华南理工大学
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Politecnico di Torino

专业学位硕士学位论文

Compact Urban Development and Vitality: A New Vision for Guangzhou Central Area

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论文提交日期	2022 年 8 月

Compact Urban Development and Vitality: A New Vision for Guangzhou Central Area

A Dissertation Submitted for the Degree of Master

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Abstract

As the largest vacancy in Zhujiang New Town Central Business District (CBD), Guangzhou, the Racecourse's low-rise building and monotonous functions necessitate a more compact urban development. However, the current concept of compact in China is rarely associated with the block level, and the construction of the city central area often achieves high-density only in terms of compact form rather than concept. This thesis aims to explore how compact urban development can enhance vitality in high-density city central area and make the design research of the Racecourse complement and refinement the concept of compact on the block level.

Through literature review and case studies, this design thesis firstly improves the characteristics of Western compact urban development to mitigate the negative impacts of high-density into appropriate medium to high-density and intensity, mixed land use, and highly accessible public space and transportation. Secondly, the Central Activities Zone (CAZ) ameliorates the weak urban vitality of the single business function in the CBD by expanding cultural and recreational activities. Thus, compact urban development can enhance urban vitality by aggregating diverse activities in the limited area. The compact urban development strategy for the Racecourse as a future CAZ includes urban form control, mixed land use, concentrated and scattered open spaces, vertical pedestrian-led public transportation, and block forms follow diverse activities. As the main outcome, the urban design of the Racecourse aims to create eco-healthy activities, sports and leisure activities, cultural and entertainment activities, and business activities at the general and block levels and to better reconstruct the Racecourse for citizens' diverse needs through compact urban development of seven different types of mixed functional blocks.

The purpose of this thesis is to investigate the characteristics and connotations of compact urban development, which explore an ideal vision for enhancing vitality in the city central area that can be adapted to actual China's urban development and citizens' needs.

Keywords: Compact urban development; Vitality; Activity; City central area; Guangzhou

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Chapter 1 Introduction

1.1 Research Background

1.1.1 Compact city as China's urban development policies

Negative misunderstandings about the concept of compact often lead citizens and even professionals to interpret compact simply as a dense and uncomfortable urban environment. But both the city level and land use, the concept of the compact has become essential in China. In the context of the land-related ministry's efforts to control the total amount of land for construction to implement sustainable development, as well as the primary national conditions of a large population base and a small amount of land per capita, compact and diversity have become the core concepts of sustainable urban development in China[1]. In 2014, the *National New Urbanization Plan 2014-2020* pointed out that "urbanization must enter a new stage of transformational development with a focus on improving quality"; in 2015, the *Central Urban Work Conference* set "compact city" as the direction of China's future urban construction, which makes full use of urban land resources to improve the efficiency of urban space use and its intensification; in August 2019, the Ministry of Natural Resources of the PRC announced the revised *Regulations on the Economical and Intensive Use of Land*, encouraging comprehensive development and utilization of land for large-scale infrastructure and other construction projects.

1.1.2 Dilemma of the compact urban development in China

The misunderstandings of compact are caused by significant differences between the political, economic, cultural, and social development contexts of Chinese and Western cities. As a result, Chinese cities seem not to be "not compact enough" but "over

[1] Qiu B X. Compactness and Diversity- The core concept of sustainable development of our cities [J]. City Planning Review, 2006(11):18-24.

compact". However, this is not the case. The current characteristics of urban development in China are only in some formal agreement with the concept of compact city. Thus, theories related to the compact city, such as New Urbanism and Smart Growth, also face a dilemma while practicing in Chinese cities after being introduced as national strategies.

Firstly, in terms of the urbanization process: at a physical level, unlike the low-density urban sprawl of the West, Chinese cities are already relatively dense in construction and sprawl, and the centripetal forces of urban development are to some extent more significant than the centrifugal forces[2]. The so-called "compact" city central area with high densities and high floor area (FAR) ratios in China are faced with a series of problems such as a homogenous urban landscape, excessive development intensity, severe pollution, and uncoordinated urban and transportation development. At a mental level, Chinese citizens are more willing and need to socialize in a "crowded" urban environment than their Western counterparts. The Chinese elite is more interested in owning their own homes in urban and even central areas to enjoy the city's highest quality of infrastructure and public services.

Secondly, in terms of land ownership, Western urban policy is often done by local governments under the premise of private land ownership. At the same time, the state owns land in China, and its policies are regulated by the government, making it easier to protect limited land resources. Therefore, although the concepts of mixed land use, small neighborhoods, and dense road networks have been proposed at the national level, local implementation has not yet seen much success due to technical, regulatory difficulties and the lack of policy support. For example, the inadequate transport system cannot support the vision of a "pedestrian paradise" [3].

[2] Cai H, He X D. The Background and Reference of New Urbanism [J]. Urban Problems, 2010(02):8-12.

[3] Calthorpe P, Wen F H. Interview with Peter Calthorpe: The Practice and Future of New Urbanlism in China [J]. Beijing Planning Review, 2019(05):191-196.

This dilemma does not mean that compact urban development in China is unreasonable, let alone unattainable utopias. With rational and appropriate improvement, the concept of the compact can also contribute to the healthy development of Chinese cities and shape the ideal urban vision by striking a balance between urban congestion and sustainable development.

1.2 Design Scope

1.2.1 The Racecourse as a vacancy in Zhujiang New Town

Under the background of diverse clusters generated by intensive use of land and functions, vitality is consequently considered the core competitiveness of Guangzhou as a megacity in China and an essential foundation for building a vibrant global city. Therefore, vitality enhancement is put forward as the optimization aim of the business district in Guangzhou, such as Tianhe Road and Huanshi East Road; the latter also proposed a vision of transforming into the Central Activities Zone (CAZ).

Fig. 1-1 Design scope and location of the Racecourse

The design site of this thesis is called the Racecourse and is located in one of the few vacancies in Zhujiang New Town Central Business District (CBD), the central core of Tianhe Road Business District (Fig.1-1).

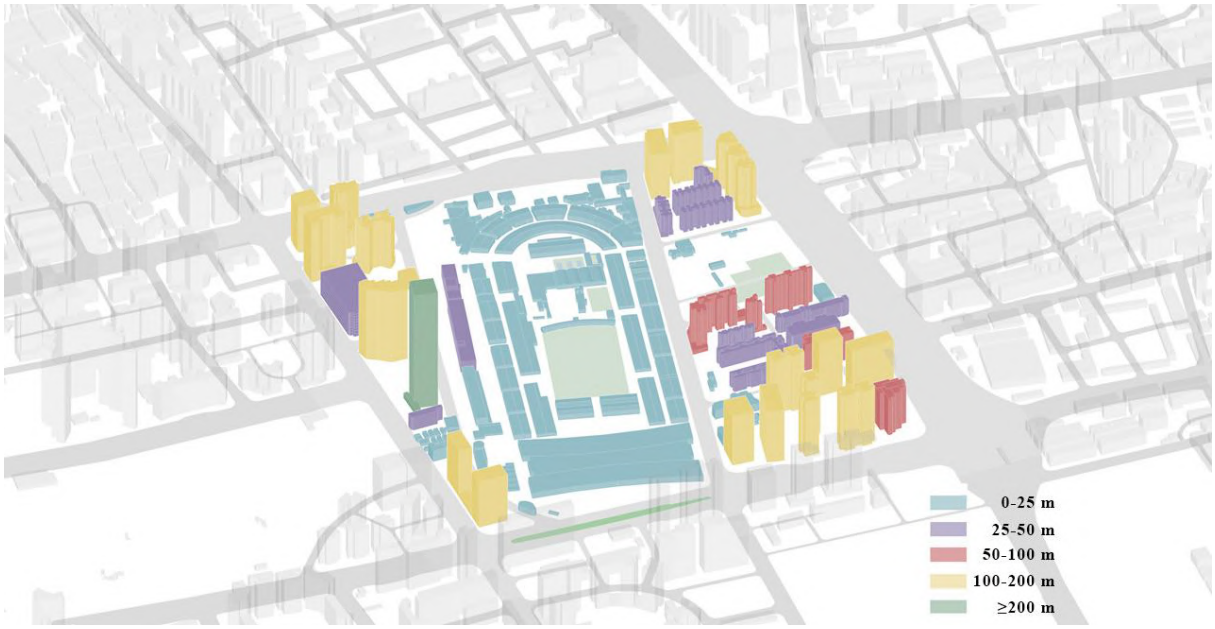

Fig. 1-2 General building height of the Racecourse

In Zhujiang New Town, with a population density of nearly 180,000 people per square kilometer and a floor area ratio (FAR) of 4.42 [4], buildings in the Racecourse are still no higher than 24 meters (Fig.1-2).

After nearly 20 years of development, Zhujiang New Town has gradually entered a refined urban quality management and operation phase since 2010. The Guangzhou Municipal Government has been conducting a comprehensive enhancement campaign to improve its urban capacity and influence. In March 2022, AECOM was commissioned by the municipal government to prepare a master plan for the overall improvement of the Zhujiang New Town CBD, with the design objective of “a city of the future with new vitality in Lingnan”, hoping to practice an innovative vision of urban

[4] Liu L X. Integrated Control Research on Spatial Form of New Urban-centre Districts in Guangzhou [D]. South China University of Technology, 2014: 185

governance through micro-renewal of the urban public realm while balancing the interests of various stakeholders. In March 2022, the *draft outline of the 14th Five-Year Plan of Tianhe District* proposed to make Zhujiang New Town a window to high-quality development of Guangzhou, a remarkable example of achieving new vitality in the old city and the proportion of the added value of modern service industries to GDP of more than 90%, forming 3-4 headquarters clusters with national influence, and significantly improving the scale and quality of the cultural industry [5].

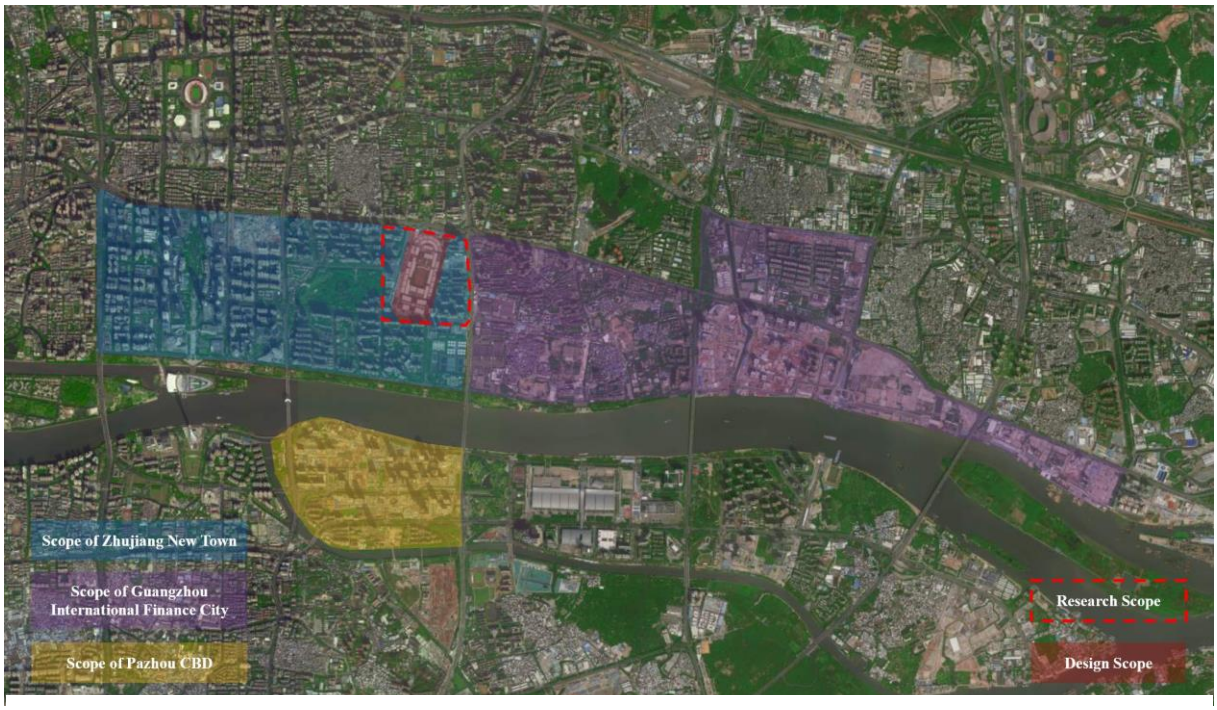

Fig. 1-3 The Racecourse locates between three CBDs of Guangzhou

The Racecourse will be between Guangzhou's future CBDs: Zhujiang New Town, Guangzhou International Finance City, and Pazhou Headquarters Business Area. It can be a surefire way for the Racecourse to offer a greater variety of urban activities and vitality amid dense populations and buildings (Fig.1-3).

[5] Government of Tianhe District. Guangzhou Tianhe Central Business District "14th Five-year" Development Plan (Draft) [EB/OL]. http://www.thnet.gov.cn/thqzdlyxxgkzl/mz/shzzxx/content/post_8202323.html, 2022-04-20/2022-06-07

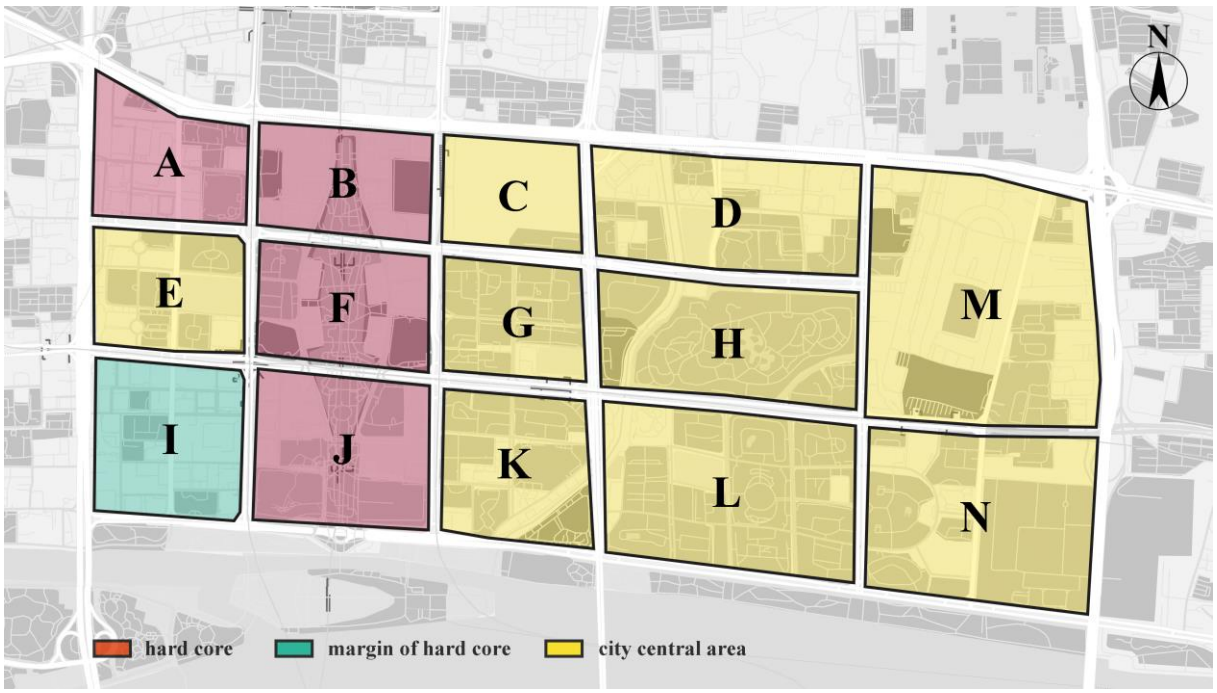

Fig. 1-4 The blocks A-N of Zhujiang New Town

Zhujiang New City is divided into 14 blocks by primary urban roads to facilitate planning and management and numbered sequentially with capital letters A-N (Fig.1-4). The development pattern of Zhujiang New Town is based on a unified road network and homogeneous blocks, which are divided by the city's primary and secondary roads regularly and homogeneously. On the one hand, the straight and vast road network of Zhujiang New Town encloses the regular and homogeneous blocks, which has the advantages of holism and efficiency, facilitating the formation of scale and distinctive features in a short period and ensuring the construction and maintenance of urban public space. On the other hand, the scale of the blocks in Zhujiang New Town is large, and the boring urban roads obliterate the individuality and characteristics of each block. The accessibility and efficiency of public facilities at the level of the whole CBD are greatly reduced, and the planning and design are significantly lacking in humanity and adaptability.

The A, B, F, and J blocks form the hard core of Zhujiang New Town, and the use of land is mainly for commerce and business, including Huacheng Square on the central axis with its land for green and gorgeous public cultural facilities such as Guangdong

Province Museum and Guangzhou Theater. The I block is the margin of the hardcore, close to the Pearl River, with a beautiful environment. The use of the land is for commerce and residence, with many high-end offices and residential areas. The rest of the blocks form the rest of the city central area in Zhujiang New Town, which includes predominantly high-rise residences with some urban parks, commerce, and education (Fig.1-5).

Fig. 1-5 The land use of Zhujiang New Town in 2003

The Racecourse was designated as land for green, culture, and sports in 2003, which is similar to the use of the site as set out in the most recent version of the upper-level plan. However, the designated land use has also objectively led to the Racecourse becoming vacant.

1.2.2 Dense migrant population

The vitality of a city is, in a sense, the vitality of citizens. Analyzing the available demographic statistics for Zhujiang New Town and Tianhe District, where Racecourse is located, enables this thesis to deduce the fundamental criteria for activities that meet citizens' needs. Clarifying activities in need of the dominant population and their

perception of Guangzhou makes the Racecourse a nice place with a specific image for them. Specifying the existing and insufficient economic and public service activities around the Racecourse will allow the selection of the suitable activities that should be placed on the Racecourse. By then, the Racecourse can genuinely provide a diverse and appropriate vitality to the three surrounding CBDs and develop with more vitality.

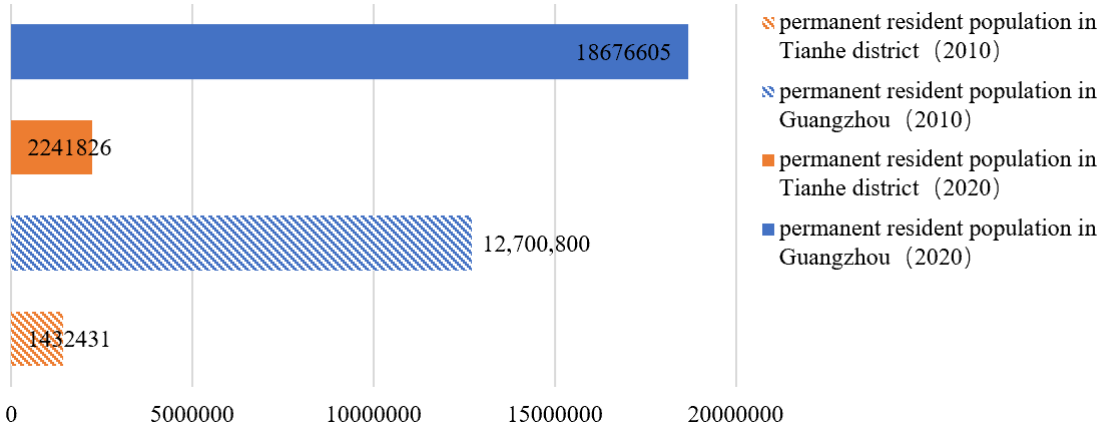

Fig. 1-6 Permanent resident population of Tianhe District and Guangzhou in 2010 and 2020

Sources: the 7th National Census Bulletin of Tianhe District

According to the data of the 7th National Census Bulletin of Tianhe District, Guangzhou, by the end of 2020, the urbanization rate of Tianhe District was 100%, and the permanent resident population who has been living in Tianhe District for the past six months was 2.2418 million, ranking third in the city. Compared with the 1.432 million resident population in the 6th National Census in 2010, the total increase of 0.809 million in ten years was 56.50%, with an average annual growth rate of 4.58%, higher than the 3.93% for the city and 1.91% for the province (Fig. 1-6). Urban regeneration over the past decade has shaped the new heart of Guangzhou, bringing economic vitality and jobs to the entire country.

By the end of 2020, the population who live in Tianhe District permanently but whose household registration is not in Tianhe District is 1, 573, 823, accounting for 70.2% of

the permanent resident population. Of these, 255, 796 people (16.25%) are migrants from other districts of Guangzhou, and 1, 318, 027 people (83.75%) are migrants from other Chinese cities 1(Fig. 1-7). It indicates that the permanent resident population in Tianhe District is still dominated by the inflow of migrant people from other cities outside Guangzhou. These citizens are usually called new Guangzhou citizens.

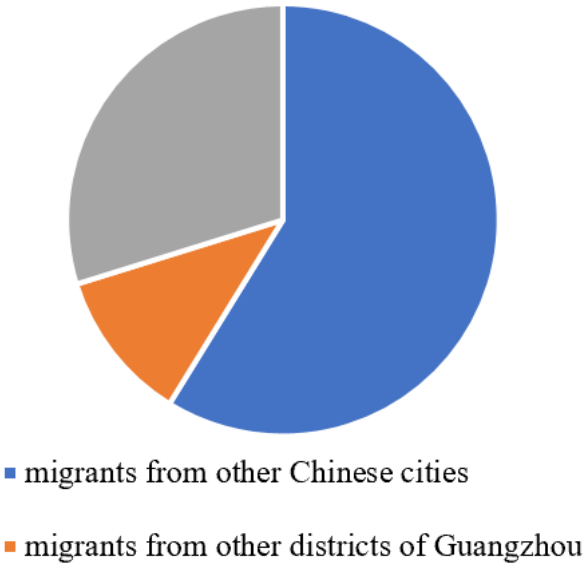

Fig. 1-7 Proportion of migrant population in Tianhe permanent resident population

Sources: the 7th National Census Bulletin of Tianhe District

Unlike original Guangzhou citizens who have deep feelings for the old city areas and images, whether they are students who come to Guangzhou for schooling or urban white-collar workers who come to Guangzhou for work, new Guangzhou citizens value abundant employment opportunities, developed educational resources, and comfortable urban infrastructure provided by Guangzhou.

In the permanent resident population of Tianhe District, there are 885,000 family households and 156,000 collective households with a household population of 1,785,300 and a collective household population of 456,500. The average population per household is 2.02, 0.2 less than the city's 2.22, the smallest among all districts in

the city, and 0.38 less than the 2.4 in the 6th Census in 2010 (Fig.1-8). The continued reduction in the size of family households is mainly influenced by the current increasingly frequent mobility of the population, as well as improved housing conditions and young people living independently after marriage.

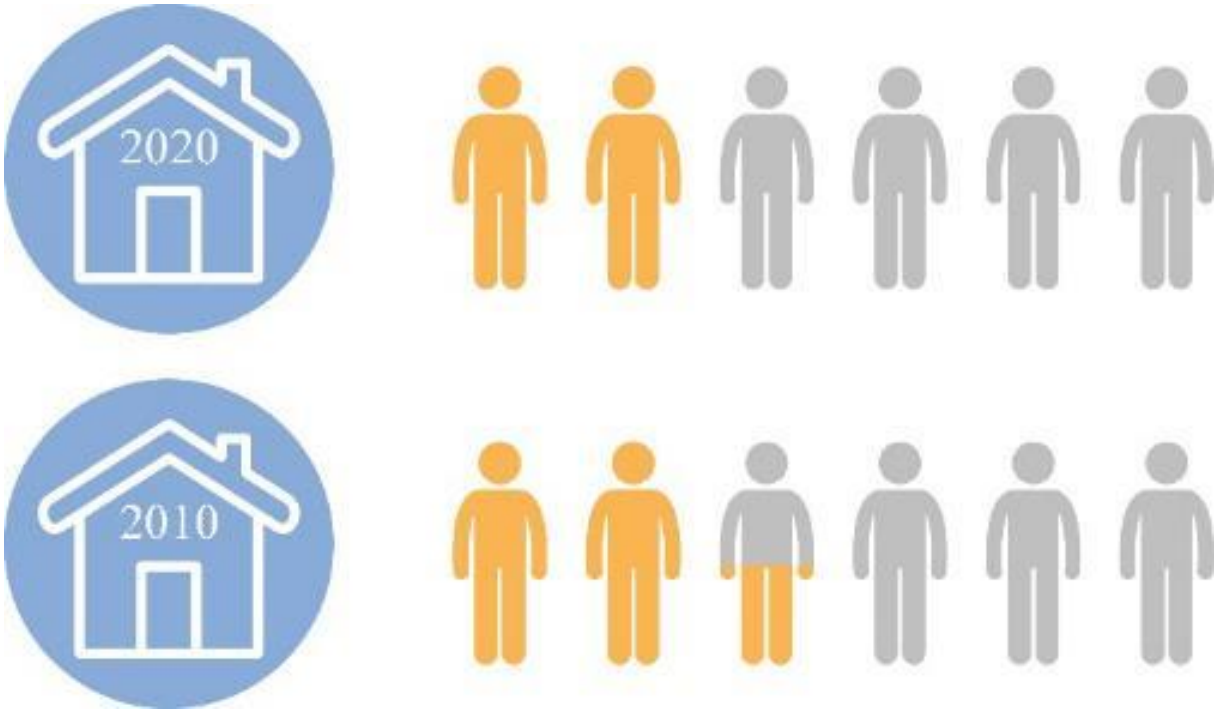

Fig. 1-8 Average population per household of Tianhe district in 2020 and 2010

Sources: the 7th National Census Bulletin of Tianhe District

By the end of 2020, Zhujiang New Town had a permanent resident population of 1,086,130 people, which dropped from 5.15% to 4.84% of the permanent resident population of Tianhe District compared to the 6th National Census Bulletin in 2010. Among the permanent resident population of Zhujiang New Town, 17,929 people aged 0-14 years old, accounting for 16.50%; 76,218 people aged 15-59 years old, accounting for 70.2%; 14,466 people aged 60 years old and above, accounting for 13.3%, of which 8.96% are aged 65 years old and above (Fig.1-9). This indicates that the population of Zhujiang New Town is dominated by young and middle-aged people, i.e., the dense labor force and jobs.

According to the international standard that an aging society is reached when the percentage of people over 65 years old is over 7%, Zhujiang New Town already has an aging trend, but due to the dense distribution of universities in Tianhe District, the percentage of people over 65 years old is reduced to 5.89%. The overall population is still in the golden period of demographic dividend.

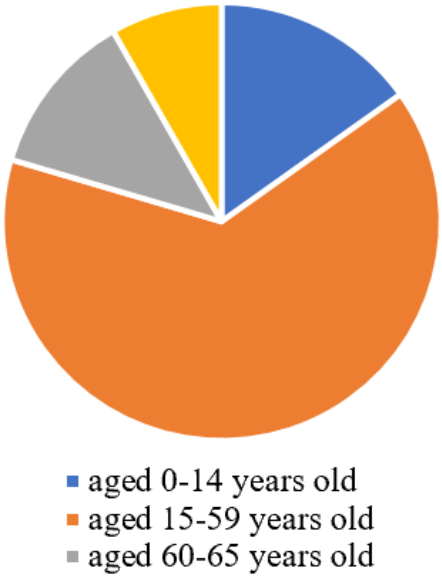

Fig. 1-9 Proportion of different age groups in Zhujiang New Town

Sources: the 7th National Census Bulletin of Tianhe District

The average age of the permanent resident population in Tianhe District is 33.2 years old, which is lower than the city average (35.4 years old) and the lowest in the city, indicating that Tianhe has the youngest population and is a dynamic area with development potential. For Zhujiang New Town, attracting more young people to Tianhe District is one of the essential ways to bring vitality. In addition, 50.47% of the population per 100,000 people in Zhujiang New City have a college education or above, which is much higher than the 27.3% in Guangzhou.

However, it is worth mentioning that the permanent resident population of 2,238,600 in Tianhe District as of the end of 2021 is 0.2% lower than the permanent resident population of 2,241,800 in Tianhe District at the end of 2020, which is the same trend

as the decrease in the percentage of the permanent resident population in Zhujiang New Town. The strong attractiveness of Zhujiang New Town and Tianhe District is perhaps slightly diminished by the high cost of living as the epidemic and the economic downturn. It thus makes people away from the city's central area in search of lower living costs and stress. However, at the end of 2021, the household registration population in Tianhe District was 1,049,300, accounting for 46.8% of the permanent resident population, an increase of 3.83% compared to Tianhe District's household registration population of 1,010,500 at the end of 2020.

New perceptions of Guangzhou from city promotional films

The future function of the Racecourse should not only meet the needs of the residents in the surrounding high-density residential areas but also meet the needs of these new Guangzhou citizens, i.e., workers and students who come from Chinese cities outside Guangzhou to work and study in Zhujiang New Town or even Tianhe District. In addition, as an essential carrier for Guangzhou to establish an international consumer center city, Zhujiang New Town should also exhibit the distinct spatial function and overall imagery of Guangzhou to the visitors who come here for consumption and travel.

In a thousand people's imaginations, there are a thousand Hamlets. This design thesis does not aim to ascertain the exact perfect imagery of the Racecourse that locals, new Guangzhou citizens, and tourists anticipate seeing through many questionnaires or supporting data. By examining the recognized industries, activities, urban imagery, and slogans in the three Guangzhou city promotional videos in 2017, 2019, and 2021, this article tries to enumerate the activities that would be appropriate for Racecourse in the future.

Guangzhou City Promotional Film in 2017 is named *Guangzhou: Flower City in Bloom*, shown in Times Square, which chooses the encounter of a young couple as the point of view for a journey of discovery about Guangzhou. The urban landscape throughout the film expresses the return of the civic spirit in the metropolitan space, outlining a

warm and romantic image of Guangzhou. The scenes include a stroll on a bicycle in a park full of flowers, a visit to the Chen Family Temple to experience the traditional architecture, enjoying shrimp dumplings and tea to appreciate the culinary culture of Guangzhou, meeting at Haixinsha Island, and climbing the Guangzhou Tower to view the night view of Guangzhou. There are also classical traditional and trendy scenes such as the Zhongshan Memorial Hall, fancy basketball fans under the Guangzhou Grand Theatre, and running a marathon in a lushly vegetated park (Fig.1-10).

Fig. 1-10 Collage Imagery of Guangzhou City Promotional Film in 2017

Sources: Guangzhou City Promotional Film in 2017

Guangzhou City Promotional Film in 2019 named *A booming World in Blooming Guangzhou*. To convey the vitality and influence of Guangzhou, the movie emphasizes Lingnan culture, the strength of science and technology, and ecological and humanistic elements. The film alternates between new and old architecture shots in the same scene before moving on to Internet-famous hotspots and then Zhujiang New Town. Additionally, numerous images of contemporary manufacturing industries can be seen in the film. Civic activities like soccer and marathons are also mentioned (Fig.1-11).

Fig. 1-11 Collage Imagery of Guangzhou City Promotional Film in 2019

Sources: Guangzhou City Promotional Film in 2019

Guangzhou City Promotional Film in 2021 named Blooming Guangzhou, Happiness Abounds. It can be quite different from the previous two: artificial intelligence, city brain, driverless, customized products, smart libraries, and a series of other innovative industries and businesses are emerging. The public activities have also shifted from popular activities such as soccer and marathon to new trendy activities such as a live house, camping, and skateboarding, which are still considered niche. Compared with the previous realistic photography, more computer effects are used in constructing urban scenery to highlight the theme of technology and innovation. In addition, the ecological environment is protected with more scenes of animals, riverside, and wetlands. The film's title highlights happiness, closely related to the more trendy and fashionable civic activities, envisioning Guangzhou's happy life and vibrant future (Fig.1-12).

Fig. 1-12 Collage Imagery of Guangzhou City Promotional Film in 2021

Sources: Guangzhou City Promotional Film in 2021

In Blooming’s trilogy, citizens’ diverse activities have been the trend in making the city’s giant landscape more humane. Many micro scenes of life, such as enjoying dim sum, flower market, camping, bars, etc., show the 24 hours vitality of Guangzhou. The

cityscape also gradually shifts from traditional imagery and cultural activities to the interweaving of old and new until the future city is simulated with computer special effects in the film in 2021, which is driven by the accelerated formation of innovative industries such as new-generation information technology, artificial intelligence, biomedicine, and new energy, new materials, design and other innovation industrial chains in Guangzhou. Ecological environments such as flowers, trees, and grass have also been essential scenes that allow citizens to step outside of dense modern city life immediately. In addition, the new axis of Guangzhou and the building clusters on the axis have been essential scenes in the promotional video, indicating the need for Racecourse to represent the new urban image of Guangzhou as part of the Zhujiang New City and to meet the higher living needs of the new Guangzhou citizens.

