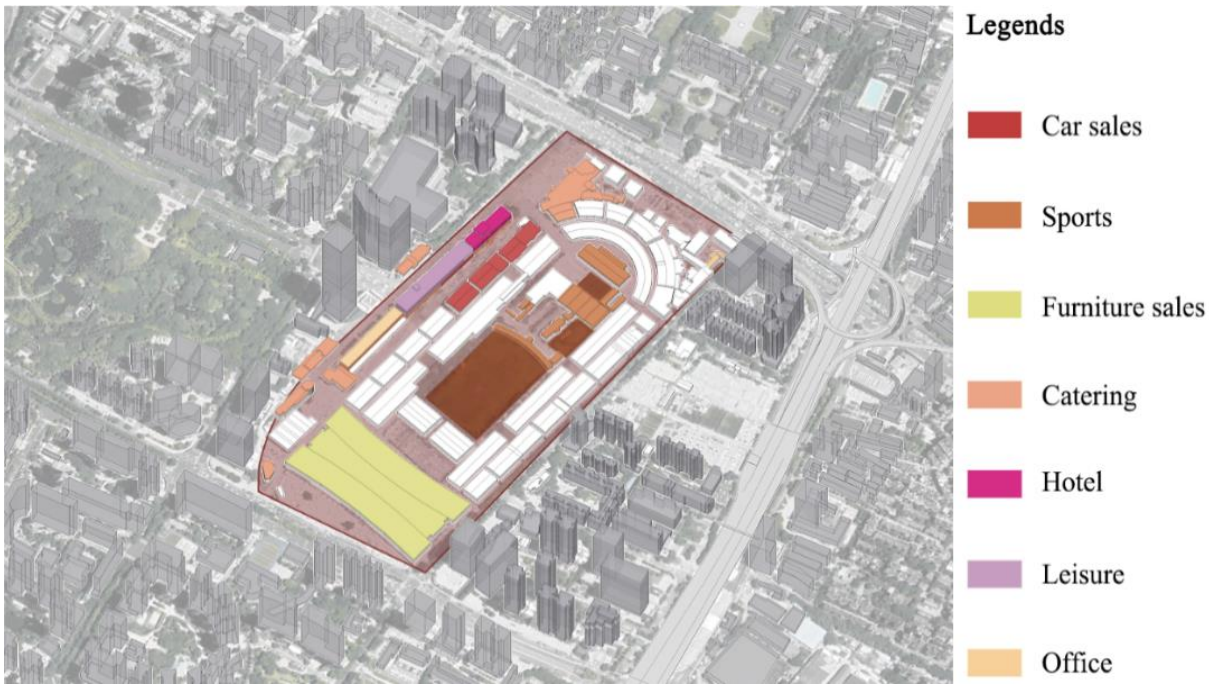


Fig 4-28 Function distribution of Racecourse
(Source: Drawn by the author, Based map from Google Earth)

There are few spaces in use now, which is composed of two formal use spaces of the west side street and the south side Machang Furniture Center, as well as the informal use space in the

central area, with a total area of about 174,000m^2. Among them, furniture sales accounted for 46%, sports functions accounted for 24%, car sales accounted for 23%, catering accounted for 12%, and entertainment and leisure accounted for 8%. The area of functional space is small, and the space utilization efficiency is extremely low. In urban design, the original functions can be retained, the natural growth of functions in the city should be respected, and its functions can be improved to form a new characteristic business circle, combining the old and new functions to form a continuity in time. (Fig 4-29)

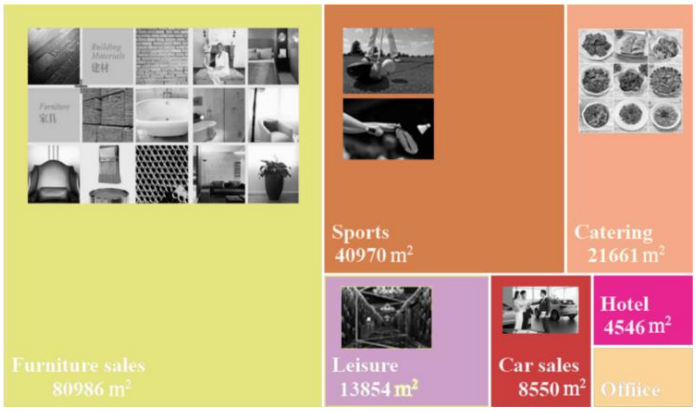


Fig 4-29 Functional area analysis (Source: Drawn by the author, Images from internet)

4.3.2 Inadequate traffic connection and walking environment

From the perspective of urban road system, the racecourse site, Ji'nan University plot, and Zhujiang Park have a large area with closed construction and management mode, which has a great impact on the urban road system in this area. The plot of the racecourse blocks the east-west Jinsui Road, and the north-south urban branch road is not consecutive. The internal traffic of the racecourse site is mainly in a circular mode. The south-north South China Expressway on the east side of the racecourse cuts the urban space to a large extent and causes great side effects on urban traffic, especially non-motorized traffic. (Fig 4-30)

According to the relevant data of Gaode Map, this study sorted out the road conditions in various periods within the block scope. The east-west Huangpu Avenue is basically congested all day. The intersection of Machang Road and Huangpu Avenue on the west side of racecourse is also solid with vehicles, and it is extremely congested in the morning and evening rush hours and lunch hours. Huacheng Avenue on the south side of the racecourse is congested during the morning and evening rush hours. The large-scale racecourse site has a great impact on the urban traffic efficiency, so more attention should be paid to the improvement of road continuity during the renewal and design process. Besides, in combination with other traffic modes such as public transit, the urban motor vehicle traffic

shall be relieved to some extent. (Fig 4-31)

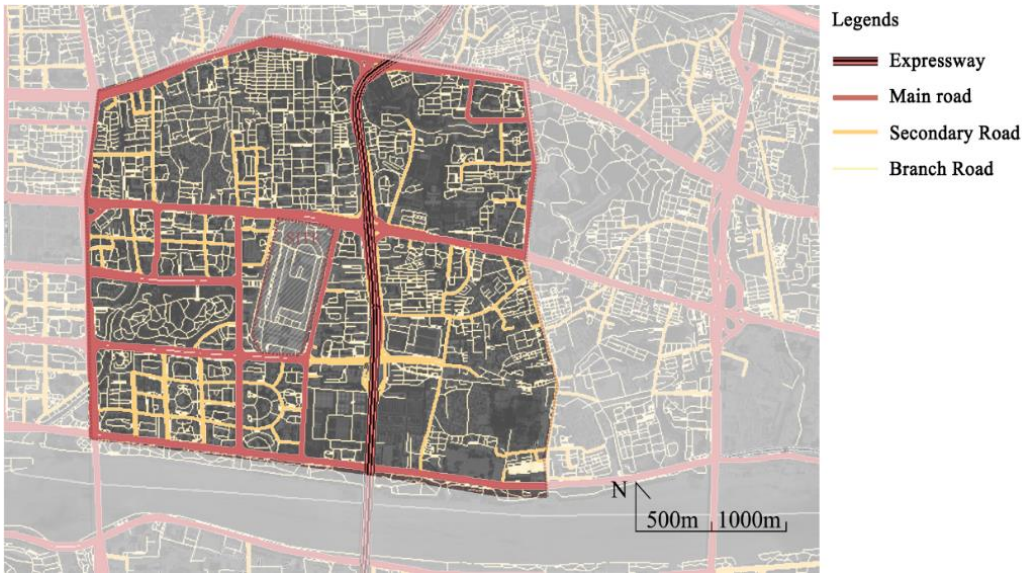
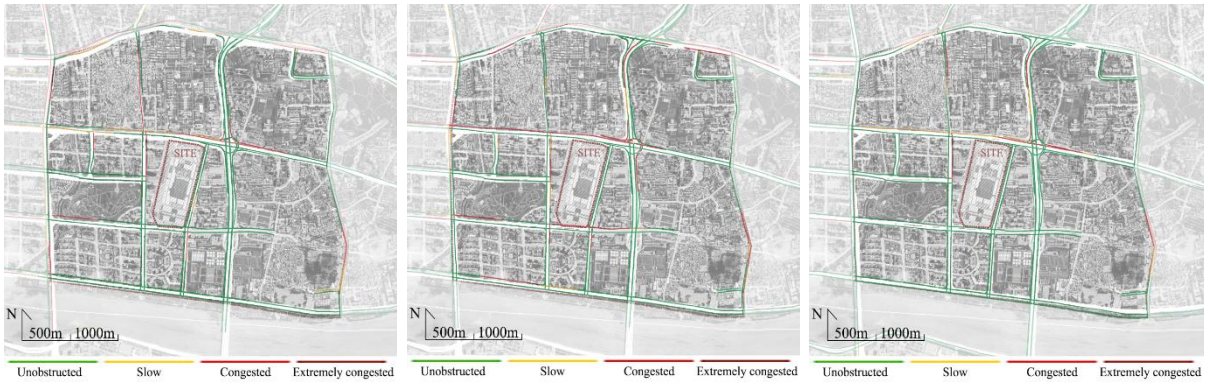
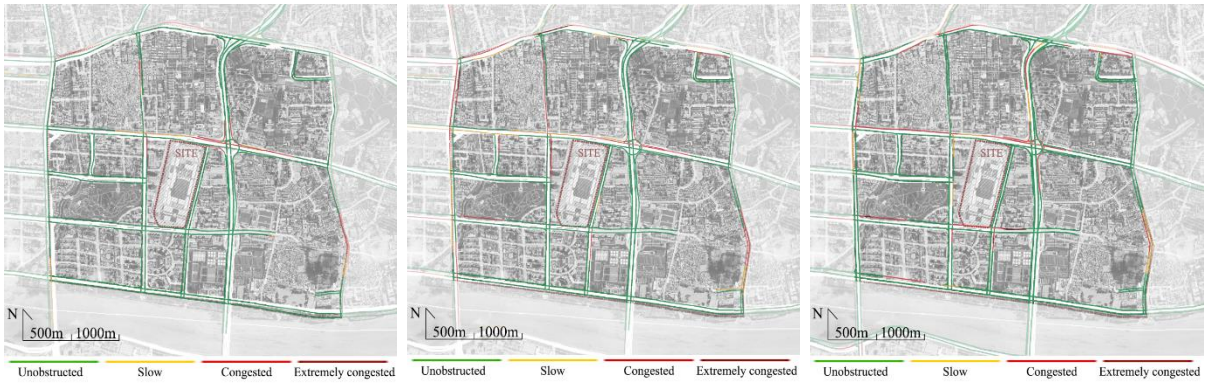


Fig 4-30 Road system analysis

(Source: Drawn by the author, Based map from Google Earth)



a) 7:00 AM b) 9:00 AM c) 2:00 PM



d) 5:00 PM e) 7:00 PM f) 9:00 PM

Fig 4-31 Road condition analysis

(Source: Drawn by the author, data from Gaode Map, Based map from Google Earth)

From the perspective of public transit, Metro Line 5 passes through the south side of the racecourse and sets up Tancun Station. In addition, Metro Line 13 is under construction. In the

future, a metro station of Metro Line 13 will be set up on the plot north of the racecourse. Bus stops are densely distributed in this area, except for some large-area blocks such as Shipai Village, Ji'nan University, Racecourse, Zujiang Park and Sewage Treatment Plant. In the renewal and design of the racecourse plot, bus stops can be appropriately added based on the original bus lines to strengthen the connection between buses and subways. It is also necessary to improve the efficiency and environmental quality of low-carbon travel mode through the construction of urban non-motorized traffic system. (Fig 4-32)

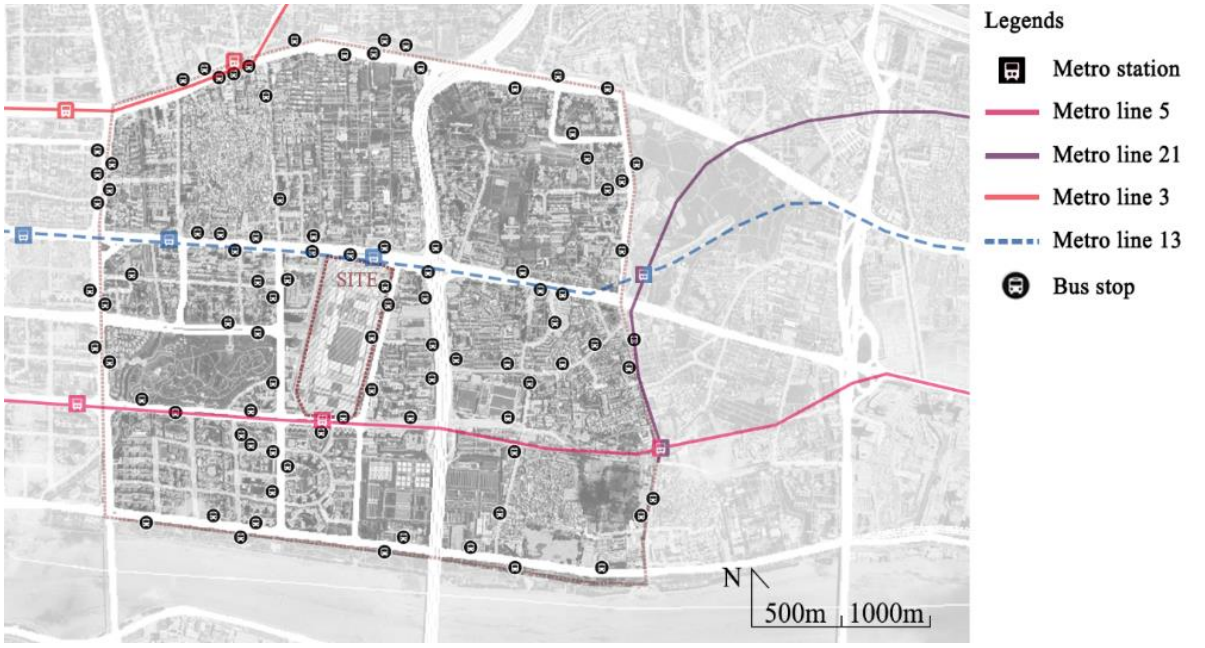


Fig 4-32 Public transit analysis

(Source: Drawn by the author, data from Gaode Map, Based map from Google Earth)

As the road traffic network and public transit nodes are described in the block scale, the road sections and the distribution of different rights are collated and analyzed in the site scale.

First of all, from the internal road of the racecourse, the width of the Racecourse West Road is about 14.6m, consisting of two lanes and parking spaces on both sides; The Racecourse Middle Road is composed of two lanes and the middle parking space; the Machang North Road consists of four lanes and parking spaces on both sides. The internal roads of the racecourse are mainly mixed used with people and vehicles, and the quality of the pedestrian environment is very poor, which is very unfriendly to non-motorized traffic.

From the section of the roads on the four sides of the racecourse, Tancun Road on the east side has a width of about 19.2m, which is a two-way four lane road with tree pools and sidewalks on both sides. However, the pedestrian space is mainly surrounded by fences, and the vitality of the pedestrian space is poor. The width of Pingchuan Road is about 12.6m,

which is a two-way single lane. There is also bicycle parking space and relatively narrow pedestrian space on both sides. The pedestrian space is mainly surrounded by fences, and there is no shelter from trees. There is no bicycle lane, so the non-motorized traffic environment is poor. The road on the south side is Huacheng Avenue, an urban main road with a width of about 32.4m. It is a two-way six lane road with trees, independent bicycle lanes and sidewalks on both sides, with a green belt set in the center. Parking lots and railings are set at the edge of the space. The pedestrian vitality and the road crossing ability is poor. Huangpu Avenue on the north side is an urban main road with a width of about 50.3m. It is a two-way 12 lane road separated by green belts. There are trees, bicycle parking space and relatively spacious pedestrian space on both sides. The crossing capacity is very poor, which has a huge impact on non-motorized traffic. (Fig 4-33)

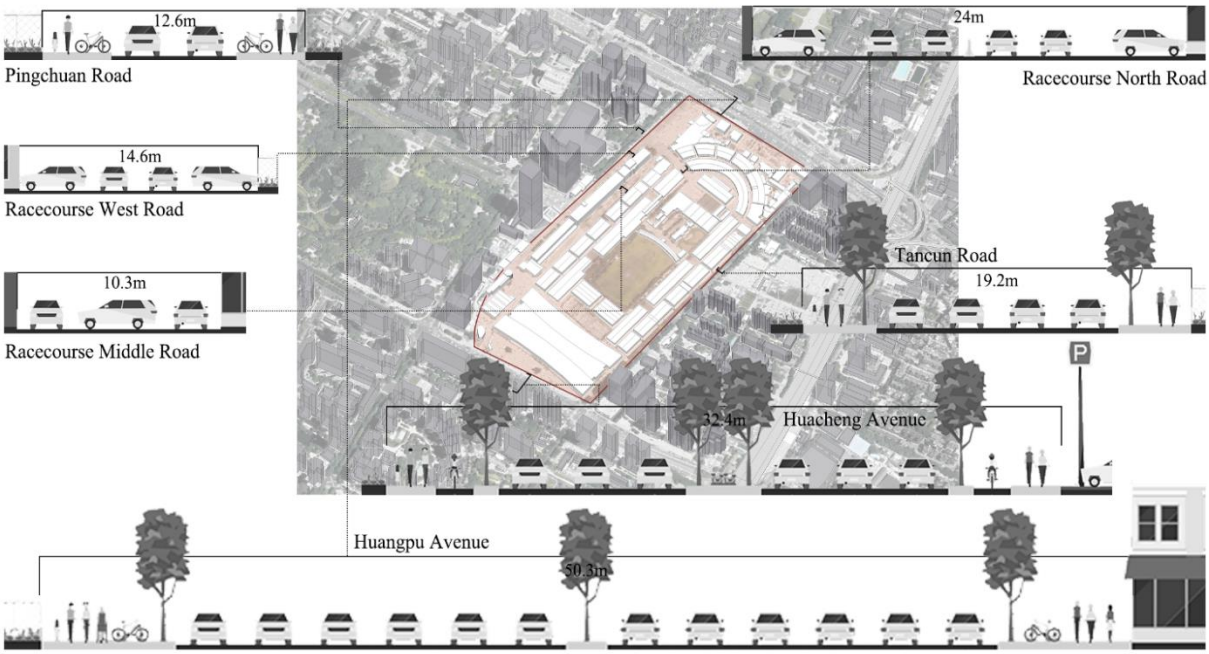


Fig 4-33 Street section analysis
(Source: Drawn by the author, Based map from Google Earth)

4.3.3 Poor quality and continuity of open public space

From the perspective of open public space, space functions can be mainly divided into sports space, parking space and the land under construction on the north side. Since the external space in the center of the site is used as a tennis and golf, the space is well maintained and the space quality is better than that in other places, but the space quality is also general and the space is relatively monotonous. In addition, the trees in the site are mainly distributed around the golf spaces, the south section of the west side of the racecourse, a small number of them

are distributed on the north side of the racecourse road and the north side of the Mahui Furniture Center. (Fig 4-34)

To some extent, the external space texture implies the space shape texture of the racetrack, which is a transformation based on the racecourse shape. In the process of urban design, the external space with good quality can be reserved and transformed to an open space with rich functions, openness and extroversion, and serve the diversified activities for the citizens. In addition, the original external space form can also be reserved in the design to further extend the texture of the memory during the horse racing period.

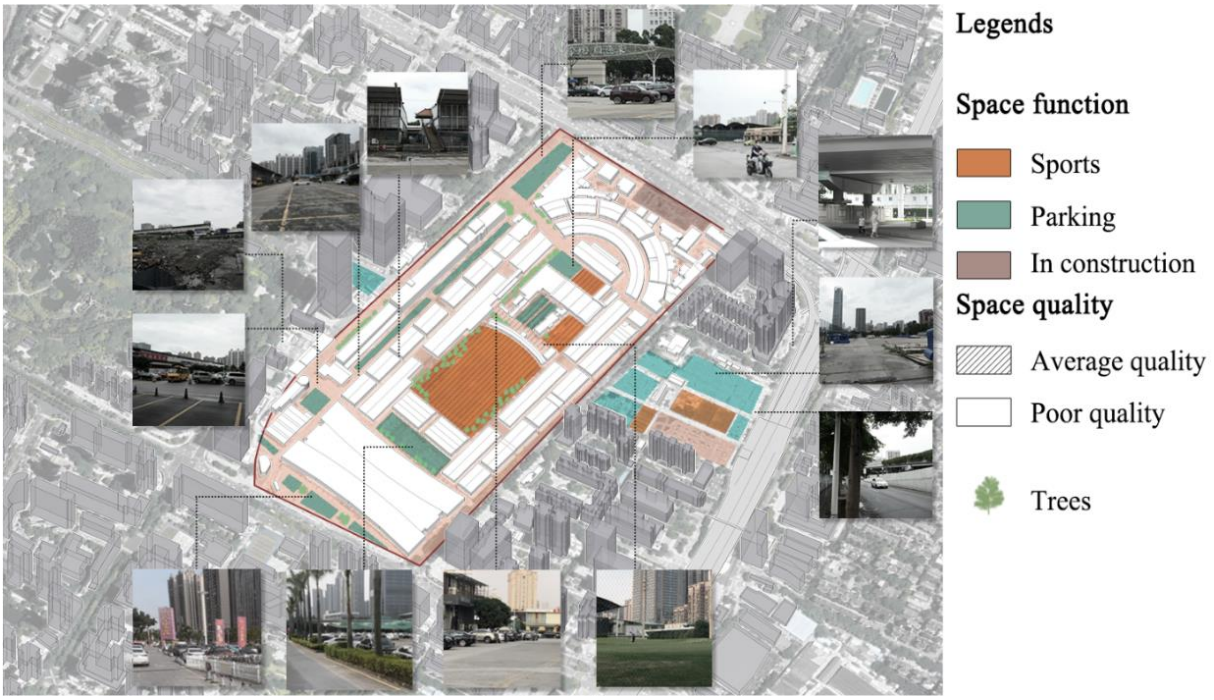


Fig 4-34 External space condition analysis
(Source: Drawn by the author, Based map from Google Earth, Photographed by the author)

4.4 Analysis of spiritual and social weaving elements

4.4.1 Weakening of historical clues

In 1992, Guangzhou formally put forward the plan for holding horse racing activities and began to build Guangzhou Racecourse on August 8, 1992. On January 28, 1993, on the large-area vegetable land near Tan Village, a modern racecourse was built, covering 33 hectares, fully in accordance with international standards and capable of accommodating 40000 spectators. This is the second largest racecourse in Asia after Hong Kong Shatin Racecourse.

The year 1994 was the most popular year for horse racing in Guangzhou. At that time, the

horse racing was held three times a week on Tuesdays, Thursdays and Sundays, and divided into day and night races. At that period, Guangzhou Racecourse enjoyed a great reputation in the country. As the glory of Guangzhou Racecourse attracted other cities to follow suit, it also buried worries for the subsequent closure.

In 1999, after 757 horse races in seven years, due to the lack of legitimacy granted by the state and the mismanagement, Guangzhou Racecourse suddenly announced the suspension of racing and canceled the function of horse racing. In December 2002, Guangzhou adopted the suggestion of Guangzhou Automobile Sales Association to transform the racecourse into an automobile city.

Until 2008. The racecourse headquarters re accepted the racecourse site, and the racecourse gradually formed three industry segments: catering, sports and entertainment, and automobile sales. However, the business was not good. In May 2012, Tianhe district, Guangzhou City proposed that the racecourse was rented for low side industries such as car sales and catering, with extremely low economic benefits, which was not commensurate with the functional positioning of Central Business district (CBD). Tianhe district would strive for the support of the municipal government, accelerate the development and construction of the racecourse site, and enhance the value of the plot. In 2013, the Racecourse Company informed that after 2013, the company would not renew contracts with operators.

From April 1, 2014, the site will be completely closed and the water and power supply will be stopped. In September 2014, most auto shops have been closed, and only the food city in the south section is still open.

Fig 4-35 Development context of racecourse

(Source: Redrawn by the author, Images from the internet or photographed by the author)

Today, there are still some car sales, catering, and the southern Mahui furniture center in the racecourse space. After years of informal use, Guangzhou “Jiumao Jiu” Catering Co., Ltd.

was also born. But overall, as a part of the urban leftover space that has been used informally, the racecourse site has become a declining combination of urban leftover spaces compared with its prosperous period. (Fig 4-35)

4.4.2 Monotonous community daily activities

According to field investigation and random interviews, the activity types, activity time periods and group portraits of the audiences in the racecourse space are sorted out, which will have certain reference value for the design and reuse of the space. The main daily activities in the racecourse space are distributed in the afternoon and evening, and the types of activities include eating, entertainment and leisure, shopping and sports. (Fig 4-36) In addition, the main audience groups of the racecourse are nearby residents, students, workers, sports fans and out-eaters.

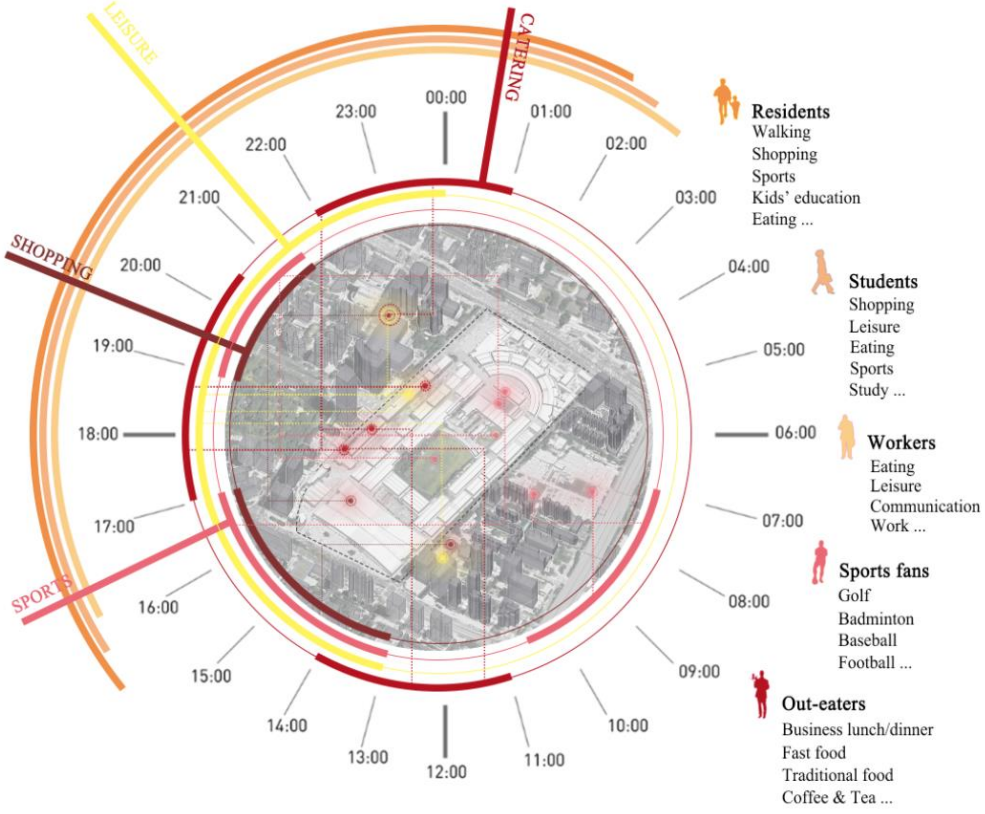


Fig 4-36 Daily activity analysis (Source: Drawn by the author)

Among them, the daily activities of urban residents mainly include walking, daily shopping, sports, kids' education, eating, etc. Their activities mainly focus on daily needs.

Students' daily activities mainly include shopping, entertainment, leisure, eating, sports, learning, etc. Their activities mainly focus on going out for entertainment and are one of the

main audiences of this business type.

The activities of workers mainly include leisure and entertainment, going out for food, work communication, etc. Their activities are mainly carried out around work and daily needs, and entertainment and other activities are carried out on non-working days. The workers have basically stable income and are the main group with stable daily consumption.

Sports fans' activities in the racecourse space are mainly golf, badminton, tennis, etc. They mainly participate in sports activities during the break time and are the main audience group of sports activities.

The characteristics of the group of out-eaters are that they go out for food all the year round. Their focus is mainly on traditional catering, fast food, business food, beverages, etc. in the catering industry.

On the whole, the daily activities in the racecourse are monotonous, and residents have a demand for various activities. In the process of updating the racecourse, it is necessary to respect the daily activities of various groups, expand and enrich the daily activities in combination with other space functions.

4.5 Space potential evaluation

4.5.1 Methods and Factors

1. Methods

Combined with the multi-dimensional and multi-level systematic characteristics of the urban system, as well as the need to visualize the evaluation results, this paper builds a comprehensive evaluation method with the qualitative and quantitative evaluations, to analyze the space potentials of the racecourse based on the Geographic Information System (GIS) and the multi-factor analysis method. The main steps of evaluation are to select evaluation factors, determine evaluation objectives, collect research data, build an evaluation structure, determine the weight of evaluation indicators, formulate quantitative standards and evaluation grades, using ArcMap to conduct a separate spatial analysis of each factor, and then determine the spatial development potential under different goal orientations through reclassification and superposition analysis calculation under different evaluation objectives.

In terms of method selection, multi-factor evaluation is one of the widely used GIS technology methods. At present, this method has been applied to land suitability evaluation, site selection analysis, ecological sensitivity and other urban planning and landscape fields.

Because the space potential also contains the influence of spatial elements in many aspects and different degrees, this paper believes that the multi-factor superposition analysis method can also be applied to the evaluation of urban space development potential. According to the difference in the importance of the evaluation factors, the visual results of multi-objective orientation can be integrated.

2. Factors

In terms of data, this paper mainly uses Gaode open POI data, Baidu heatmap data, basic CAD data, OpenStreetMap vector road data as the basis for analysis and evaluation.

According to the relevant research on the evaluation of space potential, urban space due to its different additional conditions such as location, transportation, development type, function type, and the correlation of surrounding space, leads to the differentiation of space value, which is not only reflected in the economic value, but also includes other types of development potential under different value orientations. Through three levels of investigation and research, taking space sociality, holistic thinking, and space value as the underlying logic of analysis, according to the types and mechanisms of weaving elements, this paper extracts 4 potential types determined according to 3 underlying logics, including “potential to provide public cultural and sports services” reflecting the social and public nature of space, the “potential to connect the necessary function spaces according to the survey” which aims at improving the integrality and coordination of urban space, “Traffic oriented land value potential” reflecting supporting space value. Secondly, according to the accuracy and feasibility of the available data, 9 potential indicators are extracted. (Fig 4-37).

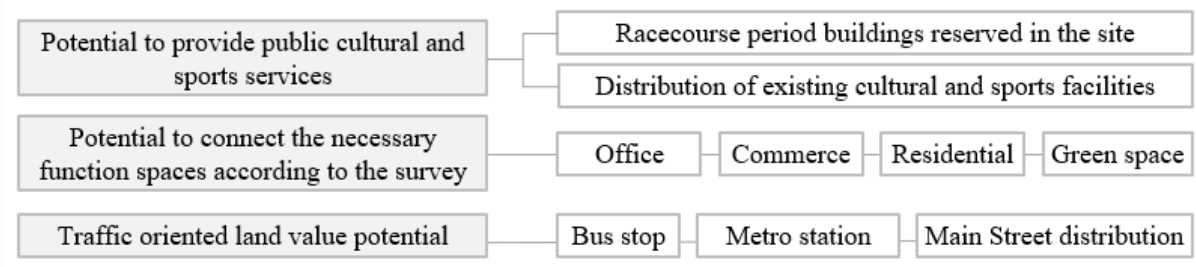


Fig 4-37 Potential types and evaluation factors (Source: Drawn by the author)

4.5.2 Single-factor assessment

First, this paper conducts single factor evaluation and analysis, and uses the neighborhood analysis, distance analysis and other analysis tools in ArcMap to form a preliminary spatial potential level analysis or preferred spatial development path according to different weaving

elements. And reclassify them to make sure that different evaluation elements have the same scoring standard, forming a space development potential level from 1 to 10. The smaller the number is, the less suitable for high-intensity development. On the contrary, the larger the number is, the more suitable for high-intensity development.

1. Factor of building reserved

Through the qualitative analysis of the historical changes, texture and spatial morphology of the racecourse at the site scale, this paper preserves the relevant buildings and structures in the racecourse space during the horse racing period, including stands, stables, scoreboards and others. As it bears the strong urban memory of horse racing in Guangzhou at the end of the 20th century, and it has been 29 years since its construction, the buffer zone is analyzed with reference to the protection scope of ancient dwellings, and the scope that is not suitable for development is determined by taking 16m away from the external wall of the building as the boundary (Fig 4-38). In the process of weaving, it emphasizes the recovery of urban memory, and shows the material heritage and Genius loci of the racecourse period to the greatest extent.

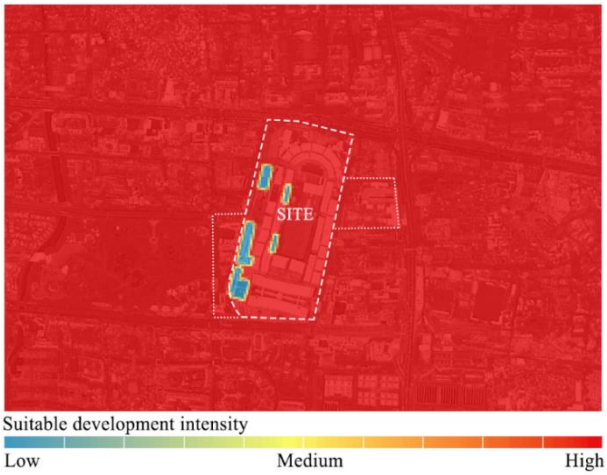


Fig 4-38 Preserved buildings (Source: Drawn by the author, Based on ArcMap technique)

2. Factor of cultural and sports facilities

Through the POI data obtained from the Gaode Map, the distribution of sports and cultural facilities in the racecourse area was collated and obtained. Through the Kernel Density Analysis, it was found that a cluster of cultural and sports facilities was formed on the west side of the racecourse (Fig 4-39). Through comparison with the investigation, it can be seen that such cultural and sports facilities are usually private, but there are drama and cultural facilities such as Guangzhou Cantonese Opera Theater and Hung Sin-nui Arts Centre in the northwest of the racecourse. From the perspective of sports and cultural facilities, public

cultural and sports service facilities can be arranged on the racecourse plot to improve the urban public service capacity of the racecourse space.

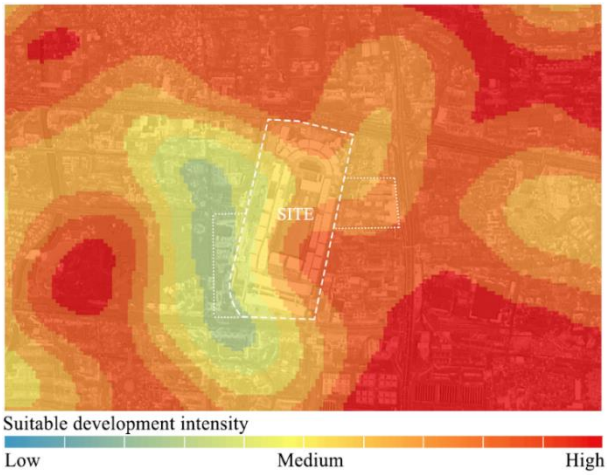


Fig 4-39 Cultural and sports facility

(Source: Drawn by the author, Data from Gaode Map API, Based on ArcMap technique)

3. Factor of office distribution

According to the office POI data obtained from the Gaode Map, office points has formed a certain concentration on the north side of Huangpu Avenue and the west side of the racecourse, but there is a certain fault in the racecourse. According to the aggregation effect of commercial and business space, the function scale can play its role in development. The grid map of Euclidean Distance is formed by analyzing the distance between each pixel and office POI (Fig 4-40). In the current urban space, the development intensity of office space is relatively high, so the space that is more likely to produce agglomeration effect also corresponds to the demand and potential of higher space development intensity.

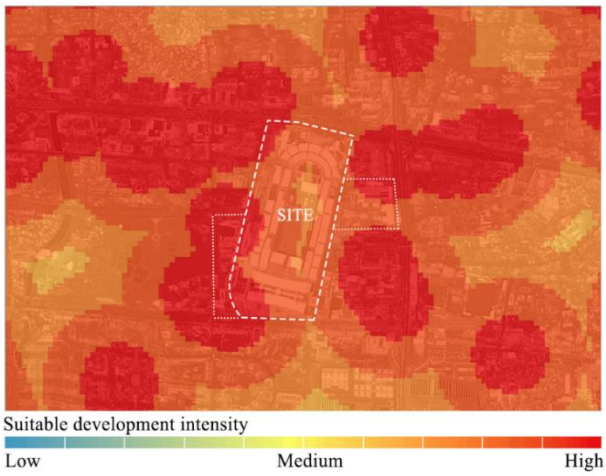


Fig 4-40 Office distribution factor

(Source: Drawn by the author, Data from Gaode Map API, Based on ArcMap technique)

4. Factor of commerce distribution

From the perspective of urban commercial district, according to the POI data of the Gaode Map, the distance between each pixel and the nearest commercial district is analyzed. It can be seen that the southeast and northwest sides of the racecourse space are closest to the original commercial district, which is easier to gather and expand the commercial district. The implantation of new commercial functions enriches the functional formats of the commercial district, forms a new scale effect on the basis of avoiding homogeneous commerce, and better meets the commercial needs of citizens. Therefore, its distance can reflect the potential of commercial functional space development to a certain extent, and it is also a kind of income potential, which can provide certain economic support to the construction of public facilities (Fig 4-41).

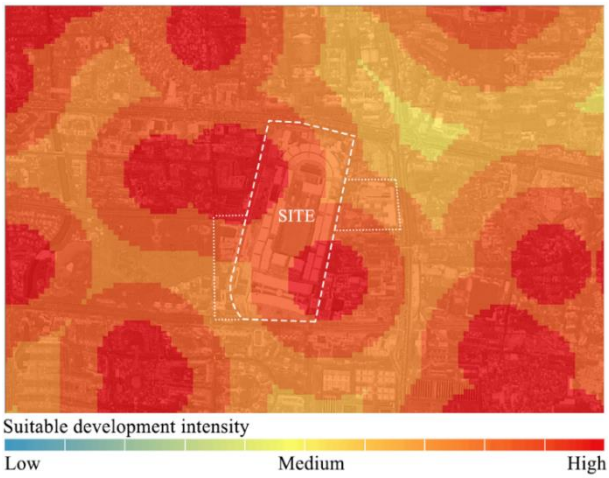


Fig 4-41 Commerce analysis

(Source: Drawn by the author, Data from Gaode Map API, Based on ArcMap technique)

5. Factor of residential area distribution

Based on the POI data of the residential area, the distance between each pixel and the residential area is in the grid map analyzed (Fig 4-42). First, both sides of the north-south central axis of the racecourse space are far away from the nearest residential area around, and the racecourse space has no residential function. On the other hand, since the residents in the surrounding residential areas are a large audience for the use of the racecourse space, from the current situation, the distance from the surrounding residential areas to a certain extent reflects the aggregation of the population density. The closer the distance is, the greater the number of such audiences can be attracted. From the perspective of the development of income potential, the closer the distance is, the higher the efficiency of the production of positive related functional spaces is, This revenue potential can have a certain feedback effect

on the improvement of the quality of urban public facilities. This evaluation is also dynamic. Under the constant urban weaving, new continuity can be formed and new revenue can be obtained, so as to provide better public services for citizens and make the urban function combination more compact and diversified.

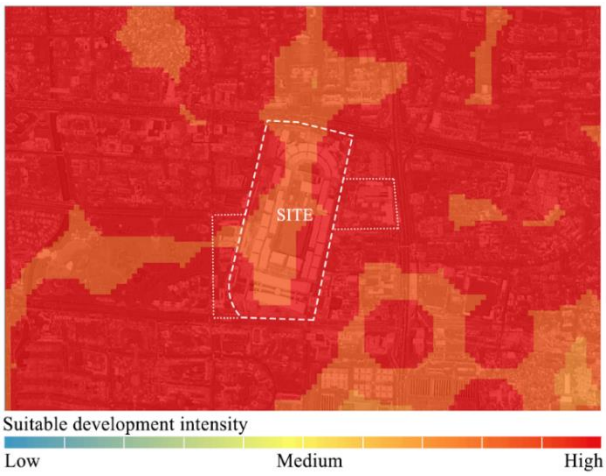


Fig 4-42 Residential distribution factor

(Source: Drawn by the author, Data from Gaode Map API, Based on ArcMap technique)

6. Factor of green space

According to the green space and public space shapefile drawn from the satellite base map, the distance from each pixel to the nearest green space or public space is extracted using the Euclidean Distance Analysis to form a grid map containing distance data (Fig 4-43). In the analysis of green space and public space, the distance can represent the distance and land use cost of green space connection to a certain extent. The southwest part of the racecourse space is most conducive to the connection of green space.

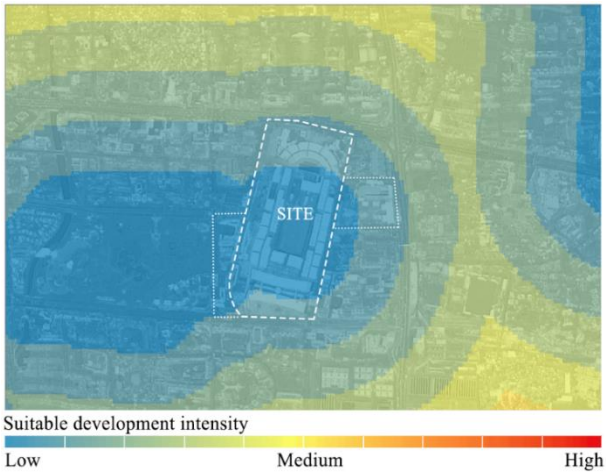


Fig 4-43 Green and open space factor

(Source: Drawn by the author, Data from Gaode Map API, Based on ArcMap technique)

7. Factor of road network

Through the Euclidean Distance Analysis of main road network data from OpenStreetMap, the distance from each pixel to the nearest road is extracted to form a grid map containing distance data (Fig 4-44).

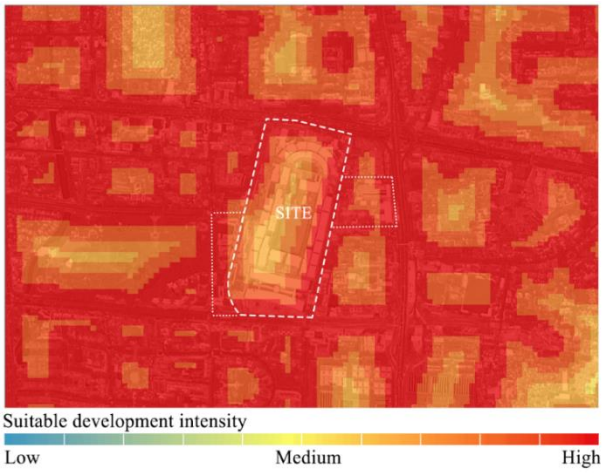


Fig 4-44 Road network factor

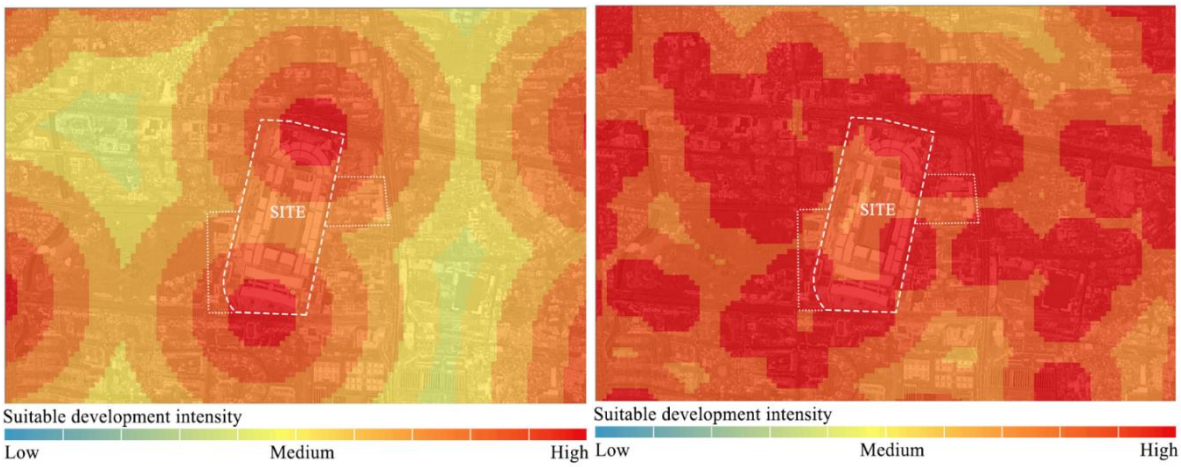
(Source: Drawn by the author, Data from Gaode Map API, Based on ArcMap technique)

According to the current state of the main roads, their accessibility reaches the highest level around the racecourse site, and according to the location theory, the value of the land will also increase in the areas with high traffic accessibility, so its space intensity development potential gradually decreases from the outside to the inside. However, it is worth noting that with the continuous improvement of the weaving process and the gradual increase of the road network density, the potential of the space development intensity in the central area of the racecourse plot will gradually increase. At this time, it is necessary to use the dynamic and progressive characteristics of the weaving to conduct re-investigation and re-evaluation, and form a new space potential evaluation in the subsequent weaving to guide a new round of urban weaving.

8. Factors of bus stop and Metro station

According to the POI data of bus stops and Metro stations captured on the Gaode Map, adding the stations of Line 13 under construction to conduct Euclidean Distance analysis, extracting the distance from each pixel to the nearest point of interest to form a grid graph containing distance data. The distance from the public transport station can, to a certain extent, show the space development potential under the public transit-oriented development goal. Under these two factors, the space development potential is the highest in the north and south, and the lowest in the middle. Under the bus stop factor, the space development potential in the

southeast of the racecourse is also high. (Fig 4-45)



a) Metro station b) Bus stop

Fig 4-45 Metro station and bus stop factors

(Source: Drawn by the author, Data from Gaode Map API, Based on ArcMap technique)

4.5.3 Multi-factor evaluation under different orientations

The weaving of urban leftover space not only needs to investigate, evaluate and analyze the weaving elements hierarchically, but also needs to prioritize the weaving elements on the basis of preliminary research, weighing the commonalities and contradictions between the objective urban environment and the subjective urban development needs. Therefore, in the evaluation of space development potential, different weights should be given to the single factors representing different weaving elements, to form an evaluation of the development potential of the objectively existing environmental urban space under the guidance of the subjective development needs of different cities.

In the leftover spaces of the racecourse, on the premise of weaving the urban functions, it should be used as a rare plot in the urban center of Guangzhou to weave the urban public service functions, so as to provide a more diversified, comfortable and high-quality urban living environment. On the other hand, in the current state of the shortage of land in the urban center, it is also necessary to improve the development intensity potential of the space to a certain extent according to the spatial location, traffic conditions, so that the required urban functions can be implanted in the racecourse plot. In addition, according to the weaving mechanism, “connection” and “fusion” play the important role in it. The integrality of a city requires the composition of urban functions, which, to a certain extent, is reflected in the uniformity and continuity of the distribution of different functions.

According to the qualitative analysis at three levels, it is necessary to retain the original

commercial functions such as restaurant, furniture sales, part of sports functions and green space functions in the racecourse plot, and make the racecourse site undertake the financial technology function, urban culture and sports functions, public leisure space. This requires the racecourse plot to achieve the combination of low, medium and high intensity development models, so the determination of development intensity in the process of redevelopment is particularly important (Fig 4-46).