1.2.3 Facilities in Zhujiang New Town

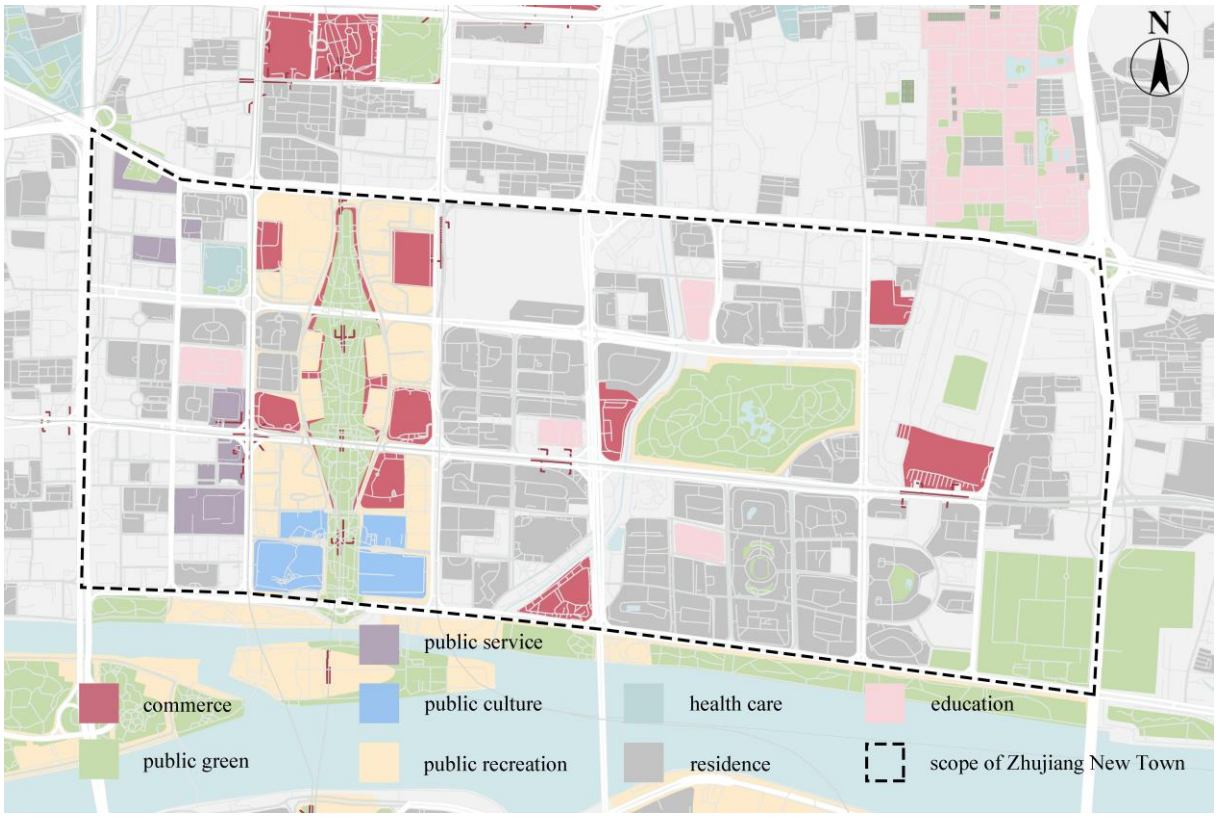

Fig.1-13 Various facilities in Zhujiang New Town

Among its industries, business services, finance, and commercial real estate mainly influence retail space layout along the central axis and on both sides. In contrast,

residential real estate affects peripheral areas. The cultural and tourism industries influence the overall image of Zhujiang New Town.

The development of the business service and financial industries provides many white-collar working-class consumers for the commercial development of Zhujiang New Town. The business service industry is an activity that offers a range of services for business enterprises. At the beginning of the 21st century, Guangzhou's business service industry grew relatively fast. Since 2010, the city’s business service facilities have gradually expanded from the old city center to the new city center, with a cluster forming in Zhujiang New Town. The demand of the business service and financial industries for office space with clustered industrial scale, convenient transportation, and a high-quality environment has promoted the establishment of a highly clustered building complex of business office facilities. It provides a substantial consumer population for the commercial development in Zhujiang New Town.

Real estate development provides consumers and space carriers for commercial facilities. The most significant influence on the retail space in Zhujiang New Town is the development of residential and commercial properties. Residential property development mainly provides the number of consumers, while commercial property development provides the spatial carrier for commercial facilities. The residential real estate development in and around Zhujiang New Town provides a permanent resident population of 1 million for commercial development. On the other hand, commercial real estate development brings a spatial carrier for commercial products, enabling more commercial enterprises to move into Zhujiang New Town, forming a clustering effect and expanding the scale of commerce.

The development of cultural and tourism industries, as well as sports and entertainment industries, helps to enhance the regional branding and popularity of Zhujiang New Town. After completing the Flower City Square in the Zhujiang New Town as a section of the new Guangzhou central axis in 2010, it has become a popular tourist

route. The rise in the number of foreign tourists is one of the driving forces behind the commercial development of Zhujiang New Town. The recreational and sporting activities at Flower City Square have contributed to the branding of Zhujiang New Town.

Based on the industry analysis, this design thesis analyses the commerce and welfare facilities mainly serving the young and middle-aged population in Zhujiang new town in more detail, as the previous section focused on.

Fig.1-14 Soft drink shops, cafes and bars in Zhujiang New Town

In China nowadays, soft drink shops, cafes, and bars have become the essential means of face-to-face social among all age groups. The soft drink shops and cafes are concentrated in the shopping malls on the ground floor of Flower City Square, while the bars are scattered throughout the commercial complexes and pedestrian streets (Fig.1-14). In addition, the cafes are also concentrated around the office buildings,

serving the working population more directly. Of the three types of shops, soft drink shops are the lowest in number, while cafes are the most numerous. These three types of shops represent the recreation vitality of weekdays, weekends, and evenings, suggesting strong demand for work on weekdays and relaxation at night. However, there are no such shops within the Racecourse and only a few in the surrounding shopping malls.

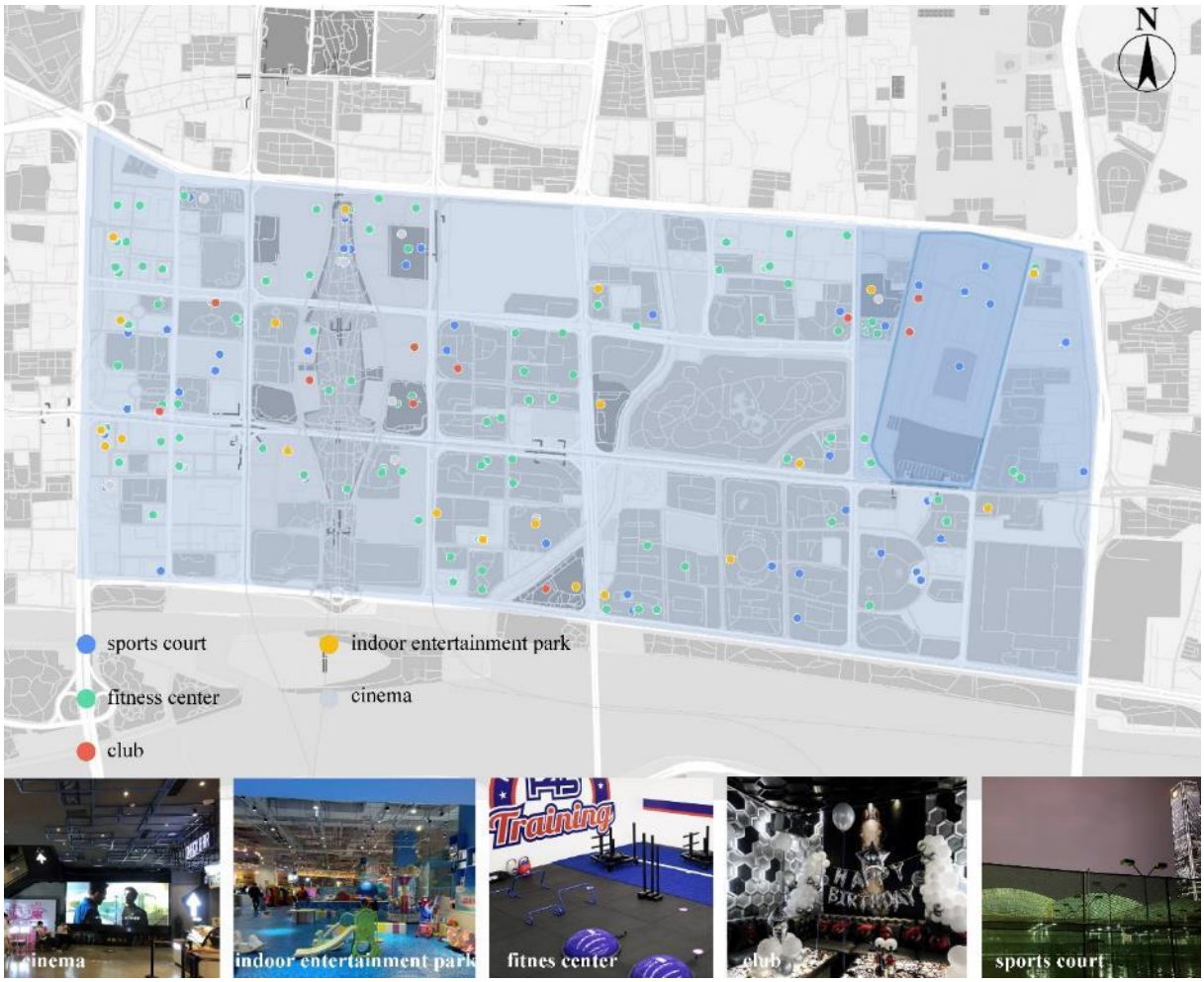

Fig.1-15 Sports and amusement facilities in Zhujiang New Town

Then, moving on to the sports and amusement facilities, it is evident that fitness centers are far more numerous than any other kind (Fig.1-15). This is because fitness centers require smaller areas and more common equipment than sports courts and are more conducive to health promotion than any other amusement. The indoor game parks in Zhujiang New Town are dominated by board games and experiential role-playing

games designed to serve the younger generations' trendy interests. Traditional clubhouses are in low demand by comparison. It is worth noting that the few sports courts are concentrated on the Racecourse, which currently has several volumes of buildings with few floors.

In terms of retail for everyday life, Zhujiang New Town is dominated by convenience stores, which can be flexibly present in any corner of the city within a tiny area (Fig.1-16). The higher quality grocery stores and the more comprehensive supermarket offer are not as well-stocked. To a certain extent, this distribution is very friendly to those who work in Zhujiang New Town, but it isn't easy to satisfy the high-income residents who live here.

Fig.1-16 Retailing in Zhujiang New Town

Finally, there is an apparent shortage of cultural facilities with a solid appeal to the public (Fig.1-17). Due to the new city's central axis of Guangzhou, the cultural facilities in Zhujiang New Town are huge buildings with a total floor area of around 50,000 square meters individually. However, it is difficult for a single large building to form an accumulation of cultural industries. More high-quality, small, and medium-sized cultural facilities often need to be brought together to attract well-established cultural activities and public use. Although the Racecourse contains no cultural facilities at all now, it has the potential to provide cultural services to the surrounding residents and the surrounding CBD in the future.

Fig.1-17 Cultural facilities in Zhujiang New Town

1.2.4 Available activities in the future Racecourse

After analyzing the crowd and the existing activities, the Racecourse needs to cater to the more fashionable and innovative consumer needs of the young and middle-aged to present new urban imagery of Guangzhou and bring a more vibrant vision. Possible future activities include the followings.

Innovative and creative industry activities. The traditional industries in Zhujiang New Town, such as finance, real estate, and law, are currently saturated and have raised land prices. The future industrial activities in the Racecourse should serve more innovative and creative industries, such as new Internet technology, environmental technology, artificial intelligence as the representative of innovative industries, and new media and design as the representative of creative industries.

Eco-health activities. Although the future vision for the Racecourse is to be more compact, healthy eco-activities should not be abandoned, especially in the post-epidemic era when everyone craves outdoor sunlight and green. In exchange for concentrated compact, there will be concentrated green spaces or other public spaces for public health.

Sports and leisure activities. The building form of the Racecourse has now been built to suit a sports arena. Although the principle of compact will no longer apply to these large, low-rise buildings in the future, sporting activities have become a virtual image of the Racecourse for many of the surrounding new migrant citizens, and the Racecourse's original function as a horse racing venue is a crucial reminder of Guangzhou. The relocation of indoor and outdoor sports activities for both the public and the niche can deepen the imagery of the particular venue.

Fashion and culture activities. As the Racecourse has an ample buildable area, complementing the inadequate cultural facilities in Zhujiang New Town is another leading activity for the future. The choice of modern, high-quality cultural facilities such as art galleries, museums, and theatres will meet the needs of the high-income groups to enjoy proximal entertainment. The Racecourse is also well suited to fashion-related

activities, with fashion brand flagship stores, concept stores, mansions, and boutiques for attracting a high-spending middle-aged and young population.

1.3 Research Aims

For the Racecourse as both the vacancy of Zhujiang New Town and central location among three future CBD of Guangzhou, this thesis aims to design a new vision for the Racecourse as city central area of more vitality through compact urban development.

To realize and simplify the main aim, sub-aims can be divided as follows.

Sub aim 1: Redefining the compact urban development in Guangzhou

In China, compact urban development is both a trend and a reality, but current characteristics of Chinese cities have only a few formal agreements with the concept of compact cities. Consequently, the compact city's critique of the unsustainable urban development model in the West has significant implications for the future development of Chinese cities. However, the compact city is a notion that has been investigated by developed countries based on its characteristics. It is not convincing to apply it immediately to China without considering the context in which it was established. There is no definitive method for achieving a compact city in urban spaces. Thus, the challenges encountered in actuality are far more complex than those outlined at the theoretical level.

Based on the features of Chinese cities and the issues they encounter, it is crucial to investigate concrete strategies for achieving the vision of the compact city as an urban development ideal. The starting point for compact urban development in China is not a blank sheet of paper but a metropolis with a rich history and strong social, economic, and cultural values. Particularly in the city central areas that are the focus of this thesis, regional identity and style are expressed in a concentrated manner, and the city and its residents derive great benefit from this. Moreover, urban space optimization frequently involves several parties and uncertainty.

Sub aim 2: Producing vitality in city central area through activities

As a product of the high concentration and intensification of business activity in the city's heart, the CBD often sacrifices the vitality of public life in exchange for more robust economic development. Although current CBDs in China have primarily improved upon the single dominant business function of the initial CBD in Western countries, the design site of this thesis, Zhujiang New Town, still has some shortcomings. The excessive building masses and strong central axis imagery have led to an inevitable loss of quality and aggregation of many small and medium-sized public cultural, recreational, and sporting spaces. Spaces for specific activity uses can only be found in high-rise buildings individually, and the disconnected urban form dissipates the diversity of vitality.

Similar problems are not only found in Zhujiang New Town, which is why the initial CBD of Guangzhou, Huanshidong Road, and the sub-center of Shanghai, Jing'an District, have both put forward the vision of building a CAZ with the development of diverse activities to shape a vibrant city center with complex functions.

The CAZ can be seen as a practical planning concept for the central area to produce more vitality. However, focusing on different functional activities, the CAZ should be more detailed regarding which activities should be selected to produce vitality suitable for certain plots in specific urban contexts and how they fit into the urban spaces.

Sub aim 3: Clarifying relationship between compact urban development and vitality

Compact urban development and vitality have become aims that often appear simultaneously in the urban policies of developed western countries, with the search for a comfortable urban life.

But is there a specific relationship between compact and vitality, and does more compact improvement more vitality? Scholarly controversy over the high-density cities that compact urban development encompasses makes this question debatable, as

excessive compact can negatively affect citizens' access to healthy, happy vitality in urban life.

This design thesis, therefore, seeks to explore the relationship between compact urban development and vitality as a basis for designing a new vision for the design site. The literature review defines this thesis's relationship between compact urban development and vitality. Still, it will finally form the specific strategies for the Racecourse, Guangzhou. The current status of compact urban development varies from city to city, and citizens in different cities have different perceptions of urban vitality. But the citizens and their everyday life make up great cities.

Sub aim 4: Designing the new vision of the Racecourse for more compact and vitality

The key to the success of compact urban development in China's city central area is the capacity to alleviate the pressure of somewhat high development intensity on the urban environment and maintain a high-quality, diverse urban vitality.

The contradiction between high growth intensity and vitality, which is also particularly obvious in China, is the most pressing issue in constructing compact cities worldwide. The density of development in several Chinese cities, particularly in the central area, is significantly higher than the densities favored by Western civilizations. The inevitable consequence of increasing development intensity indicators such as density and floor area ratio (FAR) are a rapid concentration of population, physical morphology elements, and socio-economic activities within a particular spatial area. The resulting vitality diversity is expected to positively affect city economic development and environmental protection; however, excessive development intensity frequently results in urban ecological degradation and operation inefficiencies.

Urban design is configuring urban functions, optimizing urban structure, and adjusting urban form according to human needs, considering social, economic, and environmental factors. Thus, the city has a clear and legible spatial structure, an ecologically and safely landscape environment, a convenient and rapid transport

system, efficient and comprehensive public facilities, and comfortable and safe public spaces. In fulfilling the compact and vitality, the high-quality urban design allows for the qualitative optimization of the city while meeting the quantitative enhancement of space utilization, achieving a balance between compact and vitality.

As the implications and goals of the compact city continue to develop and evolve in response to the obstacles above and issues, some scholars argue that the term “compact” should be reassessed. The author argues that the term “compact” in the Chinese context does not accurately reflect vitality, diversity, and creativity and that defining a new term may better reflect the heart of the concept of the contemporary urban context. Although it is outside the scope of this thesis to answer this question, urban design should take this into account theoretically.

1.4 Research Objects

This paper took the Racecourse as the design research object with compact urban development and the Central Activities Zone (CAZ) as theory research objects. In Chapter 1, the design scope, including the Racecourse and the surrounding Zhujiang New Town, was introduced through population and facilities to predict future activities. In Chapter 2, the core notions of compact urban development and CAZ were characterized to clarify the theoretical relationship between compact urban development and CAZ for further design strategies. In Chapter 3, the existing compact cities of Hong Kong and Melbourne were selected to analyze their advanced and current problems in compact city policies and urban forms. Chapter 4 summarizes the experience and lessons learned to propose improvement strategies for the CAZ with more vitality through compact urban development in the Racecourse, Guangzhou. In Chapter 5, a new urban vision was designed for the Racecourse's compact urban development and vitality. Finally, the theory and design research were concluded for future expectations and improvement.

1.4.1 The Racecourse

The Racecourse is located northeast of Zhujiang New Town, Guangzhou, covering an area of 380,000 square meters. The Racecourse was once a non-profit sporting and entertainment organization under the Guangzhou Municipal People's Government and was the first betting and prize racecourse in mainland China. After the authorities banned horse racing in 1999, various cars 4S shops opened in what used to be the track premises but have now also all been withdrawn. The Racecourse now has three main business segments: food and beverage, recreation and entertainment, and car services.

As Zhujiang New Town has only been developed as the new city center of Guangzhou since 2000, the Racecourse and its track have always been an extraordinary urban fabric in Zhujiang New Town, as seen on satellite maps (Fig. 1-18). In terms of density, floor area ratio, and plan form, the Racecourse differs from the surroundings in Zhujiang New Town.

This design thesis begins in Chapter 4 with the application of design strategies to the Racecourse, presenting the initial conceptual strategy associated with the design based on previous theoretical research. Chapter 5 then begins with the study of the current state of the Racecourse and the surrounding urban plots, taking full advantage of the Racecourse's current vacancy in terms of floor area and function to create an ideal compact urban development, including a defined active population and the corresponding area required for the different functions. Chapter 5 focuses on the general design at the masterplan level and the detailed design of seven different functional blocks, imagining a new vision for the future Racecourse of compact urban development with diverse vitality.

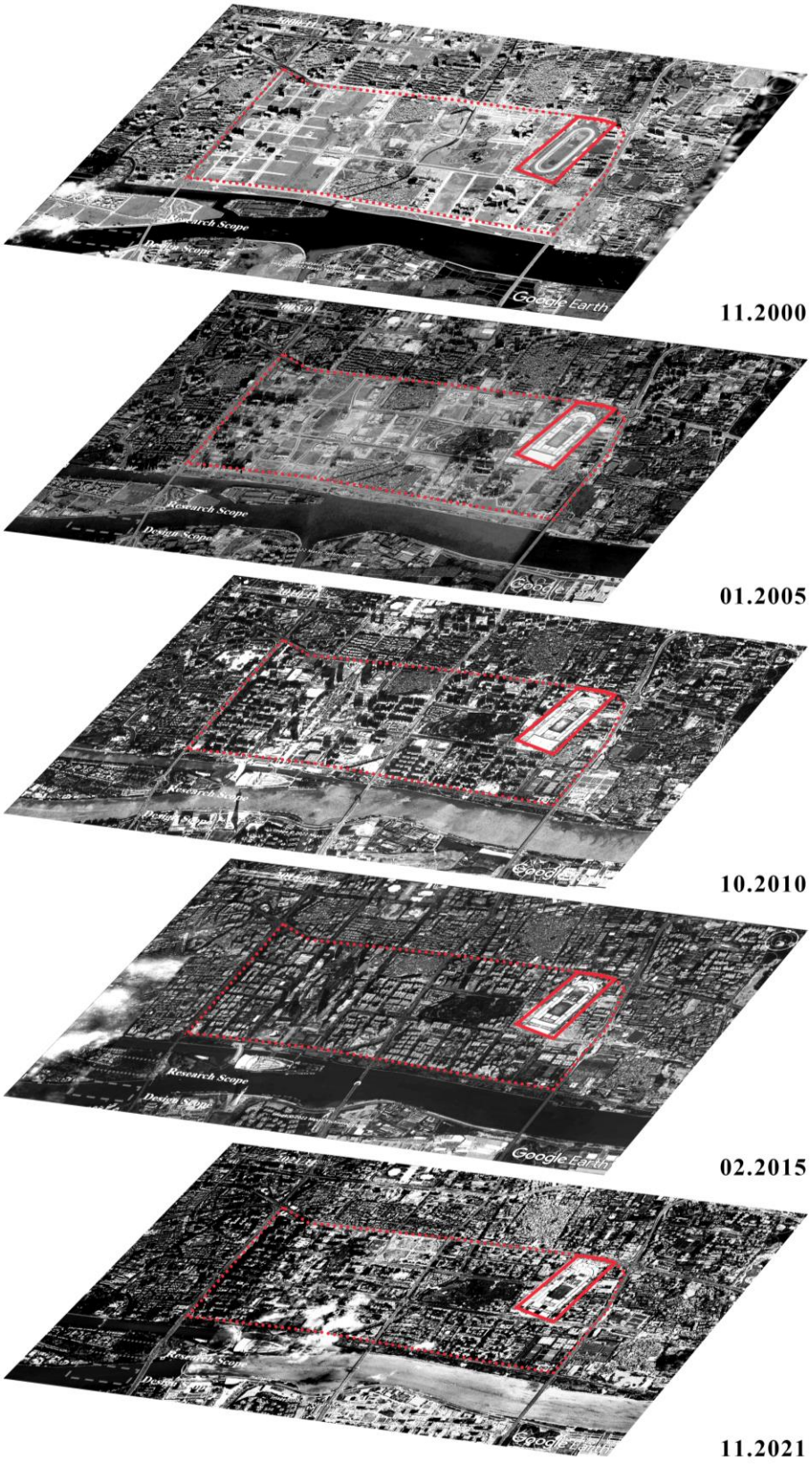

Fig. 1-18 Satellite images from the past 2 decades

Sources: Google Earth

1.4.2 Compact urban development

Compact urban development is the urban development activities on a specific development site to create compactness and is a component of and a method for achieving compact cities, often as an urban development strategy. The compact city is a theoretical policy idea for urban development at the scale of a metropolitan area. In contrast, compact urban development usually refers to development activities at the scale of a plot. Compact urban development also aims to improve urban density and promote mixed land use, public transport systems, and ecological technologies as compact city theory does [6].

As improvements to the existing urban fabric can often only be achieved through incremental change, selecting suitable sites for compact urban development projects is very important to attain compact city policy outcomes.

To improve more localized compact urban development in the Racecourse based on the vacant currency, this thesis firstly considers the concept of compact in which diversity can be both the outcoming of compact urban development and how compact urban development is achieved involves multi spatial, functional, and stakeholders use of urban spaces. There are conjunctive and interactive characteristics between the definition of compact and diversity in this thesis. The representations of compact and diversity concentrate on the activities which meet human needs and the suitable urban forms as containers of activities provided by compact urban development, including public spaces and buildings. Thus diversity encompasses a variety of activities and urban forms. The concept of compact considers the city as a diverse complex and the city's low density and sprawling development as a killer of urban diversity. The development of urban diversity is only possible when the appropriate level of compact

[6] OECD. Compact City Policies: A Comparative Assessment[M]. Paris: OECD Publishing, 2012(05): 40.

urban development is maintained, and thus vitality of the city is created and concentrated.

The concept of compact in the Racecourse can be different from its typical characteristics as the controversy of dense and compact shows the importance of minimizing negative impact instead of continuing increase of density and other indicators, especially in megacities. The typical characteristics of a recognized compact are “dense and proximate development patterns, urban areas linked by public transport systems, and accessibility to local services and jobs” [6] as the compact intends to achieve sustainability by reducing energy consumption and land waste initially. Towards a new vision of diversity and vitality, this thesis's localized characteristics of compact urban development in the Racecourse contain appropriate high and middle density and intensity, accessible public spaces and transportation, and diverse activities. Depending on the diversity of urban functions, environment use, and people’s activities, compact urban development can offer a varied and culturally enriched lifestyle by virtue of density [7] and enhance the creativity and vitality of cities [8].

1.4.3 Central activities zone (CAZ)

The Central activities zone (CAZ) is defined in this thesis as a combination of vibrant spaces providing a variety of activities in a central or sub-central urban location, which is essentially a vibrant, comprehensive public area and a center of diverse functions that meet the basic and higher level of citizens’ need. CAZ can include government administrative centers, modern service centers (financial, trade, legal, etc.), centers of commercial and cultural facilities (shopping centers, museums, art galleries, concert

[7] Fulford C. The compact city and the market: the case of residential development[J]. The Compact City: a sustainable urban form, 1996: 122-33.

[8] Chen Z, Dong B, Pei Q, et al. The impacts of urban vitality and urban density on innovation: Evidence from China's Greater Bay Area[J]. Habitat International, 2022, 119: 102490.

halls, etc.), and residential centers with a variety of activities and grades, etc. [9]. CAZ is a more integrated and sustainable interpretation of the CBD concept and the transformation of urban planning concepts and economies, which can be necessary for reshaping the urban space.

From single functional zoning to a variety of mixed uses, from efficiency-driven commercial dominance to an integrated development with a balance of commercial and residential services, from a focus on total growth to a focus on social life and quality of urban space, CAZ emphasizes the vitality of compatible mixed activities and high-quality public spaces combination. CAZ permits a variety of activities to interpenetrate in the same area to serve coexisting needs, thus realizing 24-hour city vitality.

1.5 Methodology

The methodology aimed to ‘design the research’ of this design thesis. The outcome is a framework that include main components linked to each other, and each builds upon the other to eventually synthesize the methodology in the methodological framework. It aimed to give this thesis rigidity and validity in its research methods and outcomes.

It does this by first deducting general methodologies, ideas, and paradigms from a broad range of theories in the theory chapter. Through literature review, the relation between compact urban development and urban vitality, according to academic discourse, becomes apparent. The theoretical research shows the found relations in literature between the compact urban development, vitality and CAZ. The literature review showed that introducing CAZ aspects can mitigate the negative effects of the compact urban development. However, conditions apply to be able to implement urban vitality measures.

[9] Zhang T W, Wang L. From CBD to CAZ: Spatial Need and Planning of Urban Diversified Economic Development[M]. China Architecture & Building Press, 2010(12): 23.

Mixing the results of the problem analysis in the introduction chapter with the results from theory, the core design concept was created, which is compact urban development for activities-oriented urban design. Using this core concept, the approach of compact urban development can enhance vitality in the city central area through diverse activities was made explicit. In addition,

The urban design for the Racecourse was created by formulating individual more intangible goals. The design shows how the core concept and design aspects like creativity and feasibility are related and on what factors the actual design will be based on. This is essential for a thesis in a design-oriented subject as design is not an inherently objective endeavor.

Combining these components, in turn, led to the formulation of research aims. Lastly, combining the formulated research aims and questions with robust and proven urban analysis/design methods resulted in the methodological framework. This framework shows all relations between research aims, components and underlying methods. Moreover, this framework shows how the results relate to each other and will ultimately lead to an urban design that answers the main research question: How to develop a more compact and vibrant central area in Guangzhou? (Fig. 1-19)

To realize and simplify the main research question, sub-aims can be divided as follows.

Sub aim 1: Redefining the compact urban development in Guangzhou

Sub aim 2: Producing vitality in city central area through activities

Sub aim 3: Clarifying relationship between compact urban development and vitality

Sub aim 4: Designing the new vision of the Racecourse for more compact and vitality

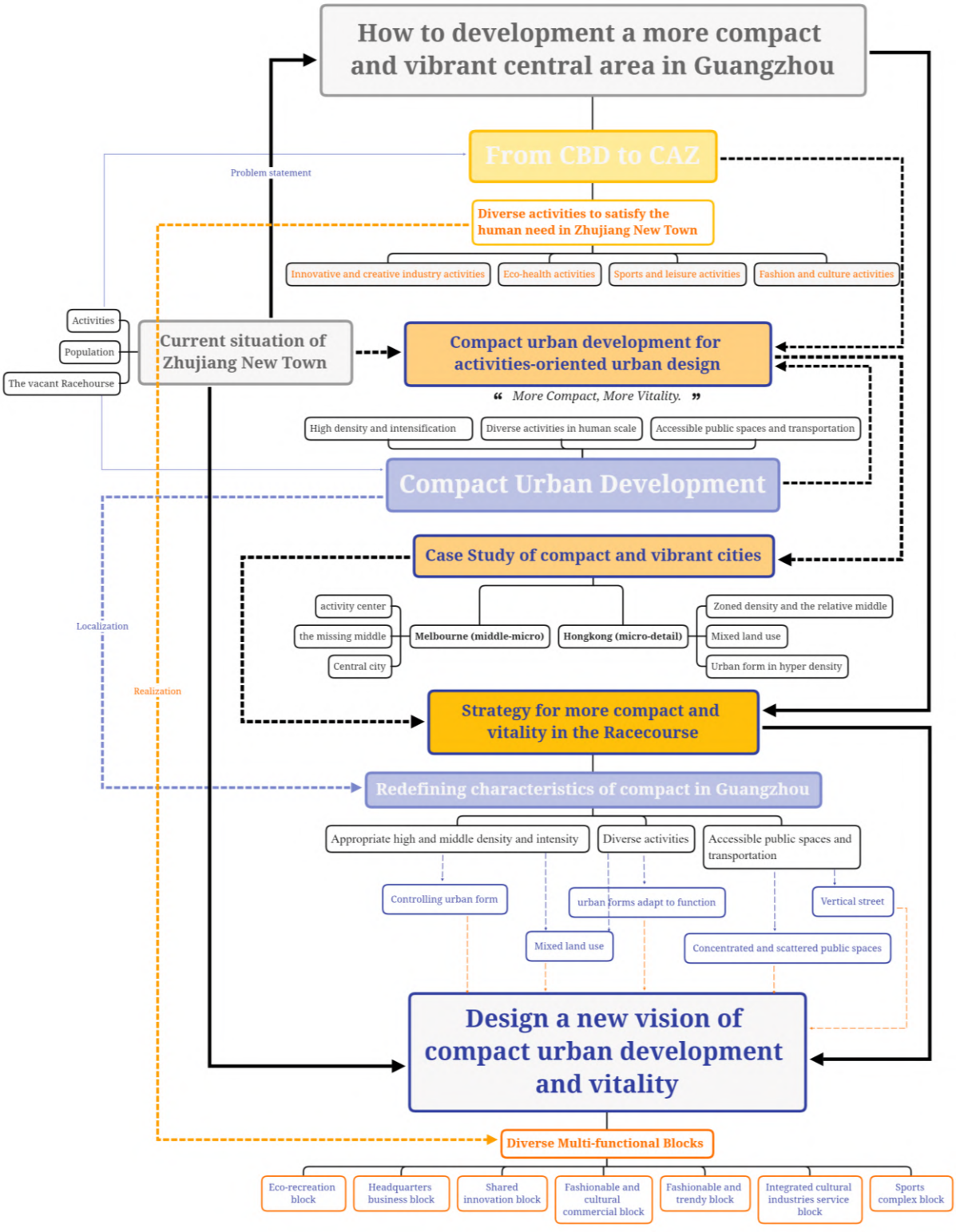

Fig. 1-19 Research framework

Designing a methodology for research that has yet to take place, is inherently based on assumptions. It does however at least give an idea of the validity of research and how that can be tested using rigid and robust methods.