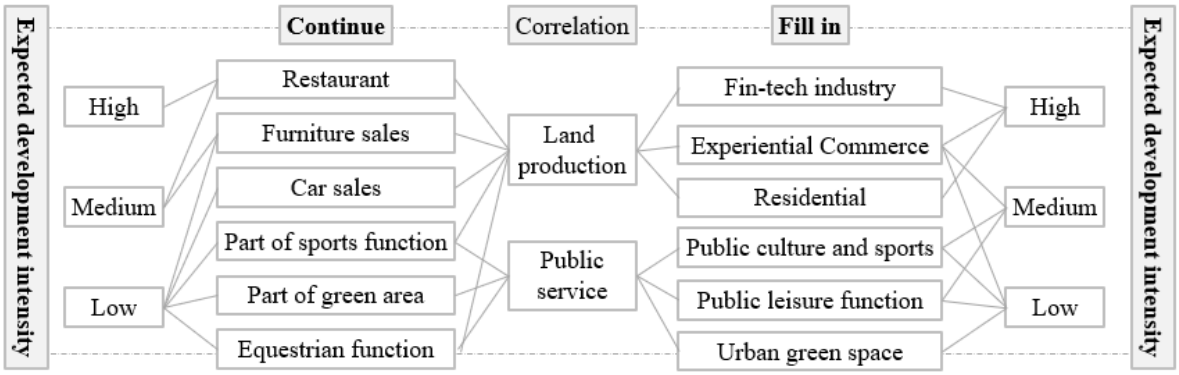


Fig 4-46 Function characteristics and corresponding development intensity mode
(Source: Drawn by the author)

The quantitative analysis result in this paper is the land development intensity. It can be divided into weaving orientation based on urban public life, based on connectivity, based on TOR developing mode according to the “social and public nature of space”, “the integrality and coordination of urban space”, “the space value”, and the three types of weaving orientation do not conflict with each other. Under the different orientations, the assignment criteria are combined with the subjective value judgment and upper planning, and similar space potential evaluation criteria in relevant literature, using Analytic Hierarchy Process to determine the weight, basing on the YAAHP software. According to different development purposes and orientations, different single analysis factor results are given different weights. The weight superposition analysis is carried out in ArcGIS to form the potential guidance of land development intensity under different goal orientations.

1. Weaving orientation based on urban public life

The weaving of urban public life includes the weaving of material space and spiritual culture to provide citizens with a better experience of public activities, including cultural activities, sports activities and leisure activities. This kind of weaving emphasizes the continuation of Genius loci and urban memory, so that they can find a sense of belonging in the urban space, which requires urban design to continue and revive buildings or external spaces with urban

memory. In the racecourse site, the main internal factor of the potential for promoting urban public life quality is the reserved racecourse buildings, and the main external factor is the aggregation and connectivity of the surrounding cultural and sports facilities. According to multiple judgment matrices and the hierarchy, the weights are obtained as follows. (Fig 4-47, Table 4-1)

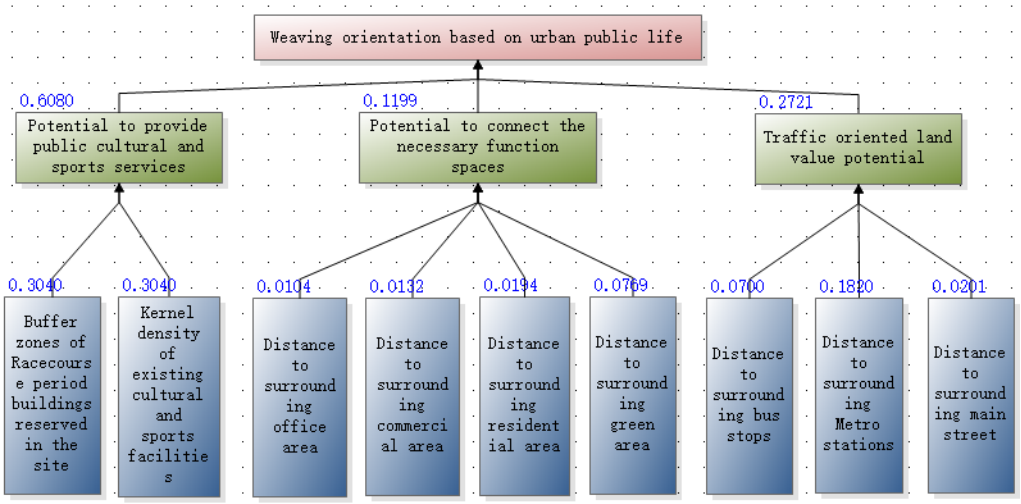


Fig 4-47 Hierarchy under the weaving orientation based on urban public life
(Source: Drawn by the author)

Table 4-1 Weight assessment under the weaving orientation based on urban public life
(Source: Drawn by the author)

Value potential type	Weight (%)	Single factors	Weight (%)	Final weight(%)
Potential to provide public cultural and sports services	52.47	Buffer zones of Racecourse period buildings reserved in the site	50.00	26.23
		Kernel density of existing cultural and sports facilities	50.00	26.23
Potential to connect the necessary function spaces according to the survey	14.16	Distance to surrounding office area	8.65	1.22
		Distance to surrounding commercial area	11.01	1.56
		Distance to surrounding residential area	16.20	2.29
		Distance to surrounding green area	64.14	9.08
Traffic oriented land value potential	33.38	Distance to surrounding bus stops	25.72	8.58
		Distance to surrounding Metro stations	66.90	22.33
		Distance to surrounding main street	7.38	2.46

Through the weighted superposition analysis, the potential level of development intensity is as follows (Fig 4-48). Due to the high weight of factors such as the retaining of the racecourse buildings and the connectivity with the surrounding culture and sports facilities in the orientation of public urban life, in addition, the retaining buildings and cultural and sports facilities are mainly distributed in the west of the racecourse. The result shows that the development intensity potential is low in the west of the site, medium in the middle of the site,

and high in the south, north and east of the site. According to the analysis of the relationship among function, development intensity and correlation in the previous article, the part with low development intensity potential is applicable to the setting of public service space, which corresponds to the high level of public life weaving potential. In the redevelopment design of this orientation, public service facilities should be set on the west side, public service related functions needed should be placed in this area, and functions that are highly relevant to space production should be placed on the southeast, east, and north sides, which mainly include financial technology industry, experience commerce, residential, apartments and other urban functions, and the southwest side should be connected with the Zhujiang Park.

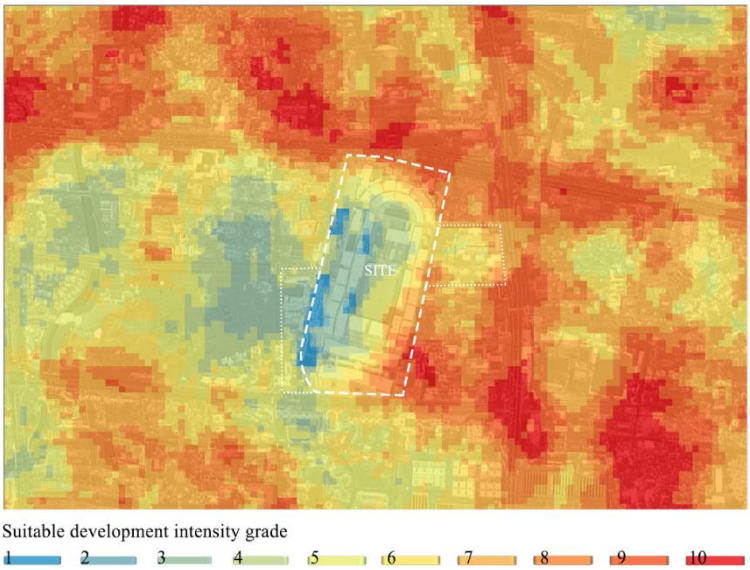


Fig 4-48 Analysis result of weaving orientation based on urban public life
(Source: Drawn by the author, Based on ArcMap technique)

2. Weaving orientation based on connectivity

The theory and mechanism of weaving emphasize the integrality, pluralism and continuity of the weaving elements, as well as the evenness and complexity of the functional distribution, which requires the improvement of the necessary urban functional connectivity, which, to a large extent, can improve the integrality and diversity of the city. According to the investigation and study of the current situation, the functions around the racecourse site are mainly commerce, business, green land, university and residence. Due to the particularity of the university area, it is not considered in the connectivity factor. In the racecourse site, the connectivity potential is mainly reflected in the type of connectivity value potential, and according to the function goals of the racecourse site, the connection between green space and business space is more important. In addition, the distribution of urban traffic, especially road

traffic, also has a high impact on connectivity, so the weight of traffic value potential type is assigned to the second level, in which the weight of distance to the main roads is higher. In combination with other value potential types, this paper finally determines the weight assignment of each factor under the weaving orientation of connectivity, as shown in the following table. (Fig 4-49, Table 4-2)

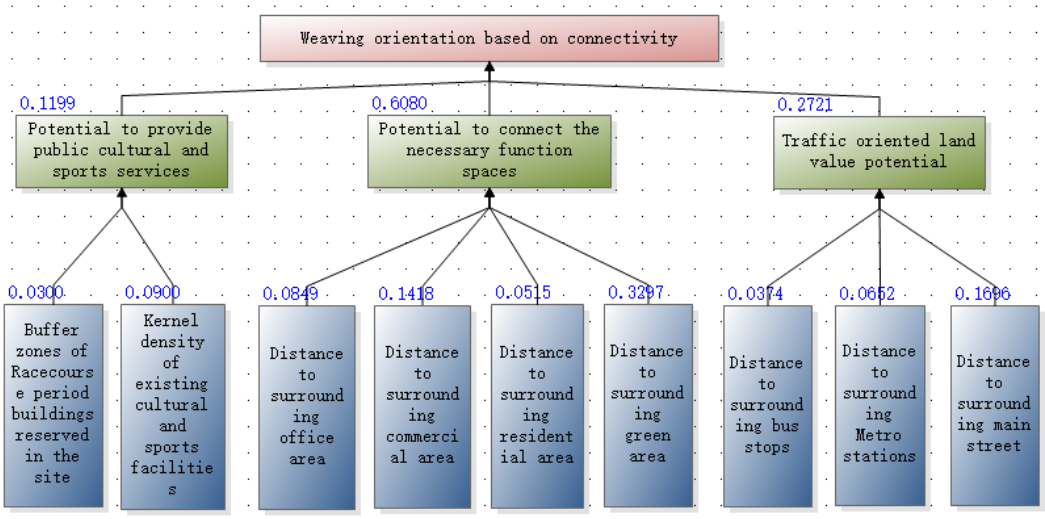


Fig 4-49 Hierarchy under the weaving orientation based on connectivity
(Source: Drawn by the author)

Table 4-2 Weight assessment under the weaving orientation based on connectivity
(Source: Drawn by the author)

Value potential type	Weight (%)	Single factors	Weight (%)	Final weight(%)
Potential to provide public cultural and sports services	11.99	Buffer zones of Racecourse period buildings reserved in the site	25.00	3.00
		Kernel density of existing cultural and sports facilities	75.00	9.00
Potential to connect the necessary function spaces according to the survey	60.80	Distance to surrounding office area	13.97	8.49
		Distance to surrounding commercial area	23.33	14.18
		Distance to surrounding residential area	8.47	5.15
		Distance to surrounding green area	54.23	32.97
Traffic oriented land value potential	27.21	Distance to surrounding bus stops	13.73	3.74
		Distance to surrounding Metro stations	23.95	6.52
		Distance to surrounding main street	62.32	16.96

Through the weighted superposition analysis, the development intensity potential grade is as follows (Fig 4-50). Due to the importance of green space connectivity in the assignment process, a connection zone has been formed between the Zhujiang Park in the southwest, the original green space in the middle of racecourse, and the leftover space in the east of the city and the open public space of the shared community in the east of South China Expressway. In the north and southeast of the racecourse, the development intensity potential is still high.

Urban functions with high spatial production relevance should be implanted, including residence, experiential commerce, financial technology industry, etc., so that the functions will be more evenly distributed in the racecourse plot and form a high degree of connectivity with the surrounding functions. In areas with low development potential, urban functions with high relevance to urban public services should be implanted, including public culture, public sports and public leisure functions. Such functions can be arranged together with urban green space to form a continuous urban public life service belt.

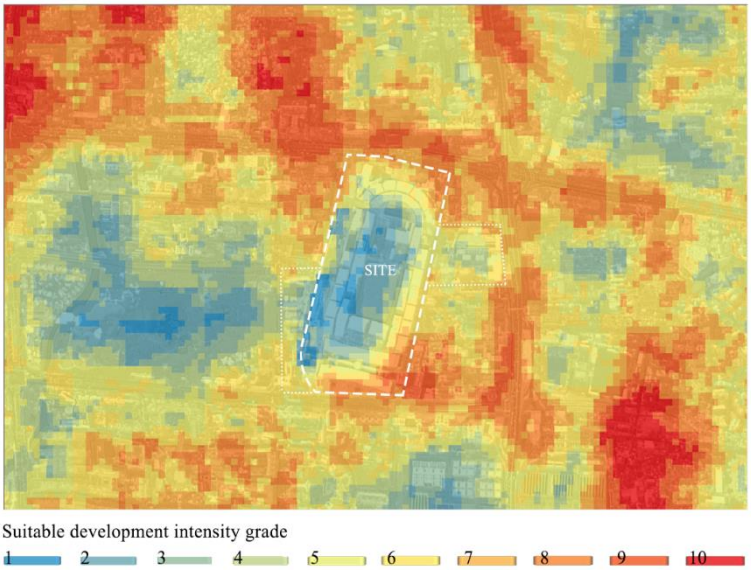


Fig 4-50 Analysis result of weaving orientation based on connectivity
(Source: Drawn by the author, Based on ArcMap technique)

3. Weaving orientation based on TOR developing mode

The proportion of public transport trips in the urban transport mode in Guangzhou is relatively high. According to the preliminary investigation, there is a subway line 3 station in the south of the racecourse plot, and a subway line 13 station will be built in the north of the racecourse plot. In combination with the upper planning and location theory, the public transport oriented redevelopment mode is a key point that must be considered. Because of the urban leftover space attribute of the racecourse plot, The TOR mode (Transit-oriented-renewal) derived from the TOD model can be used to promote the optimization of stock space, improve the quality of urban space, feedback the urban public service capacity through the improvement of land efficiency, enhance systematic and social thinking, pay attention to the needs of the urban system and social welfare effects, and seek a systematic and sustainable value-added route. In the integrated station city renewal under TOR mode, there are high requirements for urban structure reconstruction, function renewal, environment

optimization, urban scape renewal, quality improvement, and the requirement for strength control optimization.

In combination with the requirements of TOR development mode and subjective judgment of urban design objectives, in the weaving guidance of TOR mode, the weight of traffic value potential type is the highest, followed by the potential of public service capacity improvement focused on by TOR mode. In addition, in the assignment of single factors, the weight of Metro stations accounts for the highest proportion among the type of traffic value potential, followed by the consideration of cultural and sports service facilities. Considering the connecting ability of buses to Metro transit, the assignment is relatively high. In combination with other value potential types, this paper finally determines the weight assignment of each factor under the TOR mode, as shown in the following table. (Fig 4-51, Table 4-3)

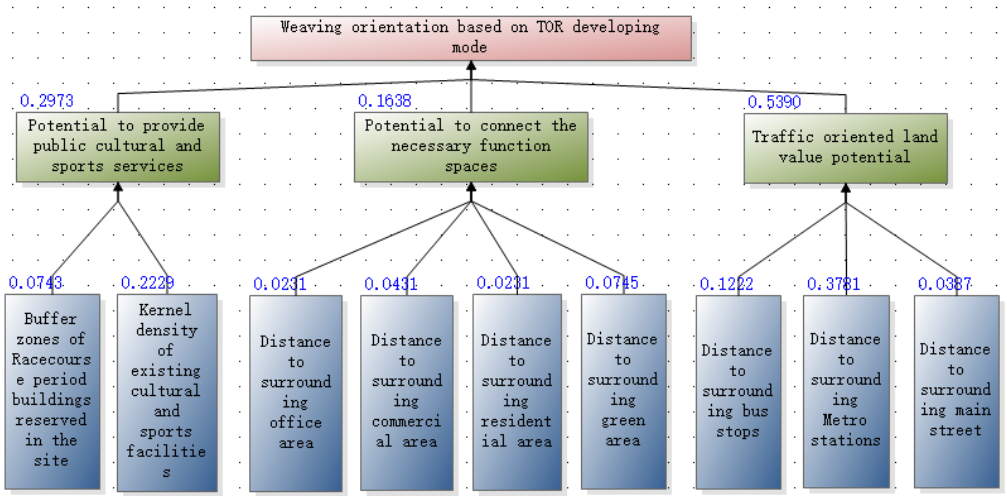


Fig 4-51 Hierarchy under the weaving orientation based on TOR developing mode
(Source: Drawn by the author)

Table 4-3 Weight assessment under the weaving orientation based on TOR developing mode
(Source: Drawn by the author)

Value potential type	Weight (%)	Single factors	Weight (%)	Final weight(%)
Potential to provide public cultural and sports services	29.73	Buffer zones of Racecourse period buildings reserved in the site	25.00	7.43
		Kernel density of existing cultural and sports facilities	75.00	22.28
Potential to connect the necessary function spaces according to the survey	16.38	Distance to surrounding office area	14.11	2.31
		Distance to surrounding commercial area	26..30	4.31
		Distance to surrounding residential area	14.11	2.31
		Distance to surrounding green area	45.47	7.45
Traffic oriented land value potential	53.90	Distance to surrounding bus stops	22.67	12.22
		Distance to surrounding Metro stations	70.15	37.81
		Distance to surrounding main street	7.18	3.87

Based on the weighted superposition analysis, the potential level of development intensity is as follows (Fig 4-52). Due to the high weight of Metro stations in the assignment process and the emphasis on the value of public transport, the overall development intensity potential is higher than the urban public life and connectivity. The space with high development intensity potential is mainly concentrated in the north, south and east. Similar to other oriented assessment models, it also forms a space with low development intensity potential in the west and the middle. Under the guidance of TOR mode, the functions with high spatial production relevance should be concentrated in the north and southeast of the site, and the development intensity should be lower in the middle, and the lowest in the southwest in which the functions with high urban public service relevance should be set.

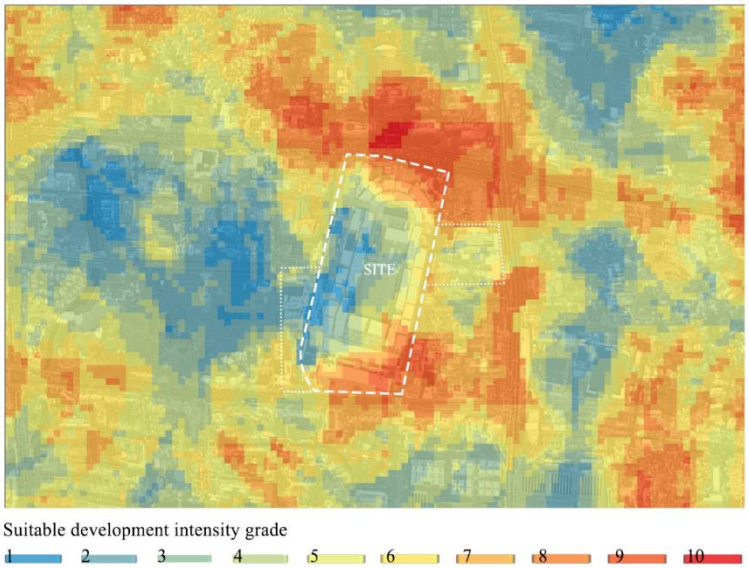


Fig 4-52 Analysis result of weaving orientation based on TOR developing mode
(Source: Drawn by the author, Based on ArcMap technique)

Based on the investigation and evaluation results, according to the upper planning, the development orientation goals are extracted from the three important weaving orientations, and according to the urban public life weaving orientation, the western urban memory axis should be formed in the design; According to the weaving guidance of urban public life and the weaving guidance of connectivity, a green culture, sports and leisure area should be formed in the design starting from the southwest at the Zhujiang Park, passing through the city memory axis in the west, and connected with the east of South China Expressway in the east leftover space; According to the connectivity oriented model and TOR mode oriented model, the development intensity should be improved on the south, north and east sides of the site, forming a development mode of mutual connection between financial technology and

surrounding business offices, implantation and supplement of residential functions, and mutual promotion between experiential commerce and urban public service facilities. On the one hand, efficient space production will feed back the improvement of urban public service capacity, On the other hand, the overall regional urban space quality and urban service quality can be promoted with high-quality and distinctive urban public facilities services.

It is worth noting that the evaluations are based on the current objective urban conditions and subjective urban development goals. However, due to the dynamic nature of urban development and the gradual nature of the weaving process, the assessment of urban leftover spaces should be carried out from a dynamic perspective. It is necessary to form a new urban development orientation in the future weaving process and conduct a new round of investigation on the objective urban environment.

4.6 Summary: Racecourse as a potential space to weave the city

Through the investigation of district, block and site scales and the evaluation of space potential under the three kinds of weaving orientation, this paper believes that the racecourse, as a combination of urban leftover spaces in the urban center, has great weaving potential. The potential is mainly reflected in (Fig 4-53):

As the junction of the three functional areas of the city, the racecourse can realize the undertaking of the financial technology functions, public service functions of the city, such as culture, sports etc., achieving the weaving of urban industry and urban services; Through the supplement of urban road traffic, public transport, non-motorized traffic, etc., the efficiency of urban roads can be improved, and the connection between various types of traffic will be strengthened. Through the supplement of the traffic on the racecourse plot and the adjustment of the connecting traffic, the traffic is weaved through the integration of the new and the old; In addition, as an early built urban space in the Zhujiang New City, the racecourse can be used as a narrator to tell the memory of the city and retain the city's imprint, so that the old urban space can echo with the new urban space, forming a urban space linking the past, the present and the future.

As the key to weave the surrounding blocks, the racecourse can supplement the functions of the street business district, implant urban public service facilities, connect the functions of the blocks, and undertake and weave the functions of the surrounding urban blocks. In addition, the racecourse can continue the development context of the blocks and weave the urban memory. To connect and weave the green space or public space such as the Zhujiang Park on

the west side and the shared community center on the east side, the racecourse can make up the public culture, sports and other functions due to the lack of leisure and entertainment of the landscape type Zhujiang Park, and provide more multi-level green space and open public space for the east side of the South China Expressway. Combined with its own spatial form characteristics and the surrounding spatial form characteristics, the racecourse can realize an urban space form, integrating the new elements and the old ones and coordinating mutually.

Since the initial construction of the racecourse, it has experienced two functional changes, and its history is also a rare memory for the city. As the current leftover space of the city, it can realize the continuation of the urban spatial context through the continuing and reshaping of the original various types of business, transportation facilities, public space and green space, texture and spatial form, buildings or structures, and daily activities, providing citizens with more urban memories and a sense of belonging to weave the spiritual context of the city.