The alignment of the separate frameworks as designed by author in the methodology alignment scheme, is an interpretation of what each framework contributes towards the end-result of the methodological framework. Working with this scheme helped in aligning and structuring the methodology.

A big limitation of this approach is that in order for the frameworks to function, the aspects of the design have to be concise and condensed. This leads to only two layers of the overall master plan level and specific blocks support diverse activities that structure the research questions. This in turn leads to a limited scope of the design, as undoubtedly more aspects play a role for designing in this context. As this research is to be conducted in more or less 9 months, the limited timeframe justifies limiting the scope of the research.

Research philosophy

As research is not neutral, it will reflect a range of my own personal interests, values and ambitions. To answer the question of ‘What research philosophies are you going to include, for what and why?' I first have to consider what my personal stance towards the two main research philosophies is.

The two philosophies are:

Positivist: positivism has come to mean objective inquiry based on measurable variable and provable propositions.

Phenomenologist: This perspective assumes that people will often influence events and act in unpredictable ways that upset any constructed rules or identifiable norms- they are often 'actors' on a human stage and shape their 'performance' according to a wide range of variables.

Considering the aforementioned research approach regarding the stated main research question and its sub-questions, it becomes clear that the two philosophies really mix in the project. The project will consider positivist approaches like literature research and verifiable indicators that will guide the design process and sub-conclusions. However, I think that designing itself is inherently a phenom-enological process: it starts with a context that is always interpreted in how we see rather than how it verifiably is. The design itself can never be purely positivist, as there is always an element of the designer that is not verifiable, predicted beforehand or value neutral. Most often, it is a normative take on a current paradigm in urban design.

Chapter 2 Literature Review

2.1 Compact Urban Development

Compact urban development is the urban development activities on a specific development site to create compactness. The core notion of fine compact urban development is to display the concept of compact through the urban form in the plot scale. The compact city is a theoretical policy idea for urban development at the scale of a metropolitan area, while the compact urban development usually refers to development activities at the scale of a plot. Thus, this section starts from the theoretical notion of compact city.

The compact city theory as an urban policy varies from city structure to urban form in blocks as the minimum unit of a city. The theoretical and practical concepts of compact are widely used in different cities. Although there is no certain definition of compact, this section tries to redefine the concept of compact for the central area with more vitality in Guangzhou through a review of literature and practices.

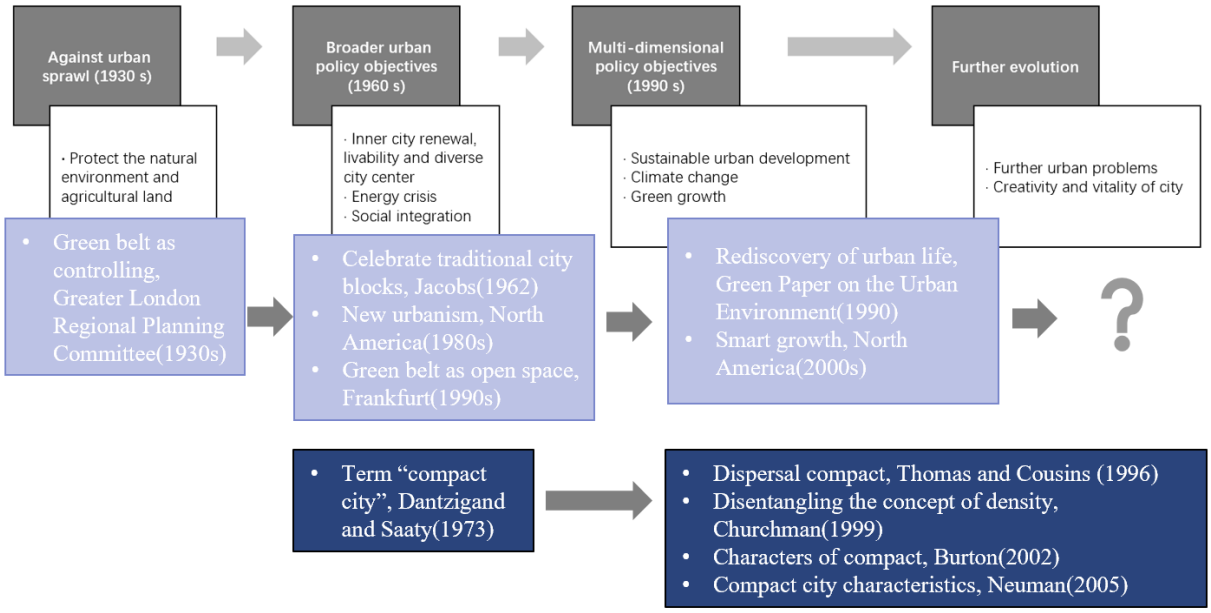

Fig. 2-1 The evolution of compact city

As a result of human thought on urban development and the link between cities and nature at various stages of urban development, the meaning and purposes of the compact city as an urban development concept have evolved and extended over time (Fig. 2-1).

The objective of the compact city during the industrial age was to safeguard the local natural environment or agricultural area from urban expansion. The compact city took on new meanings and policy objectives as time passed, such as energy saving, livability, and the global environment. As a result, the compact city is increasingly viewed as a multifunctional policy instrument covering a broader array of urban sustainability objectives. Currently, compact cities are regarded as the predominant policy instrument for attaining urban sustainability.

2.1.1 Compact urban development in West countries

Due to the advent of the notion of sustainability, the concept of compact cities has gained widespread acceptance in many Western countries since the late 1980s. *Green Paper on the Urban Environment*, published by the Commission of the European Communities in 1990, first proposed a model concept: Compact city is derived from traditional European cities, emphasizing the city's boundaries, high-density, mixed functions, pedestrian scale, social and cultural diversity. The compact city emphasizes the environment and quality of life as the policy objectives of urban development and strongly advocates intensive development and mixed-use. It signals a rediscovering of the values of urban living, thereby "expressing the failings of the suburbs: the lack of community life, the lack of culture, the lack of visual monotony, and the waste of time in commuting." [10]

Theoretically concept of compact

[10]Commission of the European Communities. Green Paper on the Urban Environment [EB/OL]. https://op.europa.eu/en/publication-detail/-/publication/0e4b169c-91b8-4de0-9fed-ead286a4efb7/language-en, 1990-06-27/2022-06-07

Scholars have studied the model, objectives, and strategies of the compact city from different perspectives and tried to define them. Generally, the concept of compact emphasizes high-intensity urban development with increased density of population and building, efficient and mixed land use linked by public transport, and accessibility to local services.

Theoretically, Jane argues that traditional urban neighborhoods represent the most desirable form of urban development due to their dynamism, mixed land use, and tradition, compared to low-density suburbs [11]. Although the term compact city is not used in this discussion, it reflects the concept of the compact city. Gordon and Richardson defined the compact city at three levels: macro, micro, and spatial structure [12]; Breheny gave a more comprehensive definition of the compact city from a goal-oriented perspective [13]; in terms of models, Graham et al. proposed virtual cities [14]. In this concept, the compact city is not a physical compact index in the traditional sense. Still, it is understood from the perspective of the effective connection between transportation modes and the urban units scattered in space. The autonomous city, advocated by Scoffham and Vale, promotes the compact index of self-sufficiency and independence from external forces [15]. Scoffham argues that a compact city is an autonomous city that is self-sufficient and independent of external forces [16].

[11] Jacobs J. The Death and Life of Great American Cities[M]. New York: Random House 1961:143-222

[12] Gordon P, Richardson H W. Are compact cities a desirable planning goal? [J]. Journal of the American planning association, 1997, 63(1): 95-106.

[13] Breheny M. Urban compaction: feasible and acceptable? [J]. Cities, 1997, 14(4): 209-217.

[14] Graham S, Aurigi A. Virtual cities, social polarization, and the crisis in urban public space[J]. Journal of Urban Technology, 1997, 4(1): 19-52.

[15] Elizabeth B. Measuring urban compactness in UK towns and cities [J]. Environment and Planning B: Planning and Design 2002, 29: 219-250.

[16] Scoffham E, Vale B. How compact is sustainable–how sustainable is compact[J]. The compact city: A sustainable urban form, 1996: 66-73.

The classic definitions in terms of practical objectives include: the term compact city was first used by Dantzig and Saaty, which can be characterized as high-rise, high-density residence, low dependence on small cars, a diverse mix of land uses, and self-sufficiency in daily life [17]. Breheny suggests that compact does not simply mean accommodating more people and functions but that increasing density only makes sense when a certain level of amenities is achieved, which implies not only strict environmental standards of energy consumption and emissions but also a good quality of life [18]. Neuman believes that a compact city should achieve the goals of high occupational density, mixed land use, granular land use, high social and economic relevance, adjacent development of sites, urban development boundaries, diverse transportation systems, high accessibility, good road connections, appropriate amount of open spaces, and adequate amenities [19].

The practical approach to depicting the compact city includes: Burton argues that the compact city can be defined in terms of intensification of built form or activity [20]; Breheny defines the compact city as one that promotes urban redevelopment and the re-emergence of central areas; the protection of agricultural land, limiting extensive development in rural areas, higher urban densities; a mixed-use site layout; prioritizing public transportation and concentrating urban development at its nodes [21]; and Galster

[17] Dantzig G B, Saaty T L. Compact city: a plan for a liveable urban environment[M]. W. H. Freeman& Co., San Francisco, 1973: 36-51.

[18] Breheny M. Centrists, decentrists and compromisers: views on the future of urban form[J]. The compact city: A sustainable urban form, 1996: 13-35.

[19] Neuman M. The Compact City Fallacy. Journal of Planning Education and Research. 2005;25(1):11-26.

[20] Williams K, Burton E, Jenks M. Achieving the compact city through intensification: An acceptable option[J]. The compact city: A sustainable urban form, 1996: 83-96.

[21] Galster G, Hanson R, Ratcliffe M R, et al. Wrestling sprawl to the ground: defining and measuring an elusive concept[J]. Housing policy debate, 2001, 12(4): 681-717.

argues that compact is a combination of clustered development and reduced per-site development [22].

From various perspectives, none of those above conceptual expressions of the compact city are fully recognized. Still, the concept of compact city in the past development process aims for sustainable development.

Practical policies and instruments of compact

In the past few decades, policies toward compact city have increasingly become part of national urban strategies in countries worldwide (Table 2-1). This thesis mainly pays attention to compact urban development policies' influence on the scale of the block. These strategies highly fit with the characteristics of compact city of intensive urban development of spaces and functions, accessibility and proximity of public services and spaces, and public transportation system-oriented district. Attractiveness and vitality are realized through the overall imagery of the city.

Table 2-1 Compact city in urban policies of western countries

City	Year	Planning Concept	Strategy toward Compact
Birmingham, United Kingdom City central area	1990	Urban regeneration	· Consumer activities such as business and entertainment that went out of the region returned to the region · Improve the image of the city, further attract investment and enhance the pride of its citizens · Enhance the vitality and attractiveness of the area through functional development · Ensure the business office, service and other diverse employment opportunities are available

[22] Bengston D N, Fletcher J O, Nelson K C. Public policies for managing urban growth and protecting open space: policy instruments and lessons learned in the United States[J]. Landscape and urban planning, 2004, 69(2-3): 271-286.

City	Year	Planning Concept	Strategy toward Compact
Amsterdam, Netherlands GWL Housing estate	1996	Non-motorized	· Public transportation policies such as car sharing, issuance of public transportation tickets, and promotion of bicycle use · Follow the principle that convenience facilities, service facilities, and employment facilities should be located near residential areas and conform to functional development · Specify and implement a construction plan that introduces an environmental symbiosis approach from the perspective of the community as a whole · Operation and management of residential areas carried out by residents and non-profit organizations
Austin, USA	2000	Smart growth	· Public Transport-oriented development (TOD) · Traditional Neighborhood Development (TND) · Designating smart growth plans for development zones and drinking water source protection Area · Improved quality of life and tax composition
Aachen, Germany	2006	-	· Small scale redevelopment coordinated with surrounding buildings · Value the urban landscape cherished by citizens in cities · Improve street circularity
Berlin, Germany	2009	-	· Orderly settlements: connections between new settlements and existing ones · Scattered and fragmented settlements are not allowed · Control real estate development in central locations and along tracks in the Berlin area. In

City	Year	Planning Concept	Strategy toward Compact
			non-central locations, internal and complementary development is possible. · Protect key service areas and local supply (site control of large retail facilities, factory stores, etc.).
Netherlands	2009	City network	· Reduce urban sprawl and restructure brownfield areas · New residential and commercial developments must be located in or adjacent to existing built-up areas or infrastructure
Helsingborg, Sweden	2010	Densely mixed nodes/areas	· Develop central and renewal areas · Make use of what already exists: strategic nodes, intermediate city, etc. · Focus energy and effort where it will make a difference in the context of the compact index.
Paris, France	2013	Le Schémadirecteur de la régionl le-de-France (SDRIF)	· Grenelle Environment Roundtable · Urban planning specifications propose density incentives and set a minimum density (SCOT/PLU) · Low-density tax (VSD) · Polycentric Paris and the corresponding public transport restructuring plan

In addition to numerous national policy papers, many governments have adopted various policy instruments, including administrative and financial, to implement compact city policies. These policy tools can be categorized according to the nature of policy intervention as regulatory, fiscal, direct investment, partnership, and information instruments. Urban growth borders, also known as urban development accommodation boundaries, which green belt is one of these regulatory instruments. The Green Belt in Hong Kong, China, is a transition zone where ambiguous and flexible development

licenses are issued [23]. Density regulations and requirements for mixed-use land have become increasingly common regulatory tools, such as low density tax in France and guidelines for building density in the United States. Fiscal instruments are also an effective measure to influence urban spatial development [24], such as density credits or amenity bonuses being provided to developers for their public service contributions that mitigate the impact of high-density.

Implementing compact city in western cities has demonstrated that the functional metropolitan area is the spatial unit employed for the compact city idea. Policy creation, planning, execution, and delivery of programs and services aimed at achieving compact city results necessitate multi-level governance structures. The experience studies suggest four thematic aspects that, when combined, can result in compact city outcomes:

- An integrated, metropolitan-wide, long-term vision;
- A detailed description of the roles and duties of all prominent actors and stakeholders;
- Arrangements for networked governance with vertical and horizontal coordination;
- Accountability, transparency, and reporting regimes to measure the implementation of the vision's progress and adapt policies accordingly.

In the context of urban design, the integrated use of public transportation, the proximity of housing and infrastructure, the intensive development of built-up areas, the clarity and mix of required functions, and the emphasis on place spirit are essential to design

[23] Tang B, Wong S, Lee A K. Green belt in a compact city: A zone for conservation or transition? [J]. Landscape and Urban planning, 2007, 79(3-4): 358-373.

[24] Cheshire P, Sheppard S. The introduction of price signals into land use planning decision-making: a proposal[J]. Urban studies, 2005, 42(4): 647-663.

elements for the realization of the compact city while maintaining appropriate high-density.

2.1.2 Compact urban development in Chinese cities

China's domestic research on the compact city has grown to some degree. From the introduction of the theory of compact city to the investigation of the spatial structure of the compact city, the study of compact index measurement, and the applicability of compact city in China, all of these topics have been covered. This thesis focuses on the research gap of compact in block scale and central area.

The theoretical concept of compact

Since the introduction of the compact city theory in China began approximately 10 years ago, discussion and research on the topic have progressed quite rapidly. The introduction and functional examination of the compact city concept and its role and relevance in China's urban development have sparked early debates and disputes amongst local experts since the turn of the century. This field of study focuses primarily on the notions of compact city and compact town, as well as discussions on how the concept influences urban spatial development, urban functions, city and land, and how to construct a compact city.

For example, the 2005 Annual Conference on Urban Planning in China clarified the concept of compact town and intensive town development mode. It regarded the compact city as one of the suitable models for urban development in China. In the same year, the 3rd China Habitat Summit in Hangzhou also introduced some concepts and definitions of the compact city planning theory, which became a hot topic of discussion[25]. The 9th International Conference on Urban Planning and Environment (ICUPE) held in Guangzhou in 2010 included urban sprawl, compact city, and

[25] Fang Q L, Qi W F. Research Progress and Thinking of Compact City and Its Measurement Methods [J]. Urban Planning Forum,2007(04):65-73.

sustainable urban form as one of the conference themes. The conference discussed various aspects of the concept of compact city planning.

The concept of compact city has been discussed by Li, Han, and Lv [26],[27], [28]. For example, Chen argued that compact cities are an effective form against urban sprawl and prevent inefficient urban proliferation. In addition, compact cities have ecological utility in the spatial form [29]. In comparing the connotations of the urban compact index and intensification, Li argues that compact cities and intensive use of urban land have remarkable similarities and considers the compact index an excellent way to achieve intensification. Yue confirmed the sustainable aspect of compact city in the discussion of its sustainability [30]. In conclusion, while introducing the concept of compact city planning from abroad, Chinese scholars have started to conduct more in-depth research on its concept and more profound meaning from the local Chinese standpoint, which is an excellent impetus to the development of Chinese planning theory.

Compact city agglomeration and the compact city

Existing domestic analyses of the compact mainly focus on the compact development of city agglomeration. The compact development of relatively gathering city agglomerations in a specific region is analyzed based on intercity transportation, city scale, and urban environment for resource conservation, efficient development, etc. There have been few studies on three-dimensional urban spatial forms up to now.

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[26] Li L. A conceptual Analysis on “Compact”[J]. Urban Planning Forum ,2008(03):41-45.

[27] Han S S, Qin B. The Compact City Sustainability Urban Development in China[J]. Urban Planning International,2004(06):23-27.

[28] Lv B, Qi L. Chen B Z. Cities, Compact while Ecological[J]. Urban Planning Forum,2008(03):28-31.Compact City: A Sustainable Way of Urbanization[J]. Urban Planning Forum,2008(04):61-63.

[29] Chen B Z. Cities, Compact while Ecological[J]. Urban Planning Forum,2008(03):28-31.

[30] Yue Y B. The Reviews of Sustainability of Compact City and Evaluation Method[J]. Urban Planning International,2009,24(06):95-101.

Fang et al. selected 23 city agglomerations in China for analysis in terms of three aspects: industrial compact index, spatial compact index, and transportation compact index of city agglomerations, to derive the high and low degree of the compact index and spatial differences of city agglomerations in China. The compact index of city agglomerations is mainly expressed in effective spatial structure and inter-allocation of resources among cities, which affects the degree of filling of tangible material space [31]. Luo used the method of corresponding mathematical statistics to quantitatively evaluate the degree of dispersion and the ease of spatial connection in terms of deviation, compact index, and travel distance by analyzing four growth stages of the three towns of Wuhan [32].

As one of the indicators in the study of urban spatial morphology evolution, the urban compact index is primarily utilized to reflect the compact and equilibrium of people, industry, urban function, and spatial density growth as expressed by urban building land on a two-dimensional plane.

Wang and Wu studied the evolutionary process of urban spatial form in Jinan by means of graphical analysis. The urban expansion orientation indicator, urban compact index indicator, and urban expansion speed indicator were selected from two aspects of urban plan form and three-dimensional form, respectively, to summarize their evolutionary characteristics[33]. Shen et al. argued that the compact and diversity of cities have a significant correlation, collated the positive correlation between compact and diversity by statistical methods on specific indicators characterizing urban diversity and compact, and proposed that the control of urban diversity and compact index

[31] Fang C L, Qi W F, Song J T. Researches on Comprehensive Measurement of Compactness of Urban Agglomerations in China [J]. Acta Geographica Sinica, 2008(10):1011-1021.

[32] Luo M H. Study on the Evolution of Urban Spatial Form of Wuhan [J]. Economic Geography,2004(04):485-489+498.

[33] Wang W, Wu Z Q. Graphics Analysis of Urban Form and Its Application in Urban Planning-a Case Study of Jinan [J]. Journal of Tongji University (Social Science Edition) ,2007(04):40-44.

should be maintained to an appropriate degree[34]; Qiu proposed the unreasonable aspects and paradoxes of compact index measurement in China and suggested diverse urban construction while maintaining a reasonable degree of compact index[35].

The studies mentioned above mainly focus on the comparative study of spatial forms between different development periods of cities or different development areas of cities. The measurement and analysis are based on two-dimensional urban spatial forms, with qualitative and quantitive methods.

Compact urban development in plots of land

The plot of land is divided by urban streets and is the fundamental unit that makes up the city. The varied activities of people, such as work, pleasure, and daily life, and the internal elements that interconnect many urban functions in the plot require emphasizing the growth of three-dimensional spatial characteristics instead of two-dimensional metrics. The existing studies of the compact in blocks scale examine the degree of spatial clustering in the plot of land. The study of compact blocks differs from the study of city agglomerations and compact urban development in terms of scale and scope, as well as its focus on human activities.

The majority of extant studies on compact in the plot scale are still focused on the compact index of cities or city agglomerations at the macro level, and the study of plot compactness index remains primarily at the qualitative research stage due to a lack of quantitative assessment studies. Jin et al. proposed a framework of compactness index indicators based on the quantitative spatial morphology at the medium and micro scales, including three first-level indicators: economy, efficiency, and comfort. The research did so by analyzing the limitations of the existing compact index

[34] Shen Q J, Xu S Y. Urban Diversity and Compactness : Characterization and Relationship [J]. City Planning Review,2009,33(10):25-34+59.

[35] Qiu B X. Compactness and Diversity (Version 2.0) : Two Core Elements of Sustainable Urban Development in China [J]. Urban Development Studies,2012,19(11):1-12.

measurement methods, which are not targeted enough, have less research at the micro level, lag in evaluation, and inadequate attention to urban livability [36].

The adaptability of compact city theory in China

In reaction to urban problems such as urban sprawl and suburbanization, Western developed countries have recommended the compact city as an urban development strategy. However, the already high urban density and level of urbanization development in Asian countries have increased the requirement for adaptable study on the application of compact city theory in China. Yu declares that the control of the compact index of compact cities in China should be maintained at an appropriate level not to enhance urban density and compactness randomly but rather to prevent urban sprawl [37]. Achieving compact cities, on the other hand, requires enough support for urban development policies that guide urban development. It is also stated that the environmental and social consequences of compact cities provide inspiration for China's urban construction and that China's urban construction should introduce compact city concepts such as TOD and other urban development models[38]. According to Peng, the application of compact cities should coordinate the relationship between the construction of new and old urban areas, ensure the social equity of urban residents, and take the issue of citizens' recognition and acceptance of urban space under high compactness, etc., seriously[39].

Particular incidents of compact city implementation are uncommon in China. Still, the planning and design of integrated urban space in conjunction with other sustainable

[36] [39] Jin J. The Morphology Theory and Spatial Measurement of Compact City in China [M]. Nanjing: Southeast University Press, 2017(12).

[37] Yu L. Thinking of Compact City[J]. Urban Planning Forum,2007(01):87-90.

[38] Li T, Shi Y T, Fu W Y. Evolving TOD Concept and Its Sinicization [J]. Urban Planning International ,2015,30(03):72-77.

[39] Peng H. Rethinking of Compact City : Key Issues in the Application of Compact City Theory in China [J]. Urban Planning International,2008(05):83-87.

city concepts, such as the planning and design of Anting New Town in Shanghai, Caofeidian in Tangshan, and New Eco-city in Tianjin, are prevalent. Most of them incorporate the ideals of compact cities and the sustainable spatial design of other cities.

2.1.3 Characteristics of compact urban development

Although there is still much debate and evolution surrounding the notion, this thesis investigates the essential aim of compact urban development from the view of urban design qualitatively through the literature review. It can be summed as improving the quality and efficiency of urban living by spatially reducing the distance between inhabitants and different public services through function mixing and density increasing within the limited land.

To further give a design-guiding approach, this section provides summarized characteristics of compact urban development: high-density and intensification, accessible public spaces and transportation, and diverse human-scale activities. There are very close and interactive links between these three characteristics.

High-density and intensification

High-density is the foundation of land usage in the concept of compact and aggregated activities, including high population density and high building and public infrastructure density. Sherlock (1990) contends that city life would be meaningless without a large population and activity density, as well as the interdependent diversity and vitality [40].

High-density has now grown to include horizontal and vertical dense; for instance, the concept of the vertical city can be seen as an embranchment of the compact city, representing spatial and functional intensification dense in three dimensions. In terms of intensive land use, each type of land use may trigger corresponding urban activities, bringing various benefits while also having a particular impact on the surrounding

[40] Breheny M. Cities are Good for us by Harley Sherlock (Book Review)[J]. RSA Journal, 1990, 138(5412): 865.

environment, thus creating a potential demand for the use of other types of land, which in turn constrains the activities that may occur around it. As for the development projects that have not yet been identified, in addition to the land use indicators and transportation conditions, the principle of land use compatibility should be taken into account, paying attention to the coordination with the surrounding environment to avoid a hollow and indifferent urban environment.

The intermixing of housing, commerce, leisure, and work in a high-density environment produces the optimal effect of intensification and provides a wide variety of activities and vibrant experiences for citizens. Nonetheless, ensuring quality while assuring several spaces has been a source of disagreement and a challenging problem to address, which will be discussed more. The following chapters will present alternative optimization approaches through localization in China.

Accessible public spaces and transportation

In addition to dense building space, dense public space and transportation and landscape infrastructures with accessibility, proximity, and convenience are necessary. The public infrastructure layout indicates the geospatial proximity of diverse structures, functions, people, and activities in different states. The accessibility of public infrastructure layout is based on human needs, taking into account the distance between people and various types of public infrastructure, the frequency of use of facilities, safety, comfort, and the degree to which needs are satisfied, strongly opposing single functional zoning, and constantly emphasizing the development of multi-centered and multi-functional cities.

In short, the quality and quantity of building space and the layout of public infrastructure with proximity, accessibility, and convenience in a compact city are the keys to effective compact utilization of the environment and the foundation for optimal city operation.

Diverse activities on the human scale

People are in the city, and the city is in the ordinary life of people. As a result of the aspiration of urban development under the pursuit of the goal of good living by people, the social attributes of urban space are also applicable to the concept of compact city. Close neighborhood relations, inclusiveness, and diversity to meet the human need by the concept of compact. Therefore, highlighting people as the center of the city, the urban spatial structure should reflect the human scale and emphasize the need to build and improve the urban space from the perspective of human needs.

One of the sustainability of compact cities is to obtain more and more effective social interactions through intensive development and humane use of public space, generating closer neighborhoods, accommodating diverse populations that might otherwise be socially segregated to some extent, and deriving more diverse cultural and recreational activities. How urban residents perceive their neighbors depends on their understanding of how neighborhoods are formed. For example, with public transportation orientation, walkable spaces bring more possibilities for encounters and exchanges among residents. In contrast, the gathering of communities in space is more likely to generate specific social groups and enhance residents' sense of belonging and dependence on the place.

Therefore, the compact on high-density emphasizes giving people maximum convenience, comfort, and safety, consistently placing the care for people in the first place. Production and consumption in economic activities are also required to achieve a balance that forms a circle of life within a specific range.

In this design thesis, the concept of compact gives a design-guidance approach toward a new urban vision. The preceding part clarifies how to transfer the concept of compact into a physical space design strategy. The basic meaning of a compact city is comprised of appropriate high-density, accessible public spaces and transportation, and diverse activities on the human scale, all of which indicate diversity and consequent vitality. As stated in section 1.2.1, there is an interaction and conjugative

link between diversity and compact. The growth of urban diversity is only feasible when the proper level of compaction is maintained; only then can the vitality of a city be concentrated and generated. The diversity of urban space could exemplify diverse urban vitality after filtering by human needs; this will be discussed in the next section.

2.1.4 Controversy of practices in developed countries

The controversy over the compact city and compact urban development focuses on the negative impact that excessive density and intensification can have on the urban eco-environment, the economy, and the quality of citizen lives. The problem is now common in mega, high-density cities worldwide.

Numerous studies have demonstrated that relatively compact urban forms are conducive to land conservation, preservation of natural landscapes, urban regeneration, reduction of automobile use, energy consumption, and exhaust emissions, and may bring additional social, economic, and environmental benefits. However, other academics have voiced skepticism that compact cities ignore economic development and market forces and may lack public acceptance due to the deterioration of environmental quality and the increased cost of living induced by high-density. The argument continues (Table 2-2).

Table 2-2 Controversy over the various impacts of compact cities in developed countries

Aspects of Influence	Supporters' Opinion	Opponents' Opinion
Economical Utilization of Resources	· Shorten the travel distance and change the travel pattern of citizens · The adoption of low-energy housing will effectively reduce energy and resource use	· There is no clear link between motor travel and energy conservation, and there are other deep causes of the energy crisis · The benefits of compact cities are offset by environmental degradation in other urban systems

Aspects of Influence	Supporters' Opinion	Opponents' Opinion
	· The improvement of urban infrastructure utilization rate	· The high-density living environment has a certain impact on indoor ventilation and lighting [41]
Land Use Control	· It is conducive to saving land and reducing the disorderly occupation of suburban land and agricultural land by urban development · Make effective use of idle land in built-up areas	· Urban high-density construction may occupy existing green and open spaces [42] · Soared land prices [43]
Market Development	· Compact cities should place social and economic concerns equally with environmental concerns	· Increased housing costs impede labor market mobility, and the company operating expenses in cities with housing shortages will steadily rise [44]
Urban Traffic	· Reduce people's dependence on private cars and reduce exhaust emissions · Promote public traffic development for flexible and	· Dense cities lead to traffic deterioration, parking difficulties, longer travel time, etc., affecting urban efficiency and air quality [45]

[41] Randolph B. Delivering the compact city in Australia: current trends and future implications[J]. Urban policy and research, 2006, 24(4): 473-490.

[42] Williams K, Burton E, Jenks M. Achieving the compact city through intensification: An acceptable option[J]. The compact city: A sustainable urban form, 1996: 83-96.

[43] Bishop P, Cheshire L, Howes M, et al..Engaged Government: A study of government-community engagement for regional outcomes-Report 2: Selection of Case Studies[M], Rockhampton: Central Queensland University, 2016(03):17-21.

[44] Baker J. Analyzing urban poverty: a summary of methods and approaches[M]. World Bank Publications, 2004(09):51-56.

[45] Howley P, Scott M, Redmond D. Sustainability versus liveability: an investigation of neighbourhood satisfaction[J]. Journal of environmental planning and management, 2009, 52(6): 847-864.

Aspects of Influence	Supporters' Opinion	Opponents' Opinion
	efficient use of walking and cycling transport	
Urban Environment	· It is entirely feasible to build the eco-type compact city in a long period · Reducing the damage to the ecological environment is conducive to the protection of biodiversity	· Increased residential density leads to reduced ability to dispose of household waste and reduced recycling possibilities [46] · Reduce the ability to capture or treat rainfall in urban areas and reduce its run-off · Increases urban heat island effect and disrupts microclimate [47],[48]
Life Quality	· Residents have more chances to walk and increase the opportunities to meet and communicate. It is easier to form a community that can communicate closely with each other · Step-by-step routes and market-matching mechanisms can eliminate the tension between compact cities and quality of life · Improves the efficiency of public services with lower infrastructure	· Overcrowded environment makes cities tend to become dirty and messy, which increases the possibility of disease transmission and bad social security factors · The high-rise housing common in compact cities is detrimental to community and neighborhood interaction and outdoor activities of residents, especially the elderly and children

[46] Troy P N. Environmental stress and urban policy[J]. The compact city: a sustainable urban form, 1996: 200-211.

[47] Voogt J A , Oke T R . Thermal remote sensing of urban climates[J]. Remote Sensing of Environment, 2003, 86(3):370-384.

[48] Raman S. Designing a liveable compact city: physical forms of city and social life in urban neighbourhoods[J]. Built environment, 2010, 36(1): 63-80.

Aspects of Influence	Supporters' Opinion	Opponents' Opinion
	investment and maintenance costs	· widen the wealth gap between homeowners and other households [49]

In addition, there is an eclectic portion of the academic community. Although they believe that the compact city policy is a prudent choice for the development of Western cities, they raise concerns regarding the practicability of compact cities. They contend significant economic, technical, and policy obstacles to building compact cities. The economic factor is a hitherto disregarded aspect of the debate on small cities. Changing a long-established and entrenched paradigm of urban decentralization into a compact model is technically far more challenging than was previously believed. Equally problematic is the policy dimension, primarily due to the discrepancy between national and local government objectives. Therefore, some researchers have proposed a convergence model, "decentralized concentration", "urban networks", or "urban country", in which intra-regional compact and inter-regional decentralization are complementary.

Therefore, whether on a city scale or a block scale, compact urban space needs to be maintained to an appropriate degree and not just a high-density and highly intensive unstructured stacked development.

2.2 City Activities Zone

2.2.1 From CBD to CAZ

Initially, Central Business District (CBD) in the developed West was dominated by single business activity and working population as the primary function and the main

[49] Baker A. Governments, firms, and national wealth: a new pulp and paper industry in postwar New Zealand[J]. Enterprise & Society, 2004, 5(4): 669-690.

user; this single vitality gradually failed to meet the city's demand for a more diverse function of the central area. The concept of a City Activities Zone (CAZ) with a diverse range of activities at its core was proposed to shape a more prominent and integrated position of the central area.

Burgess first introduced the notion of CBD in 1925[50]. He pointed out that CBDs are generally the core of urban operations, providing spaces to support high-level industries and functioning as the hub of the city's transit system. Murphy says that a CBD can be classified as a central business district if the area of office buildings in a given location of a city reaches one-third of the total floor area [51]. Chen (2006) splits the concept of a central business district into broad and narrow senses [52]. Firstly, in terms of function, the broad notion considers the CBD as the main section of the urban space strongly associated with business functions. At the same time, the narrow CBD refers exclusively to the specialized office sector located in the city's center. This broad and narrow separation is reflected in the spatial scale: such as the broad definition of New York's CBD encompasses the bigger half of Manhattan Island. In contrast, the tight definition refers to the 3-5km^2 zone that comprises Midtown and 1/10th of Manhattan Island. Chicago's CBD is even smaller, with the broader CBD being the 4.1km^2 region of Chicago's elevated train loop known as the Loop. The narrower definition is the few blocks of financial and commercial buildings on both sides of Russell Street in the Loop, covering less than 2km^2.

The definition of CBD

[50] Burgess E W. The Growth of the City: an Introduction to a Research Project[J]. The Trend of Population,1925,18:85-97.

[51] Murphy R E . The Central Business District: A Study in Urban Geography[J]. Geografiska Annaler, 1974, 26(4):448-460.

[52] Chen Y X. Urban Planning Design and Practice of CBD [M]. Beijing: China Architecture & Building Press, 2006(09)

This study describes the concept of a CBD as a district located in the central area of a city that provides activity space and infrastructure for concentrated financial and business activities. The origin of the CBD refers to the concentration of business offices on a single site. In the minds of many domestic city decision-makers, the standard sample of CBD is Wall Street in Manhattan, Lujiazui in Pudong, etc., which is considered to concentrate the important economic activities of the city and is a space for business activities such as finance, high-end services (primarily legal services), and multinational corporate management. Therefore, this district serves the city's and the region's production and economic institutions as a whole rather than the general people within the city. The size of the CBD is not necessarily tied to the size of the city's population; it is influenced by the extent to which international and regional capital is concentrated in the city, based on the number and character of commercial establishments and their business flows[53]. The size of the CBD that can be maintained reflects the city's place in the regional and world city system.

The drawback of the CBD

The drawback of the CBD is the lack of connectivity between the sector and the rest of the city regarding function and citizens. The lack of linkages between the CBD's purest functional set-up and the rest of the city is also damaging to the city's development as a whole.

The experience of developed countries proves that the stronger the global function of a city, the closer the ties between the city and other foreign economic centers. In contrast, the relationship with the neighboring cities of the country may be weakened, and the more likely the central area of the city will be internally isolated, i.e., the ties between the CBD area and the general population of the city will be weak. Especially the CBD is positioned as a concentration of outward-looking companies in the city. Its

[53] Yuan Q F. On Guangzhou CBD in the 21st Century (GCBD21) [J]. Urban Planning Forum, 2001(04):31-37+79-80.

industrial structure is a convergence of primary industries in the distribution of the economic base, targeting external consumers and providing fewer services to the city's internal residents. This is especially likely if the CBD lacks functional arrangements directly tied to the general population, such as housing and traditional services. At the same time, CBDs supply occupations with considerable wage disparity, leading to social isolation between the CBD and the surrounding area. In large cities in developed countries, it is usual for clusters of low-end service personnel serving the CBD to form around the CBD.

The deficiency of function contributes to the fact that people who do not work in the CBD generally do not travel to the district, making the area after work popularity frigid and producing a variety of social problems. Many U.S. CBDs were historically termed "dead cities" because they were empty after 5 p.m. closing time. The clear suburbanization of U.S. cities has resulted in a significant drop in the population of CBD. In recent years, with the structural transformation of the economy and the promotion of mixed land use, the central district of U.S. cities has begun to attract young professionals and business workers to move into apartments in the heart of the city. This trend has led to a gradual change in the CBD from a single-use business district to a mixed-use activity district. As a result, major U.S. cities' central business areas are now increasingly intermingled with various land uses. London also intends to improve the vibrancy and appeal of the CBD and encourage a 24-hour lifestyle, designated in academic circles by the new term: Central Activity Zone (CAZ) [54].

The significant difference between CAZ and CBD is the mixed functions, a crucial component lacking in building many citY central areas in China. Thus the research on CAZ is sure of tremendous importance. However, the most significant difficulty in CAZ construction is how to cope with and facilitate the transformation from pure functional

[54] City Planning Group. CAZ Planning & Transportation Supplementary Planning Guidance[R]. London: Westminster City Council, 2001.

zoning to mixed spatial use, as well as to meet the needs of increasingly integrated production for mixed spatial use [55], which requires an in-depth exploration of the relationship between the hybrid model and urban design.

CAZ is crucial to modern city strategy plans. It has been on the agenda for certain prominent decentralized mega-cities such as Australia, Canada, the United States, and sections of New Zealand, such as the London Plan, the Melbourne 2030, and the new Midtown in Sydney CBD as a mirror of Manhattan.

While the CBD is shaped by business and industry, the CAZ is adapted to the activities that meet citizens' needs and the vitality that may be inspired, and the CAZ is more of an upgrade in concept and principle than the CBD.

The following are the basic spatial characteristic of a CAZ.

Centralized location and transportation environment

The more diverse population and concentrated cultural and sporting activities make CAZ a more central area than CBD, both symbolically and practically.

A CAZ can be found in the city center or a sub-center near the city center that serves as the sub-economic center's backbone, such as North Michigan Avenue and National Avenue in Chicago or Nanjing Road and Huaihai Road in Shanghai. In short, it is the central business district of a city, where the essence of diverse industries is concentrated, and transportation has a distinct advantage. The CAZ offers excellent accessibility, with the best internal and external links in the city and region, allowing for the most accessibility in the shortest amount of time. As a result, CAZ should have the highest density of people, cars, and buildings. However, pedestrian-oriented transportation is promoted, and it is anticipated that an increased number of walkers will be able to link with other places via easy public transportation.

[55] Chen N, Chen K S, Cui Y Y. The Development Mode of Mixed Use in City Small Unit of Central Urban District: The Enlightenment of London CAZ [J]. Urban Planning International ,2016,31(03):56-62.

Compounded business cores

Whether it is Broadway in New York, Lister Square in London, the Champs Elysees in Paris, or Darling Harbor in Sydney, the CAZ of these modern international metropolises is generally positioned in the city center. It has a close relationship with the CBD, either symbiotically or physically. CAZ frequently brings together the most modern and established tertiary industries, including finance, insurance, securities, intermediaries, convention and exposition, tourism, etc. It also features shopping areas such as specialty stores and colossal department stores, as well as leisure areas such as fitness and entertainment, forming a complex function that can suit the needs of business and commercial activities to the greatest extent possible. It is worth mentioning that the residential function of CAZ serves the mobile population that comes and goes, mainly the tourist and commercial mobile population, rather than the fixed residential population.

Diversification of the served population

Diversification of land use in CAZ can attract a diverse range of consumers and residential populations. Various compatible and interactive land uses, preferred consumer types, and consumption levels within the CAZ are encouraged. The diversity of the served population allows the CAZ to maintain its continued economic vitality and attractiveness to urban life and strengthen its connections to the rest of the city.

High-quality public space system

A system of high-quality public spaces, as opposed to a single public space (e.g., a vast plaza), is an essential element that offers the circumstances for integrating the diverse activities of the CAZ's spatial structure. The public space system consists of parks, squares, open spaces in front of buildings, and boulevard walks of varying dimensions, uses, and characteristics. Mixed land use necessitates the coordinated cohabitation of multiple purposes, and green spaces, plazas, playgrounds, and pedestrian trails can successfully separate and connect public places.

The public space system includes pedestrian-friendly paths and places. Integrating distinct public areas allows for various activities within the same area, boosting the functional density between sites. The pedestrian-oriented design enables people to move comfortably both outside and within the bottom floor building, avoiding the circumstance in which the structure's exterior is given priority over walking. The space of the CAZ must reflect the human size, preventing the design of Shanghai Lujiazui, which is excessively large and devoid of the human scale for the sole purpose of accommodating automobile traffic.

Clustering of public activity amenities

The CAZ is the heart of urban recreational activities; thus its recreational facilities and products must be clustered according to a specific type and amount in order to meet the various and extensive market demands of city inhabitants and foreign tourists. Integrated entertainment facilities such as plazas, parks, museums, movies, theaters, dance halls, restaurants, bars, and cafes are frequently grouped. The vitality of the CAZ in a contemporary international metropolis area is in the high quality of its entertainment products. The CAZ offers various leisure and entertainment options from classical opera to modern drama, street performances to museum exhibits, upscale restaurants, and lounge bars. In addition, the location criteria establish that the demand CAZ radiation region encompasses the entire city; therefore, there must be an institution or site that serves the whole city, and its service facilities must be of the best quality that other places cannot match.

CAZ exhibits the so-called "7-24" (7 days x 24 hours) activities pattern due to its diverse and extensive activities, facility, and service experience. Maintaining the presence of continuous activity in the central area necessitates the availability of multiple optional facilities within a specific area; hence, mixed-use is gradually favored in urban development among countries.

2.3.2 Activity and vitality to satisfy citizens' needs

What differentiates CAZ from CBD is the aggregation of various activities. Activities that meet the needs of individuals are the sources of vitality [56], and a more vibrant vision of the city central area is what CAZ actually pursuing. Therefore, this paper contends that understanding where a city's vitality comes from is a significant consideration in understanding urban design. The discussion of urban vitality started in the 1960s, picking up speed towards the late 1980s with the fear of the decline of the city center. Throughout the 1990s, there was fierce discussion regarding the cultural regeneration of the cities through the promotion of urban vitality.

Discussion of urban vitality

Urban vitality is a socially constructed concept with diverse interpretations and measurements. Jacobs defined urban vitality as the capacity of urban places to stimulate human interaction and to induce lively social and economic activities. For Maas, urban vitality is the synergy arising from a variety of somewhat unique commercial and entertainment opportunities and a dense, socially heterogeneous pedestrian population[57]. Identified by Kevin Lynch in *Good City Form*, vitality—the degree to which the form of places supports the functions, biological requirements, and capabilities of human beings—is considered an essential performance dimension of urban design. Montgomery considered urban vitality as what distinguishes prosperous urban areas from the others. Vitality refers to the numbers of people in and around the street (pedestrian flows) across different times of the day and night, the uptake of facilities, the number of cultural events and celebrations over the year, the presence of active street life, and generally the extent to which a place feels alive or lively[58].

Activities as sources of vitality

[56] Lynch K. Good city form[M]. MIT press, 1984.

[57] Maas P R. Towards a theory of urban vitality[D]. University of British Columbia, 1984(09): 2.

[58] Montgomery J. Making a city: Urbanity, vitality and urban design[J]. Journal of urban design, 1998, 3(1): 93-116.

Lynch and Jacobs define the sources of vitality as the need for individuals' survival met by their ability from their environment, which includes both primary and higher levels of citizens' needs. Therefore, mixed and aggregate activities are the key to forming the vitality of urban places. This mixture necessitates a wide variety of ingredients, the availability of which is contingent on sufficient levels of demand to support diverse economic activities. These economic activities, as everyday-life scenes shown in the Guangzhou city promotion video, include teahouses and cafés, foreign grocery stores, delicatessens, cake shops, theaters, galleries, and pubs, which can be sustained by the citizens living in relative proximity. It is possible to locate all these large and small, ordinary and unusual objects.

This means that the key to sustaining vitality lies in there being, within easy traveling distance, relatively large numbers of people with different tastes and proclivities. In other words, a relatively dense aggregation of population. With rising car ownership and more fluid travel patterns, it is nowadays more likely than it once was that relatively small places (towns and even suburbs) can attract enough people to support vitality because of intensive and mixed-use. But, on balance, the tendency is for larger, more dense settlements to be the ones that can maintain vitality for longer. It is possible to generate more vitality, at least for particular slots of time, by programming events and activities to occur in the streets, buildings, and spaces. However, long-term urban vitality can only be achieved where there is a complex diversity of primary land uses and (primarily economic) activity.

In short, as defined in this design thesis, vitality is based on aggregating diverse activities after being filtered by citizens' basic and higher life needs. In addition to satisfying basic human life needs such as sunlight, green, housing, and work, citizens' pursuit of health and happiness should also be happy, as scenes shown in the collage of Guangzhou city imagery of camping, live house, new trendy niche hobbies, or more inclusive workplace, more attractive traditional activities.

2.3.3 Strength and weakness of CAZ

The development of the CBD into a CAZ reflects the evolution of urban planning concepts which considers more diverse human needs. The shift is from single-function zoning to multifunctional mixed-use, from an emphasis on the physical built environment such as buildings to a focus on the quality of life and an emphasis on total growth to improved quality of life. Based on this shift, CAZ has the merits of being more integrated, sustainable, and stable than the Central Business District.

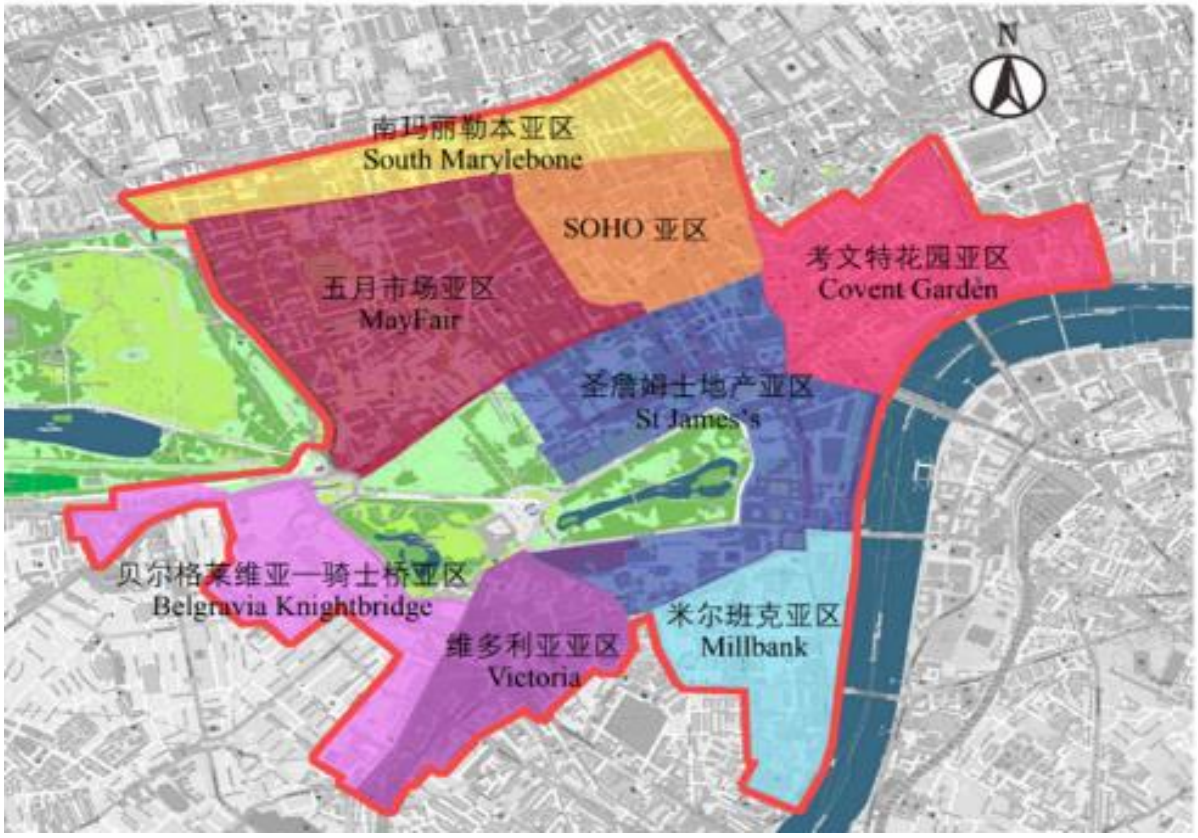


Fig. 2-3 8 Sub Areas in Westminster CAZ

One of the advantages of the CAZ is that it contributes to creating humane places due to the multifunctional complex. With the transition from development to management comes a shift in the content of creativity, and creating quality of life becomes more important. This creation and re-creation can be applied to individual buildings and the entire city center and is reflected in the details of public space creation. On a regional level, London's Westminster CAZ consists of eight sub-areas positioned differently and

containing rich functions. Still, the overall function establishes a 4:1:1:1 mix of office, retail, residential, and hotel functions in the area (Fig. 2-3).

The Boston Redevelopment Authority, on the other hand, proposes to put the urban transportation arteries underground, thereby acquiring land to build parks. At the same time, cultural and recreational facilities are increasingly concentrated in the central part of the city as part of the city's high quality of life. In addition, along with introducing the headquarters company into CAZ, the retailing of small stores along the streets and large superstores is also likely to bring more common and diverse vitality to the city. Western cities are also beginning to focus on the renaissance of cinemas and theatres in the city, for example, by developing the top floor space of buildings as experimental theatres and introducing art galleries and studio spaces in central areas. The CAZ is more concerned with the spatial quality sought by different residents, visitors, and workers and is constantly improving and updating human places and activities. The area's attractiveness and vitality can be sustained 24 hours a day, 7 days a week, because of the complicated coexistence of diverse functions. City central area is supported not only by the commercial real estate economy but also by various economic activities, all of which create a variety of tax revenues.

Second, the CAZ would provide a more balanced mix of living and working, promote high-capacity rail transit, and connect the various modes of public transportation to increase mobility in the core region. Policies that make better and more effective use of existing roadways and amenities are becoming increasingly popular in the city center region. Dedicated lanes for car-pool journeys, demand reduction through commuter transit policies or parking and trip reduction laws, or the construction of homes and many related facilities in the CAZ are some of the feasible policies. Through the interaction of functions, the CAZ will improve the area's traffic flow and travel environment by acting as a hub for diverse traffic concentrations and offering a high-quality public space for people moving through the site.

In contrast to the CBD, the CAZ places a high priority on housing development. Young employees who are not married or married with no children usually prefer to live in a central location with a range of leisure options and high popularity. When it comes to finding a place to live, young, high-earning employees from the CAZ will prefer compact, well-serviced flats or apartments because of their employment mobility. The CAZ also has a large population of retired seniors. Older people with savings remain in the city central area, which offers a wide range of services and amenities. The housing possibilities in the CAZ should be as diverse as possible. People who work and reside in the CAZ are crucial to the area's health and well-being, as they foster a strong sense of place.

The main drawback of the CAZ is the difficulty of controlling the multiple diverse functions in the planning and implementation process. Although different land use properties may be linked and have a cascading effect, they may also conflict and cause inconvenience among users. Therefore, it is necessary to list the mutually tolerant land use properties and requirements for space in detail in the planning and decide the degree of mixing of different functions. Then, strictly follow the planning in the implementation process to control the appearance of incompatible uses in the CAZ.

The Racecourse is in the central location among three future CDBs of Guangzhou, and the current status of cultural and sporting facilities in Zhujiang New Town has not been sufficiently and effectively enough. It can be an attempt to discover a version of CBD in the Racecourse's compact and vibrant CAZ design.

2.3 Relationship between Compact and Vitality in CAZ

Before understanding the possible practical impact of compact urban development and CAZ on space from the vision of urban design, it is also necessary to clarify the conceptual logic between compact and vitality, which represents the core idea of compact urban development and CAZ, respectively. This can be meaningful for the subsequent research on spatial characteristics of compact and vibrant CAZ.

2.3.1 More compact, more vitality

This thesis uses the term “diversity” as an intermediary to better understand the relationship between compact and vitality, which Jacobs values as one of the universal principles is the need for cities to have a most intricate and fine-grained diversity of uses that give each other constant mutual support, both economically and socially. The components of this diversity can differ enormously. Still, they muse supplement each other in specific concrete ways, which means diversity may explain many logics relationships in the urban field and can be the crucial reason for making a good place. As Jacobs’ book describes, compact city can be the primary generation of diversity. And vitality is the social concept or performance of diversity. Now the definition of vitality can be clarified. Vitality is the product of two separate but related concepts: compact and sequent diverse activities (Fig. 2-4).

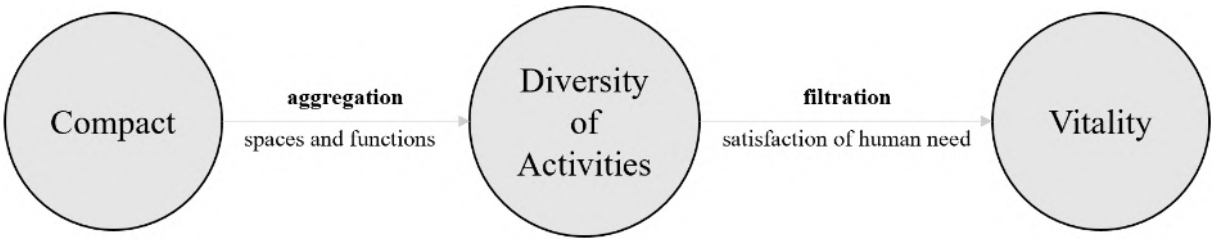


Fig. 2-4 Diversity of activities as intermediary between compact and vitality

The opinion of this thesis is that appropriate compact urban development generates aggregated diverse urban spaces and functions, which contain and create diverse activities; diversity encompasses both functional diversity and spatial form diversity and refers to the use of density to set up a wide variety of urban functions and spaces in a high-density environment. Compact as a prerequisite for diversity provides a physical environment to accommodate such living and behavior. High building capacity provides the basis of the physical environment for the diversity of building functions and spatial forms. In contrast, diversity offers the functional and spatial guarantee for resource concentration, convenience, and efficiency and the survival and vitality of

buildings in a high-density environment. Today, cities that exhibit diversity are far more vibrant than those that are monolithic, which is the secret to their prosperity.

The study of compact and vitality can compensate for the mismatch between spatial form and function. According to global statistics, there was a significant positive spatial autocorrelation between compact and urban vitality. Socio-economic activities were found to be concentrated in densely developed urban areas. However, local spatial mismatches were found in all the cities, indicating overcrowded or underutilized urban spaces. Such relationships showed different daytime and night-time features, old urban and newly developed areas, and different land use functions and mixtures. These results will further advance the theory of compact development and fill the gap in which traditional urban planning practices ignore the spatial mismatches between urban physical spaces and activities which simulate urban vitality. Substantial insights from this paper can assist in sustainable urban spatial form and central area optimization. For example, the revealed overcrowded and underutilized urban spaces can be used to identify appropriate anchors or for regenerating vitality. However, due to the complex measurements of compact and urban vitality and the various design ideas of different functional urban spaces, decisions must be made based on the considerations of multiple stakeholders and to what extent compact can promote vitality.

However, as in the controversy over the compact city concept in section 2.1.3, diverse activities can be positive or negative, so the positive activities need to be filtered and organized to satisfy human needs. Thus, the resulting vitality can lead to more vibrant city life by stimulating economic, social, and ecological activities.

Related evidence can be found from the controversy of compact city theory and the research between compact and vitality. The following section will try to redefine the compact urban development in Guangzhou theoretically and practically.

In the concept of the compact city, residential buildings are positioned in or near urban centers, allowing inhabitants convenient access to a vast array of urban amenities and resources [66]. Moreover, compact urban forms such as high-rise and high-density living make open spaces and natural environments within walking distance and contribute significantly to residents' quality of life [59]. However, some evidence indicates that the level of resident happiness with housing has little to do with density or height; it does correspond to other housing environment characteristics[60]. Urban spaces with high-density can connect more human agencies and drive increased social tie formation in everyday life [61],[62]. Establishing walkable areas and promoting public transit as compact city values will reduce travel lengths and, consequently, energy consumption and car emissions[63],[64]. Another positive response to compact urban development is that economic activities and enterprises, offices, and households are effectively clustered to offer specialized facilities, services, and cultural possibilities [65], thereby minimizing individuals' and products' excessive daily movement.

On the contrary, as many scholars argued about the negative effect of the compact city, excessive density can also adversely affect citizens and the biophysical environment.

[59] Bardhan R, Kurisu K, Hanaki K. Does compact urban forms relate to good quality of life in high-density cities of India? Case of Kolkata[J]. Cities, 2015, 48: 55-65.

[60] Whittemore A H, BenDor T K. Talking about density: An empirical investigation of framing[J]. Land use policy, 2018, 72: 181-191.

[61] Pan W, Ghoshal G, Krumme C, et al. Urban characteristics attributable to density-driven tie formation[J]. Nature communications, 2013, 4(1): 1-7.

[62] Tavassoli S, Obschonka M, Audretsch D B. Entrepreneurship in cities[J]. Research Policy, 2021, 50(7): 104255.

[63] Chen Y, Li X, Zheng Y, et al. Estimating the relationship between urban forms and energy consumption: A case study in the Pearl River Delta, 2005–2008[J]. Landscape and urban planning, 2011, 102(1): 33-42.

[64] Yang B, Xu T, Shi L. Analysis on sustainable urban development levels and trends in China's cities[J]. Journal of Cleaner Production, 2017, 141: 868-880.

[65] Vallance S A, Moore K, Perkins H C. The effects of infill housing on neighbours in Christchurch[J]. 2005.

It may thus be harmful to stimulating urban vitality[66],[67],[68]. Urban buildings can substantially influence the UHI effect, amplify traffic noise, aggravate air and water pollution, and produce excessive waste[69],[70],[71]. For example, in areas with high buildings and narrow streets, large quantities of solar heat are trapped and cool down slowly, resulting in limited exposure to the cool night sky. The heat island in the evening increases amidst high-density urban development, especially in the summer. Moreover, the vertical growth of the urban landscape can affect city residents' living habits and lifestyles. For example, citizens suffer from narrow living spaces and crowded traffic services resulting from high population densities. Furthermore, high densities lead to isolation, tensions, and lack of privacy. However, these problems may not appear to have a significant effect on residents' perception of their life quality owing to the different levels of cultural tolerance of crowded living environments. Although a reasonable level of urban compact may bring environmental benefits, it may cause environmental problems instead of the claimed benefits when it goes beyond a certain degree. Thus, the evolutionary and targeted concept of compact can improve this situation and provide more localized compact urban development for the Racecourse.

[66] Ho H C, Wong M S, Yang L, et al. Spatiotemporal influence of temperature, air quality, and urban environment on cause-specific mortality during hazy days[J]. Environment international, 2018, 112: 10-22.

[67] Mouratidis K. Is compact city livable? The impact of compact versus sprawled neighbourhoods on neighbourhood satisfaction[J]. Urban studies, 2018, 55(11): 2408-2430.

[68] Vallance S, Perkins H C, Moore K. The results of making a city more compact: neighbours' interpretation of urban infill[J]. Environment and Planning B: Planning and design, 2005, 32(5): 715-733.

[69] Chun B, Guldmann J M. Spatial statistical analysis and simulation of the urban heat island in high-density central cities[J]. Landscape and urban planning, 2014, 125: 76-88.

[70] Hankey S, Marshall J D, Brauer M. Health impacts of the built environment: within-urban variability in physical inactivity, air pollution, and ischemic heart disease mortality[J]. Environmental health perspectives, 2012, 120(2): 247-253.

[71] Liddle B. Urban density and climate change: A STIRPAT analysis using city-level data[J]. Journal of Transport Geography, 2013, 28: 22-29.

As the result of the intersection of activities and compact, urban vitality requires a variety of mixed functions to facilitate the generation of multiple activities when designing urban spaces. The study of Jacobs and Comediaon's diversity is a good illustration of realizing a compact city with vitality[72].

- the extent of variation in primary land uses, including residential;
- the proportions of locally owned or more generally independent businesses, mainly shops;
- patterns in opening hours, including the existence of evening and night-time activity;
- the presence and size of street markets, and types of specialism;
- the availability of cinemas, theatres, wine bars, cafes, pubs, restaurants, and other cultural and meeting places offering services of different kinds at varying prices and degrees of quality;
- the availability of spaces, including gardens, squares, and corners, to enable people-watching and other activities such as cultural animation programs;
- patterns of mixed land ownership so that self-improvement and small-scale investment in property are possible;
- the availability of different unit sizes of property at varying degrees of cost, so that small business can gain a foothold and not be driven out of business by sudden rises in rent and property taxes;
- the degree of innovation and confidence in new architecture so that, where possible, there should be a variety of building types, styles, and designs;
- the presence of active street life and active street frontages.

[72] Comedia UK. Out of Hours: A Study of Economic, Social and Cultural Life in Twelve Town Centres in the UK: Summary Report[M]. London: Comedia Publishing Group, 1991(05).

With these guidelines, a general vision of compact urban development can already be sketched to enhance vitality. However, as improvement strategies for urban design, more detailed and distinct principles still need further derivation before they can be applied in the actual design of the Racecourse. The next chapter will search for more precise approaches to morphology, spatial guidance strategies, etc., through an empirical study of compact cities and vibrant CAZs recognized as having successful benefits worldwide.

2.3.2 Apply compact to improve vitality in CAZ

Based on theoretical research on the relationship between compact and vitality as two crucial ideas, in this section, the reason why compact urban development is appropriate for CAZ design is going to be studied.

Considering the origins of the idea of compact city in preventing urban expansion and regenerating the city center, the need for compact urban development is especially applicable to the city central area. As the core of a city, the central area is a landmark location that displays the city's history and character and the achievements of construction. It concentrates a city's most vital public identity, maximum building density, and greatest traffic concentration due to urbanization.

Due to China's fast urbanization, compact urban development is an efficient solution for the current environment and traffic congestion. The high-density growth of the city central area has been shifting from a single horizontal expansion to a three-dimensional expansion, thus prominently reducing the urban efficiency of the entire city. In the current context of transformation development, it is necessary to improve public space quality to adapt to and better meet the future demand for efficient, high-capacity, and humanized public activities in the city central area.

Due to extensive urbanization and reliance on land finance, a significant quantity of residential construction has damaged the city's central area's roles and features. The construction of city central area across the nation is preoccupied with the quest for

high-density, resulting in the homogenization of urban landscapes and the eradication of regional cultural distinctions. From the standpoint of high-density criteria for compact cities, most Chinese city central areas are compact. From the perspective of compact city needs for quality of life, most Chinese city central areas do not match the criteria for actual compact urban development. As the image of a city, the central area should best express and symbolize the degree of urban growth and quality of life depicted by mood, surroundings, population, and activities in central area.

How can additional space be created on the restricted land in the central area while maintaining a higher quality of life? How can the city central area become a popular and vibrant meeting place? How can the city center be functionally blended and generate additional public space and activities? How can the congestion of the city become more efficient with higher capacity? These issues are fundamental to the development of the city center in the context of China's urban reality. Compact urban development aims to enhance the accessibility, efficiency, and capacity of activities and suitable spaces in the restricted central area. Therefore, employing compact urban development to investigate the optimization and growth of city center areas in China makes sense.

Based on the preceding compact city literature study, the next portion of this article discusses how to implement the compact city idea at the medium- and micro-levels of Chinese cities to create greater vitality in the center areas and transform them into CAZ. The objective of the CAZ transformation should be to consolidate and maintain its key position, including updating the current inadaptable functions, boosting the area's attractiveness and vitality, and enhancing its overall environment.

Therefore, exploring the new vision of compact urban development for the city central area in the context of China's transformation in urban design should focus on the performance and requirements for the central area in terms of activities that meet the human needs for vitality enhancement and appropriate level of compact for maintaining

the comfortable and livable environment, and other aspects related to the comprehensive benefits of the city.