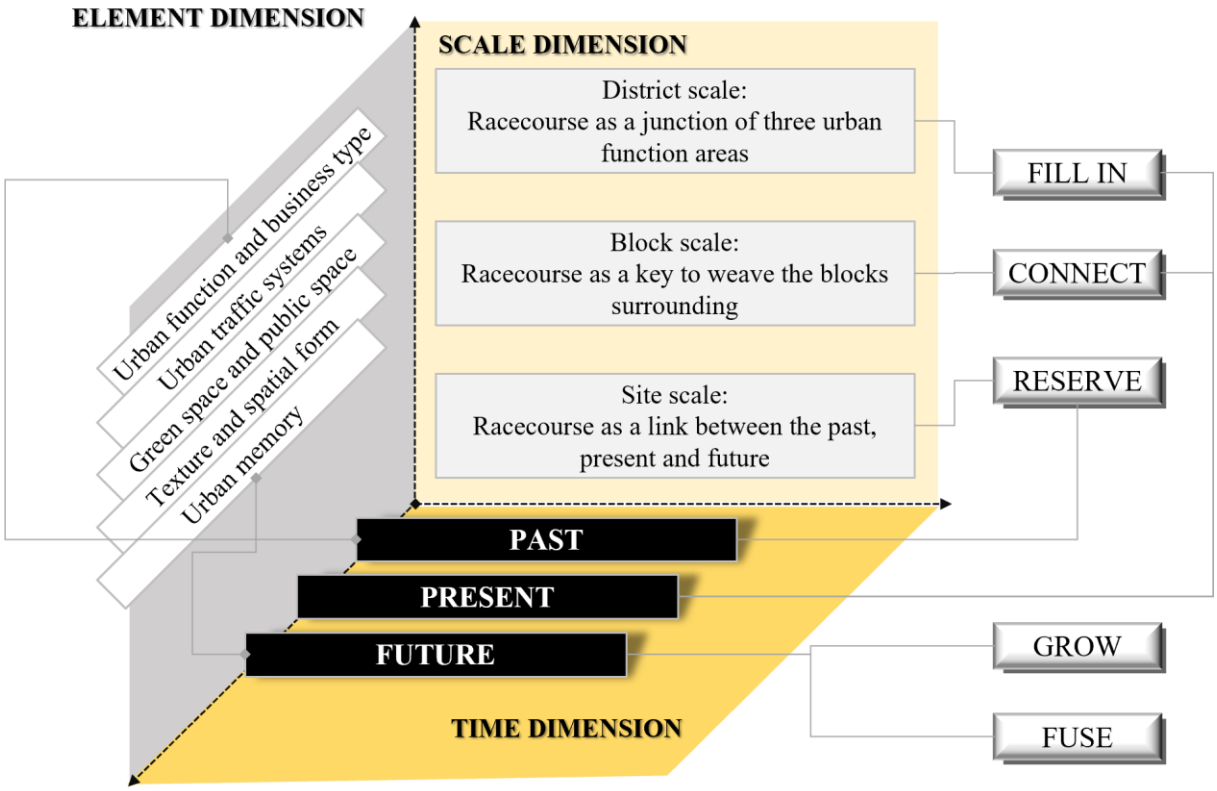


Fig 4-53 Potential of racecourse to weave the city in different dimensions
(Source: Drawn by the author)

Chapter5 “Weaving” strategies of the Racecourse

Based on the current situation research and potential analysis of the Guangzhou Racecourse, the “Weaving” methodology of the urban leftover space is introduced into the design and update of the racecourse plot. This chapter discusses the “Weaving” process of the racecourse and forms the design results for reference.

5.1 Overall strategies

According to the aforementioned weaving mechanism and framework, combined with the investigation, research and evaluation analysis of the racecourse site, In view of the function dislocation and insufficient linkage caused by different urban development stages and industrial structure adjustment and other urban development processes; the ecological fragmentation caused by the lack of reservation of urban ecological space in previous urban planning and design; the traffic jam and structural imbalance caused by the difference of urban traffic system construction stages and the lack of consideration of non-motorized traffic; the context fault and memory dissociation are caused due to the lack of exploration and continuation of urban memory; the urban space fragment caused by the lack of consideration of the spatial form relationship between new and old urban spaces, The overall orientation of the redevelopment and urban design of the racecourse has been made, and the weaving mechanism has been applied to different urban weaving elements, including function, green spaces and urban open spaces, traffic systems, spatial texture and form, urban context, etc.

As the guidance of the framework, principle and system level, the concept and mechanism of weaving should select the elements under the guidance of the framework, construct the weaving skeleton, and extend the skeleton to form a network, to achieve the integration and coordination of the old urban space and the new.

The design process follows the principle of Weaving, including Integrality and Coordination, Complexity and Diversity. The weaving process in racecourse follows the principle of Dynamics and Graduality, treats urban design and urban development from the perspective of dynamic development, and adheres to Historism and Humanism in the weaving process, focusing on the construction of a pleasant living environment.

5.1.1 Design goals

As a rare urban leftover space in the current development state of Zhujiang New City, the

racecourse has great development potential. It is particularly important to undertake the new demand for urban functions and optimize and weave the urban system in the future development of the racecourse, aiming to improve the overall efficiency of the urban system, create new connections with the surrounding block and continue its own development potential and cultural context. Based on the investigation, research and evaluation of the different weaving elements, combined with the urban development needs of Guangzhou, the overall goals of the racecourse were determined.

1. Economic goal: according to the industrial investigation and research at the district scale, this paper clearly recognizes that the core position of the financial industry in the area where the racecourse is located, and the rapid development trend of the new generation of information technology. As the junction of Zhujiang New City, Guangzhou International Financial City, and Wushan Higher Education Area, the racecourse should undertake the responsibility to improve and integrate urban industries, improve the coupling between positive related industries. Taking scientific research resources as the background, with the financial industry as the fulcrum and the information technology industry as the lever, the racecourse will develop a new generation of financial technology industry to help the economic development of the region where the racecourse is located.
2. Environmental goal: It is important to seek an ecological development method, reserve urban ecological space, strengthen the connection between urban architectural environment and ecological environment, weave the urban green space and open space, improve the quality of urban living environment and external space, and form a diversified urban environment with good ecological environment. On the other hand, the design should advocate a low-carbon travel mode, weave the urban transport system, integrate the road system, public transit system and non-motorized traffic system, improve the public travel rate, combining the good external space environment, to achieve a low-carbon urban lifestyle.
3. Space goal: The current space situation of the racecourse is relatively closed, lacking contact with other urban spaces, like an island, which is not only reflected in barriers such as fences, but also reflected in the closeness of the overall space. In the process of weaving, on the basis of continuing the texture of the original racecourse and coordinating the spatial relationship with the surrounding urban areas, the openness of the racecourse space should be strengthened and a distinctive and harmonious urban space should be form through the design of racecourse.

4. Social goal: On the basis of the improvement of economy, environment and urban space, it is also necessary to weave the urban social life, create a harmonious and prosperous community life, enhance the sense of community belonging, and build a community life with shared culture and vitality.
5. Context goal: Through the preservation and renewal of urban physical space with urban personality and memory, the insertion of new spirit of urban culture and sports, the continuation of cultural context, the injection of era vitality, the creation of a new venue spirit bearing horse racing culture, the reinforcement of urban cultural connotation, and the enrichment of urban spiritual network.

5.1.2 Development orientations

According to the overall goals of the redevelopment of the racecourse, undertaking the needs of urban development, it is determined that the industrial function of the racecourse is financial technology industry. Combining the original commercial functions, it will create a green and open urban leisure area, form a shared living space mainly for young people, and continue the development context and equestrian culture of the racecourse. Based on the current conditions of the racecourse and the principle and mechanism of urban leftover space weaving, the following development orientation is formed (Fig 5-1):

1. The Financial Technology Industry Incubation Center linking Tianhe CBD and the Guangzhou International Financial City: This orientation supplements the main industries of Tianhe district, combine the two main industries, incubate high-quality enterprises in new industries, optimize the financial and new generation information technology industry chain of Tianhe district, form a richer industrial hierarchy, to weave the urban functions.
2. Vigorous residential zone oriented to the young financial technology talents relying on Wushan Higher Education Area: This orientation is aimed at attracting scientific research talents and provide a power for urban industrial development, which requires providing youth groups with good supporting facilities, rich shared space, and creating urban space conducive to stimulating creativity.
3. The green diversified leisure, culture and sports sub center at the district scale that mainly serves Tianhe district and benefits Guangzhou: The racecourse will provide the functions of culture and sports, leisure and entertainment, experience business, creative market, etc. to the surrounding areas and even the whole Guangzhou, integrate urban architectural

environment and landscape green space, to provide citizens with rich urban life, green and ecological urban environment, and activates urban vitality.

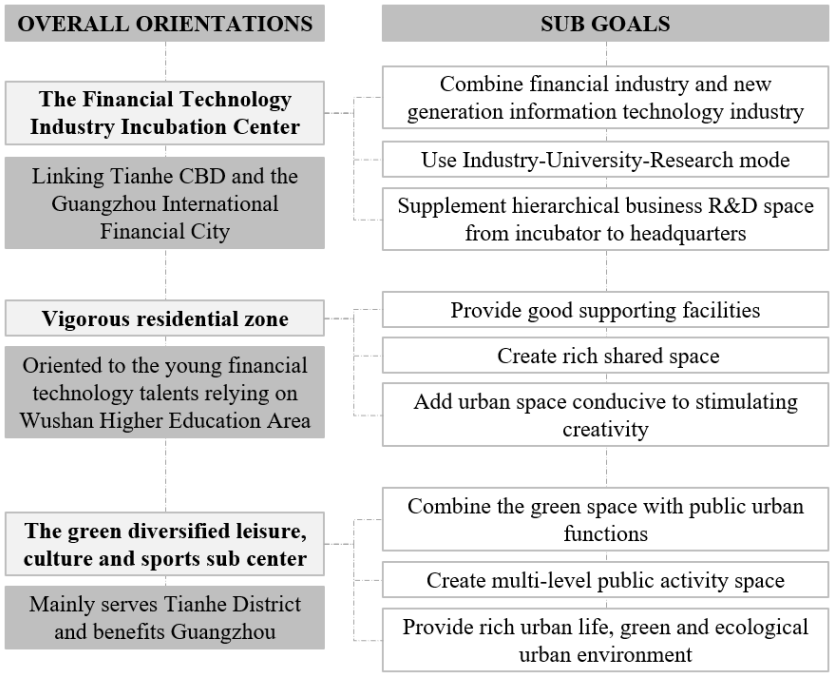


Fig 5-1 The development orientations (Source: Drawn by the author)

5.1.3 Mechanism and process

1. Mechanism

The weaving mechanism of the racecourse follows the weaving mechanism of the urban leftover space. Based on the investigation and research, the process sorts out the weaving elements that need to be continued in the racecourse space, supplements the functions required by the city through the leftover spaces, connects the new elements with the old elements, and reshapes the overall structure. Finally, it forms an urban organism through the establishment, growth, and mutual connection of different element systems, and ultimately feeds back the surrounding urban space and the whole city. (Fig 5-2)

In the weaving of the racecourse, according to the investigation, research and evaluation analysis of the three levels of weaving elements in the previous chapter, the site scale weaving elements are first investigated and screened. According to the importance, development potential and compatibility with the development orientation, some buildings and constructions shall be retained, regenerated or reconstructed, including the entrance buildings, reserved stands, stables, and two scoreboards built in the racecourse period on the west side of racecourse. The original green space shall be redeveloped, and the urban roads shall be

adjusted according to the equilibrium of road network and the overall consideration of other weaving elements.

Secondly, the weaving will supplement the functions required for urban development, including financial technology industry integrating headquarters enterprises, small and medium-sized enterprises in the Industry-University-Research mode, and fill in the urban public service functions such as leisure, culture and sports.

Third, the weaving will form the racecourse memory axis and green leisure sports belt, optimize the road network, and reshape the main space structure of the racecourse.

Fourth, on the basis of the main space structure, the catalyst points of the public dynamic space should be implanted, and the matching functions should be placed according to the development intensity potential analysis.

Finally, through the mutual influence and constant adjustment of various systems, a organic urban space will be formed by gradual integration, and will have a positive impact on the surrounding areas as a new urban support.

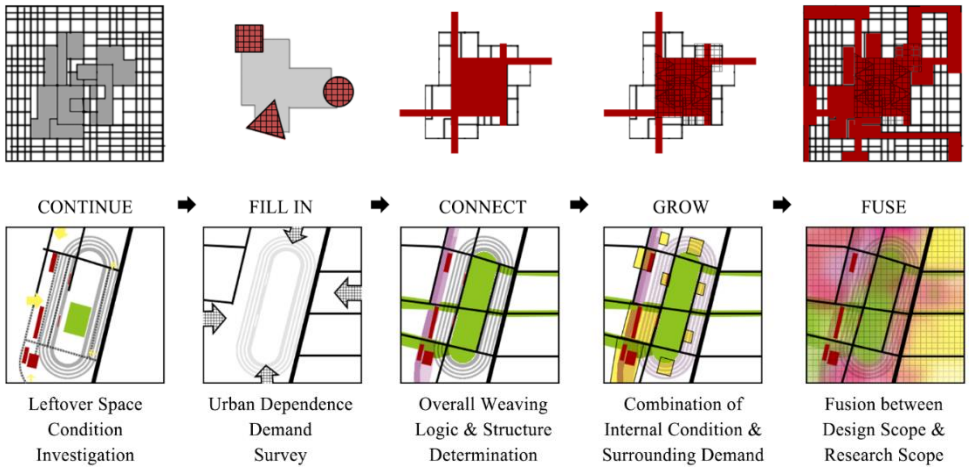


Fig 5-2 The weaving mechanism of racecourse (Source: Drawn by the author)

2. Process

The weaving logic of the racecourse starts from the continuation and extraction of the context, forming the racecourse memory axis and the racetrack roaming ring. Secondly, the weaving reserves, increases and connects the public open spaces. The original road network is taken as the framework to adjust the block, and the adjustment process respects the overall spatial context structure and open public space structure. According to the functions required by the overall orientations, new motifs are put into the racecourse to form the overall logic, guiding the more detailed weaving of each element. (Fig 5-3)

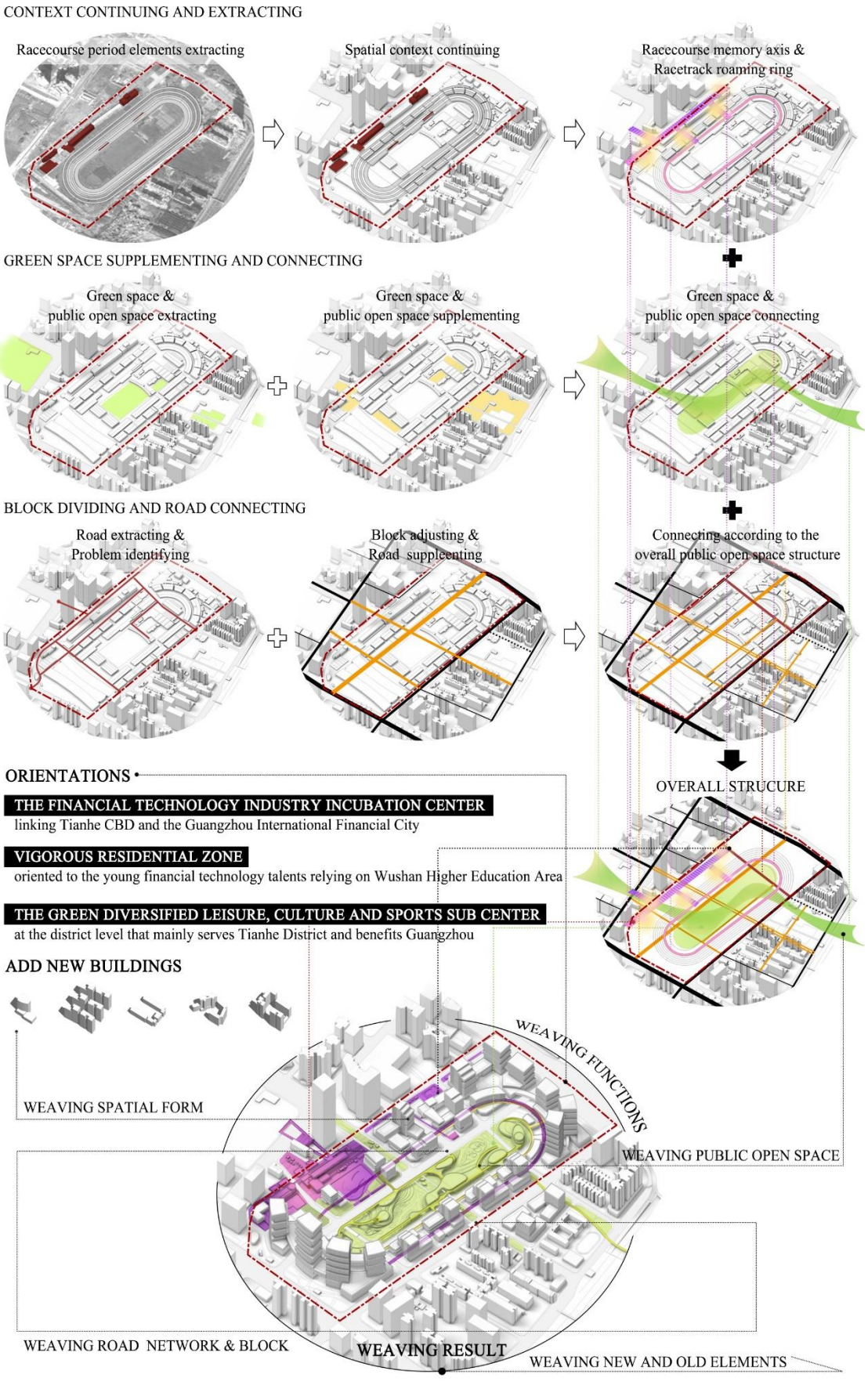


Fig 5-3 The weaving process (Source: Drawn by the author)

5.2 “Weaving” for new and original functions

5.2.1 Process

In the function weaving, through the investigation and research on the functional changes of the racecourse at the site scale, this paper finds that the racecourse has experienced two functional changes，originating from the disappearance of the horse racing function, including the transformation to the automobile sales function and finally to the combination of the furniture sales and catering functions at present. Along with the function changes, the influence of the racecourse in the city has gradually decreased. The racecourse was a popular urban activity space during the horse racing period at the end of the last century, which has occupied a precious memory of the citizens. In addition, the name of the racecourse has been used continuously in the subsequent development, and the buildings of the horse racing period were partially preserved, which is enough to illustrate the influence of the past horse racing activity in Guangzhou. Therefore, in the weaving of the racecourse, this paper continues some memories belonging to the horse racing period, inherits the equestrian culture, and emphasizes the prosperous of the horse racing period to a certain extent. In addition, by exploring and redeveloping the functions existing in the current racecourse space, some functions that bear the urban memory or have certain upgrading and developing potential are also retained.

In addition to continuity and reservation, the function weaving will supplement the urban function demand obtained from the district scale analysis and the urban public service facility demand obtained from the block scale into the racecourse space, aiming to provide high-quality urban functions and public services for the surrounding urban space and the whole city. According to the development orientations in the weaving framework, it is essential to supplement the functions of financial technology industry, residential function, commercial function, public cultural facilities, public sports facilities, etc.

By connecting and reshaping the racecourse memory axis and the green leisure open space belt, filling in the functions continued, reserved and newly filled in, the racecourse will become an urban area with mixed, diversified and dynamic functions. (Fig5-4)

In the subsequent construction and development of the racecourse, the method of phased construction is used to gradually realize the recovery of space vitality, the weaving will also reasonably use the catalytic effect of public service facilities, balance the benefits of land

development and the urban public welfare, and make each development stage take the integrality and coordination of functions into account. Finally, the urban space vitality around the racecourse will be further improved by realizing the transformation from urban leftover space to urban vitality space.

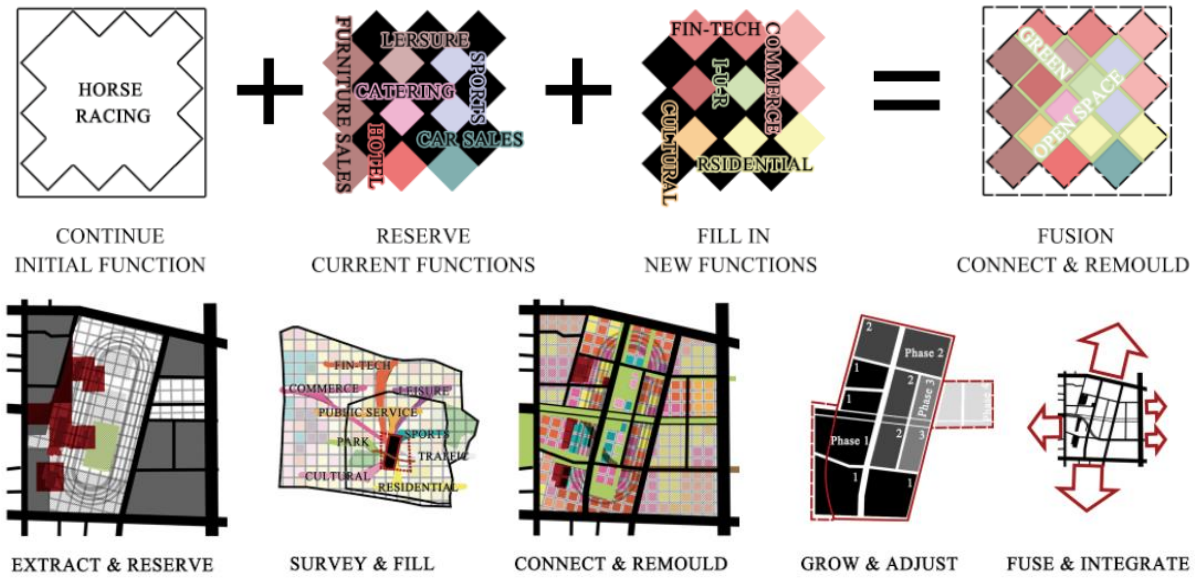


Fig 5-4 Function weaving process (Source: Drawn by the author)

5.2.2 Undertaking the vision of urban industrial development

In the function weaving, according to the undertaking of urban regional functions and the supplementary demand for public service facilities in the surrounding blocks (Fig 5-5), the functions of the racecourse will include the I-U-R(Industry-University-Research) function and business function dominated by financial technology industry, comprehensive commercial functions, public service functions, public park functions, and residential functions dominated by youth apartments. (Fig 5-5)

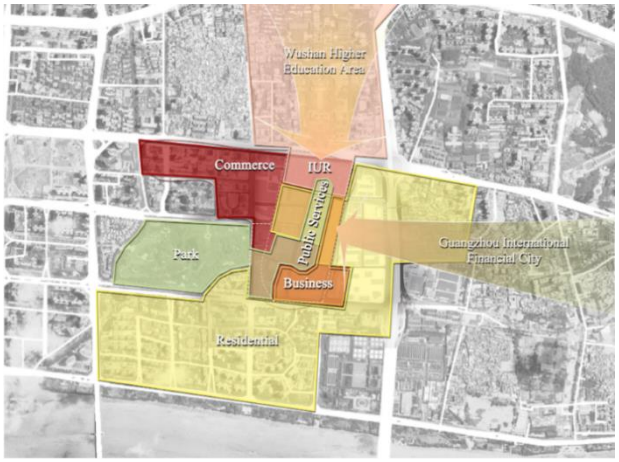


Fig 5-5 Function undertaking (Source: Drawn by the author, Based map from Google Earth)

1. I-U-R(Industry-University-Research) and business function

The development of the racecourse will be embedded in the Fin-tech (Financial technology) industry, which refers to the traditional finance industry that changes the information collection source, investment decision-making process, credit intermediary role, etc., through the latest IT technologies such as big data, cloud computing, artificial intelligence, blockchain, etc., and greatly improves the efficiency of traditional finance. It is an industry type integrating traditional finance and the new generation of information technology industry, which plays a certain role in promoting the development of the regional core industries, and it is a kind of integration and weaving of new and traditional industries. Representative industrial technologies include big data credit reporting, supply chain finance, etc.

In the development of Fin-tech industry, it is essential to cultivate talents and promote industries. The racecourse will rely on the northern Wushan Higher Education district, absorb young research talents, create an I-U-R (Industry-University-Research) development mode, and incubate small and medium-sized Fin-tech industries with the help of headquarters enterprises to provide a platform for the development of Fin-tech, forming an industrial upgrading path of “universities, R&D (Research and Development), incubation, small and medium-sized enterprises, headquarters enterprises” (Fig 5-6).