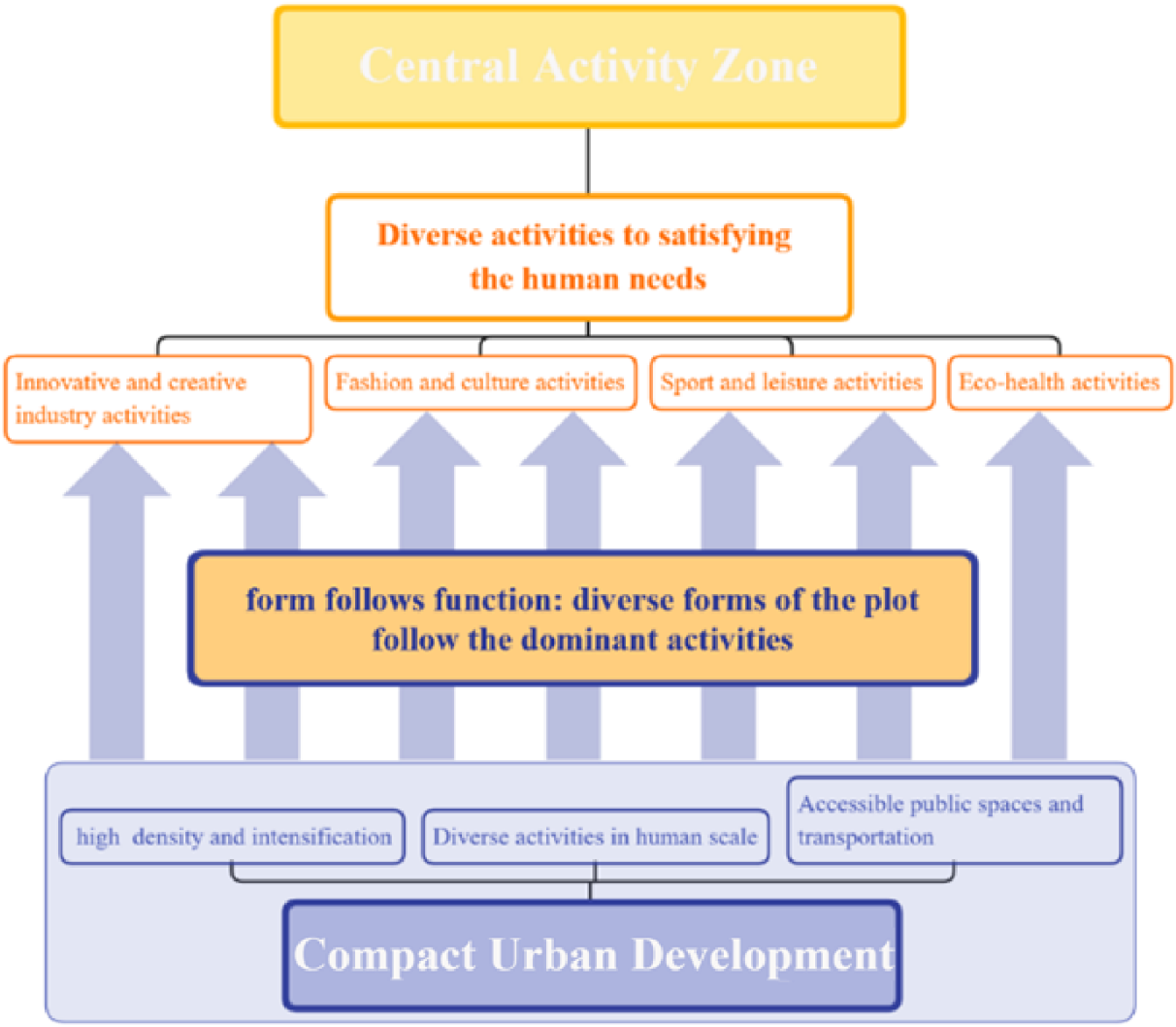


Fig. 2-5 Relationship between compact urban development and CAZ

Through literature review, the relationships between the compact urban development and the CAZ are integrated from the characteristics of compact and specific activities required by CAZ (Fig.2-5). Activities in CAZ are considered goals of design, and the plots containing different activities should satisfy the principle of form following function as goal-driven design. Each characteristic of compact urban development should be a guideline of form design in any activities dominant plot, so the plot in CAZ will be more compact under the comprehensive effect of all characteristics equally. The approach

to how characteristics of compact urban development impact the forms of activities dominant plot will be the strategy for designing a new vision of compact and vitality in the Racecourse.

The next chapter of this thesis discusses theoretically and practically through case study of how to implement these characteristics of compact urban development at plot and building scale in Guangzhou and further transform the Racecourse into a more compact and vibrant CAZ.

2.4 Summary

A city has to be economically viable, socially equitable, and physically appropriate. For the vision of enhancing urban vitality through the compact urban development in Chinese cities described in this thesis, it is not sufficient to take from western planning theories. Instead, one must endeavor to actualize localized theoretical innovation based on China's urbanization reality.

Compact urban development as the foundation of diversity for vitality

Compact urban development is in the scale of the plot. Compact urban development incorporates high-density and intensification, accessible public spaces and transportation, and diverse activities on the human scale. The aim of applying compact urban development in Guangzhou is the precondition for rich urban diversity, and urban vitality can come from urban diversity filtering by human needs. Thus, a link exists between the two, which may be summarized as more compact, more vitality, with diverse activities as both the result of compact and foundation of vitality. The extent of compact determines whether the diversity of activities is livable, while human needs determine whether the diversity of activities can form healthy and positive urban vitality. Therefore, in the following chapters, diverse activities are the crucial clues in this thesis to organize the design strategies, and the extent of the compact will be the principles to controlling the excellent urban form by studies of cases and related indicators.

Minimize the negative impacts of excessive compact

It is worth noting that the extent of compact in Guangzhou and other megacities in China is incomparable to most other cities, which has been named compact city.

This thesis focuses on how to increase the linkage between compact, diverse functional activities, and vitality and reduce the negative impacts in high-density urban spaces to highlight the benefits of compact urban form in terms of urban diversity and urban vitality enhancement; in China's central or non-central areas of large cities, the urban status quo of high-density and high FAR has essentially been formed, so it is pointless to focus solely on the increase of indicators but should minimize the negative impacts. For instance, the excessive building height brings higher congestion costs and fire risks, the tidal phenomenon of urban CBD vitality, the poor accessibility of residents to public space due to the distinctive edges, and insufficient cultural and sporting facilities, as shown in Zhejiang New Town, and other significant issues.

By exploring the compact urban development in China's urban space suitable for the existing high-density urban environment, sustainable urban development will be achieved through urban vitality as the benefit of diversity from compact urban development.

Chapter 3 Case Study: Existing Experience for Compact and Vitality

The city's compact urban development and vitality are reflected both in the physical urban and architectural spaces and in the psychological civic social relations. As concluded through the literature review in the last chapter, the characteristics of compact urban development involve high-density and highly accessible urban spaces, community spirit, and diverse and intensive activities. Vitality, on the other hand, is the vitality of aggregated people, spaces, and activities, which arises from the space needing satisfaction for the primary and higher needs of human life.

It is difficult to capture the rich meanings of compact and vitality in specific measures. Therefore, rather than analyzing what makes a city compact and vibrant through a fully quantitative study, this chapter examines some of the cities in the world that are recognized as compact and vibrant through analytical diagrams and verbal descriptions. This chapter aims to gain worldwide experiences that apply to Guangzhou’s development of a more compact and vibrant city central area. These experiences include the guidance and design of urban spatial forms, guidelines for social governance, etc.

The urban centers of established compact cities with well-known urban vitality- Hong Kong and Melbourne - are selected as the studied cases. Compact, diversity, activity, vitality, and even CAZ frequently appear in the design guidelines or local regulations.

From the structure of urban development to the allocation of functional activity centers, Melbourne has achieved compact at different scales. On the other hand, the space usage of buildings in Hong Kong is a creative exploration of a livable form in a high-density city. Therefore, their urban spatial forms and design guidelines are highly relevant.

Hong Kong and Melbourne represent two types of compact cities with vitality. The constraint of land use control is an endogenous factor in the development of compact cities, and the control of inefficient urban sprawl, improved public travel patterns, and environmental pollution are exogenous factors in promoting compact development. Compact cities that have been built in the world can be divided into three categories.

(a) (b) (c)

Fig. 3-1 Different categories of compact cities in the world

Hong Kong, Shenzhen, Singapore (Fig. 3-1(a)): This category is represented by large Asian cities with spatial resource constraints, large sparse and dense urban spaces, high intensity of development of functional nodes, and a high degree of mixing.

Paris, Melbourne, Vancouver (Fig. 3-1(b)): This category of cities is represented by large European cities formed before World War II, with carpeted urban buildings, little difference in building height, high overall density, and pleasant spatial scale.

Toyama, Tama, Portland (Fig. 3-1(c)): These cities are represented by the small and medium-sized cities and new towns formed after World War II, which are sparse and dense, intensive and efficient, and dynamic.

3.1 Melbourne

The official approach to strategic planning in Melbourne has evolved in stages. From 1922 to the latest round strategy of 2017, the Melbourne Metropolitan Strategic Plan has addressed three main themes (Table 3-1).

Table 3-1 History of Melbourne's planning

Year	Event
1922	Metropolitan Town Planning Commission is established
1929	report of the Metropolitan Town Planning Commission proposes a planning scheme to prevent 'misuse' of land and protect property values, highlighting traffic congestion, the distribution of recreational open space and haphazard intermingling of land uses
1954	first comprehensive planning scheme for the metropolitan area, prepared by the Melbourne and Metropolitan Board of Works (MMBW), introduces the concept of district business centers and focuses major retail activity on designated centers on the public transport system that also provide central locations for housing, transport, employment and community activity
1971	the MMBW report, Planning Policies for the Melbourne Metropolitan Region, introduces long-term conservation and development policies through growth corridor and green wedge principles, and contains outward growth to a limited number of areas on the edge of the city
1980	the MMBW's Metropolitan Strategy reinforces the 1954 policy on district centers, encourages development in existing areas, and concentrates housing, transport, employment and community facilities at highly accessible points
1983	new district center zones encourage office development in 14 centers and restrict it elsewhere
1987	Shaping Melbourne's Future reinforces the thrust of the 1980 Strategy
1995	Living Suburbs relaxes metropolitan wide planning direction and controls, for example, on green wedge boundaries and the hierarchy of activity centers, and devolves much decision-making to local level or on a case-by-case basis
2002	Melbourne 2030 planning for sustainable growth to manage growth and change across metropolitan Melbourne and the surrounding region. It emphasizes the city's interdependence with regional Victoria, to provide maximum benefit to the whole State. The core of Melbourne 2030 is 9 'directions' – or desired results – that a more compact city is the first the most impression direction
2014	Plan Melbourne 2017-2050 ensure Melbourne grows more sustainable, productive, and livable as its population approaches 8 million. The plan presented a vision for Melbourne as a global city of opportunity and choice and came up with 9 principles

First, the management of residential and population growth in new distant suburbs or outlying areas, such as predicting how much growth will occur and how that growth will fit with various aspects of service needs, and the missing middle is a creative way to enhance the efficiency of the low-density suburb. The second concerns the organization of established suburbs, where specialized sites have been found at different times and with different designations. Examples include the term activity centers, district centers, or nodes. They are centers of public and commercial services that enhance the accessibility of these suburban communities. Third, attention is paid to the scale and functional intensification of the central city. The central city was the starting point of urban development. Still, its function has changed as new activity centers have been built in fringe or distant suburbs, and some have moved away following the population change trend.

The Melbourne case study is followed by discussing the missing middle, activities centers, and controlling urban form in central Melbourne.

3.1.1 Evolving concept of compact city in Melbourne metropolitan planning

The concept of compactness in Melbourne metropolitan planning involves the introduction of the corridor as an axis of urban development in the urban structure in 1971 and the introduction of the activities center as a more detailed approach to compact city practice in the subsequent policies of 1981, 2002 and 2015.

The core of the 1981 strategic plan was to contain urban sprawl as much as possible by reducing the amount of land available for new residential development in both central Melbourne and the periphery and increasing the population in existing locations by allocating district centers among the whole of Melbourne. The policy was named urban consolidation and was refined through a series of policy documents that influenced the design and siting of high-density housing (Fig. 3-2).

Fig. 3-2 Plan of central Melbourne and district centers

Sources: Metropolitan Strategy Implementation, 1981

In the decade before 2001, much of the development was beyond the reach of the suburban rail system that had supported earlier growth. Concerns about the consequences of urban sprawl have been raised, including growing air pollution problems and poor access to public services in some new suburban settlements.

Growing awareness of the potential benefits of over-dispersed compact cities in transport, creative industry development, and improved accessibility to public services is influencing the debate on how to address the city problem. Therefore Melbourne 2030 proposes nine related strategies (Fig.3-3).

The first strategy for a more compact city proposes three specific implementation elements. First, build up activity centers to focus on high-quality development, activity, and living for the whole community (Fig.3-4). Second, broaden the base of activity in centers currently dominated by shopping to include a broader range of services over more extended hours and restrict out-of-center development. Third, locate a

substantial proportion of new housing in or close to activity centers and other strategic redevelopment sites that offer good access to services and transport.

Direction 1. A more compact city

Direction 2. Better management of metropolitan growth

Direction 3. Networks with the regional cities

Direction 4. A more prosperous city

Direction 5. A great place to be

Direction 6. A fairer city

Direction 7. A greener city

Direction 8. Better transport links

Fig. 3-3 Directions of Melbourne 2030

Sources: Melbourne 2030, 2002

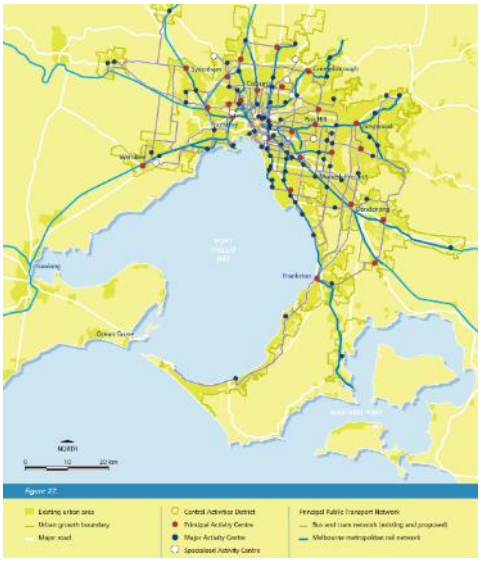


Fig. 3-4 Activities centers plan

Sources: Melbourne 2030, 2002

Fig. 3-5 Principles of Plan Melbourne

Sources: Plan Melbourne 2017-2050, 2014

After several feedbacks on Melbourne 2030, coupled with the change of ruling party, etc. Plan Melbourne 2017 – 2050 as a new metropolitan planning strategy was

developed to define the future shape of Melbourne over the next 35 years (Fig. 3-5). The term compact city does not appear explicitly, but the fundamental concepts of compact cities such as activity center, 20min communities, mixed land use, and transport diversification appear separately.

In terms of economic measures, Plan Melbourne proposes to expand the boundary of the central city to make Melbourne central city the most significant business and residential center in Australia through urban regeneration and the allocation of the National Employment and Innovation Cluster around the central city (Fig. 3-6), which can be considered as transforming the Racecourse a CAZ to provide more vitality for the surrounding CBDs.

In terms of community, the 20-minute neighborhood planning concept is used throughout the community section in Plan Melbourne, which promotes the idea that residents' daily needs, including stores, schools, hospitals, parks, and recreation facilities, can be met within a 20-minute commute by walking, biking, or public transportation (Fig. 3-7).

In continuation with Melbourne 2030, Plan Melbourne continues the construction of activity centers as Action 9, 10, and 11 (Fig. 3-8); Plan Melbourne transforms the term activity center into activity center zone, which will serve as the backbone of Melbourne's evolution from a monocentric to a polycentric city.

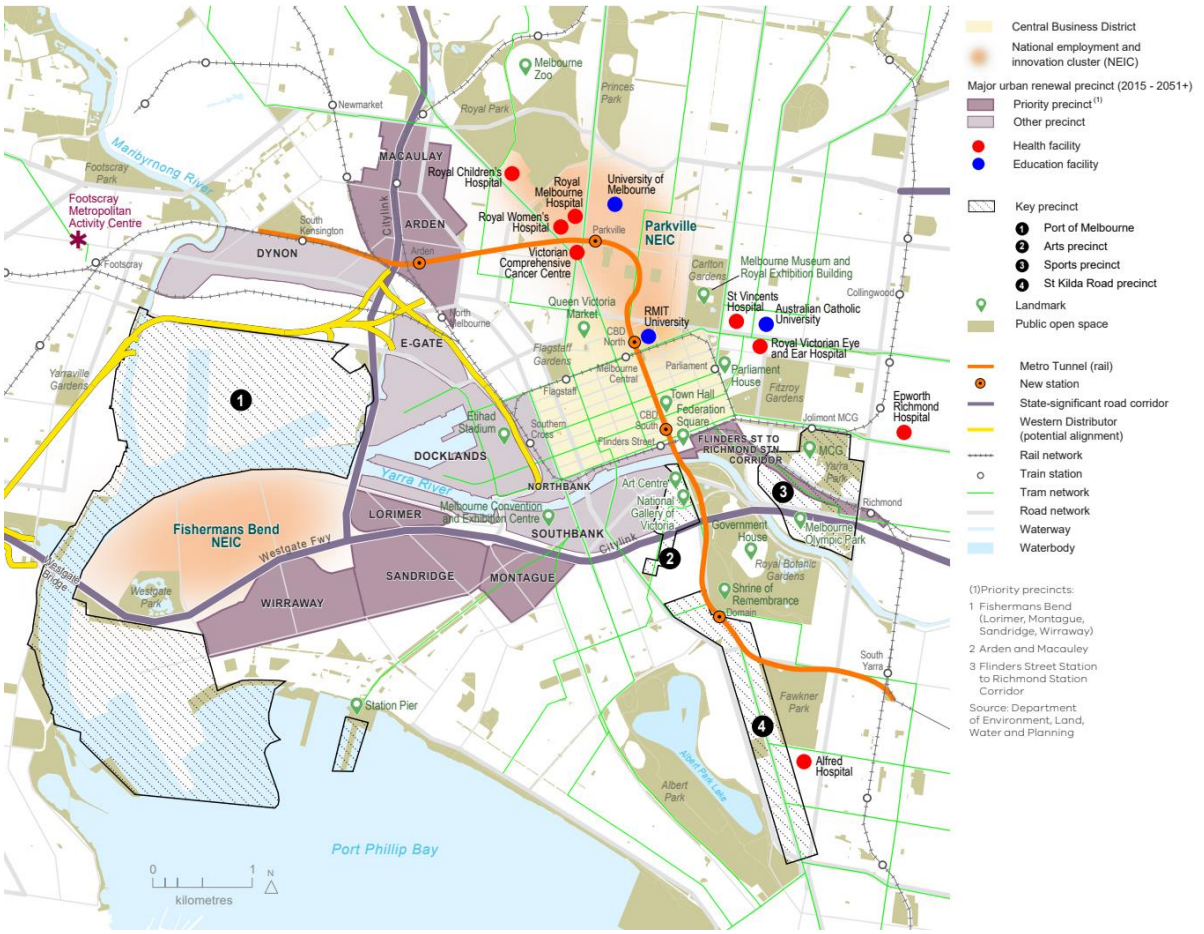


Fig. 3-6 Broaden Melbourne's central city

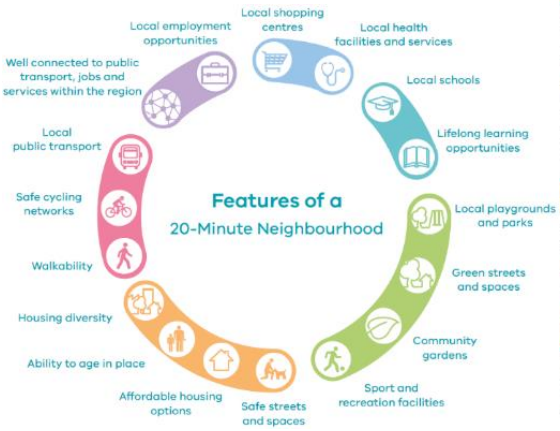


Fig. 3-7 Features of a 20-minute neighborhood

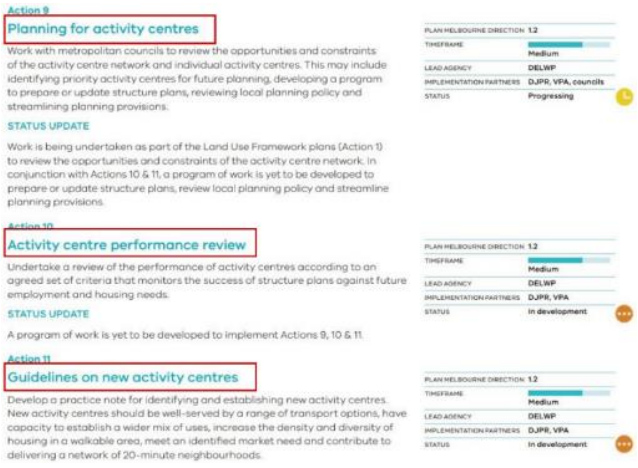


Fig. 3-8 Actions related to activity centers

Sources: Plan Melbourne 2017-2050, 2014

3.1.2 Activity centers

The concept of the activity center, or activity zone, is essentially one of functional intensification and mixed use of land. The central activity district established in Melbourne's central city is, to some extent, the CAZ of Melbourne version.

To manage population growth sustainably, Melbourne 2030 encourages new development at activity centers near current infrastructure as the key platform of a 'multi-center' structure for metropolitan Melbourne where people can enjoy the benefits of living closer to work with less congestion on roads and public transport networks.

Activity centers provide the focus for services, employment, and social interaction in cities and towns. They are where people shop, work, meet, relax and live. Usually well-served by public transport, they range in size and intensity of use from local neighborhood strip centers to traditional universities and major regional malls. They are not just shopping centers; they are multifunctional.

Activity centers attract many people and generate significant trips in metropolitan Melbourne. Because of the vital role activity centers play in everyday urban life, their planning is always essential. Since the 1950s, the activity center policy has been a feature of urban planning in Victoria. Essentially, this is a matter of general clustering – rather than dispersing – uses and activities to derive social, environmental, and economic benefits for the community and business.

Types of activity centers in Melbourne

Metropolitan Melbourne has a network of around 1,000 activity centers of various types and sizes. They are focal points for the community and meet many needs.

There are five types of activity centers (Fig.3-9):

Central Activities Districts – It should be the most important center of activity with the most incredible variety of uses and the most intense concentration of development. The Central Activities Districts include Melbourne's Central City, which contains the Central Business District, Docklands, the Sports and Entertainment Precinct, the Arts

Precinct, and Southbank. Melbourne will continue to be the preferred location for activities that have State or national significance. The designation of an additional six Central Activities Districts in the future for a national employment cluster led by 6 industries will allow Melbourne to move away from one large inner center (focused around the Central Business District) to several larger centers, like mini-CBDs in the suburbs, and will be the focus of a substantial proportion of future employment growth and public investment.

Principal Activity Centers – These are large centers with a mix of activities that are well served by public transport (e.g., Coburg, Preston, Knox City, Werribee). The size and location of Principal Activity Centers mean they have a significant role to play as a focus for community activity, services, and investment.

Major Activity Centers – These are similar to Principal Activity Centers but serve smaller catchment areas. They provide additional scope to accommodate ongoing investment and change in retail, office, community, service, and residential markets.

Specialized Activity Centers – These are essential economic precincts (e.g., Monash University/Health Research Precinct, Melbourne Airport) that provide a mix of economic activities that generate high work and visitor trips. Their planning and development should reinforce their specialized economic function.

Neighborhood Activity Centers – These centers have a limited mix of uses meeting local needs and are dominated by small businesses and shops and limited community services. They offer some local convenience services and public transport provisions but are not necessarily located on the Principal Public Transport Network (PPTN).

Based on Melbourne 2030's principles for developing urban design guidelines, the design of activity centers should follow some principles. First, an activity center should improve community safety by promoting public space surveillance, 'active' ground floors facing public spaces, and identifying public and private spaces. Second, a development that supports convenient pedestrian access and amenity should be

encouraged. Third, compatible land uses that are mixed to promote vitality and variety should be offered. Fourth, activity centers are open, accessible, and welcoming to all and are integrated with the surrounding area. The last principle is to promote a focus on public transport, with developments demonstrating the ease of access and community safety.

These concerns are applied at every type of activity center in Melbourne so that the Racecourse can be considered as part of the Central Activities Districts or a separate Principal Activity center in a compact city, and these principles can be used as the most basic guidelines for designing a compact and vibrant CAZ in the Racecourse.

A fictitious Principal Activity Center in a real place

In 2010, the Department of Planning and Community Development of Melbourne designed a fictitious Principal Activity Center (PAC) for the region in Ruby Town. It published a guideline for other activity centers' design.

Ruby Town has a unique position in the metropolitan area, is located on a public transport junction, adjacent to significant parklands and a river, and hosting a wide range of retail, commercial, educational and civic activities. Based on the analysis of regional role and context, the fictitious vision for Ruby Town is to be a place that sustains and engages people and maximizes opportunities and choices for living, working, and recreation.

The final designed framework of PAC identifies precincts (or sub-areas) and development sites that require more detailed planning, along with critical elements or themes. The objectives, strategies, and implementation plan for each essential component or theme can refer to the whole of the activity center and inform the individual precinct plans (Fig. 3-10).

The plan provides a complex public transportation network, with land uses divided according to different zoning districts and specific building forms.

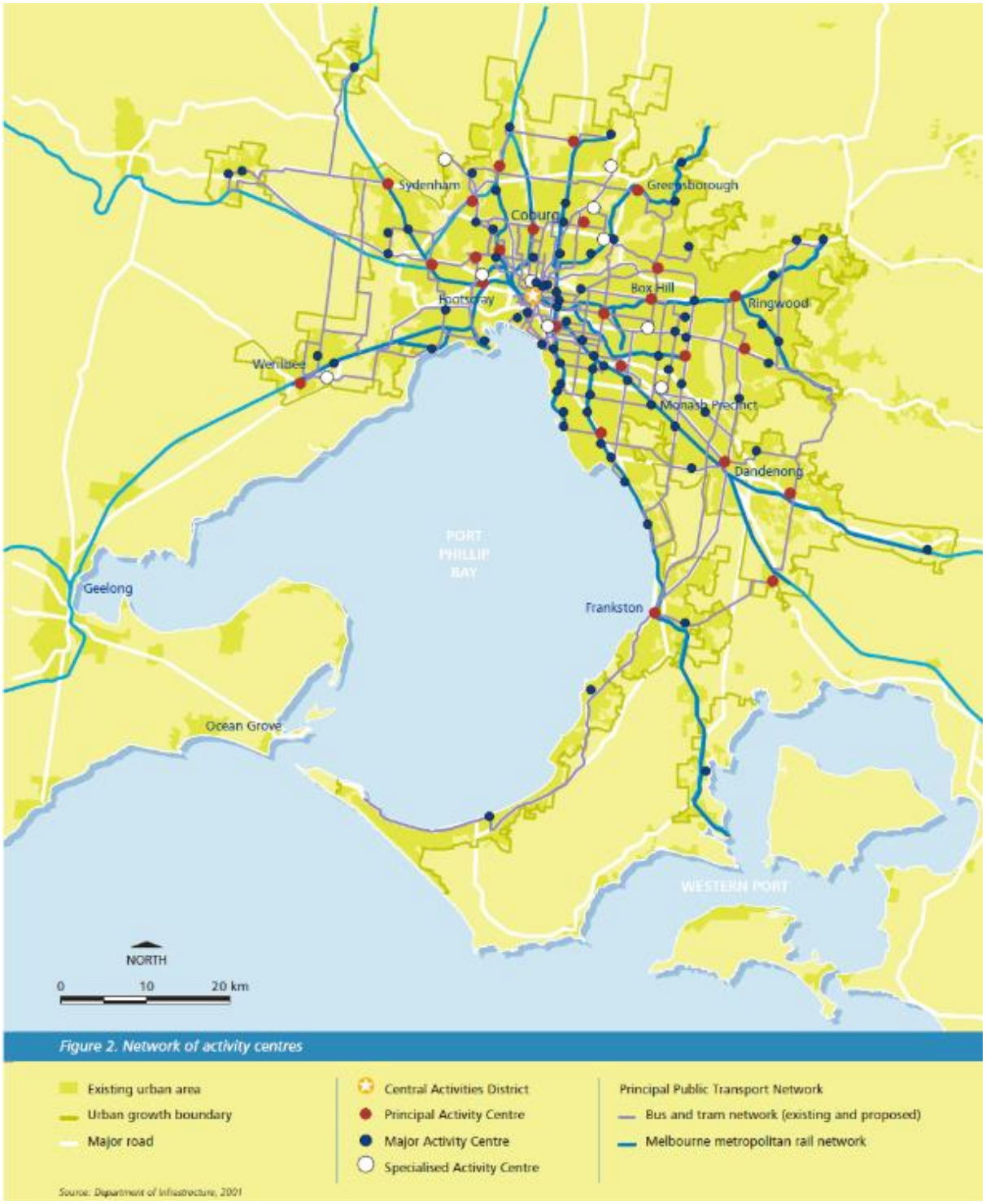


Fig. 3-9 Networks of activity centers

Sources: Melbourne 2030, 2002

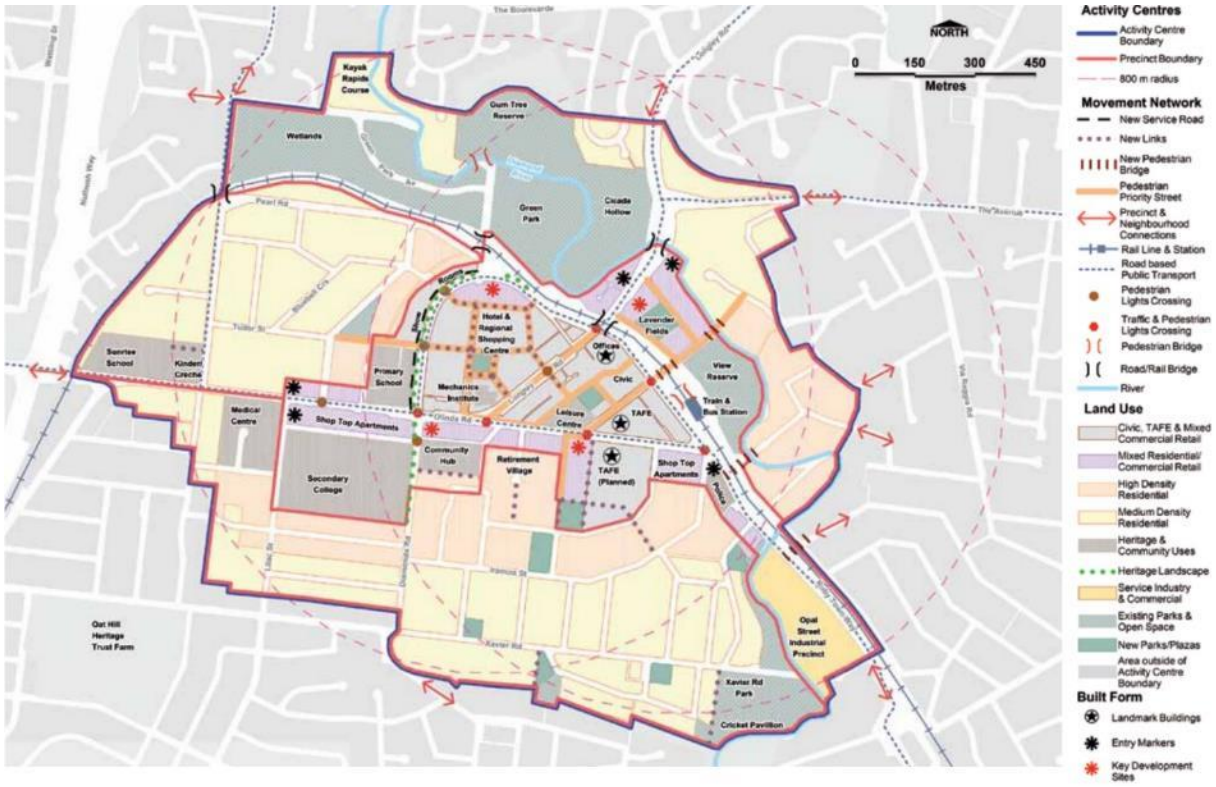


Fig. 3-10 Development Framework Plan – Activity, Land Use & Built Form

Sources: Ruby Town Structure Plan, 2010

At the regional scale, around a central area of high-density mixed commercial retail space, high-density and medium-density residential regions develop outwards in sequence. The public services of the community act as a buffer between the central mixed commercial area and the residential area. Regarding building scale, landmark buildings, entry markers, and critical development sites will have detailed design requirements such as preferred maximum height, including basement, design element height, and setbacks (Fig. 3-11).