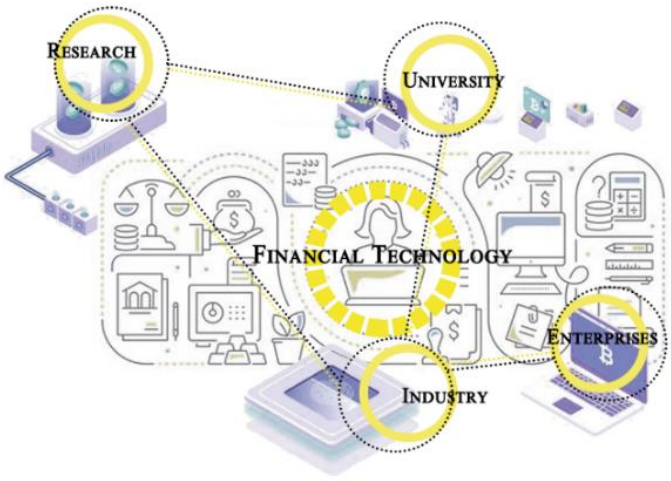


Fig 5-6 Developing mode of Fin-tech industry (Source: Redrawn by the author)

2. Public service functions combined with the park

The weaving continues the landscape function of the Zhujiang Park on the southwest side of the racecourse, connects the V-Park sharing community on the east side, places cultural facilities and sports facilities lacking in the surrounding blocks, combining with a small number of leisure experiential commerce to form a green and diversified leisure culture and

sports core, serving the racecourse and the surrounding urban areas. All functions are integrated into the dynamic green space in the form of earth covered buildings, including skateboard parks, roller skating hall, badminton halls and other sports functions, cultural exhibitions, art salons and other cultural facilities, which complement the leisure and entertainment functions that Zhujiang Park lacks, providing citizens with a variety of urban activities (Fig 5-7).

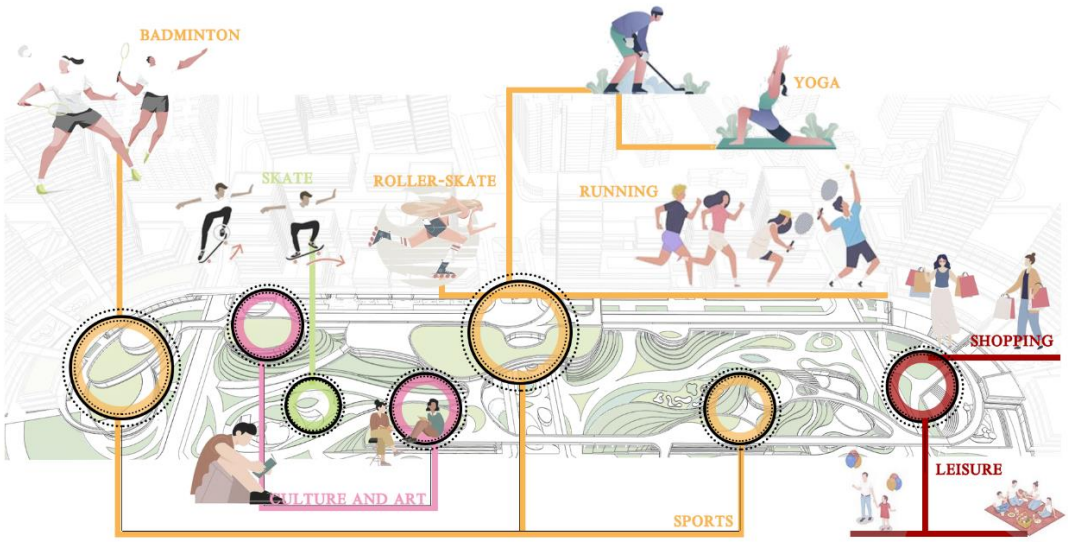


Fig 5-7 Diversified urban activities (Source: Drawn by the author)

3. Comprehensive commercial functions

In combination with Fin-tech industry and urban service functions, the Weaving will fill in comprehensive commercial functions to form an urban synthesis. Using podium buildings, diversified commercial functions will be supplemented to form a comprehensive commercial space which includes financial industry type, headquarters business type, shopping complex type, cultural and commercial street type, residential type, rail station type, sports and leisure type, and cultural and creative type, providing convenient commercial services for different functional groups. (Fig 5-8)

Fig 5-8 Bottom commercial space (Source: Drawn by the author)

4. Residential functions

The goals and development path of the Fin-tech industry and the overall orientation of the Racecourse require that the racecourse should provide industrial talents with diverse functions and complete supporting facilities, which can stimulate innovation ability and provide space for sharing and communication platforms. The apartment space and office space are filled in the high-rise building space, and the podium space and corridor space are used for the shared communication space, catering space and commercial space, with the green open space as the core of the courtyard (Fig 5-9). As a result, the community bond will be formed, providing space for the optimization of neighborhood relations, and ultimately attracting young talents to live.

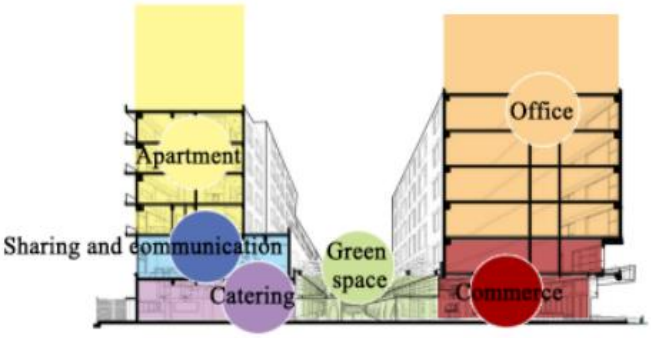


Fig 5-9 Sharing residential block (Source: Redrawn by the author)

5.2.3 Continuing the original functions with potential

According to the investigation and assessment, the original horse racing function of the racecourse will be partially restored and continued, and the horse racing that originally required huge ground space has been converted into an obstacle course that requires less space. In combination with the stands and scoreboards of the original racecourse period, the terrace-backwards buildings will be put into the space to reflect the epitome of the racecourse in the horse racing period. In this way, the equestrian function and culture are retained in the space of the racecourse.

The original catering function of the racecourse is mainly concentrated in the southwest side of the racecourse, interwoven with the surrounding buildings. The weaving will fill in more catering space, redeveloping the catering function of the original racecourse, and combining the memory of the racecourse and urban open space to create a characteristic catering functional space.

As the product of the second functional period of the racecourse, the car sales function also

carries certain urban memories. At present, the car sales function in the site is still in effective operation, but the current building conditions are poor. In the weaving process, the original building will be demolished and rebuilt, and the original car sales function will be replaced to achieve the continuation of the function and the improvement of the building state.

The original Racecourse Furniture Center in the racecourse still occupies furniture retail in Guangzhou in some extent, and its operating status is good, but the volume of building is huge, which has caused a great negative impact on urban traffic. In addition, the intensity can not meet the space needs of the racecourse under the overall orientation. The weaving strategy of demolition and reconstruction will be adopted to it, to increase the intensity of land development, retaining the function of furniture sales in the racecourse.

Due to the high requirements for development intensity and public services on the racecourse, the original golf course needs to be compromised due to its large area and strong private attributes. The Miniature Golf mode will be adopted to reduce the area, but the function will be retained to a certain extent in the racecourse and the publicity of the function will be improve. In addition, badminton and tennis activities will also be retained to form a leisure, cultural and sports center together with other new sports activities. (Fig 5-10)

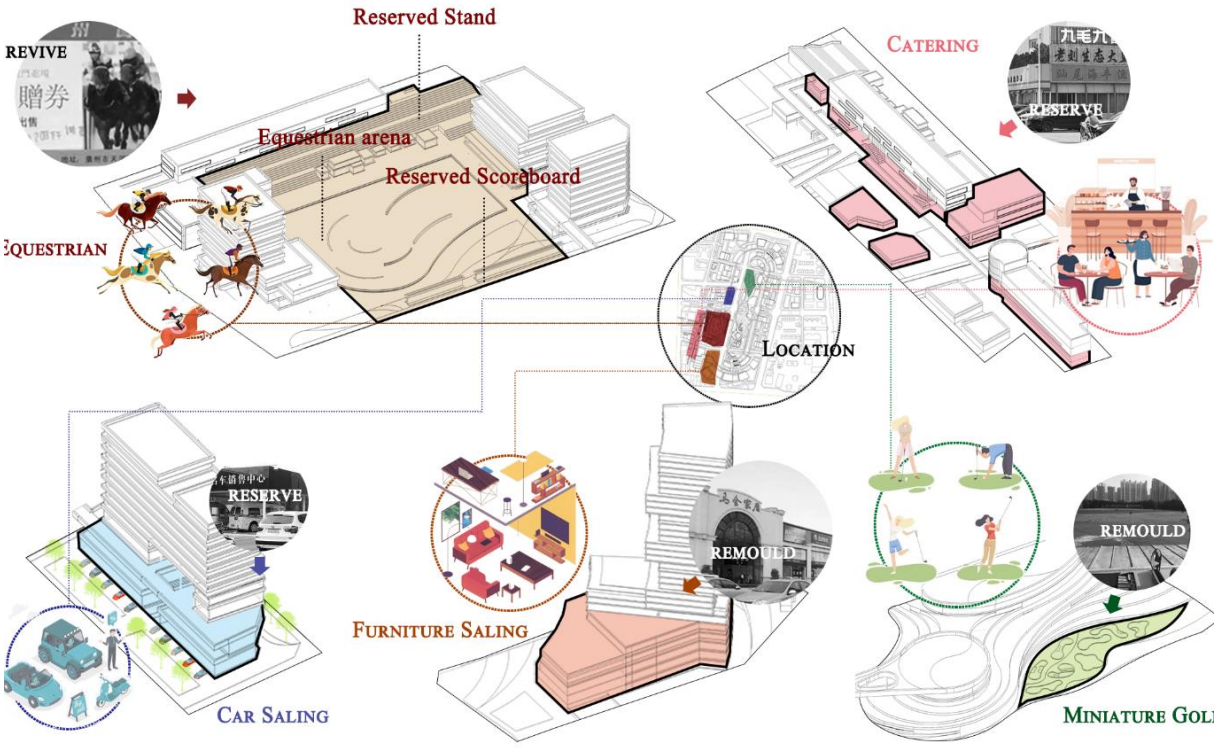


Fig 5-10 Continuation of functions (Source: Drawn by the author)

5.2.4 Completing diverse function structure

In combination with the Fin-tech industry function, youth apartment residential function, public leisure service functions, continuation and reservation functions, and green space function, six functional areas will be formed, including the “I-U-R zone”, “Incubation zone”, “Headquarters business zone”, “Youth apartment zone”, zone with racecourse memory as the leading role, and “Public leisure green zone” with urban life activities as the leading role. The original racetrack space will be used as a “Roaming ring” in series connecting different functional groups as well as the “Racecourse memory axis” and “Sharing axis”, and finally the public service function of the surrounding blocks will be weaved through the “Vital green belt” (Fig 5-11).

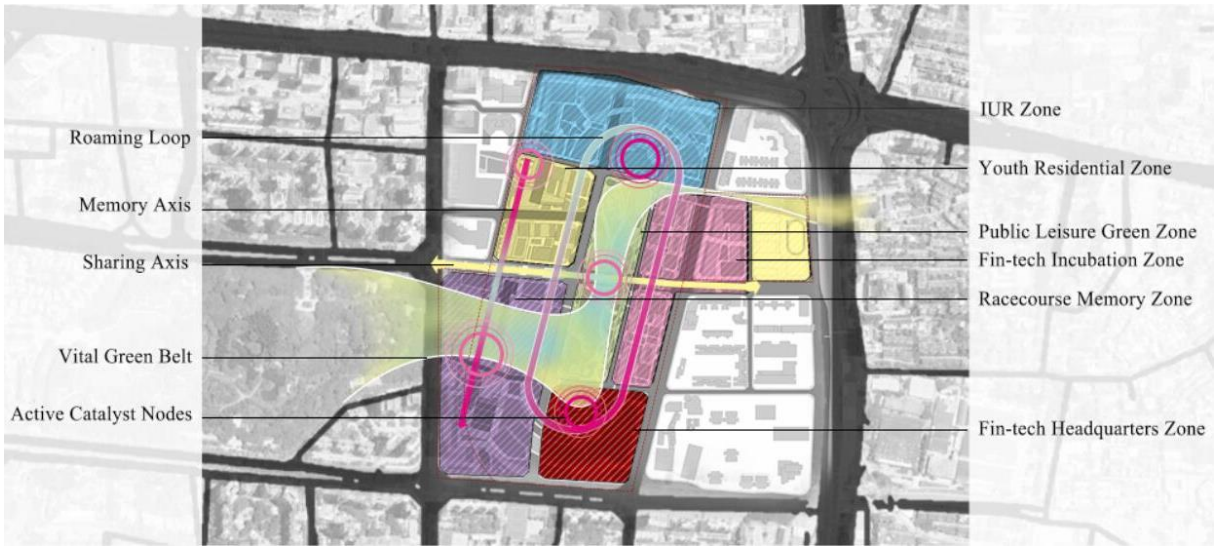


Fig 5-11 Function Structure
(Source: Drawn by the author, Based map from Google Earth)

According to the results of space development intensity analysis in the weaving analysis, a mixed functional layout conforming to different characteristics of development intensity will be formed, and a multi-functional space will be put into it, to form a shared and composite space, which follows the weaving mechanism. (Fig 5-12)

In the Fin-tech headquarters zone, the sunken plaza will be the commercial core of the podium building, forming a commercial synthesis. The headquarters business function and some hotel functions will be arranged in the high-rise buildings and the space above the furniture sales podium building, the original stable function and catering function will be retained in the west of the headquarters area, and the new cultural function and children experience business function will also be placed. In addition, one floor commercial function

and two floor parking function will be set underground and connected with the south subway station.

In the Racecourse memory zone, more catering function space, catering office space, children's commerce space, cultural space and a small number of enterprise spaces will be placed around the equestrian field and the original catering space. In addition, two-layer parking function will be set in the underground.

In the Youth residential zone, around the original entrance building of the racecourse, relying on the original catering function, a characteristic leisure and entertainment functional space will be formed, in which multi-functional space and some small and medium-sized enterprise incubation spaces will be placed. Two floors of underground parking shall be set.

In the Public leisure green zone, various leisure, cultural and sports functions will be put into the park, and a small number of commercial space are added to improve the diversity of central green space functions and enrich urban public life. In addition, leisure and entertainment functions, sports function, commercial functions and cultural functions will be put in the basement.

In the east incubation area, small and medium-sized enterprises incubation space, a small number of residential space will be filled in, and the commercial function will be mainly arranged in the podium building, multi-functional space will be put into this zone. In addition, two floors of parking space will be set underground.

A primary school will be set on the east side of the Fin-tech incubation zone according to the standard to meet the supporting services.

In the northern I-U-R zone, research space and industrial incubation space will be added according to the weaving strategy, and commercial functions and catering functions will be set at the bottom of the buildings, and multi-functional space will also be set into the center of the I-U-R zone. In addition, some research space, commercial space, and parking space will be set underground.

Through the function weaving of the racecourse, the space development intensity will be greatly improved, the functions required by the city will be implanted, and the initial and original functions of the racecourse with urban memory and development potential will be continued.

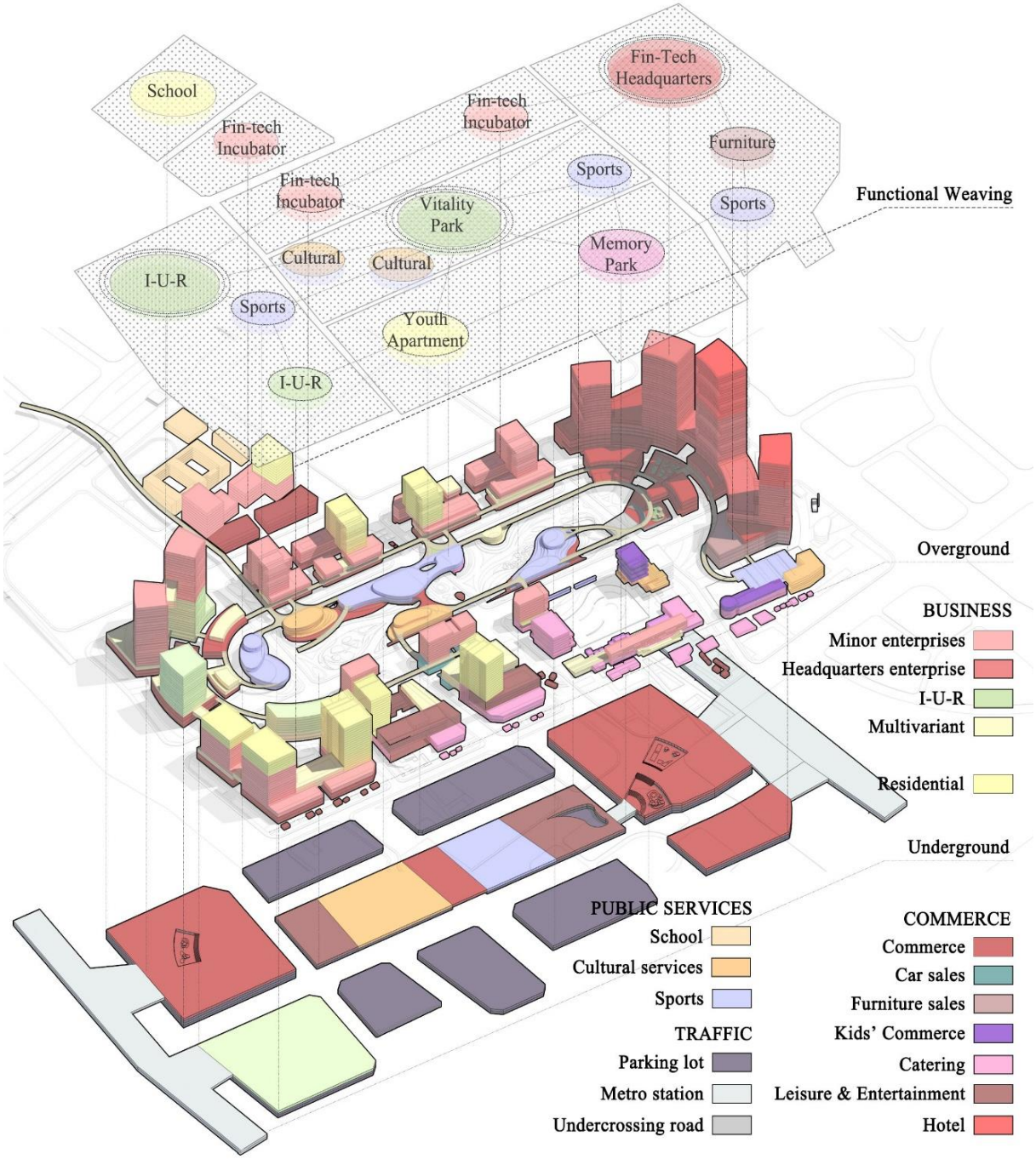


Fig 5-12 Three-dimensional function mixing strategy
(Source: Drawn by the author)

The floorages of different functions are shown in Table 5-1, the floorage of sports, hotel, catering and leisure function will increase. The floorage of furniture sales and car sales will be similar to the original condition. Through function weaving, the racecourse can provide about 1500 residences and 10000 jobs, to support the economic development objective.

Table 5-1 Function floorages of different functions
(Source: Made by the author)

Function category	Functional subcategory	Floorage(m^2)
Residential	Residential	149,526
Business	Minor enterprises	244,796
	Headquarters enterprise	162,081
	IUR	96,221
	Multivariant	54,988
Commerce	General Commerce	214,230
	Car Sales	8,474
	Furniture Sales	75,830
	Kids' Commerce	7,743
	Catering	40,471
	Leisure & Entertainment	39,738
	Hotel	60,795
Public Services	School	48,590
	Cultural services	31,166
	Sports	52,414
Traffic	Parking Lot	361,059

5.3 “Weaving” the city and nature

5.3.1 Process

The weaving of the green open space in the racecourse includes two aspects. On the one hand, it is the continuation of the green open space in the Zhujiang Park on the west side and the connection with the open space in the V-Park sharing block on the east side of the South China Expressway, so that urban residents can reach the urban open space more conveniently. On the other hand, it weaves its own open space. (Fig 5-13)

Firstly, according to the research results and evaluation analysis, the leftover spaces with connection potential or cultural value in the racecourse shall be extracted and reserved, as well as the spaces on the east or west side of racecourse, including the space around reserved buildings, the central green space using for golf, etc.

Secondly, at different open space levels, the Weaving puts more public open spaces into the racecourse, respecting the texture of the racetrack, emphasizes the centrality and continuity of the public space, forms a central open green space. Then, the Weaving connects the public space with an original racetrack as the ring, and put different types of activities into the external space.

Finally, by increasing the connection between green space or public open space, a multi-level and three-dimensional urban green open space system will be formed.

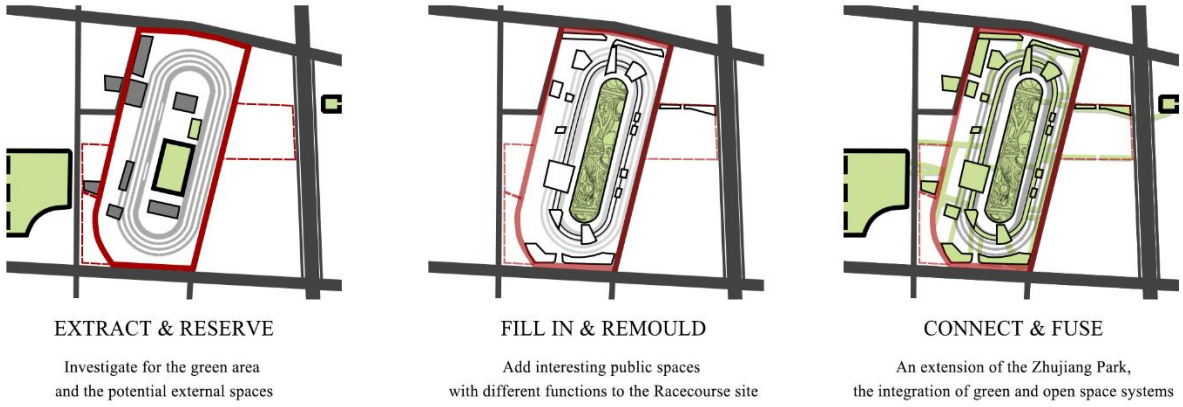


Fig 5-13 Green open space weaving process
(Source: Drawn by the author)

5.3.2 Connecting the public open space structure

In the weaving of green open space, the most important thing to be emphasized is "Connection". The weaving of the green open space in the racecourse is not only reflected in the design scope, but also in the connection with the surrounding green open space. Due to the closure of university campuses and residential areas on both sides of the north and south, the connection of green open space cannot be substantially enhanced. As for the east and west sides of the racecourse, according to the investigation and evaluation analysis, the green space of Zhujiang Park in the west and the open space around V-Park in the east can be relied on to form a continuous green open space system by taking the leftover spaces between Zhujiang Park and the racecourse, the spaces between the racecourse and South China Expressway into account.

For the creation of the internal green open space of the racecourse, the texture characteristics of the racecourse are extracted by the Weaving, and the original green space and external space with development potential are explored to form a circular and centripetal public space structure. In addition, due to the existence of the buildings belonging to the horse racing period at the southwest side of the racecourse, it is conducive to the reshaping of the Genius Loci. Therefore, the open space with the theme of horse racing memory will be expanded to connect the Zhujiang Park and the central vitality park, forming a green open space structure integrating green landscape, urban context and urban public life, weaving of the urban green network and open space network. (Fig 5-14)

Fig 5-14 Green open space structure
(Source: Drawn by the author, Based map from Google Earth)

5.3.3 Filling in public leisure activities

The functional diversity of green open space is very important to enhance the vitality of open space, which can form a differentiated development path with Zhujiang Park to a large extent. In the process of selecting leisure activities in the public space of the racecourse, the weaving strategy emphasizes the publicity and appreciation of the activities, aiming to enhance the vitality of the catalyst point and the overall public open space. Activities mainly include equestrian practice and competition, miniature golf, urban marathon and cycling, experiential commerce, creative market, etc.