Similar density control measures for the central area and the periphery of the central area in Melbourne in will be discussed in the following section.

Sub Precinct	Preferred Maximum Height including Basement	Design Element Height	Setbacks
TAFE (1A)	36m	None Specified	4.0m to front podium edge from front boundary
Olinda Road (1B)	21m	None Specified	3.0m to front podium edge from front boundary
Ruby Town Hotel & Shopping Centre (1C)	36m	8.0m above maximum height	3.0m to front podium edge from front boundary
Opal Street Industrial Precinct (1D)	None Specified	None Specified	None Specified

Fig. 3-11 Design requirements for built form

3.1.3 The missing middle

In cities with high densities and high levels of intensification, appropriately controlled and complementary medium density and medium intensification plots can better focus on the human scale, mitigate the negative effects of high-density and accommodate a greater variety of activities through a diversity of building forms in plots. The theoretical discussion and practice development of medium density and medium intensification in China is discussed further in Chapter 4. This section shows the initial concept of the missing middle in the West as an introduction.

The missing middle was coined in 2010 by American architect Daniel Parolek to define a variety of multi-family or clustered dwelling forms compatible with single-family or transitional neighborhoods [73]. The purpose of missing middle housing is to meet the desire for walkable areas, adapt to shifting populations, and supply housing at varying

[73] Parolek D G. Missing Middle Housing: Thinking Big and Building Small to Respond to Today's Housing Crisis [M]. Washington: Island Press, 2020.

price points. The middle is low to medium scale and intensity and often geographically linked with the middle ring suburbs. The notion has become increasingly attractive to Australian state governments as a potentially sensitive form of densification.

For a broader discussion on the block scale, is there something between the detached, suburban building and the urban high-rise? In the case of Ruby Town, there are middle-density residences outside the central area, meaning the middle can be understood as a pattern of block organization. Interestingly, low and high densities can make for isolated environments [74]. Medium-rise blocks can deliver both high-density and human scale at the same time, better connecting people to the ground and each other.

In the next chapter on the design strategy for compact and vibrant city central area in Guangzhou, the accurate definition of 'the middle' will be defined through quantitative indicators that efficiently control the form of blocks.

3.1.4 Central city

The control of the urban form of Melbourne's central city through the indicators is a valuable reference for considering how to control the urban form of the Racecourse as a central area.

Over the past 20 years, Melbourne has experienced significant growth in the number and density of new developments in the central city. This challenges the urban amenity that drives Melbourne's renowned livability and the efficient operation of the planning process that facilitates it.

In September 2015, the Minister for Planning announced a review of Melbourne's central city building form and introduced interim controls to manage development outcomes. The review was underway, and permanent controls were being developed. The new controls apply to Melbourne's central city, including the Hoddle Grid and

[74] David S. Soft City: Building Density for Everyday Life [M]. Washington: Island Press, 2019.

Southbank (Fig. 3-13), and bring Melbourne up to speed with planning rules used in cities worldwide, such as New York, Singapore, Vancouver, and Sydney.

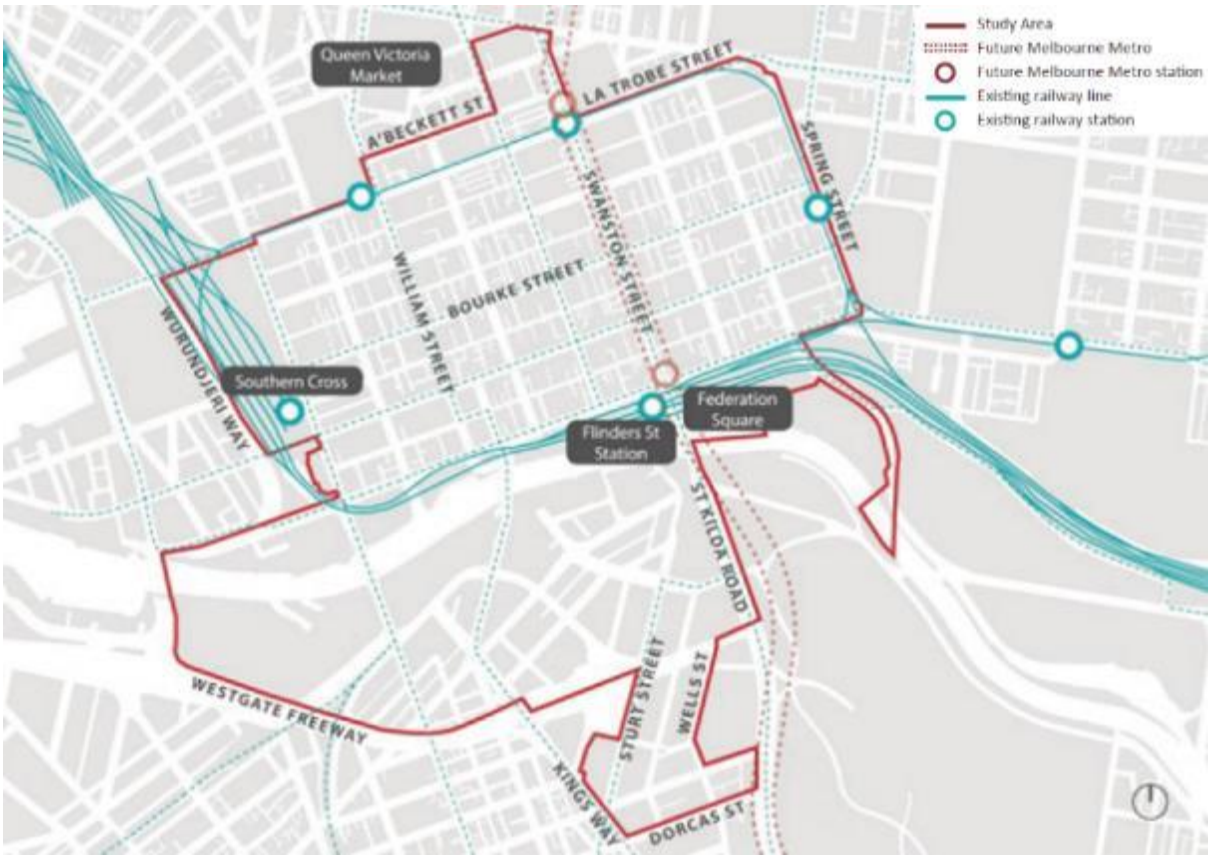


Fig. 3-13 Central city area

Sources: Melbourne Amendment C270, 2016

Floor area ratio with public benefits

The central city will continue to offer a competitive FAR of 18:1, which is more generous than most international cities. A reasonable base floor area ratio of 18: 1, with discretion to agree to a floor area uplift bonus if all relevant built form parameters are met and an appropriate public benefit is provided to share added value (Fig.3-14). Floor area uplift is a kind of compensation for publicity for the high-rise building and dense city.

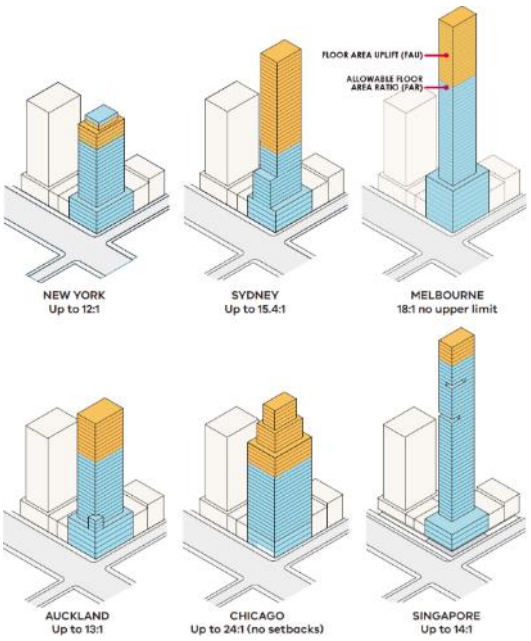


Fig. 3-14 Floor area uplift on base FAR

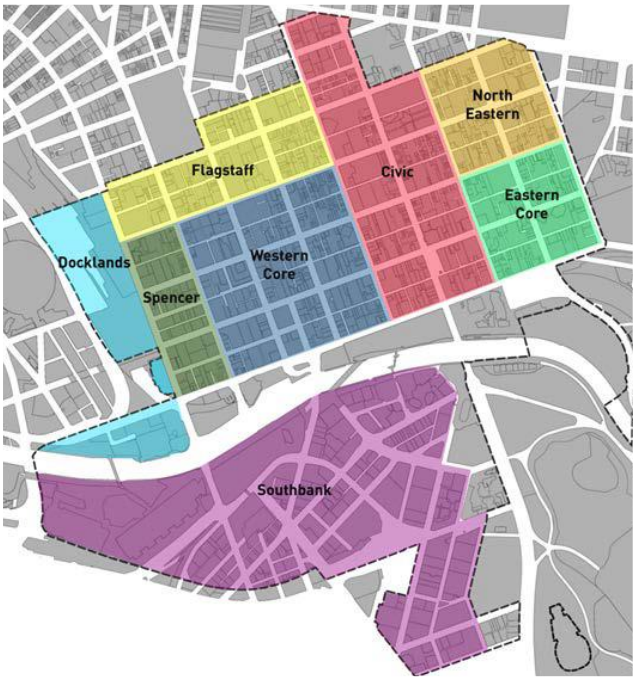


Fig. 3-15 GRV precincts map

Sources: Melbourne Amendment C270, 2016

The value of the extra floor area will be transparently calculated, and the public benefits will be publicly reported and measured as 10% of the gross realization value per square meter (GRV/m^2) for all additional floor areas above the allowable 18:1 floor area ratio.

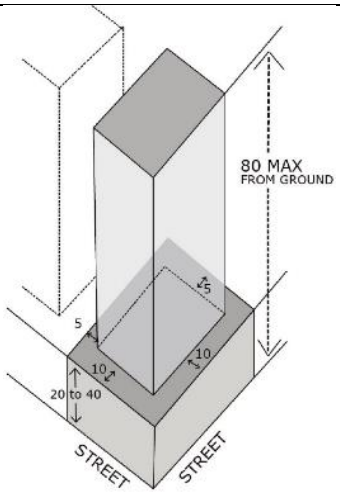
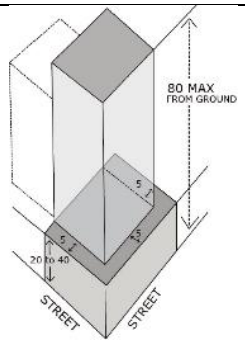
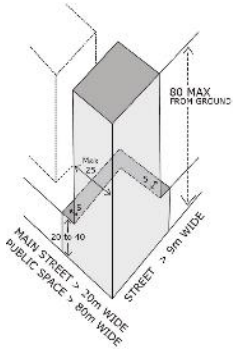
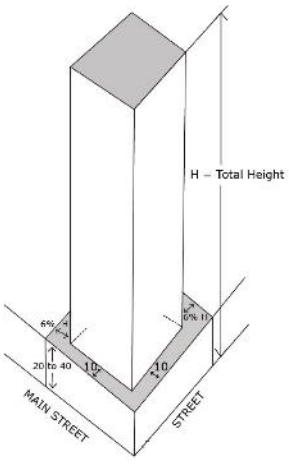
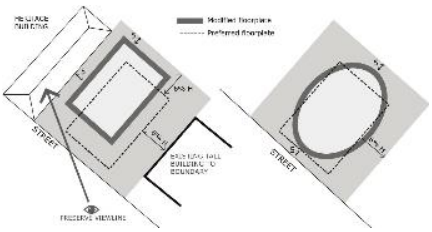
The value of any Floor Area Uplift depends on the corresponding uses and the precinct in which the development is located (Fig.3-15). According to the data from SGS in 2016, among these precincts, the Eastern Core takes the highest GRV of $17,000 per square meter for retail and $9,000 per square meter for hospitality, commercial and residential, while the Southbank takes the lowest GRV for $12,000 per square meter for retail, and $6, 500 per square meter for hospitality, commercial and residential.

Fixed tower setbacks with defined flexibility

All pre-existing height controls have been maintained, and the towers setback is divided into different cases according to whether its height exceeds 80 meters. (Table. 3-2)

Table. 3-2 Fixed tower setback according to total height

Source: Melbourne Amendment C270, 2016

Total height	Preferred requirement	Modified requirement
Towers up to 80 meters	 Street setbacks = 10m minimum Side & rear setbacks= 5m minimum	 Building to one boundary Street setbacks = 5m minimum  Building to corner or public space
Towers greater than 80 meters	 Street setbacks = 10m minimum Side & rear setbacks = 6% total height minimum	 No increase in floor plate area Street setback = 5m minimum Side or rear setback = 5m minimum

Under the above new controls, the simulation of development potential in Melbourne's central city shows a more humanized, compact, and vibrant form. Take Bourke Street and Spencer Street in Hoddle Grid as a sample area; the new controls bring a more flexible form (Fig. 3-16).

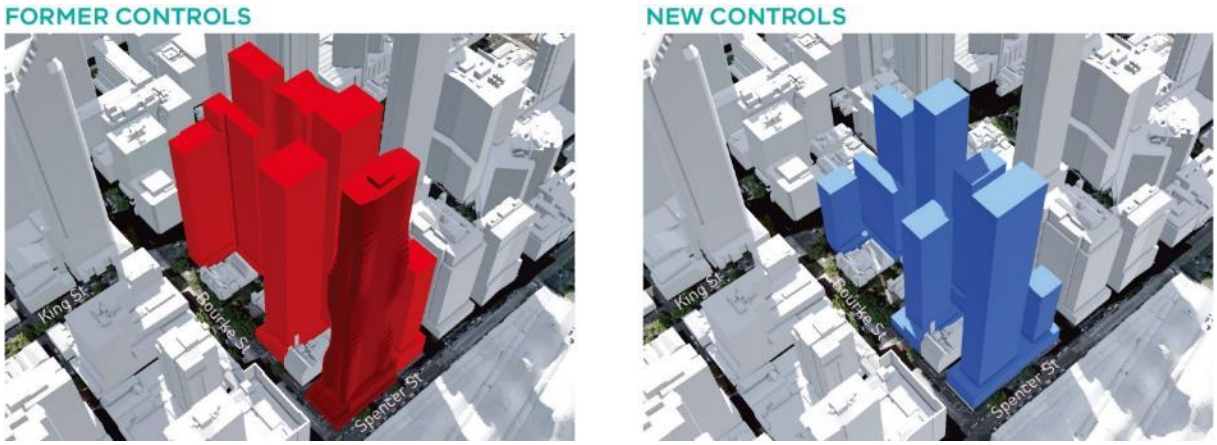


Fig. 3-16 New form under the new controls of the sample area

Sources: Melbourne Amendment C270, 2016

As for the function, the central city is to provide for the continued growth of knowledge-intensive and high-skilled firms while continuing to be a major area for tourism, retail, residential, entertainment, sporting, and cultural activities.

3.1.5 Melbourne experience

In the Melbourne experience, the three key measures this section focuses on have clear implications for developing a more compact and vibrant city center (Fig.3-17).

The activity center, as a mixed-use central area complex, is intended to attract and engage neighborhood residents through a concentration of activities and functions. Although there may be some negative growth in the surrounding area due to not fully meeting the needs of the citizens, the activity center already clearly direct to the CAZ concept used in this thesis, and the principal requirement can even be seen as a guideline for the design.

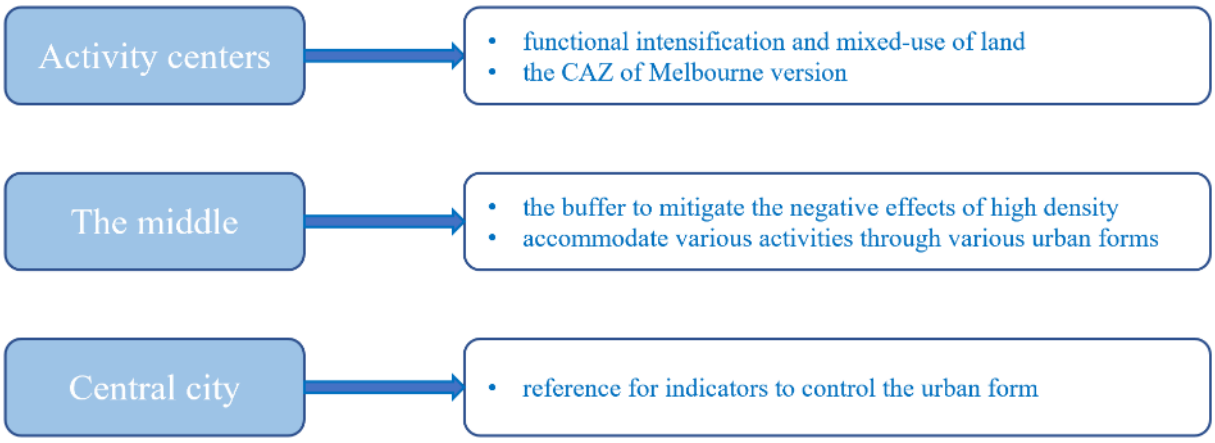


Fig. 3-17 Melbourne experience for the Racecourse

Ruby town, for example, offers a very reasonable diversity in land use which can be extended to the middle, i.e., the central activity center is highly intensive, while the public services and housing at the periphery of the center change from high-density to medium density. Medium density is a more humane buffer between high and low density and relief in a complete high-density environment. The medium density of Melbourne cannot be directly transposed to the Racecourse in Guangzhou due to the different land-use status and application targets. However, it is still a good concept for a compact city.

Finally, the central city's urban form controlling regulations, including compensation for public benefit and flexible control of FAR, height, and setbacks, have detailed implications for developing a compact and vibrant central area in Guangzhou.

3.2 Hongkong

The overlay of Hong Kong's hyper-density urban form and high population density has resulted in a unique urban landscape different from any other metropolis in the world, where the 24-hour operation and the hustle and bustle make the city full of interest and diversity.

In the conception of citizens and scholars, high-density means congestion, constraint, tension, and stress. High-density cities often point to unpleasant imagery of urban life

with overloaded land use, exhaustive exploitation of resources, and competition between public and private spaces. But the process of urbanization also proceeds inexorably. Every construction in Hong Kong is an experiment in unconventional urban possibilities by various urban forces in a hyper density urban space. These experiments are particular experiences in the creative treatment of high-density urban construction. The future Racecourse requires some imagination of more compact and vitality in terms of detailed knowledge.

This section will analyze how Hong Kong retains urban amenity and livability in hyper density, starting from the block scale of zoned density and mixed land use and then returning to how detailed building form can provide a more vibrant urban life at the human scale.

3.2.1 Zoned density and the relative middle

Zoned density in Hong Kong is a means to effectively control high-density and building height. Its purpose is to alleviate the negative impact of high-density on the urban environment and natural environment. This has also been practiced in China for a long time. Although there are numerical differences in density, building height and FAR between Hong Kong and Melbourne, both have high, medium, and low numerical value levels. Therefore, the concept of the Middle is relative and determined according to different urban contexts.

Hong Kong has adopted the basic principle of striking a balance between the economic benefits of land and paying attention to the protection and cultivation of the natural environment to address the acute conflict between people and land and strictly controlling the available area for urban development should not exceed 24% of the land in Hong Kong.

Table 3-3 Four density zoning of Hongkong

Density zoning	Maximum FAR		General building height	Maximum upper cover area		Greenery coverage
	residence	industry		residence	industry	
Zone 1	6.5/7.5/8.0/9.0/10.0	9.5	17 floors and above	30%-40%	100%	Public housing ⩾ 30%; no requirement for others
Zone 2	5/6	8.0	17 floors and above	30%	100%	
Zone 3	3.6	5.0	12 floors	20%	40%-60%	
Zone 4	0.8	1.6/2.5	Low floor	-	40%-60%	

Due to limited land resources, the development will inevitably result in a dense urban development with very little space for greening and recreation. Based on the rail transportation service coverage level, Hong Kong has divided the major metropolitan areas and new towns into four types of development density zoning [75] (Table 3-3, Fig.3-18). Among them, the fourth density zone is a particular constraint area; the third density zone is a severely infrastructure-constrained area; the first density zone and the second density zone are major construction areas, and the building height in these two zones is generally 17 floors, and above, the FAR can reach 5.0~10.0, the residential building density is between 30%~40%, and the industrial building density can reach 100%. The green coverage is only required for public housing (⩾ 30%), which is in line with the intuitive imagery of hyper density construction in Hong Kong cities.

[75] Zheng D G, Dong S M, Lin C H. The Necessity and Control Strategy of “Medium Density” in Metropolis [J]. Urban Planning International, 2021, 36(04):1-9.

Due to land resource constraints, Hong Kong has adopted an extremely sparse and dense building pattern to protect a certain proportion of ecological and open space. But the hyper rise, hyper FAR, and hyper density construction approach within the city also poses considerable safety, social, and energy consumption issues. Comparing the empirical values of density in the current study, sites with FAR up to 5.0 and above in Hong Kong greatly need high-capacity public transport, which also leads to higher commuting energy consumption. Building heights are concentrated above 17 floors, resulting in high building energy consumption and fire safety hazards. At the same time, the lack of control over open space ratio in Hong Kong is far from the 60% open space ratio in New York, 50% in Tokyo, and 100% in Singapore, resulting in a lower level of comfort for people living. It is also found that many high-rise residential developments hinder ventilation, inhibit natural cooling by convection, exacerbate the heat island effect, and pollute streets and public spaces with dust from buildings and wind tunnels, as well as car exhaust. The density of buildings also reduces natural light on roads, streets, and elsewhere, and a severe lack of open space[76]. Complete high-density is not the ideal direction for urban development.

[76] Zheng Y S, Shi Y, Ren C, Wu E R. Urban Ventilation Strategies for Micro Climate Improvement in Subtropical High-density Cities: A Case Study of Tai Po Market in Hong Kong [J]. Urban Planning International,2016,31(05):68-75.

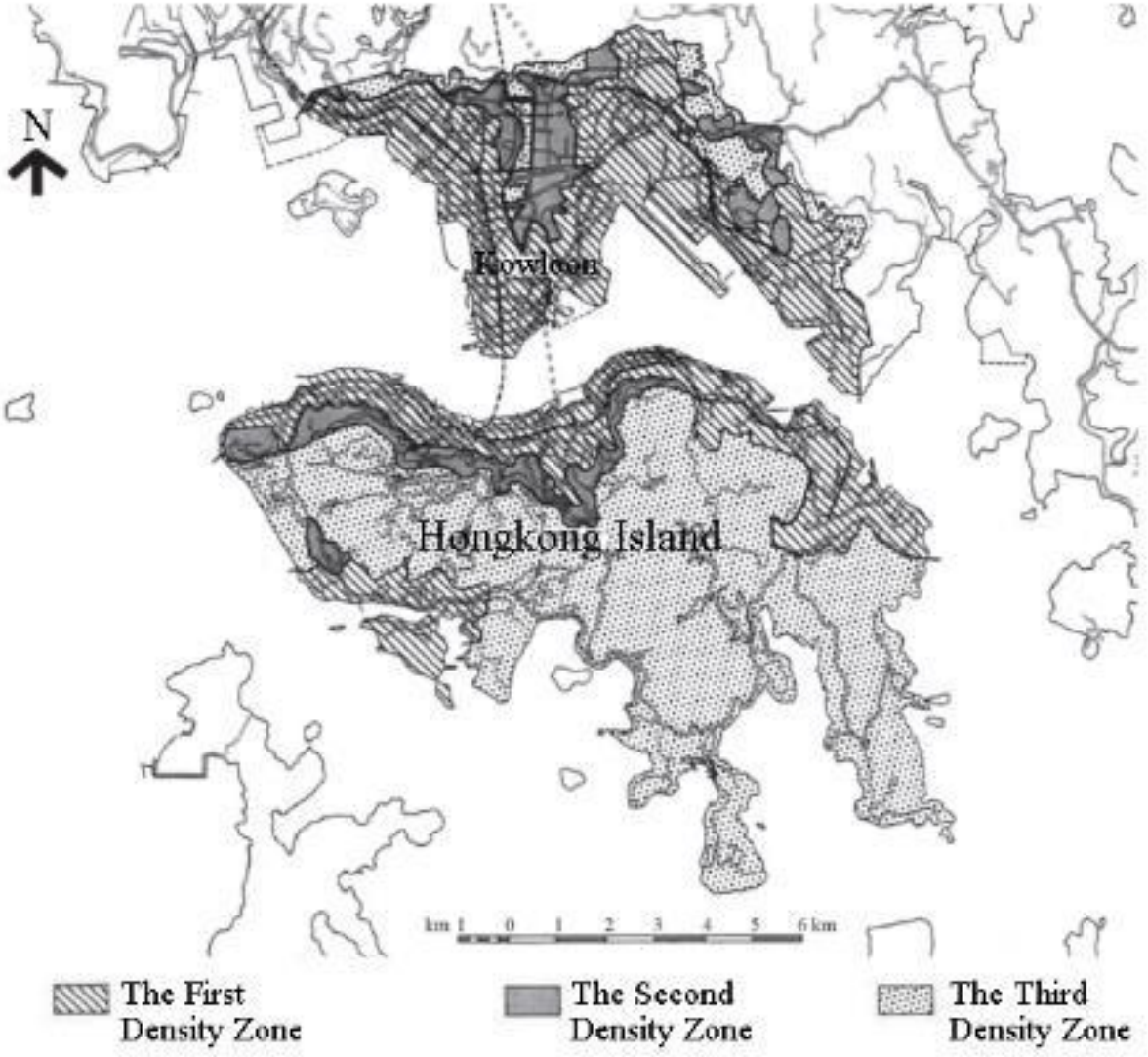


Fig. 3-18 Density zoning of Hongkong

Sources: Hong Kong Planning Standards and Guidelines, 2019

3.2.2 Mixed land use

Hong Kong's planning guidelines for the mixed-use of urban land have long been cited as an example, and these guidelines are concentrated in Hong Kong's statutory plan system, which is in line with the British local planning system and is a legally effective control system that has been formed in conjunction with Hong Kong's urban characteristics. The mixed-use of land in Hong Kong is guided in two main ways.

Each land use has an inherently compatible and mixed character

Table 3-4 Notes on Business Purpose of Hongkong Statutory

Sources: https://www.pland.gov.hk/pland_sc/tech_doc/hkpsg/full/

Business	
The first column:	**The second column:**
Frequently permitted uses	**The application must be made to the Town Planning Board for use that may be approved with or without conditions**
commercial bath/massage parlor	studio, television studio and/or film studio
canteen	stratified housing
educational institution	government refuses collection points
exhibition or conference hall	hospital
government Use (not otherwise specified)	housing (other than renovation of New Territories exempted houses or replacement of existing domestic buildings by New Territories exempted houses as permitted under the explanatory page of the Notes)
institutional use (not otherwise specified)	MTR ventilation towers and/or other structures above road surface (other than entrance)
library	gas station
street market	accommodation institution
off-track betting station	
office	
entertainment venues	
leisure and sports venues	
private club	
government clinics	
public toilet facilities	
bus terminal or station	
public utilities installation	
public carparks (not container vehicles)	
recyclable material recovery center	
religious institutions	

village committee offices
school
shops and service industries
social welfare facilities
training center
utility installations for the private
wholesale industry

Without the medium and detailed categories specified in the National Standards of Mainland China, Hong Kong's statutory plan system restricts land uses by defining two detailed types for each use, which are frequently permitted subject to prior application to the Town Planning Board and may be permitted with or without conditions (Table 3-4). Therefore, in contrast to the National Standards of Mainland China, which adopts one color for one use to satisfy one functional need and is exclusive, each type of use color in Hong Kong defines the planning intention of one dominant use, which is highly compatible and mixed. This flexible planning intention can not only significantly enhance the urban vitality and increase the market value of land but also increase planning flexibility and reduce the administrative resources consumption of administrative permit applications to change land functions.

Land of integrated development as a type to maximize the flexibility of the land use

According to the Hong Kong Statutory Plan Notes, uses within the land of integrated development are subject to application to the Town Planning Board for uses that may be permitted with or without conditions, and there is flexibility and scope for developers to apply for a mix of up to 30 different land uses. It covers a combination of development, redevelopment for residential or commercial uses, and the provision of open space and other ancillary facilities. Due to various environmental, traffic, infrastructural constraints, and other limitations, the land of integrated development is

formed to permit adequate planning control over the mix, scale, design, and layout of the development.

Statutory plans of Hong Kong are renowned for openness and flexibility in planning and implementation, and mixed-use is the result of this flexibility. The openness is concentrated in the textual annotations of the corresponding plans, as the plans only provide rough functional zoning of the land, with a specific list of permitted development functions in the text for each type of functional zone to guide construction. There are two main categories of facilities listed in the table - frequently permitted and subject to approval. For example, the construction of libraries, retail businesses, schools, etc., in addition to residential, is frequently permitted in the land of residence. Not only does the wide range of uses covered in the table allow for selective management and mixed-use, but completed buildings can also apply for mixed-use by the table. Although the Hong Kong Statutory Plans allow for a high degree of planning adaptability, the high degree of uncertainty about the market freedom and effects of construction existing in the planning and implementation system makes planning making and management implementation potentially more difficult.

3.2.3 Urban form in hyper density

High-density does not necessarily point to negative impacts; at least high-density urban environments offer convenience, efficiency, and concentration of resources that are not available at low density[77]. This section focuses on relations between buildings of hybridization and coexistence, efficient and convenient urban transportation such as overpasses and subways, and urban motifs represented by residence plans and urban grid.

Hybridization and coexist

[77] Zhang W P. Invisible Logic: Hongkong, as Asian Culture of Congestion [M].Nanjing: Southeast University Press, 2009(05).

There are six approaches to coexisting in detailed building form relationships, which can be found in Lan Kwai Fong as representative examples, containing countless small bars and stores (Fig. 3-19). This is relevant to realizing nighttime vitality in CAZ through gathering bars and other retail stores.

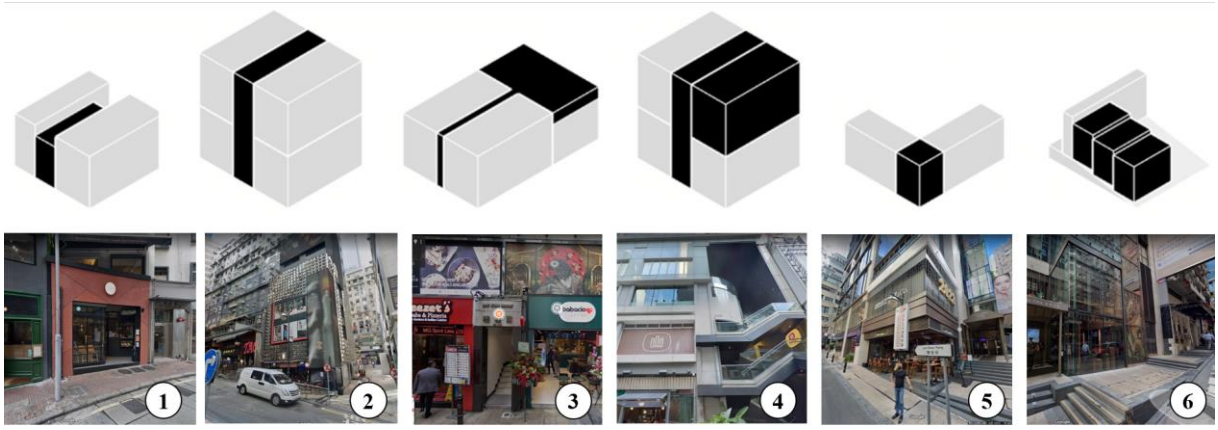


Fig. 3-19 Types of coexist in Hongkong

Sources: Google Map and Zhang, 2009

The coexistence of the building is due to the overcrowding along the facade face to the street and, thus, the need to seek space backward and upwards. For example, the bars are left with only one entrance along the street facade and access to the main space through aisles that lead horizontally to the backyard or vertically to the second floor.

The surroundings infect the first type of hybridization with proximity brought by high-density so that the properties of the buildings are no longer stable and specific but are combined by functionally superimposing. For example, the Kau Yan School in Sai Wan is both a podium of a high-rise and a church school influenced by the nearby church. Another similar hybridization is to ignore the influence of the surroundings, where buildings of different eras maintain different styles and evolve together in a collage. For example, along the lifted highway parallel with the coast of Causeway Bay, there is a mix of grand high-rise office buildings and dilapidated high-rise residential buildings (Fig. 3-20). This is a common scene in Asian cities.