Among them, miniature golf is derived from the function of golf driving range in the original racecourse. Because the original function occupies a large area and has low publicity, the Weaving will transform it into a more extroverted miniature golf sport (Fig 5-15). Miniature golf is a miniature version of the traditional golf course. While retaining some functions of the original golf course, it increases the fun of public space activities, expands the audience group and improves the space publicity.

Fig 5-15 Miniature Golf (Source: Drawn by the author)

Under the guidance of weaving, the open public space not only exists on the ground, but also will be connected with the underground space. (Fig 5-16) The Weaving connects the different blocks with strong publicity through sunken plazas, and the experiential commerce, retailing, sports and entertainment functions are added to improve the quality of underground space and form a multi-level urban open space system.

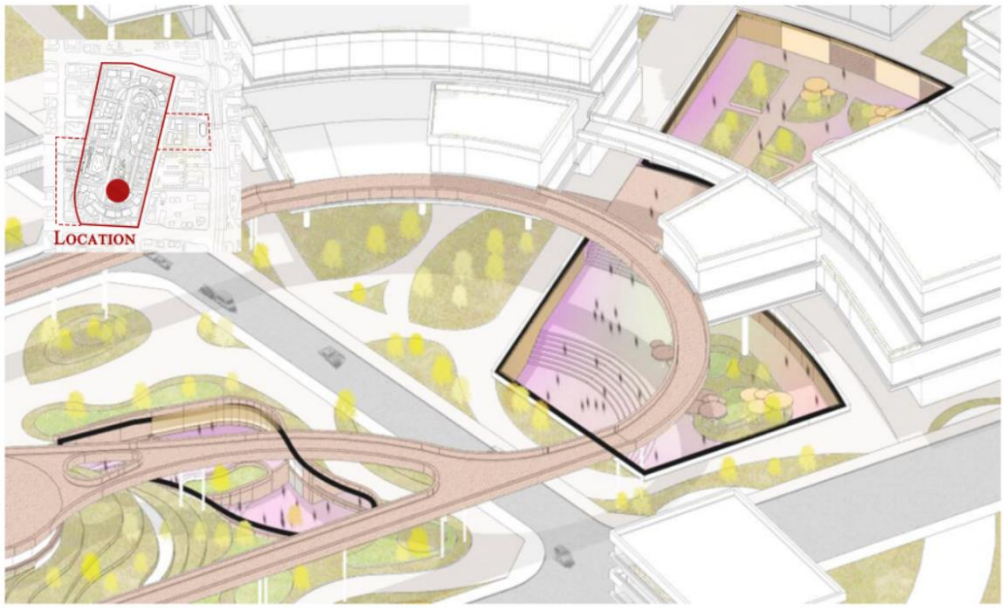


Fig 5-16 Commercial sunken plazas (Source: Drawn by the author)

In the Racecourse memory park, a equestrian field conforming to the type of obstacle equestrian competition will be built based on the space between the original stands and scoreboards to continue the horse racing culture of the plot. (Fig 5-17) The equestrian arena can be opened to the public when there are no training events, which will deepen the citizens' immpression of equestrian sports and show the development context of the racecourse.

Fig 5-17 Equestrian arena (Source: Drawn by the author)

5.3.4 Forming a three-dimensional landscape

According to the structure of green open space and the placement of open space activity types, a three-dimensional, continuous and multi-level open space system is formed to connect the urban green open space network and integrate rich urban public activities. "Weaving" takes the plane green space structure as the skeleton, complements green space and public open activity space in the vertical direction, and forms a multi-level urban green open space network through the superposition. On the one hand, it can optimize the urban ecological landscape, on the other hand, it can promote the construction of urban open space pattern and integrate the urban architectural environment with the natural landscape environment, forming an urban environment where the city and nature are intertwined (Fig 5-18).

On the ground, a green public space corresponding to the texture of the racecourse will be formed, with the central vitality park as the core, and the original racetrack as the public space roaming ring, connecting the open space nodes. Cultural and sports activities will be placed in the earth sheltered buildings of the center to create a city landscape with height difference.

In the second-floor space, “Weaving” connects the internal environment of the building with green public open space, integrates green public open spaces with corridors suitable for walking and riding, to improve the accessibility between the buildings and open spaces, increase the area of public open space of the racecourse in the vertical direction, and finally form a second urban interface.

“Weaving” adds gardens into the roof of each high-rise building to provide more private open activity space and improve the three-dimensional landscape quality of the racecourse.

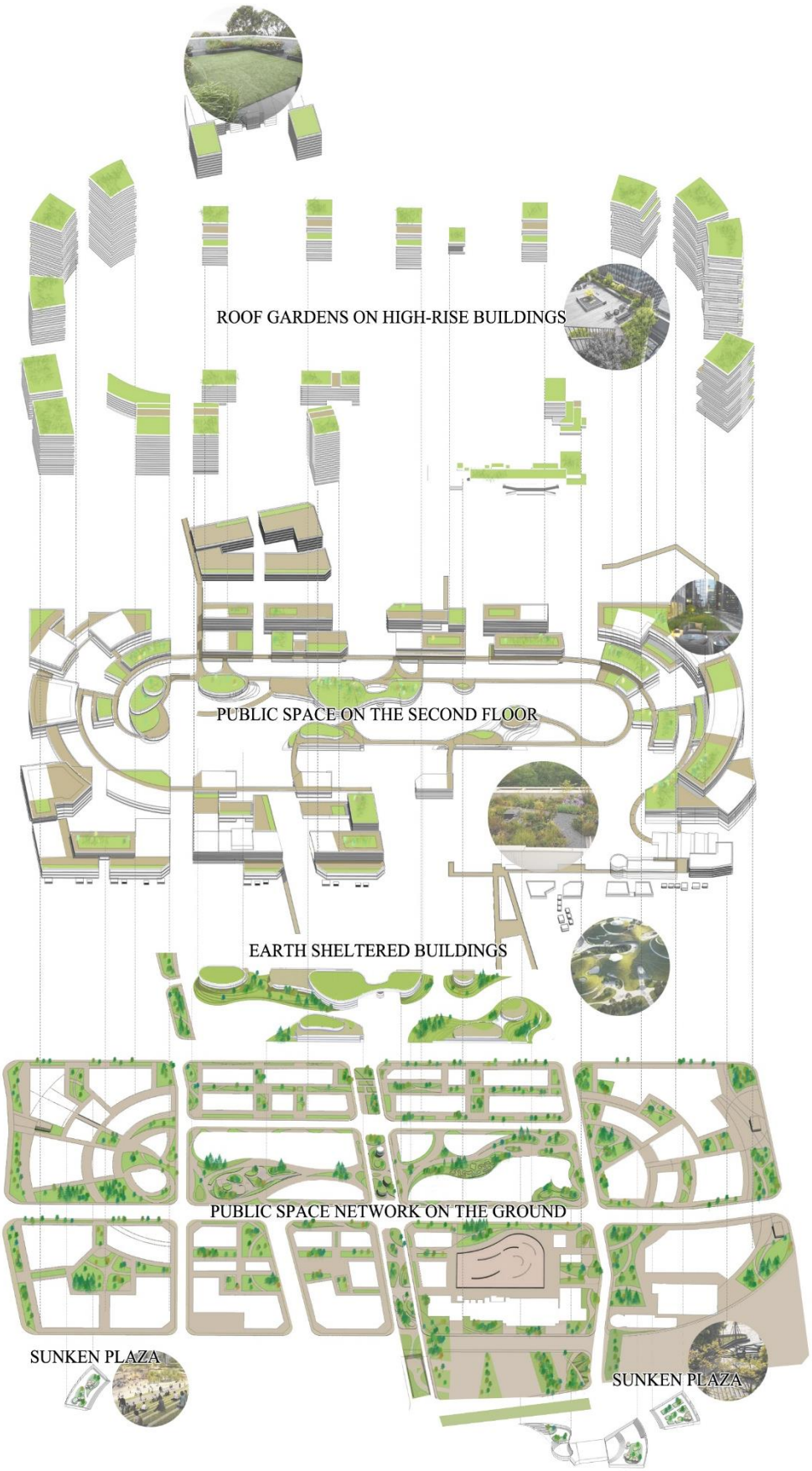


Fig 5-18 Multi-level landscape (Source: Drawn by the author)

Through the weaving of multi-level vertical green open public spaces, a three-dimensional urban landscape is created, giving the racecourse building users a high-quality visual experience. The multi-level vertical public space system not only enriches the daily life of citizens, but also improves the overall space quality of the city (Fig 5-19).

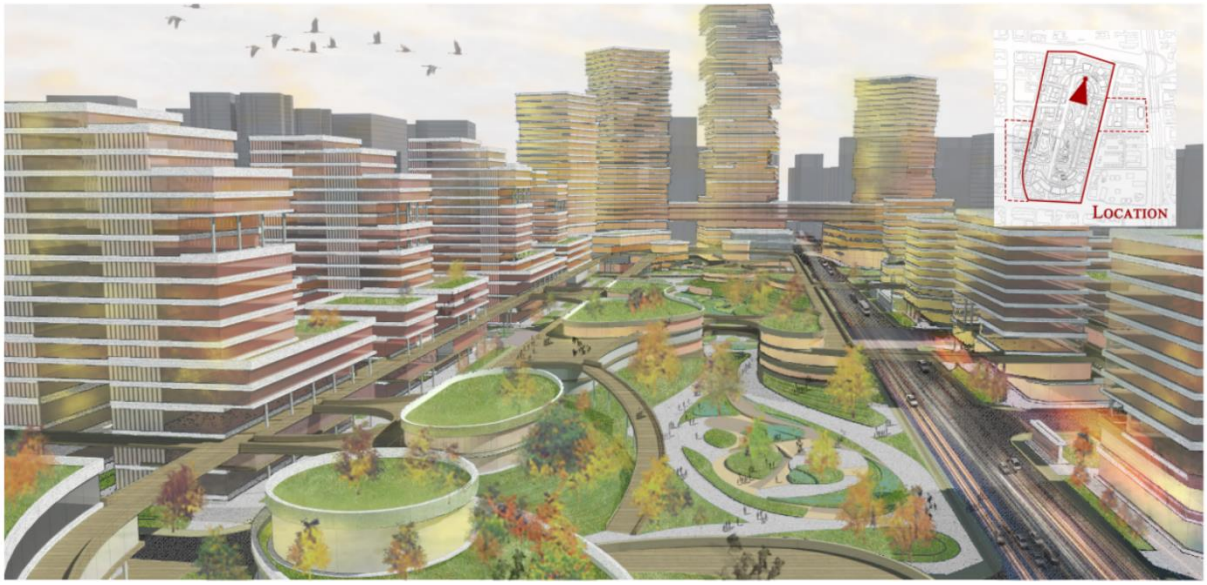


Fig 5-19 Three-dimensional landscape (Source: Drawn by the author)

5.4 “Weaving” for continuous transportation system

5.4.1 Process

In the weaving of traffic, first of all, according to the investigation results, the original traffic condition has been analyzed, and the road will be adjusted and added to solve the problems of discontinuous road traffic, low road density, uneven road distribution, etc. The "Weaving" cancels the south section of the road on the west side of the racecourse. On the one hand, it is for the continuation of the memory zone of the racecourse, and on the other hand, it is because the original road is too close to the Machang Road and the angle between the road and Huacheng Avenue is too small.

Secondly, according to the evenness of the road, the original road condition, the texture of the horse racing track, and the tunnel location according to the upper planning, the “Weaving” adds east-west and north-south urban roads to improve road continuity, balance the density of the road network, and maximize the display of the racecourse memory park.

Finally, through the supplement of public transit stations and the layout of non-motorized traffic network, the urban transport network will be weaved, the road traffic efficiency will be improved, the low-carbon travel environment will be optimized, and the urban transport travel

mode will be upgraded. (Fig 5-20)

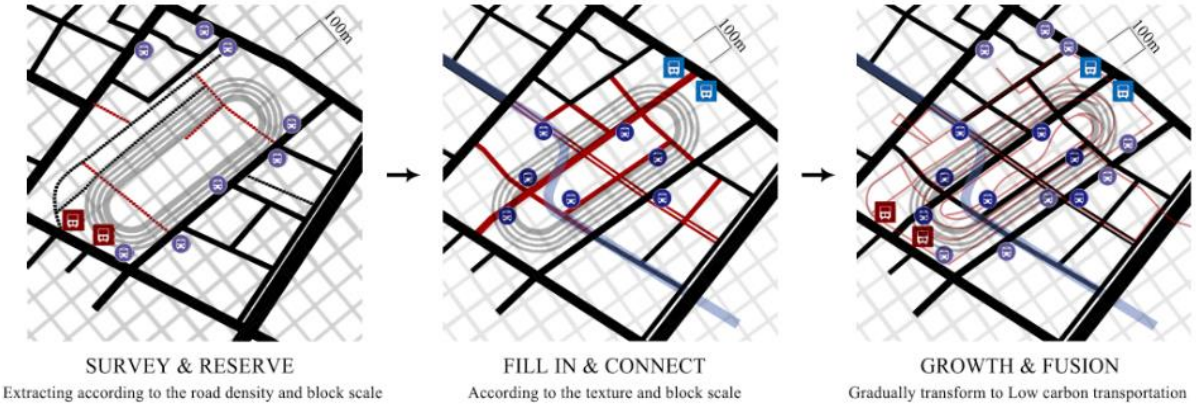


Fig 5-20 Traffic weaving process (Source: Drawn by the author)

5.4.2 Connecting the road network

The weaving of the road traffic network should improve the integrality, connectivity, urban road traffic efficiency, and reduce the obstruction and impact of the racecourse space on urban traffic.

Fig 5-21 Road Traffic Weaving (Source: Drawn by the author)

Due to the existence of South China Expressway, Jinsui Road cannot directly pass through the expressway to connect with the east area, so the upper planning planned a tunnel to solve the problem of road traffic connection on the east and west sides of South China Expressway through the way of road undercrossing.

Therefore, the east-west roads in the racecourse site will mainly serve the internal traffic of

the racecourse and provide a small amount of transit traffic. Among them, the roads connecting Jinsui Road are two one-way roads, and the other roads are designed for connecting with the roads in the surrounding blocks. In addition, because of the tunnel planning, high-rise buildings shall not be built in the upper space of it to reserve the construction space.

In terms of north-south traffic, the main road will be built between Machang Road and Tancun Road according to the original road entering to the golf course to improve the transit traffic. According to the evenness of the road, a north-south branch road mainly serving for internal traffic will be set between the planned main road and Tancun Road. (Fig 5-21)

5.4.3 Integrating public transit and non-motorized traffic system

According to the overall goals and development orientation of the Racecourse weaving, it is necessary to take TOR development mode as the guidance, promote low-carbon travel, improve the quality of non-motorized traffic environment, and enhance the conversion of public transport to non-motorized traffic, Metro station to bus station. Based on the green public open space, slow paths will be filled in, and the buildings with the functions of culture, sports, leisure and entertainment will be combined with the vertical traffic to connect the public open spaces at different levels. (Fig 5-22)

On the ground floor, a community bus line will be added around the central vitality park, and bus stops will be added to the original bus route. In terms of non-motorized traffic, “Weaving” relies on the green open space structure to form an independent non-motorized traffic space from vehicles, in addition, the “Weaving” adds non-motorized traffic space into the urban road space to enhance the continuity of the non-motorized traffic system. In addition, the non-motorized traffic network will be extended to the Zhujiang Park in the west, etc. to enhance the continuity between the racecourse and the surrounding area.

In the underground space, the slow path is connected with the ground non-motorized traffic network through vertical traffic, and the Metro station, sunken plaza, and underground cultural, sports and entertainment functional space will also be connected by the slow path.

From the perspective of the second-floor space, it is also connected with the non-motorized traffic network on the ground floor through the vertical traffic. Temporary bicycle parking points and slopes are set to make the riding paths extend from the ground floor to the second-floor space. The “Weaving” will also set building entrances on the slow path to improve the connection of indoor space and outdoor space. In addition, on the premise of

complying with the clearance requirements, the public open space of the racecourse can be connected with the Zhujiang Park and V-Park Community Sharing Center through the air corridor in the west and east to make them a whole.

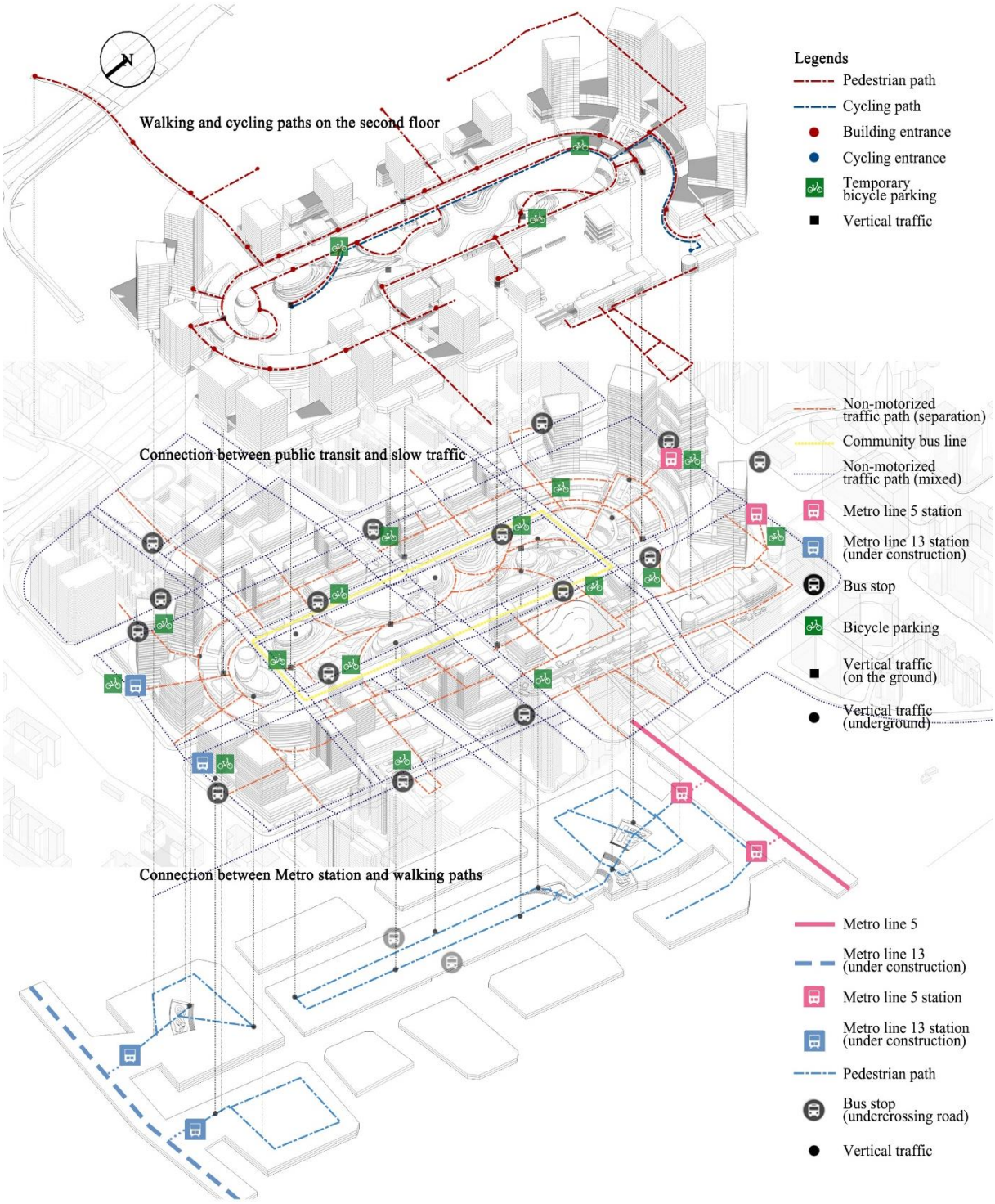


Fig 5-22 Public transit and non-motorized traffic weaving (Source: Drawn by the author)

5.4.4 Fusing the boundary between different traffic mode

“Weaving” emphasizes urban construction and renewal from a dynamic perspective. In the development trend of urban road space, the boundary between non-motorized traffic and motor vehicle traffic is bound to gradually blur, and in the future, motor vehicle traffic space will even be transformed into non-motorized traffic space to a large extent.

In the racecourse, the main road is still mainly used for motor traffic at present, but in the process of weaving, more consideration should be given to non-motorized traffic. Take Road A as an example, it is a two-way four lane road, mainly providing transit traffic. The bicycle lane and motorway are separated by green belts, and sidewalks are set on both sides. Trees and eaves of buildings along the street provide a certain shelter for pedestrians (Fig 5-23).

The branch road mainly serves for internal traffic. Taking Road B as an example, one side of the branch road is the racecourse memory axis, which requires more open space for relevant functions. Road B is a two-way road, and bicycle lanes are set on both sides of it. Sidewalks with commerce as the main function and sidewalks with landscape as the main function can be set up near buildings, and rest areas are set up too. On the one hand, the rest area can provide a rest space for pedestrians, on the other hand, it can be used as an expansion space for shops along the street, so that the street can accommodate more types of activities and increase the diversity of the street.

The mixed road reflects the extremely indistinct boundary between motor vehicle traffic and non-motorized traffic. Due to the construction of tunnels in the future, Road C will become a mixed street potentially. Road C is dominated by non-motorized traffic, supplemented by motor vehicle traffic. Non-motorized traffic space, leisure and entertainment space and landscape space are set in the center, extending 4m to both sides as a mixed driving space for motor vehicles and bicycles, and special flooring materials are used to reduce the speed of motor vehicles, which further weakening the boundary between motor vehicle traffic and non-motorized traffic. Non-motorized traffic space, bicycle parking space, etc. shall be set in the space adjacent to the building to make the street space return to non-motorized traffic space. In addition, in Road C, buildings passing from above blur the boundaries between indoor space and outdoor space in some sections, at the same time, providing shelter for citizens.

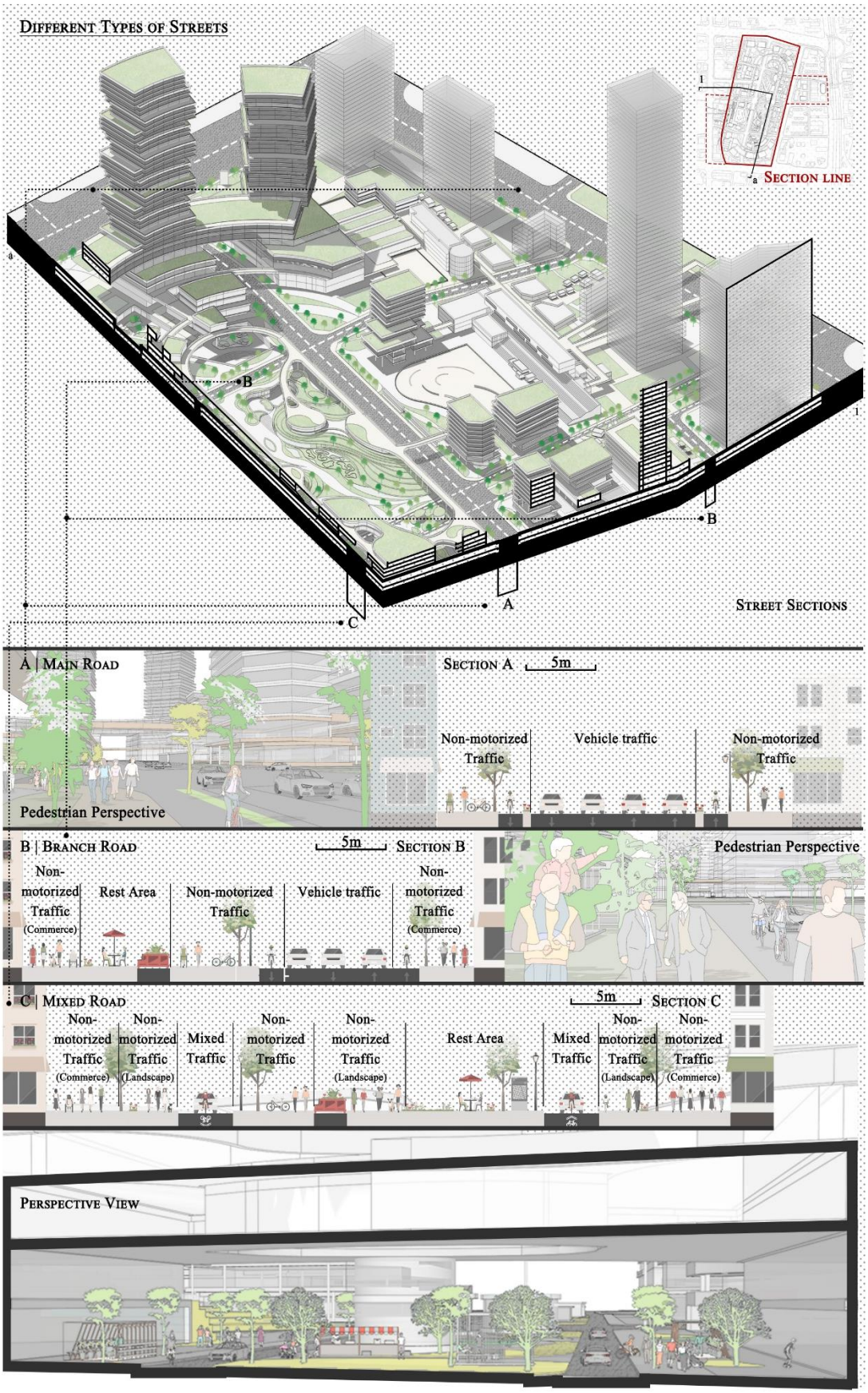


Fig 5-23 Vehicular traffic and non-motorized traffic weaving (Source: Drawn by the author)

5.5 “Weaving” for new and old texture and spatial form

5.5.1 Process

Weaving of texture and spatial form emphasizes the continuation of the original space texture, and the preservation and renewal of the original buildings and structures born at the racecourse stage. Due to the overall goals and development orientation of "weaving", the newly built Fin-tech industry and other functions have a large demand for space, and the public culture, sports and leisure functions have a large demand for open space. Therefore, "Weaving" needs to translate the original texture and spatial form of the racecourse and combine the new functional requirements to form a characteristic urban texture and spatial form that conforms to the current development needs of the racecourse (Fig 5-24).

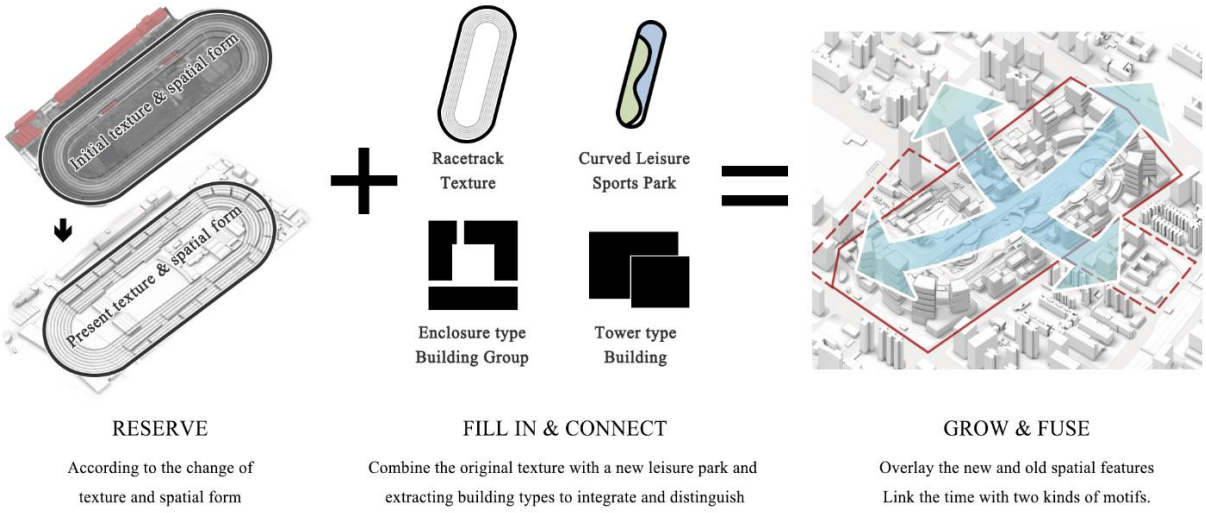


Fig 5-24 Texture and spatial form weaving process (Source: Drawn by the author)

First, according to the results of the investigation and evaluation analysis, the architectural elements with cultural value are retained. By superimposing the map of the racecourse in the initial period and the Figure-Ground relationship image of the current architectural space, the memory axis of the racecourse in the west will be formed, and the external space based on the racecourse racetrack is extracted to support the green open space structure with historical memory.

Secondly, "Weaving" implants a new motif in the center of the racetrack space. The interesting and curved space is used to compose the central vitality park. On the one hand, the texture of the racetrack can be better recognized through the difference of motifs, and on the other hand, it can provide citizens with a variety of landscape environments. In addition, the texture of surrounding urban space is summarized to form different basic spatial vocabularies.

Finally, the original space elements and the new spatial vocabulary are combined to make the racecourse space grow again, forming an urban space with the intention of the original racecourse, spatial integrality and diversity.

5.5.2 Supplementing development intensity

As the racecourse undertakes the new demand of the city, the increasement of development intensity is inevitable. According to the space demand of new functions and the evaluation results of development intensity potential, “Weaving” will form a development intensity layout mode with TOR mode as the leading goal. According to the evaluation of open space weaving orientation and continuity orientation, the development intensity will be adjusted to form an urban space conducive to the continuity of open space and the continuity of urban memory. (Fig 5-25)

The area with the highest development intensity is located around the Metro stations on the north and south sides, and a low development intensity area will be formed in the center and the southwest side to meet the layout of different functions.

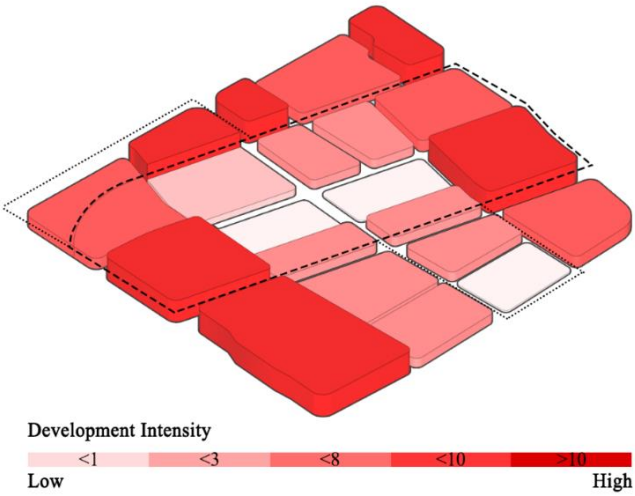


Fig 5-25 Development intensity of racecourse (Source: Drawn by the author)

5.5.3 Respecting the original texture and spatial form

The texture of the racecourse has experienced a transformation from the horse racing course to the Mo-town space. The texture has changed from virtual body to entity. The entity texture was translated based on the racetrack. Expect the furniture center on the south side, the inner circle of the racetrack was mainly used as the “ground” and the outer circle as the “figure” in the Figure-ground relationship, and the special texture of the racetrack was retained. The combination of racetrack texture, linear texture on the west and block texture on the south

form a unique urban texture.

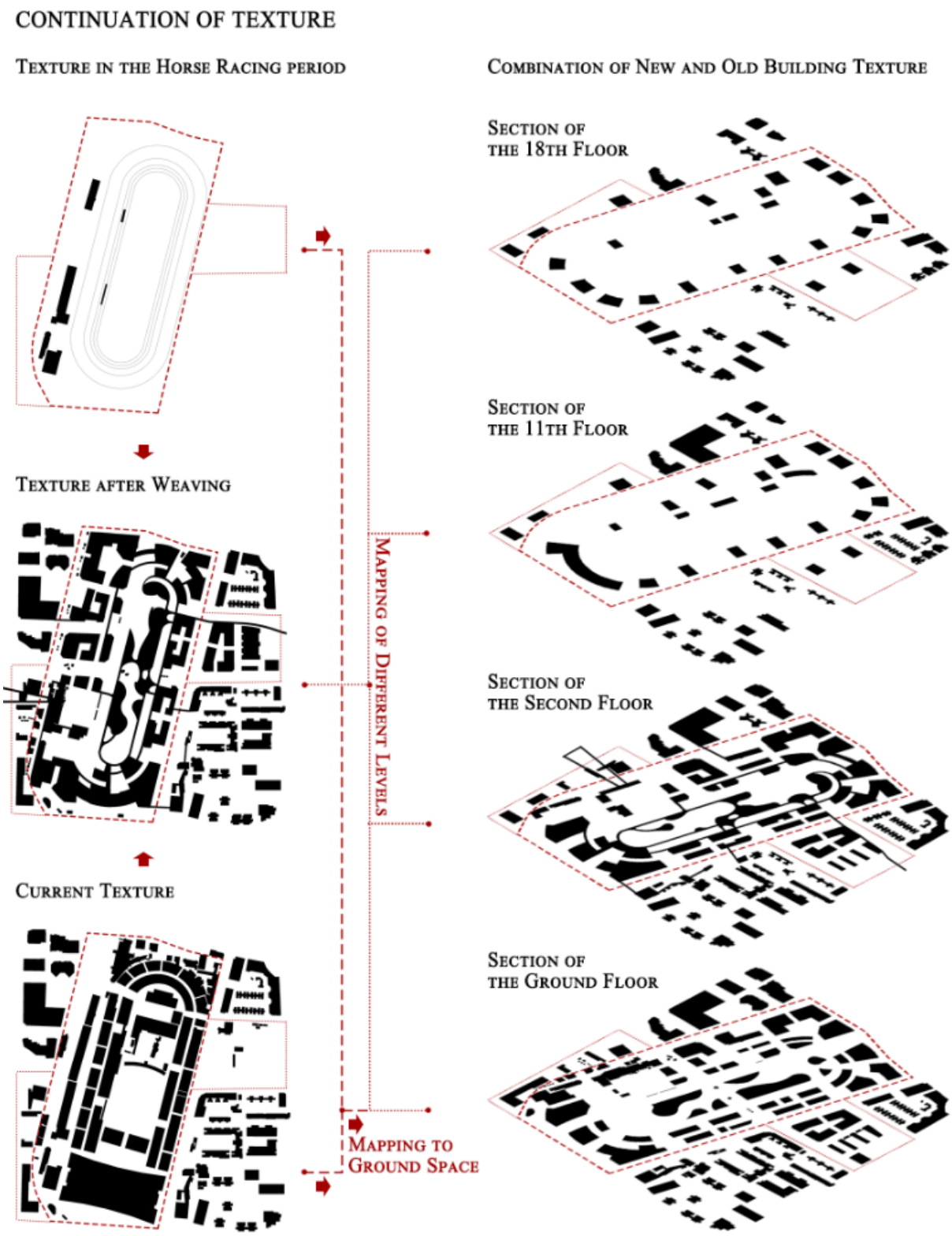


Fig 5-26 Continuation of the texture (Source: Drawn by the author)

Due to the weaving of other systems of the racecourse, the road density and the block size is reduced, and the demand for development intensity is increased. The original building texture

cannot be completely preserved, and the continuity of the ground texture will be damaged by the roads. Because the development of urban space has changed from plane to three-dimensional, the texture combination at different levels has become the fifth facade of space.

In the weaving of the texture, the space elements with historical memory are retained first, and the texture of the Racetrack and the Mo-Town stage are extracted. Through the combination of entities and virtual bodies, the racetrack texture of the ground layer is formed. Two kinds of motifs are filled in to deal with the racetrack texture, so that the inner texture and outer one will have differences in architectural morphology vocabulary, strengthening the distinctness of the racecourse structure. In the outer racetrack space, based on the structure of the racetrack, architectural forms that can meet the requirements of functions are added to form the texture of the ground space.

On the second floor, buildings are connected through the air corridors, on the one hand, the public open space on the second floor is connected, and on the other hand, the intention of the racetrack can be strengthened in urban texture. In addition, the connection between the west linear building group and the racetrack structure is strengthened to increase the texture integrality,

At a higher spatial level, the building volumes are determined according to the new function requirements, and the layout takes the racetrack as the prototype.

Finally, the weaved texture can have the particularity of the initial racetrack, meet the rationality of function requirements, and integrate into the urban form (Fig 5-26).

In the continuation of the space form of the racecourse, “Weaving” extracts the space form characteristics of the original racecourse stand, shapes a space form with the height decreasing from the outside to the inside, and increases the centricity of the racecourse structure. At the same time, according to the development intensity zoning determined by the evaluation results in the previous chapter, the architectural cluster modes extracted from the surrounding urban space are implanted to complete the spatial form weaving (Fig 5-27).

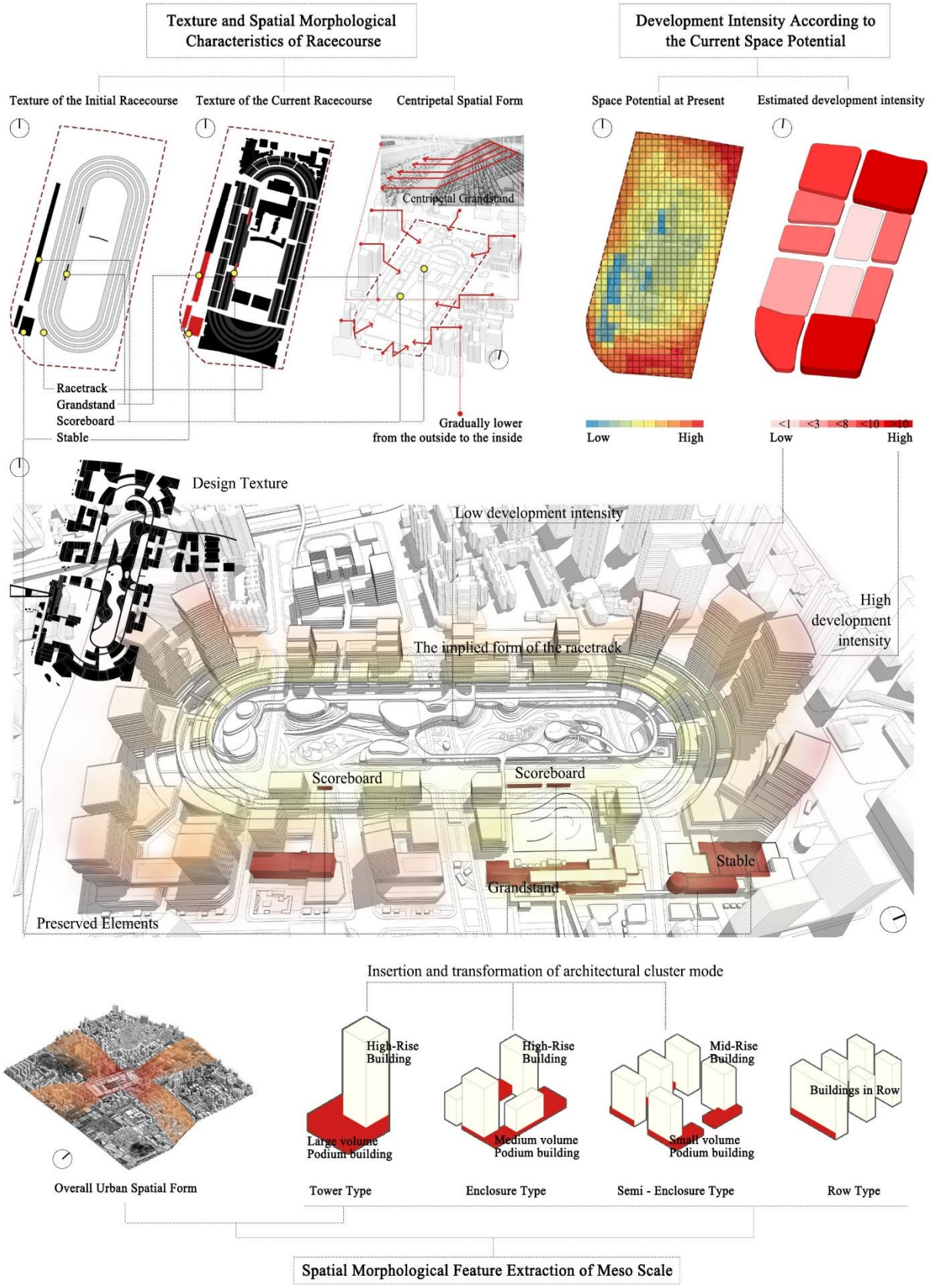


Fig 5-27 Continuation of the spatial form
(Source: Drawn by the author)

5.5.4 Implanting new motifs

In the weaving of the racecourse, two different motifs are implanted based on the overall texture structure to form two spatial clues, making the space texture characteristics of the racetrack more distinct. On the outer of the racetrack structure, a regular enclosed building cluster motif is filled in, emphasizing the texture and shape of the racetrack through an orderly rhythm; On the inner side of the racetrack structure, a relatively free curvilinear earth covered building cluster is placed, combining with the central vitality park, echoing the arc-shaped space form on the south and north sides, forming a diversified green open public space, and making the building more harmonious in the landscape. In addition, although there are differences in morphological characteristics between the inner and outer motifs, "Weaving" makes the two clues more closely intertwined through the harmony of landscape and architecture (Fig 5-28).

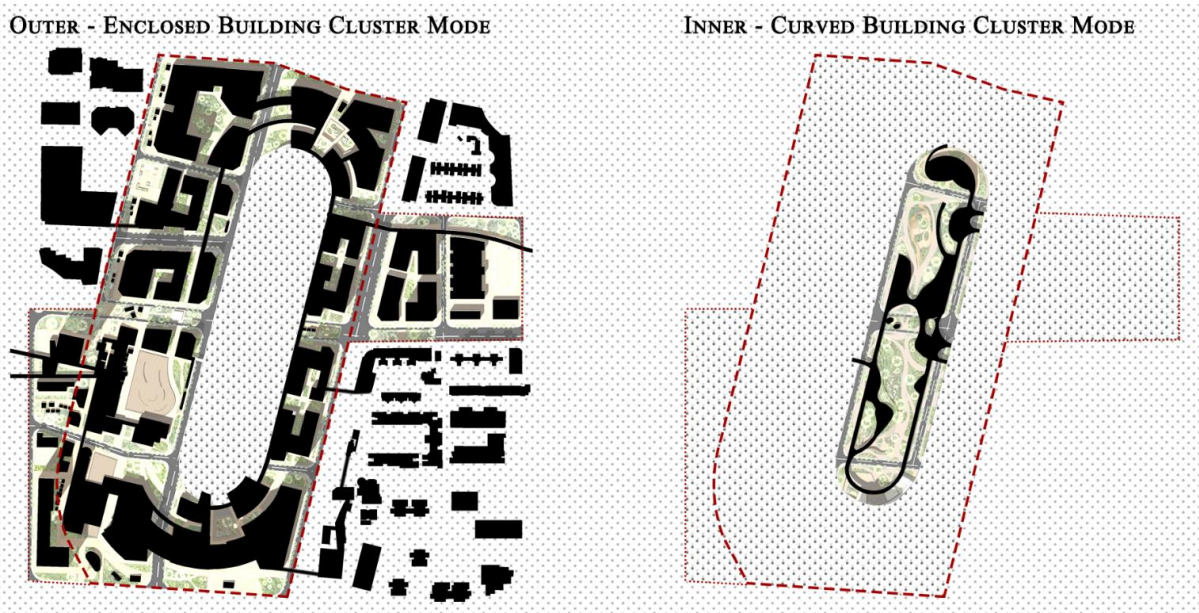


Fig 5-28 Implantation of new motifs (Source: Drawn by the author)

5.5.5 Integrating buildings in different periods

The "Weaving" emphasizes the integration of new and old urban elements, which is reflected in the "Racecourse memory axis". The preserved buildings and new buildings will coordinate and integrate with each other through the new urban open space to form a memory axis with multiple functions, rich landscapes and vitality (Fig 5-29).

The building on the north side of the "Racecourse memory axis" is the entrance building of the original racecourse. However, after the transformation in 2007, the building was expanded

based on the original building, and the characteristics of the building facade were changed a lot. Through the restoration of the facade of the building, “Weaving” makes it reappear the appearance and shape of the horse racing period. In combination with its current function of Racecourse Hotel, a floor of catering space is built at the south corner to strengthen the continuity of the street interface of the “Racecourse memory axis”.

The podium of the new building on the south side of the Racecourse Hotel should be coordinated with the reserved buildings, and to some extent, it can improve the continuity of the street of “Racecourse memory axis”. In addition, the parking demand of the reserved buildings’ audience can be relieved through underground space of the new building.

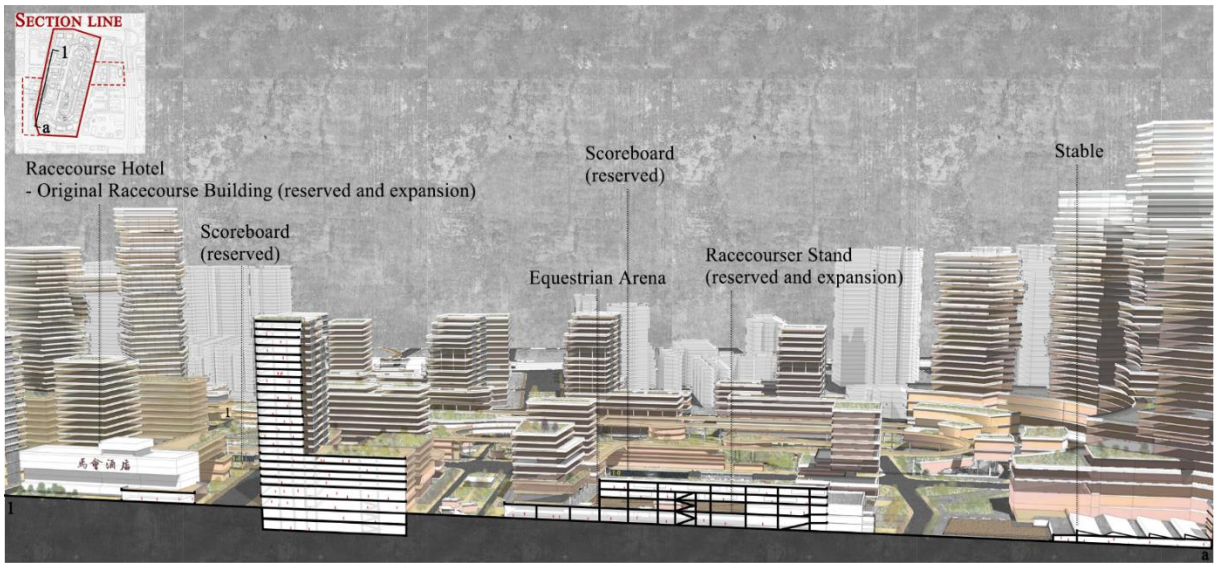


Fig 5-29 Section of the racecourse memory axis
(Source: Drawn by the author)

For the stand of the racecourse, through the investigation of the condition, it is found that there are additional space in the horizontal and vertical directions. Among them, the ground floor space in the front of the stand is the kitchen space, the additional space in the horizontal direction in the south is the restaurant space, and the vertical direction is the office space of the “Jiumao Jiu” company. “Weaving” looks at the space at the bottom of the stand and the additional space above the stand from an overall perspective and adjusts the internal space of the building to make it a semi open architectural space. The east side will continue to be used as the stand, combining with the equestrian field and the reserved scoreboard, and the space on the west side will combine with the current mature catering function to form a memory catalyst point integrating culture, sports, catering, leisure and entertainment, connecting to the Zhujiang Park in the west and the Vitality Park in the center of the

racecourse (Fig5-30).