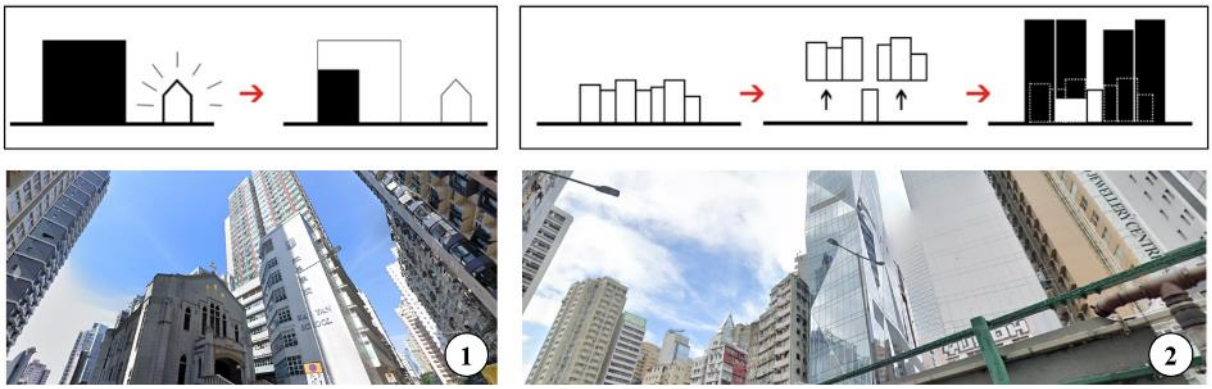


Fig. 3-20 Hybridization of infection and evolution in Hongkong

Sources: Google Map and Zhang, 2009

The second type of hybridization can be named insertion, such as a metro station in a brand store. The metro exit is right in the flagship store in Central, and the commercial makes the visiting route go through their own space. This can be a perfect combination of infrastructure and commerce that use the long distance exit path to create maximum meeting points for all the stores (Fig. 3-21).

Stacking as the third type of hybridization means the programs are mixed on basic principles of efficiency and benefit. The standard logic loses its effect in the high-density condition, one of the typical housing blocks in TsuenWan; its uniqueness is represented by the condensing of the community in one building block: the residence, the parking, and the commercial are all above the ground, stacking on top of each other. It is also the superimposition of 3 types of spatial mode: juxtaposition, rhizomatic, and spiral (Fig. 3-22).

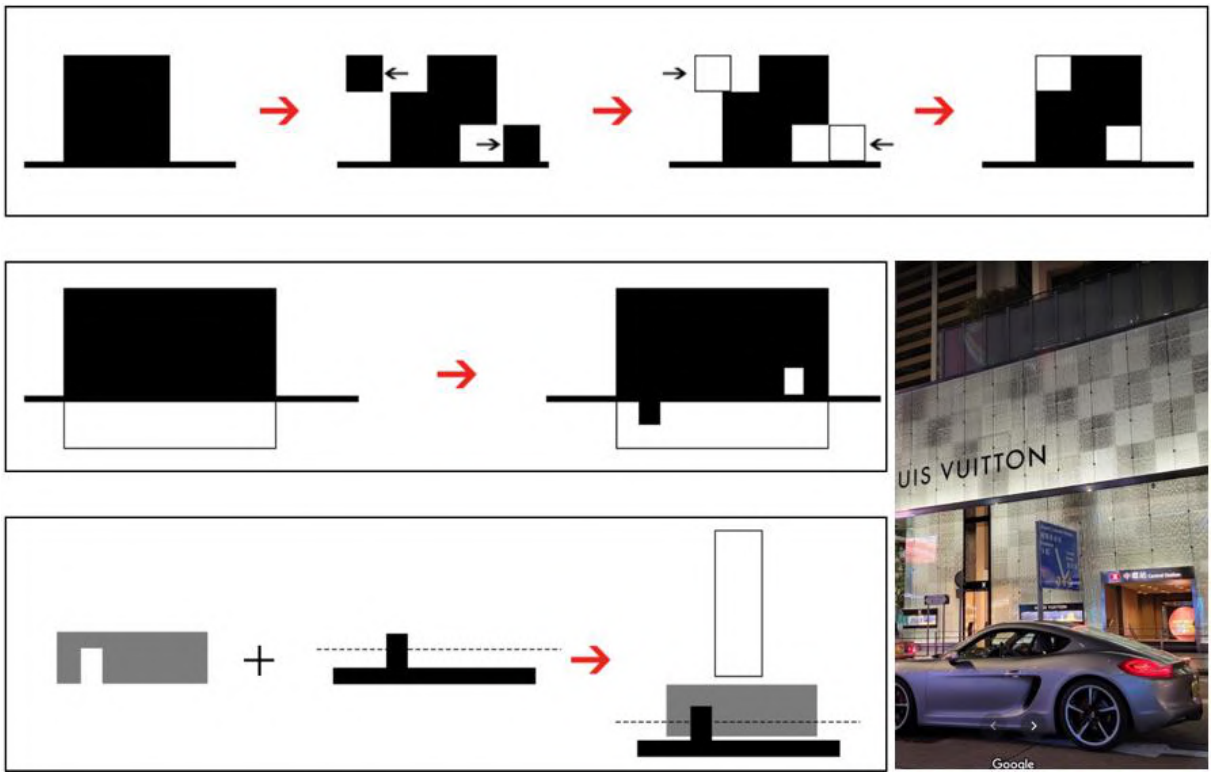


Fig. 3-21 Hybridization of insertion in Hongkong

Sources: Google Map and Zhang, 2009

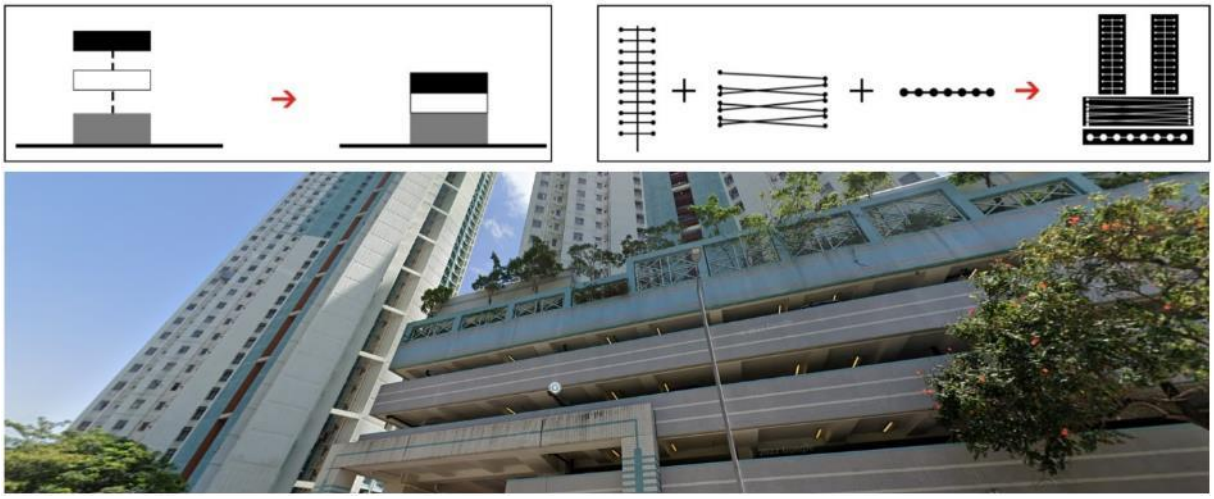


Fig. 3-22 Hybridization of stacking in Hongkong

Sources: Google Map and Zhang, 2009

Transportation

The critical factor for a high-density city to run smoothly is the completeness of highly efficient infrastructure. While the huge population condenses and the density increases

sharply, all kinds of flows (pedestrians, vehicles, objects, information) will have to arrive, transport, and evacuate as quickly as possible. The aggregation of flows will also lead to conflict between different routes. The limits in the capacity of the transportation joints exacerbate the conflicts. The highly efficient infrastructure must function multiply, sort out, divide and transmit the flows; to make the city organs work in harmony without interference from each other.

The transportation layers in Hongkong are inspired by the density, expanding simultaneously upward and downward. The terrace established by the overpasses separates the city users into two worlds according to the speed.

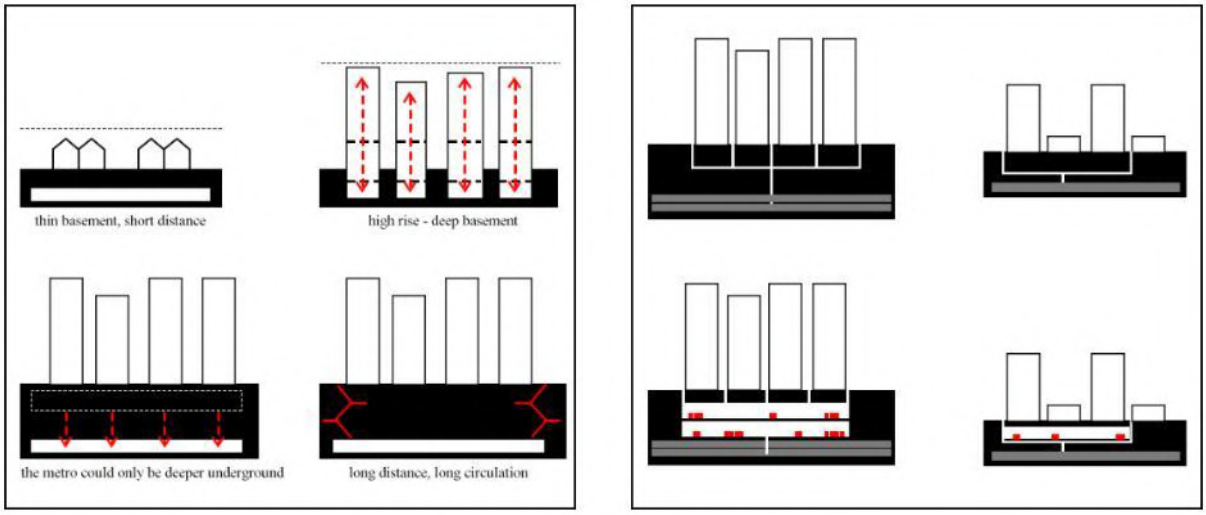


Fig. 3-23 Modes of Hongkong metro

The high-density development in Asian metropolis is not only the skyscrapers toward the sky but also something toward the ground (3-23). It's a mirrored development process in the higher density developed above the ground; the same depth has to be achieved under the ground. With deepening the metro station dig into the ground, the more complex and completed service facilities the station has, the more exits, paths, and broader connections will be left on the ground level.

The overpasses link all the buildings from the metro station to the Exhibition Hall and become a non-obstacle connection with maximum accessibility and convenience for the pedestrian, regaining efficiency for the vehicle road (Fig. 3-24). The continuity of

the landscape increases the plot value; every part is operated within a whole system. Visitors can experience a series of episodes, such as cultural buildings, commercials, and landscapes.

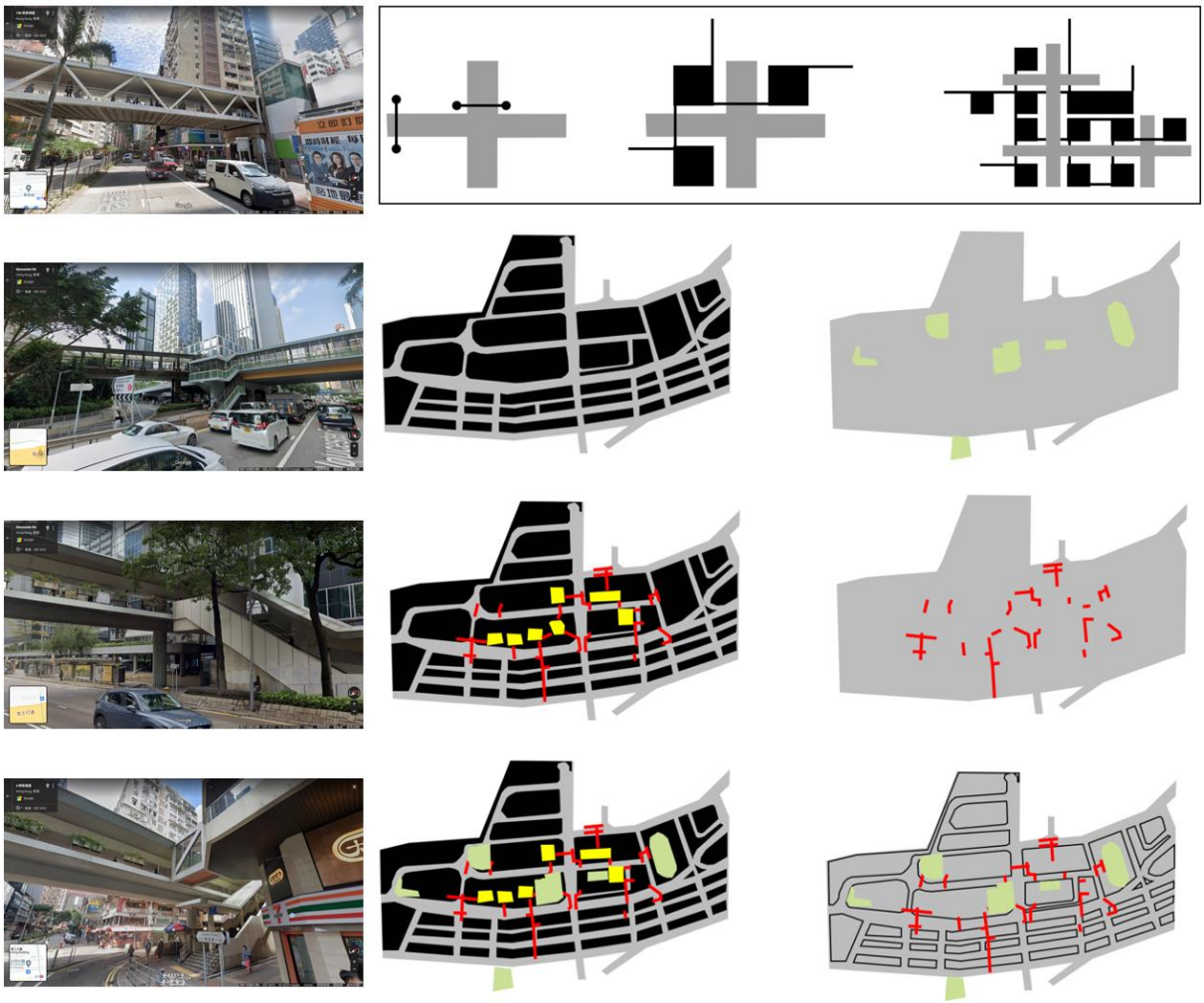


Fig. 3-24 Connected overpasses of Central

The way overpasses connect to the buildings verifies a lot from each other, depending on their aims. In other words, the connections show how the building owner wants the people to get onto their land and how to pass through; it generally gives such kind of information: welcoming, defense, guiding, or luring (Fig. 3-25).

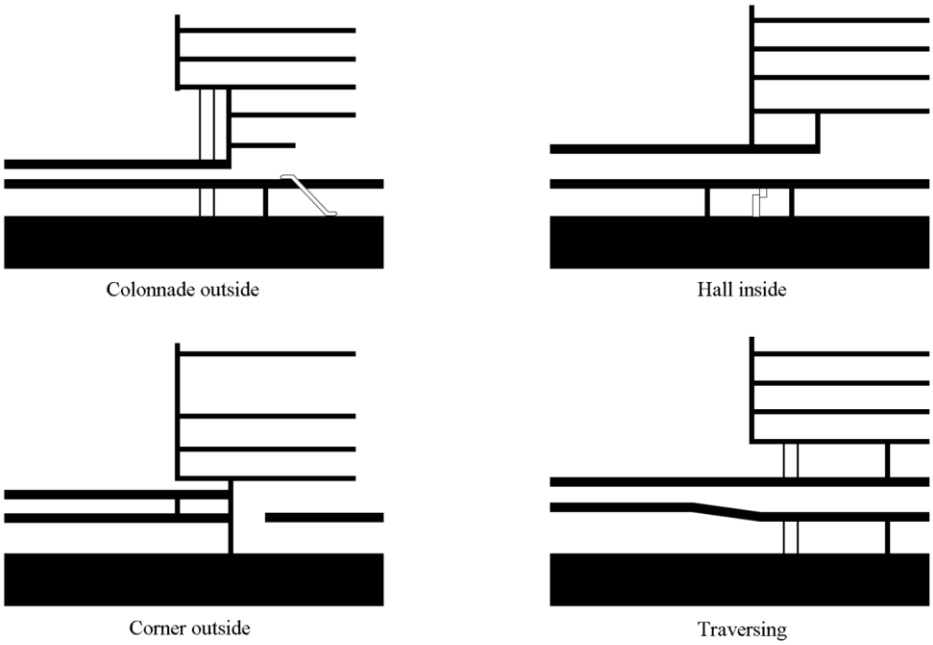


Fig. 3-25 The ways of overpasses connect to building

Standard and flexibility

The standardized residence plan and urban grid in Hong Kong provide a mix of spaces and variations on a standard basis. Some “successful” prototypes are spread repeatedly among the whole site in an almost “structuralism” way-in, the same form but without the same spirit: humanism.

Standard plan and super high rise are 2 common features shared by the most frequently applied dwelling typologies. The cross plan is considered the most economical and efficient way to explore the land’s full potential. The high rise is formed due to the high pressure of increased property value and extremely high population density. Thus, several most popular typologies are widely applied in HK housing development to meet the principle of density, expanding to all possible directions, and maximum efficiency. These viable prototypes are reused as a single element within the base, resulting in a dense cluster of skyscrapers planted on various sites throughout Hong Kong (Fig. 3-26). Although the collective monumentality gains from sacrificing

individual identity, there is no doubt high rise dwellings have become a monotonous typology in Hongkong.

The Urban structure of Mong Kok reveals a similar feature to Manhattan Grid, which also follows the spirit of Manhattan. The seemingly simple urban structure combines the plot definiteness with the programmatic instability. Within this system, everything on the plot could be easily modified without changing the whole layout; simultaneously, it achieves maximum program, typological diversity, and flexibility (Fig. 3-27).

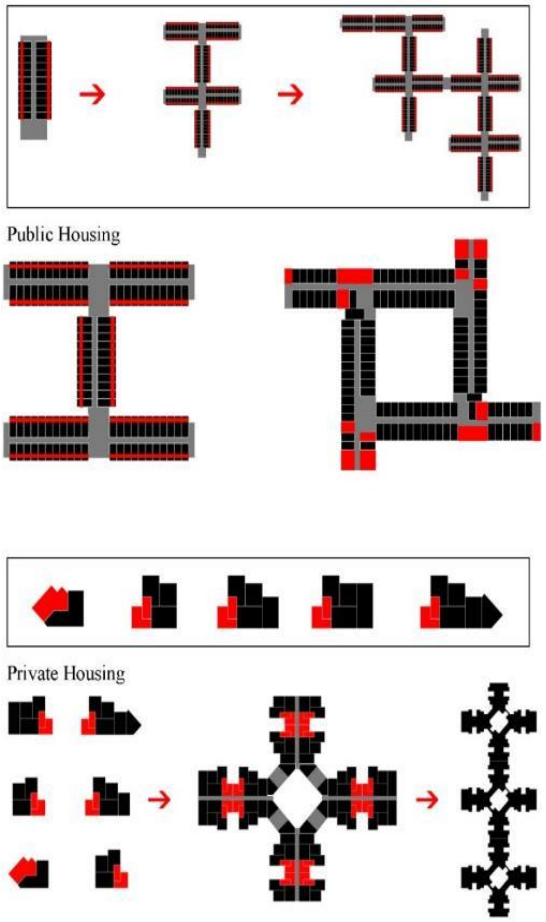


Fig. 3-26 Combination of standard plans

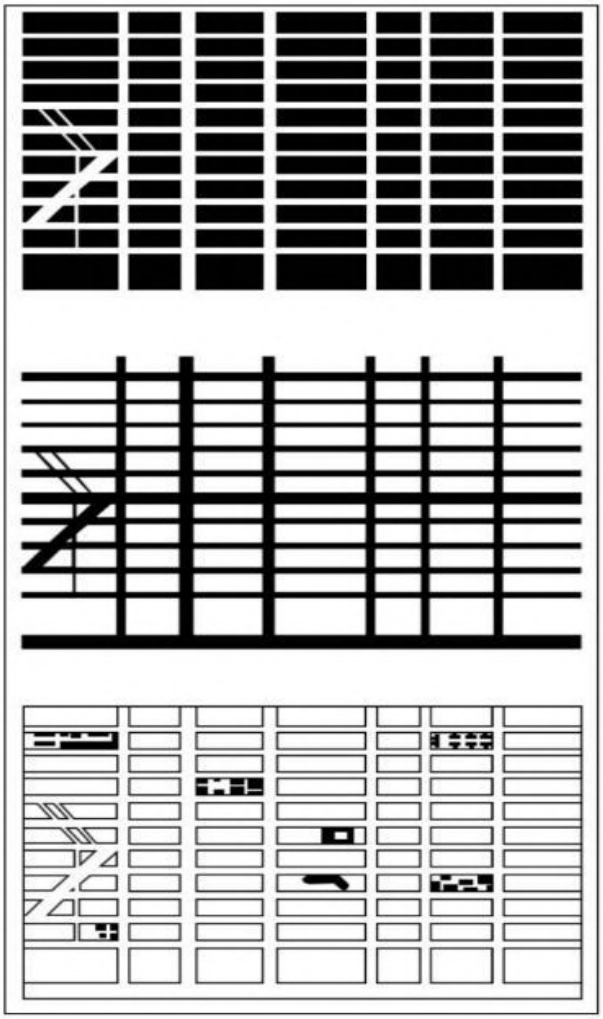


Fig. 3-27 The urban structure of Mongkok

3.3 Summary

To achieve compact urban development and mitigate the negative effects of high-density in the central areas of China's metropolitan areas, chapter 3 examines the well-known compact and vibrant cities of Melbourne and Hong Kong and draws lessons from their urban development that can be applied to enhance compact urban development in Guangzhou.

For Melbourne, this thesis firstly focuses on activity centers as Melbourne's most crucial compact city strategy, where different levels of activity centers aggregate different public services and commercial functions to drive the demographic and economic growth of the surrounding community. The missing middle is a housing pattern in Melbourne as the mediation between high-density and low-density housing, which enhances the humanity and diversity of the metropolitan environment. In addition, controlling block and building forms in the Central city provides available quantitative indicators for compact urban development in the central area.

For Hong Kong, this thesis firstly focuses on zoned density and the relative middle, which is particularly important for hyper density. Mixed land use in Hongkong increases urban intensification based on the high-density, allowing the city and its inhabitants to have a more diverse vitality. As a creative production of Hong Kong's development, urban form in hyper density has the potential to alleviate the unfavorable judgments of high-density held by the general public.

In conclusion, the case study’s lessons will practically guide this thesis to improve the characteristics of compact urban development in Guangzhou in chapter 4. These lessons include regulating block forms in central areas, adding medium density and medium FAR blocks, and the intensification and mixed use of land.

Chapter 4 Improvement Strategies for the Racecourse with More Compact and Vitality

In the perspective of the “more compact, more vitality” of this thesis, the activity of the human needs that the CAZ needs to meet is the goal of urban design. Therefore, the generation of compact urban development is goal-oriented. To promote vitality and mitigate the negative impact of excessive compact, this chapter combines the experience gained from the case study with the characteristics of compact urban development summarized from the literature review and redefines localized characteristics of compact urban development in Guangzhou.

Design strategies are based on the localized characteristics of compact urban development. They are used to generate preliminary images of the future Racecourse. The fictitious design ranges from land use and form control to motif evolution for generating blocks adapt to different functions and detailed alternatives for public spaces and infrastructures.

All these strategies will together form the vision of compact urban development and vitality in line with this thesis and serve as a transition from theoretical analysis to design practice, culminating in the design for the Racecourse in chapter 5.

4.1 Improved Characteristics of Compact Urban Development in Guangzhou

In 2.4, the characteristics of compact urban development are concentrated on high-density and intensification, accessible public spaces and transportation, and diverse activities on the human scale. It has been clarified in this thesis that appropriate extent as there is still controversy.

Existing dense city in China only aligns with the concept of compact urban development in some forms without achieving core characteristics, such as adequate

mixed land use, accessible public spaces, and transportation support by the pedestrian, which also results in public cultural and sports buildings in urban centers that are often large, individual buildings that do not form clusters of multiple activities. In Zhujiang New Town, for example, the individual high-rise buildings have resulted in large building intervals, and planned overpasses between buildings have not been successfully built yet, while the traffic dominated by the motor has allowed citizens who do not work here to gather only in Huacheng Square (Fig.4-1).

Facing the above problems, this thesis has studied the construction of compact and vibrant cities in Melbourne and Hong Kong and has obtained some feasible experience.

- Rational control of urban form in the central area through indicators, including controlling different densities and heights between plots and the combination and placement approach of building forms within the plots.
- Mixed and inclusive land and space utilization, including the intensification of land and the vertical intensification of different functions in buildings.
- Assembly of variable building forms through a unifying motif, which can be building plan forms or assemblage approach, etc.
- Centralized or decentralized public spaces, including centralized compensation for open green spaces and activities spaces and greening in and between buildings, streets, and setbacks scattered within the individual plot.
- Vertical transportation, creating a more pedestrian-friendly environment and partially sinking vehicular traffic, with TOD and overpasses in the air.

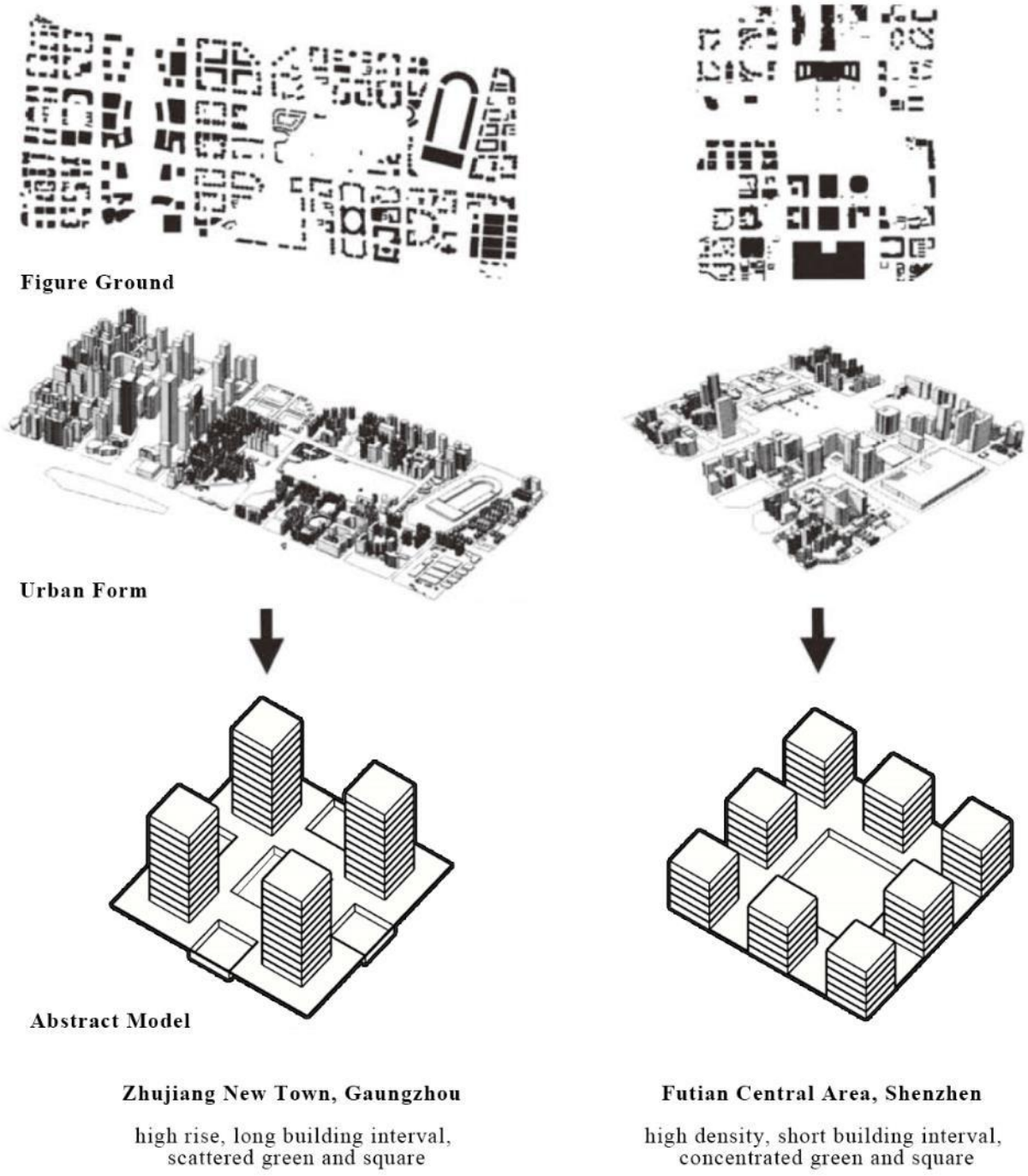


Fig. 4-1 Comparison of urban morphology in Guangzhou and Shenzhen

Therefore, this section proposes to characterize redefined compact urban development in Guangzhou as the following (Fig. 4-2).

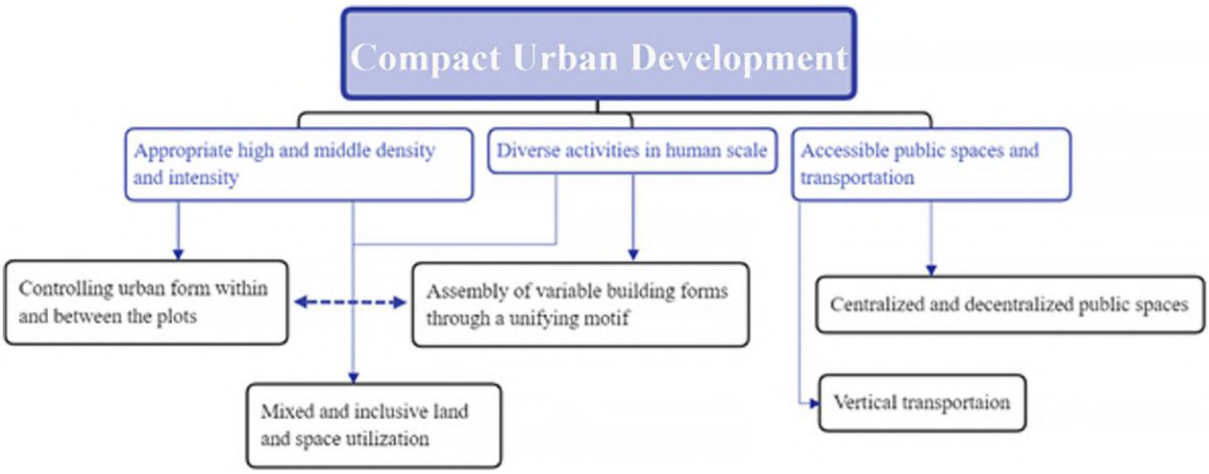


Fig. 4-2 Characteristics of compact urban development in Guangzhou

4.2 Improvement Strategies for More Compact and Vitality in the Racecourse

As stated at the beginning of this chapter, activities in CAZ are considered as designed goals, so the plots containing different activities should satisfy the principle of form follows function as a goal-driven design, and the approach of form follows function as the following strategy (Fig. 4-3). Each characteristic of compact urban development, after localization with concluded practical design methods from the case study, is a guideline of form design in any activities dominant plot, so the plot in CAZ will be more compact under the comprehensive effect of all characteristics equally. Each strategy will introduce how compact urban development impact the forms of activities dominant plot separately by specific indicator value or form evolution.

This design thesis addresses the urban form controlled in this chapter at the block scale in terms of material elements: building elements, open space elements, road elements and natural environment elements. These elements and their form control factors are not fully covered by the concept of compact urban development.

The building is the basic physical unit that constitutes the city and is the main physical element of the built environment. Building form is the most important factor in forming

the urban fabric, including building type, layout, form, massing, height, facade expression, materials, texture, color, etc.

This design thesis focuses on open space, which refers to the public external space of the city, including squares, streets, public green spaces, and spaces between buildings. Section 4.2.3 attempts to provide reasonable suggestions and specifications for the design of urban open space through its systematic organization, functional layout, morphological design, landscape organization, scale control and interface treatment.