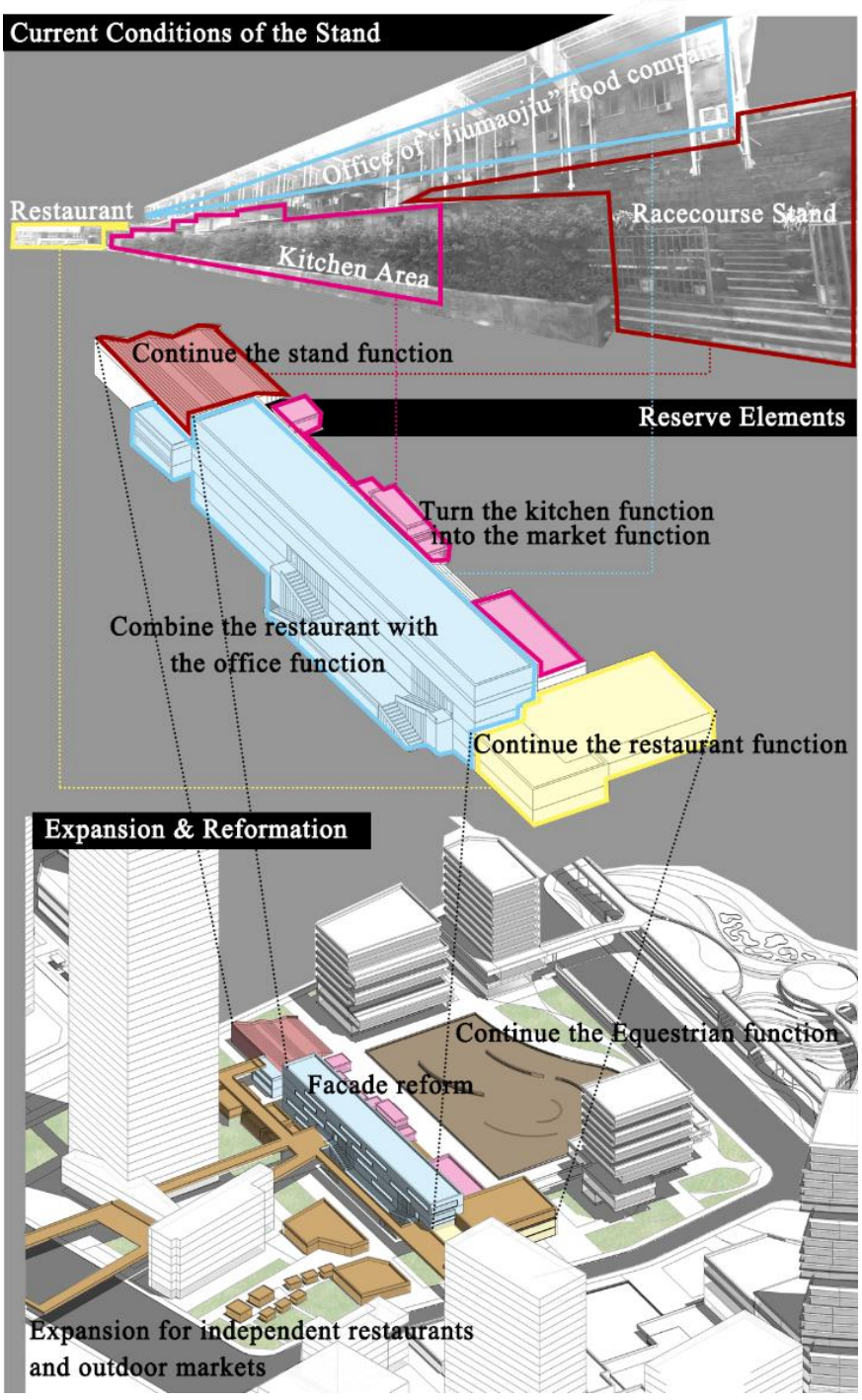


Fig 5-30 Regeneration of the racecourse stand (Source: Drawn by the author)

The stable on the south side of the "Racecourse memory axis" will be repaired and expanded horizontally, and small equestrian courses will be set up on the north and south sides of the stable, so that the citizens will have the opportunity to experience the equestrian culture well. In addition, management and office space related to equestrian activities, cultural and sports activities will be placed in the expanded space to provide management guarantee for cultural

and sports activities. In addition, a second-floor platform will be added to improve the connectivity of the public open space on the one hand, and to give audience different views of equestrian activities on the other hand (Fig5-31).

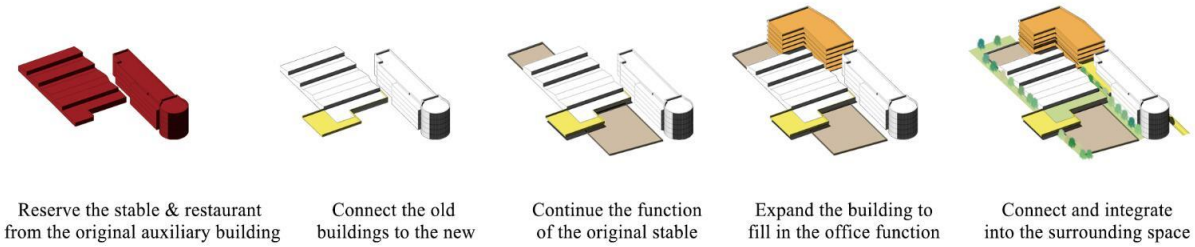


Fig 5-31 Regeneration of the racecourse stable (Source: Drawn by the author)

5.6 “Weaving” for context continuation

5.6.1 Process

The urban context weaving is the inheritance to contextualism and humanism. The context elements in the types of weaving elements can be divided into the material level and the immaterial level. The material level is reflected in the preservation of the historical material elements and the continuity and inheritance of the texture and spatial form, as mentioned above, stands, stables, scoreboards, etc. In the immaterial level, it is reflected in the continuation of urban functions and citizens' daily activities. In the weaving of the urban context, material elements and non-material elements always complement each other, which are embodied in the various systems of the city (Fig 5-32).

In the function weaving, green open space weaving, traffic weaving, urban texture and spatial form weaving, the weaving of urban context has already begun. The weaving of the context starts with the exploration and preservation of the material and immaterial memories retained by the urban development, and recovers the vitality of the urban memory points through the method of regeneration and reuse.

Secondly, put new functions into or around the old urban space, so that the new and old functions can be integrated and fused, then, connected to form a memory axis. In addition, the urban open public space will be complemented, and multiple and mixed urban functions will be fused to form a vitality belt.

Finally, the past, present and future of the city will grow together in the racecourse to reshape the Genius Loci that links time and space, serving as a catalyst for surrounding space to enhance the urban vitality.

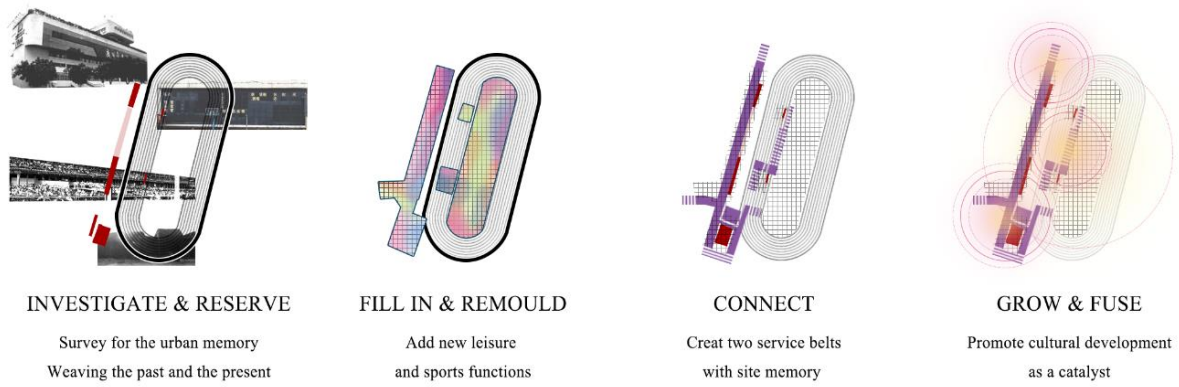


Fig 5-32 City context weaving process (Source: Drawn by the author)

5.6.2 Continuing racecourse context

The context continuity of the racecourse is mainly reflected in the preservation of the material and immaterial elements with historical memory. According to the conclusion of the investigation, “Weaving” preserves and regenerates the stand, stable, scoreboards and entrance buildings belonging to the horse racing period, revives cultural memory around such material elements, implants equestrian cultural and experiential activities, and creates a “Racecourse memory axis”. Followed by the transformation and continuation of the racetrack spatial form, to carry over to the context of the racecourse in space.

In addition to the continuation of the material element space and the display of the immaterial elements during the horse racing period, the “weaving” will also retain and redevelop the functions which have certain development potential in the original location, bearing the memory of the development context of the racecourse, including the car sales function, furniture sales function, catering function, badminton and other sports functions, so as to respect the development of the city from the bottom-up. This weaving strategy can enable citizens to find clues to the development of the city through the daily use of reserved functions.

5.6.3 Filling in diversified new activities

As “weaving” emphasizes the growth and integration of the new and the old, the new functions required by the city and the activities required by the citizens are put into the racecourse space. On the one hand, it is to undertake the needs of urban development, and on the other hand, it is to improve the diversity of the racecourse activities. The included activities such as sports, cultural exhibitions, art salons, creative fairs, handicraft activities, etc. will combine with experiential commerce to form a rich combination of leisure and

entertainment space.

In addition, multi-functional shared office space and youth apartment shared activity space provide interesting communication space for people who will live and work in the racecourse space which will increase the sense of belonging of the community. The central Vitality Park and the Memory Park provide the surrounding citizens with various functions and good environment for leisure, entertainment and social communication.

5.6.4 Growing and fusing for a new Genius Loci

Through the recovery, continuation and supplement of citizens' daily life activities, new memories will be activated and continuously integrated with the original Genius Loci to form a new Genius Loci belonging to the racecourse. The new Genius Loci will also become a part of the racecourse context in the future, constantly influencing other urban spaces and strengthening the construction of urban spiritual civilization. (Fig 5-33)

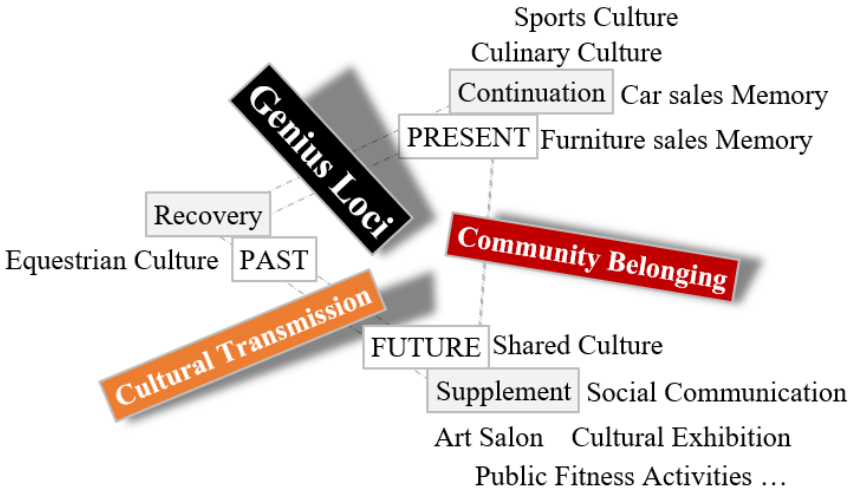


Fig 5-33 Fusion of new Genius Loci (Source: Drawn by the author)

5.7 A guiding mode for “Weaving” implementation

5.7.1 Urban design guideline

The implementation of the “weaving” strategies should be guided by the urban design guidelines. The guidelines shall make rules to control the implementation or provide suggestions according to the weaving strategies. The mandatory requirements mainly include the scope line of urban open space, the building height, the development intensity, the building setback line, the proportion of street wall, etc. On this basis, the method of renewal and reuse of reserved buildings should be added, the entrance of open public space should be

controlled, to ensure the realization of the overall structure of urban public space and architectural space form, make the historical context of the racecourse can be continued to the greatest extent. Guiding requirements mainly include architectural material style, landscape form, street interface, etc., to improve the integrality and coordination of the racecourse space.

5.7.2 Progressive construction mode

The phased construction mode reflects the gradual nature of the weaving. In the actual process of urban reconstruction and development, due to the limitations of funds and resources, the urban spaces always need to be constructed step by step. Priority can be given to the construction of the space rich in the racecourse memory, to create a characteristic brand for the racecourse, and carry out space development around the existing Metro station, so that the construction funds can be balanced to a certain extent.

Secondly, construction activities can be carried out around the Metro station under construction on the north side to form a new vitality center, and the construction of the Central Vitality Park can be carried out through the funds obtained from the production of Metro station space, so as to enhance the attraction of the racecourse area.

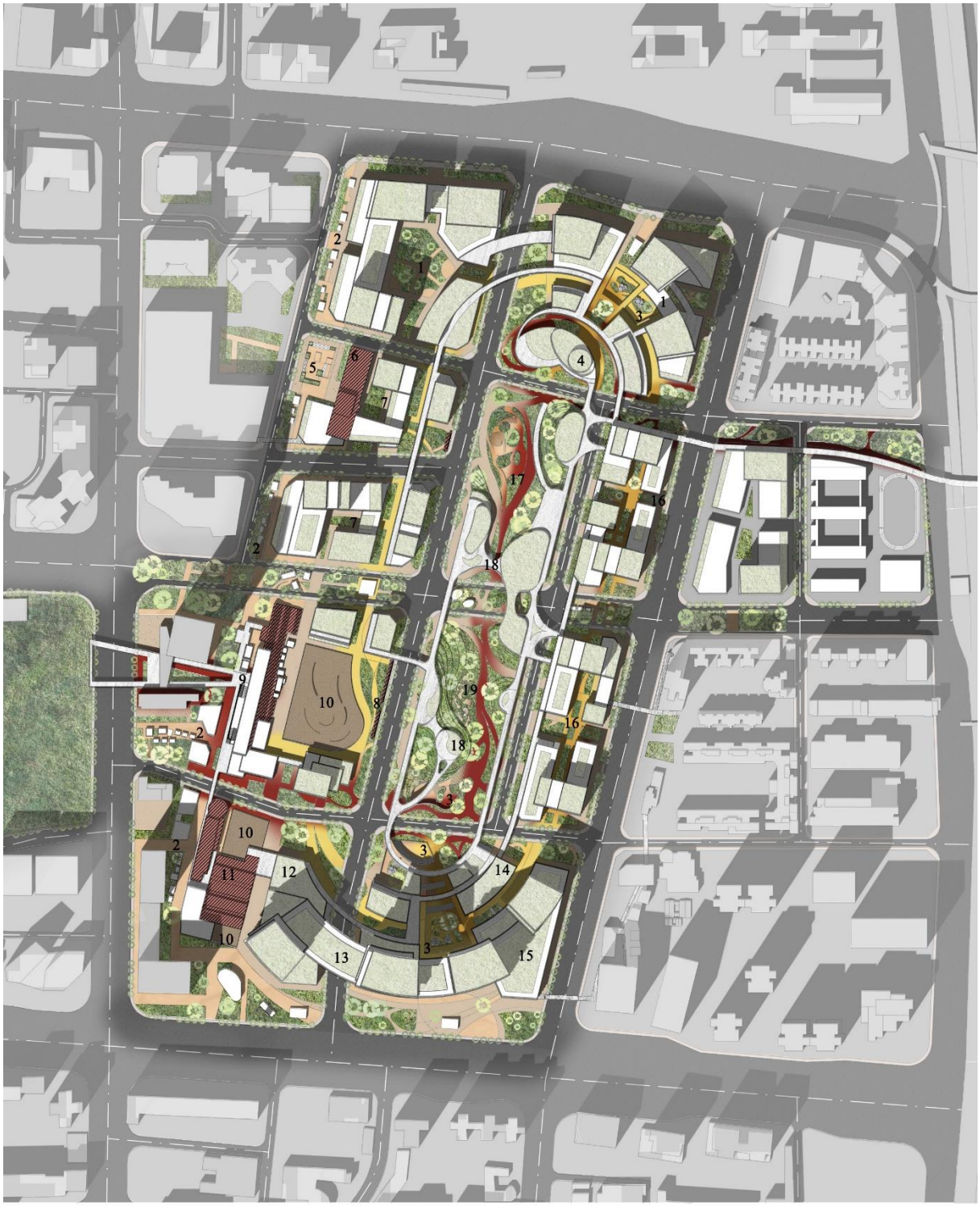
Finally, based on the good urban public service capacity created in the first two stages, the investment and agglomeration of Fin-tech industries on both sides of the north and south, the incubator space for small and medium-sized enterprises in the eastern plot will be built, with headquarters enterprises and I-U-R mode as the industrial power. And with the development of the racecourse space and the settlement of talents, the school on the east side will be built, which is also the demand of the city for the educational resources.

In addition, in the phased construction, the “weaving” strategy can be adjusted on the basis of the original structure according to the changes of the current condition. At the same time, attention should be paid to avoid the interference of the subsequent phased construction process on the built area.

5.8 “Weaving” results

Through the integration and coordination of weaving elements, the overall layout is formed, and the urban design master plan and aerial view are obtained (Fig 5-34, 5-35).

1. Master plan



50m 100m 200m

1. Industry-University-Research
2. Bazaar
3. Sunken Plaza
4. Badminton Theme Hall
5. Corner Stage
6. Racecourse Hotel
7. Youth Sharing Mixed Block
8. Racecourse Scoreboard
9. Food Street
10. Equestrian Arena
11. Stable
12. Racecourse Furniture City
13. Headquarters Business
14. Experiential Commerce
15. Commercial Complex
16. Fin-tech incubator
17. Skateboard Park
18. Sports Culture Cluster
19. Sports and Cultural Park

Fig 5-34 Master plan (Source: Drawn by the author)

2. Aerial view

Fig 5-35 Aerial view
(Source: Drawn by the author)

Chapter6 Conclusion

6.1 Conclusion

In Chinese cities, especially mega cities, the urban development mode has gradually changed from the incremental development mode to the stock development mode. With the passage of time, urban functional structure and other systems will change. Inevitably, some urban space vitality will gradually decline and enter the stage of "urban leftover space", resulting in a series of urban problems. However, from another perspective, urban leftover space always has great development potential. Under the background of stock development, as a developable space in the city, it can supplement the new needs of the whole city, so as to constantly optimize the urban system and improve the urban service capacity. Then, as an urban space attached to the urban mainstream space and in the "leftover" stage, its redevelopment needs to be considered from two aspects, including its characteristics and current conditions as the urban leftover space, as well as its relationship with the surrounding urban space and even the urban regional area. The “Weaving” emphasizes integrality, coordination, diversity, complexity, dynamics and graduality, support the contextualism and humanism, which is very similar to the requirements for the redevelopment of urban leftover space. As a combination of the leftover space in the urban center, Racecourse in Tianhe district, Guangzhou is representative in the development of the leftover space in the city. Therefore, based on the “Weaving”, this paper discusses the weaving framework and strategies of urban leftover space by taking the Racecourse as an example. The conclusions are as follows:

1. Summarizing the coupling relationship between the “Weaving” concept and urban leftover space, and forming the “Weaving” framework of urban leftover space

According to the research and summary of the “Weaving” and the concept of urban leftover space, it is concluded that the weaving elements in urban space mainly include two attributes: material elements and immaterial elements, which can be divided into function elements, traffic system elements, landscape environment elements, spatial form elements, context elements, and city life elements, and each element can be classified and observed through district, block, and site scales.

The classification standard of urban leftover space overlaps with the types of weaving elements to a great extent in element dimension and scale dimension. From the perspective of the redevelopment of urban leftover space, the weaving mechanism has a high degree of

adaptation to the overall goals. Relying on the theory of weaving, the redevelopment of urban leftover space has universal significance and positive potential.

Through the coupling of elements and mechanisms, this paper emphasizes the importance of basic investigation and evaluation analysis, and forms an overall weaving mechanism of “Supplement, Connection, Growing, and Fusion”. Among them, “Supplement” mainly refers to the undertaking of new urban functional needs, “Connection” mainly refers to the connection of new and old elements, the connection of urban leftover space and other urban spaces, and “Growing” mainly refers to the interweaving of different weaving elements and urban systems, As well as a gradual and dynamic path of urban leftover space redevelopment, “Fusion” mainly refers to the gradual improvement of the integrality and coordination of urban leftover space and surrounding urban space, and emphasizes that the space can feed back other urban spaces in the future, becoming a new support for urban vitality.

2. Learning from relevant cases and summarizing the “Weaving” strategies suitable for the framework

Through the exploration and study of four weaving cases, this paper sorts out the strategies for different elements and stages of weaving, to provide reference for the weaving of urban leftover space. This includes “Chang’ an Mills”" treatment of urban green public space, transformation and reuse of reserved buildings; The continuity of historical context, the shaping of landscape environment, the mixed function development model and the DIBO management model in Taoxichuan Porcelain district redevelopment; The current situation investigation and assessment method, flexible comprehensive function development mode, road traffic weaving method, public transport and non-motorized traffic connection method, continuation and reconstruction method of texture and spatial form, and application of urban catalyst in London King's Cross Central Development; In Aviapolis Urban Blocks district, the strategies include “connecting cities with grids”, “grid growth”, putting multiple functions into the green space. Combined with the weaving strategies and framework, a weaving method that can guide the urban leftover space is formed.

3. Investigating the conditions, analyzing the problems and development path, and proposing strategies for different “Weaving” elements.

According to the weaving framework of the urban leftover space, the current conditions of the racecourse was investigated, analyzed and evaluated qualitatively and quantitatively from different perspectives of three scales, and the space potential of the racecourse as “the

junction of the three functional areas", "the key to weave the surrounding blocks", "a link between the past, present and future" was put forward. The current problems and opportunities including the aspects of functions, open space, traffic, texture and spatial form, and continuity of context are concluded. The racecourse development orientations were proposed, which contain "The Financial Technology Industry Innovation Center linking Tianhe CBD and the Guangzhou International Financial City", "Vigorous residential zone oriented to the young financial technology interests related on Wushan Higher Education Area", and "the green diversified leisure, culture and sports sub center at the district scale that mainly serves Tianhe district and benefits Guangzhou".

Secondly, according to the weaving framework, this paper proposes the function weaving, green public space weaving, traffic weaving, texture and spatial form weaving, urban context weaving mechanism, and uses the weaving strategies to redevelop each element, finally forming an urban design that conforms to the urban leftover space weaving mechanism, providing references for the redevelopment of other urban leftover spaces.

6.2 Discussion

The redevelopment of urban leftover space from the perspective of "Weaving" has effects on the improvement of urban systems, and the emergence of urban leftover space is inevitable, which means that in the future, it is necessary to continue to study the redevelopment of urban leftover space. For future research, there are still three aspects to deepen and expand:

1. This paper constructs a weaving framework of urban leftover space and summarizes the weaving strategy. However, the weaving strategies are mainly focused on "Supplement" and "Connection". In the follow-up research, more research will be conducted on the two stages of "Growing" and "Fusion", emphasizing the dynamic and graduality of weaving.

2. The follow-up research can increase the discussion on the weaving strategies of different urban leftover space types in other dimensions, and conduct finer exploration, so that the weaving can be more targeted.

3. In the quantitative evaluation of urban leftover space, the objectivity can be strengthened. For example, the simulation and prediction can be add, to further ensure the scientific nature of the weaving mechanism.

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