The control of road elements usually includes the form and scale of road intersections, road local alignment and section organization, road greening, three-dimensional traffic including the arrangement and form of pedestrian bridges and underpasses, pavement section organization and installation, car parks, public transport interchange points, etc., so as to coordinate the relationship between traffic facilities and buildings and public space. Section 4.2.4 presents the morphological control of roads for compact urban development.

The Racecourse, as a central area of the city, should be more concerned with maintaining a good light, wind and sound environment in a high-density environment in terms of the control and guidance of natural environmental elements.

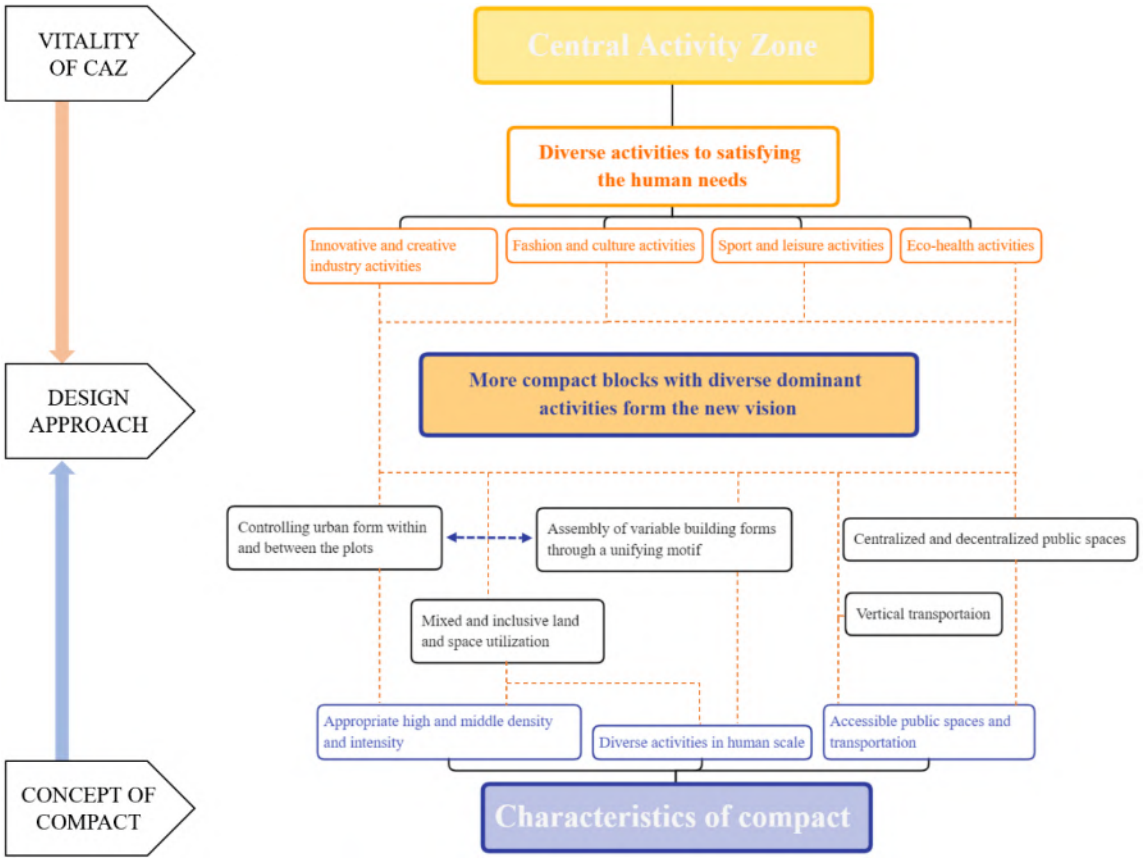


Fig. 4-3 Design approach in the Racecourse for compact urban development

4.2.1 Controlling urban form within and between the plots

High-density, as a prerequisite for compact urban development, remains one of the essential characteristics. The controlling or the relaxation of density is an inevitable means to cope with small-scale blocks and dense road networks formed by highly accessible and proximal infrastructure under the concept of compact[78]. Therefore, controlling the overall form of different activities blocks through fundamental indicators such as density, FAR, and more targeted indicators such as building-to-line ratio and open space ratio, as well as enabling the presence of medium density and medium intensification to mitigate the negative effects of high-density, are still the most basic

[78] Li R R, Yuan Q F, Han G F. Density Control With “Small Block, Dense Road Network”: Building Density and Green Space Ratio in Commercial Land Use [J]. Planners, 2019,35(18):40-47.

strategies towards a compact central area. Thus, different plots have generated different initial overall shapes according to the needs of the activity.

For further images of the new vision for the Racecourse, this section has chosen to envisage a more appropriate urban form at the master plan level by collaging different urban fabrics into the surroundings of the Racecourse (Fig. 4-4). This design thesis considers the collage as a translation from theoretical research to practical design.

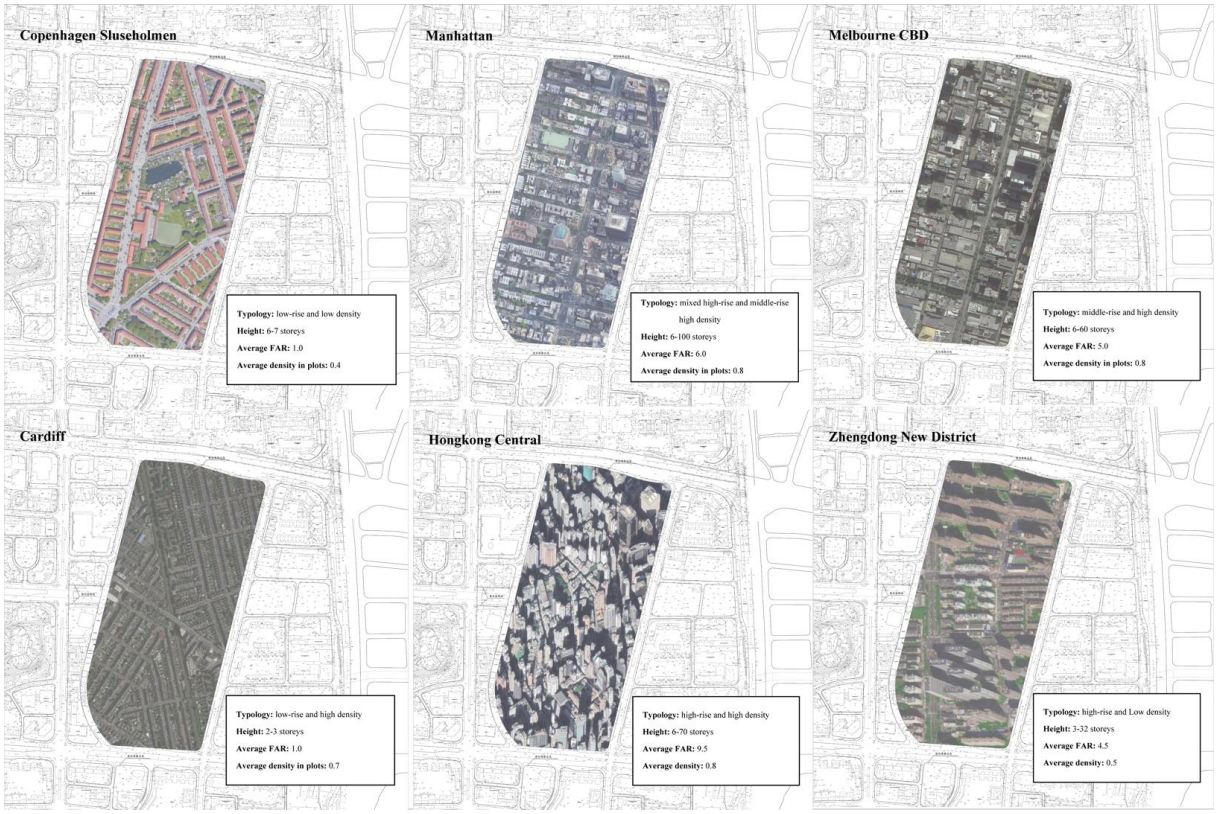


Fig. 4-4 Collage of other cities into the Racecourse

Six central or sub-central areas of different cities with their characteristics are selected. The building height, average FAR, and density of the overall area are the criteria for differentiation and selection. Melbourne CBD and Hongkong, which have been studied as case studies in Chapter 3, are typical representations of middle-rise and high-rise with high-density. Manhattan and Cardiff are other two typologies of high-density with mixed high-rise and low-rise separately, which certainly form the different vision of the city. This design thesis considers the urban form of Melbourne as the most appropriate

one for its strict urban form controlling the central area, which has been studied in section 3.1.4.

Besides, Zhengdong New District and Copenhagen Sluseholmen contain low density with high-rise and low-rise. Although their urban forms are unsuitable for the concept of compact city, they are worthy of being studied as wrong cases for the future of the Racecourse.

In conclusion, in the current reality of controlling the construction of high-rise buildings in Chinese metropolitans, the development and improvement of city central areas should prevent urban form at a more reasonable and livable level by avoiding excessively high or excessively low indicators. The following indicators are those that this design thesis considers being of significance for compact urban development.

Building density

Some scholars have studied the building density of the central district in Tokyo, Midosuji in Osaka, Bay-Orchard in Singapore, Gangbei in Seoul, and Hong Kong Island, which have obvious characteristics of small blocks. It was found that the building density of commercial land is high, especially in the core part of the central district. The highest building densities were 94.51%, 91.18%, 91.07%, 88.28% and 97.03%, respectively[79]. The building density is usually extremely high for commercial land under small blocks, and there is almost no independent green space within the plots. An analysis of these cities' technical regulations or planning standards reveals that these countries or regions either do not control the building density and green rate of commercial land or allow high building density. Hong Kong, China, and Japan can

[79] Shi B X. The Quantitative Research on the Hardcore-Agglomeration Phenomenon of Asian Urban Central Districts [D]. Southeast University，2014.

have up to 100% building density[80],[81]. Take Shenzhen, with advanced urban planning and management in China, as an example. The Urban Planning Standards and Guidelines of Shenzhen (2014) stipulate that the upper limit of building coverage is 65%, and the lower limit of green coverage is 30% for commercial land[82]. In practice, however, neither of these indicators is mandatory. Building density and green land rate are not controlled in the index control of commercial land in Shenzhen statutory.

Floor Area Ratio (FAR)

FAR is not a decisive or necessary factor in compact urban development, but CAZ still needs to meet the high FAR of the actual city central area. It is worth noting that excessive FAR is not informative for the Racecourse in the current situation in China, in which the construction of super high-rise buildings is gradually restricted. According to literature research, in Hong Kong and Shenzhen, two big cities that adopt density zoning, the FAR benchmark value of commercial land in the area with the highest density is set at 9.5 and 5.4 respectively, and buildings are highly concentrated above the 17th floor. In the actual construction, the FAR in most areas of Shenzhen is far higher than the benchmark FAR due to the existence of transfer FAR and incentive FAR mechanisms. In this thesis, the benchmark high FAR is about 5.0 for the mixed-use land dominated by commerce in CAZ.

Open Space Ratio (OSR)

[80] Department of Justice, Hongkong. Building (Planning) Regulations [EB/OL]. https://www.elegislation.gov.hk/hk/cap123F, available in 2022-06.

[81] Building Center of Japan. Introduction to the Building Standard Law [EB/OL]. https://www.bcj.or.jp/upload/international/baseline/BSLIntroduction201307_e.pdf, available

[82] Shenzhen Government. The Urban Planning Standards and Guidelines of Shenzhen (2014) [EB/OL]. http://www.sz.gov.cn/attachment/0/396/396623/6581255.pdf, available in 2022-06.

However, both Hongkong and Shenzhen lack control over the Open Space Ratio (OSR), which is far from 60% in New York, 50% in Tokyo, and 100% in Singapore (Table 4-1), resulting in the lower comfort level of people's living[83],[84],[85].

Table 4-1 Term, connotation and control requirements of open space in various cities

City	Term	Connotation	Control Requirements
New York	Open Space Ratio	Ratio of open space area to total floor area. Open space includes public open space such as park, green space and square, as well as privately owned public space conforming to incentive system	High-density apartments of 1 to 17 floors, with FAR of 0.94~6.02, OSR of 5.9%~11.9%; Medium density apartments of 1 to 14 floors, with FAR of 0.87-3.44 and OSR of 15.5%-25.5%; Multi-type residential combination of 1 to 13 floors, FAR of 0.78 to 2.43, OSR of 27.5% to 37.5%
Singapore	LRA: landscape replacement areas	Ratio of LRA area to land area (%). Specifically, it includes green planting areas with certain soil covering depth, areas with public facilities such as activity squares, playground and water features, and publicly visible wall and roof greening	70%~100% in the strategic area; 30%~40% outside the strategic area

[83] New York City Department of City Planning. Zoning handbook [EB/OL]. www.nyc.gov/planning. (2020-09-23) [2022-06-01].

[84] Bureau of Urban Development Tokyo Metropolitan Government. Tokyo Metropolitan Government Specific City Block Operation Standards [S/OL]. https://www.toshiseibi.metro.tokyo.lg.jp/seisaku/new_ctiy/katsuyo_hoshin/koudo_unyo-kijun_1904.html. (2022-03-11) [2022-06-01].

[85] Urban Redevelopment Authority of Singapore. Guidelines for development control: landscaping for urban spaces and high-rise [EB/OL]. https://www.ura.gov.sg/Corporate/Guidelines/DevelopmentControl. (2020-10-20)[2022-06-01].

		(no more than 10% of the land). These areas should have unenclosed and open skies and, if covered, requirements such as open sides, natural ventilation, etc. need to be met (e.g. sky terraces, covered ground gardens, etc.).	
Tokyo	Effective Vacancy Ratio	The ratio of effective open vacancy to site area. Effective open space includes public open space such as green areas, open spaces such as plazas, public spaces in buildings, rooftop greenery, etc.	Land for commercial use 30%~40%; land for other uses 50%

Combining the control experience of large cities with the control of open space ratio for the Middle, this study clarifies the calculating technique for open space area as follows according to Zheng and Dong proposed in 2021. The open space area equals the sum of undeveloped land, 50% area of open garden on the bottom floor, 50%area of open terrace, and 20% area of vertical vegetation (this item does not exceed 10 percent of the site area).

In addition, corresponding to the building density of various types of land in China, which ranges from 20% to 50%, the thesis suggests that the OSR should be divided into two levels for control: medium OSR (above 60%) and high OSR (above 80%).

Build-to-line Ratio

As for the Build-to-line Ratio, the wider-to-height ratio of the street section (D/H) proposed by Camillo Sitte and the wider-to-height ratio of the street building (W/D) proposed by Ashuhara Yoshinobu is widely influential. These two parameters are often used to describe the local spatial properties of street interfaces. In recent years, quantitative parameters such as Building-to-Line Rate and Street Interface Density have appeared in the research field of the street interface in China. In particular, the parameter of Building-to-Line Rate has become a common technical indicator for controlling street interface in planning practice. Practical cases of planning control

using this parameter have appeared in Shenzhen, Ningbo, Tianjin, Shanghai, Guangzhou, Jinan, Kunming, and other places in China[86],[87],[88].

This thesis adopts the Building-to-Line Ratio in the context of high-density blocks. This concept focuses on the continuity of street-side building interfaces within a single plot and is more suitable for planning and controlling specific plots. In the *Technical Regulations of Shanghai Urban Planning and Management*, the calculation formula of Building-to-Line Ratio equals the ratio of the length of the interface along to street and the length of the buildable area control line along the street [89].

Through the comparison between Chinese and Western cities [90], it can be seen that the street interface of western cities is primarily neat and straight, with the characteristic of being near the controlling line. However, the street interface in Chinese cities is mainly concave and convex, without the characteristic of being near the controlling line. The difference near the controlling line between the Chinese and western street interface is closely related to the relevant planning control laws and architectural and cultural traditions. Western street outline and the tradition of attaching importance to urban public space and building facade make the street interface have the characteristic of being near the controlling line, and many streets can even reach the ratio value of about 90%. In China, the street outline and the group layout mode dominated by the traditional gate and hall concept, as well as the zigzagging

[86] Zhou Y. Exploration on "Build-to-Line Ratio" in Urban Planning Control on Street Interface [J]. City Planning Review, 2016,40(08):25-29+35.

[87] Jiang Y, Gu P Q, Chen Y L, Mao Q Z. Continuity of Street Facade Analysis with GIS: A Case Study of Jinan City [J]. Urban Transport of China,2016,14(04):1-7.

[88] Liu Q, Zhang Z Y. Building Setback Control under Multi-factor Influence: Case Study of Panyu District in Guangzhou City [J]. Urban Planning Forum, 2016(01):63-71.

[89] Shanghai Government. Technical Regulations of Shanghai Urban Planning and Management. https://hd.ghzyj.sh.gov.cn/zcfg/ghss/201912/P020191216616332879928.pdf, (2019-12-16)[2022-06-01].

[90] Wang J. Research on the Street Interface Design under the Conditions of High Near-Line Rate [D]. Tsinghua University, 2013.

appearance characteristics of wood-framed buildings and the monomeric combination mode with scattered interfaces, make the traditional street interface have the characteristics of rich layers, the value of Building-to-line Ratio often reaching 60% in traditional blocks, while about 70% in new blocks.

The urban block form of street interface, whether near the control line, is not an isolated problem; it is affected by many complex factors. There is no specific positive or negative correlation between the value of the Building-to-line Ratio and the city's vitality. A high Building-to-line Ratio is beneficial to ensure the integrity of urban form, increase the sense of enclosing street space, establish the connection between adjacent buildings, and create rich street life. However, while ensuring the tidiness of the street surface, the high Building-to-line Ratio limits the possible expression of architectural individuality, affecting the street's richness and expression of life. The failure of undesigned high Building-to-line Ratio streets is common in European and American street spaces.

The city structure, the arrangement of buildings, and the single form of buildings are all related to the street interface building-to-line form. Referring to the planning and management experience of Shenzhen, Los Angeles, and other places, this paper focuses on the commercial interface with a height of fewer than 24m. It proposes to control the Building-to-line Ratio at 70%-85%. In CAZ, the commercial area beside the primary and secondary roads should be held at a medium Building-to-line Ratio of over 70%, and the featured commercial blocks should be controlled at a high Building-to-line Ratio of 90%-100%.

The appropriate medium density and intensity

Driven by the compact urban development and the logic of capital, the emergence of high-density is more natural based on mixed land use. Still, for a plot needing more human-scale spaces， the medium density and intensity are required to follow the function and mitigate the negative impact. The traffic congestion, degradation of spatial

environmental quality, lack of green urban open space, and severe air pollution can be the most critical debates on the compact city, which are negative impacts of excessive development intensity in urban centers. The high cost and risk associated with high-rise and supertall buildings and the population overcrowding are also urban problems that cannot be ignored behind the dependence on land finance.

From the perspective of cooling and heating energy consumption of neighborhood buildings, traffic energy consumption, and economic efficiency, many scholars believe that there is a U-shaped relationship between the influence of both building height and building density on energy consumption. From the perspective of urban economic efficiency, empirical data has been used to argue about the inverted U-shaped relationship between urban density and economic output efficiency. When urban density is low, increasing density can significantly save land consumption and infrastructure construction and promote economic growth; when density exceeds a particular threshold value, the negative effects of increasing density, such as traffic congestion and air and noise pollution, will outweigh the positive effects, i.e., increasing density at this time is not beneficial to economic growth (Fig.4-4)[91].

[91] Newman P W G, Kenworthy J R. Gasoline consumption and cities: a comparison of US cities with a global survey[J]. Journal of the American Planning Association, 1989, 55: 24-37.

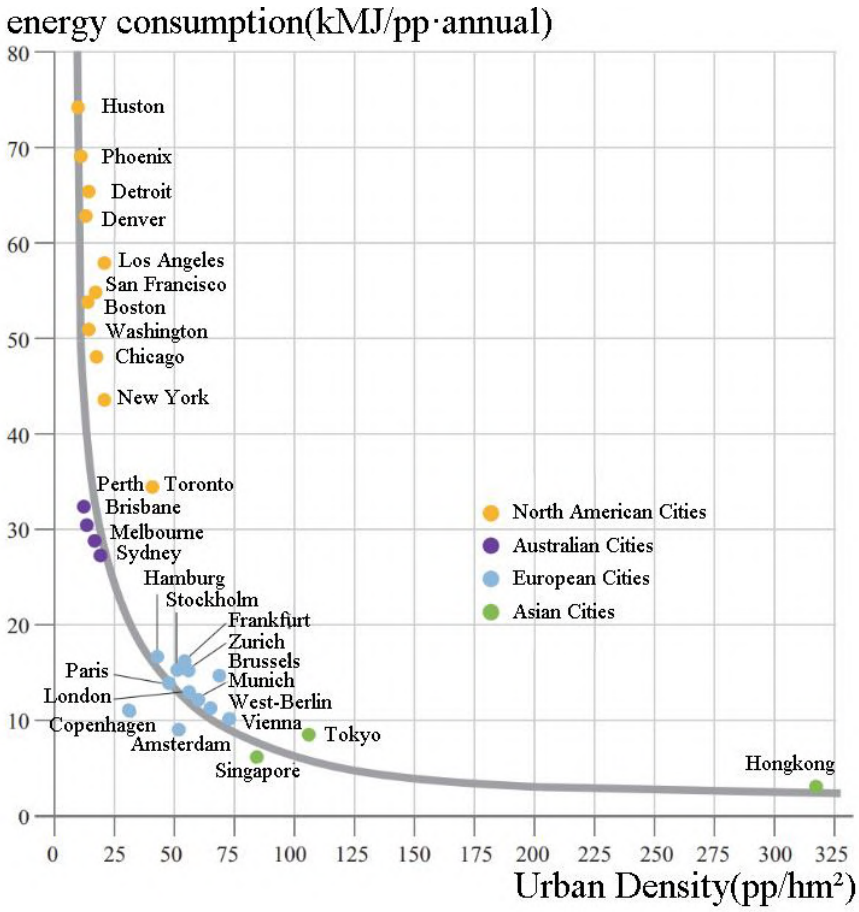


Fig. 4-4 Relationship between Energy Consumption and Urban Density

Source: Newman P W G, Kenworthy J R, 1989

The quantitative relationship between population density, economic density and economic growth in the global 5 km grid was further analyzed by using multivariate spatial network data [92], and proposed that the inflection point of population density that is most favorable to economic growth is about 20,000 persons/km^2, which is roughly equivalent to the plot density of residential land and commercial land in China with a FAR of 2.0. In an analysis of a large number of neighborhoods in Portland and Atlanta, there is a U-shaped relationship between building height and heat and cold

[92] Xie Y, Chen X, Zhang J. Economic Development Efficiency and Urban Density Inflection Point: An Empirical Examination Based on Global 5km Spatial Grid Data [C]. Sharing and Quality: Proceedings of the 2018 China Urban Planning Annual Conference (16: Regional Planning and Urban Economy).,2018:67-82.

energy consumption per unit area for different building densities. When the building height is about 6 stories, the heat and cold energy consumption per unit area is the lowest. When the building height is certain, the higher the building density, the smaller the heat and cold energy consumption per unit area, but different climatic conditions do not affect the relationship between the three[93]. Other studies on urban neighborhoods in Taiyuan, Changchun, and Harbin found that building densities between 15% and 70% have little effect on thermal and cold energy consumption. As the building height increases to 6 stories (18 m), the decreasing trend of thermal and cold energy consumption per unit building becomes slower, and the decreasing trend drops to the lowest at 11 stories (35 m)[94],[95],[96].

This thesis concludes that a theoretically optimal density and intensity exist for urban areas. Appropriately supplementing the medium density and intensity can reduce the negative benefits of high intensity. For this concept, the drawbacks of high and low densities can be balanced to maximize economic, environmental, and human benefits (Table 4-2).

The FAR has a somewhat high effect on economic benefit and traffic consumption, with the best FAR values for various city sizes ranging from 1.5 to 3.0. As building height increases, optimal values for building heat and cold energy consumption and urban safety decrease from 18 m to 35 m to 45 m. The ratio of building density to open space influences the spatial comfort of individuals. Based on a particular continuous

[93] Liu Z L, Qin B. Urban Form and Low-carbon Cities: Research Progress and Planning Strategies [J]. Urban Planning International, 2013,28(02):4-11.

[94] Yang Z W. Study and Analysis of the Impact of Block Spatial Form on Building Energy Consumption Based on Dest-h Model Simulation Taking Taiyuan as an Example [D]. Taiyuan University of Technology, 2019.

[95] Zhang C. Research on the Relationship between Residential Design Parameters and Energy Consumption in Northeast China [D]. Jilin Agricultural University, 2018.

[96] Diao Z. The Influence of Building Layout on the Energy Consumption at the Block Level of Harbin Old Town District [D]. Harbin Institute of Technology, 2018.

building interface, the larger the open space ratio, the greater the comfort level. The medium density and intensity are interval values, not precise values. It is not a set value but rather a dynamic value that fluctuates when urban development conditions and other things change.

Table 4-2 Medium Density Indicators of Case Studied Cities

Parameter	FAR		Dominant building height	Open space ratio
	Land of residential	Land of non-residential		
Literature Review	1.5~4.0		45m, 35m, 18m	60%
Hongkong	5.0-6.0	8.0	Over 17 floors	-
Shanghai	1.6-2.0	2.5-3.0	40m for 11 floors	-

The quantitative relationship between population density, economic density, and economic growth in the global 5 km grid was further analyzed by using multivariate spatial network data [97]and proposed that the inflection point of population density that is most favorable to economic growth is about 20,000 persons/km^2, which is roughly equivalent to the plot density of residential land and commercial land in China with a FAR of 2.0. In an analysis of many neighborhoods in Portland and Atlanta, there is a U-shaped relationship between building height and heat and cold energy consumption per unit area for different building densities. When the building height is about 6 storeys, the heat and cold energy consumption per unit area are the lowest. When the building

[97] Xie Y, Chen X, Zhang J. Economic Development Efficiency and Urban Density Inflection Point: An Empirical Examination Based on Global 5km Spatial Grid Data [C]. Sharing and Quality: Proceedings of the 2018 China Urban Planning Annual Conference (16: Regional Planning and Urban Economy).,2018:67-82.

height is certain, the higher the building density, the smaller the heat and cold energy consumption per unit area. However, different climatic conditions do not affect the 3 relationships [98]. Other studies on urban neighborhoods in Taiyuan, Changchun, and Harbin found that building densities between 15% and 70% affect thermal and cold energy consumption. As the building height increases to 6 stories (18 m), the decreasing trend of thermal and cold energy consumption per unit building becomes slower, and the decreasing trend drops to the lowest at 11 stories (35 m)[99],[100],[101].

Regarding medium FAR control, all megacities, except Hong Kong, have selected a value between 1.6 to 2.0 for residential plots and 2.5 to 3.0 for non-residential plots as the acceptable medium development intensity for cities. Numerous studies have demonstrated that this intensity can generate enormous economic benefits and lower traffic and energy usage. Thus, the benchmark FAR for the medium intensity in large cities should be between 1.6 to 2.0 for residential land and 2.5 to 3.0 for non-residential land in this paper.

Large cities present a more diverse control orientation in terms of building height control in the medium intensity. This thesis combines the relevant classification standards for building height in the *Code for Design of Civil Buildings* (GB50352-2005) and the *Standards for Urban Residential Planning and Design* (GB50180-2018). It proposes that the building height control of the medium intensity can be divided into 3 types, namely, multi-story buildings (7-9 storeys, within 27m), mid-rise buildings (10-

[98] Liu Z L, Qin B. Urban Form and Low-carbon Cities: Research Progress and Planning Strategies [J]. Urban Planning International, 2013,28(02):4-11.

[99] Yang Z W. Study and Analysis of the Impact of Block Spatial Form on Building Energy Consumption Based on Dest-h Model Simulation Taking Taiyuan as an Example [D]. Taiyuan University of Technology, 2019.

[100] Zhang C. Research on the Relationship between Residential Design Parameters and Energy Consumption in Northeast China [D]. Jilin Agricultural University, 2018.

[101] Diao Z. The Influence of Building Layout on the Energy Consumption at the Block Level of Harbin Old Town District [D]. Harbin Institute of Technology, 2018.

15 storeys, within 50 m), and high-rise buildings (over 15 storeys, within 50 m), and encourage the selection of multi-story buildings as the height control index for the medium intensity.

As for the OSR for the medium density, this thesis also suggests the same technique of calculation mentioned before and divides the OSR into 2 levels for control: medium OSR (above 60%) and high OSR (above 80%).

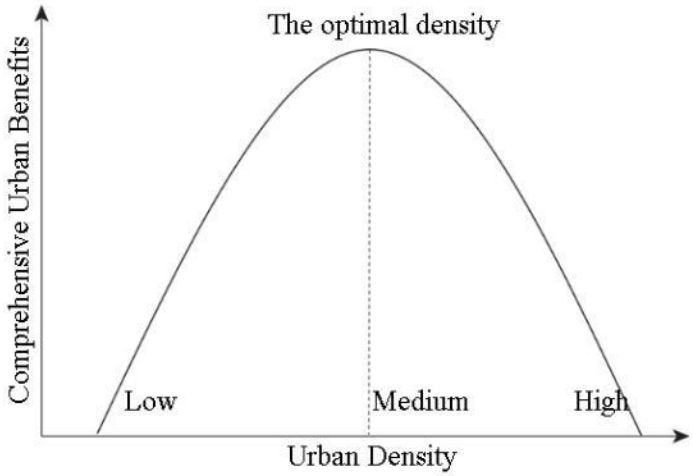


Fig. 4-3 Relationship between Comprehensive Urban Benefits and Urban Density

Source: Zheng, Dong, and Lin, 2021

The medium density and medium intensity can obtain more significant comprehensive urban benefits (Fig. 4-3). At the same time, the construction experience of Asian mega-cities such as Hong Kong and Shanghai also shows that medium-density construction is a suitable way for large cities to operate efficiently, solve the contradiction between people and land, and improve urban quality. Therefore, the discussion of medium density in this thesis hopes to give the suggested index range from three aspects: FAR, building height, and open space ratio, and different cities can determine their own medium density benchmark index by taking into account their actual situation.

In summary, this thesis concludes that large cities in China can be controlled based on the three major index intervals to determine the medium density and intensity

benchmarks. Combined with the city scale and natural resource conditions, the medium density and intensity will meet the city's respective characteristics. In particular, China is now controlling the construction of super high-rise buildings. Under such control, the urban form is not single but may form a variety of urban forms (Table 4-3).

Table 4-3 Combination of indicators in medium level

Parameter Combination	FAR	Building Height	Open Space Ratio	Possible Urban Form
Combination 1	medium	multi-story building	medium	compact blocks with medium rise and high-density
Combination 2	medium	medium and high-rise building	high	stereoscopic open blocks with medium high-rise and medium density
Combination 3	medium	medium and high-rise building	medium	plank-type buildings with medium high-rise and medium density
Combination 4	medium	high-rise building	high	open point-style buildings with high-rise
Combination 5	medium	high-rise building	medium	open point-style buildings with high-rise

Therefore, it's meaningful to appropriately control the fundamental indicators while realizing the intensive use of urban and architectural space in the city central area of China (Table 4-4). The mix of high and medium density and intensity is more conducive to buffering and promoting the bridging of compact development and the surrounding environment that still needs to be improved and to form a more affordable, inclusive, and diverse urban space. In addition, the area of both high and medium intensity areas should be determined in specific proportions by function.

Table 4-4 Overall indicators for compact urban development

Area	FAR	OSR	Building-to-line Ratio	Building Height
High Intensity Area	Over 5.0	60% or 80%	70% or 90%	high-rise (15-18 stories)
Middle Intensity Area	2.5-3.0	60% or 80%	70% or 90%	multi-story (7-9 stories) medium rise (10-15 stories) high-rise (over 15 stories)

The fictitious design in hypothetical urban plot

The possible urban form based on a discussion about indicators including FAR, OSR, and building-to-line Ratio, and the middle in the high are experimented with in the hypothetical plot of 100m*200m (Fig.4-4), which can be a motif of urban form within and between the plots for urban design in the context which compact plays a crucial role.

It can be seen in the hypothetical plot that, once the building-to-line Ratio is controlled with a high FAR value of 3 or 5, the enclosed buildings sticking to the building control line will be formed, and the enclosed space in the center can be used for both addition buildings and open space, which reflects the different densities. Green roofs, elevated story, and platforms in air connect to the buildings can be used as a means to improve the OSR when the above indicators are determined.

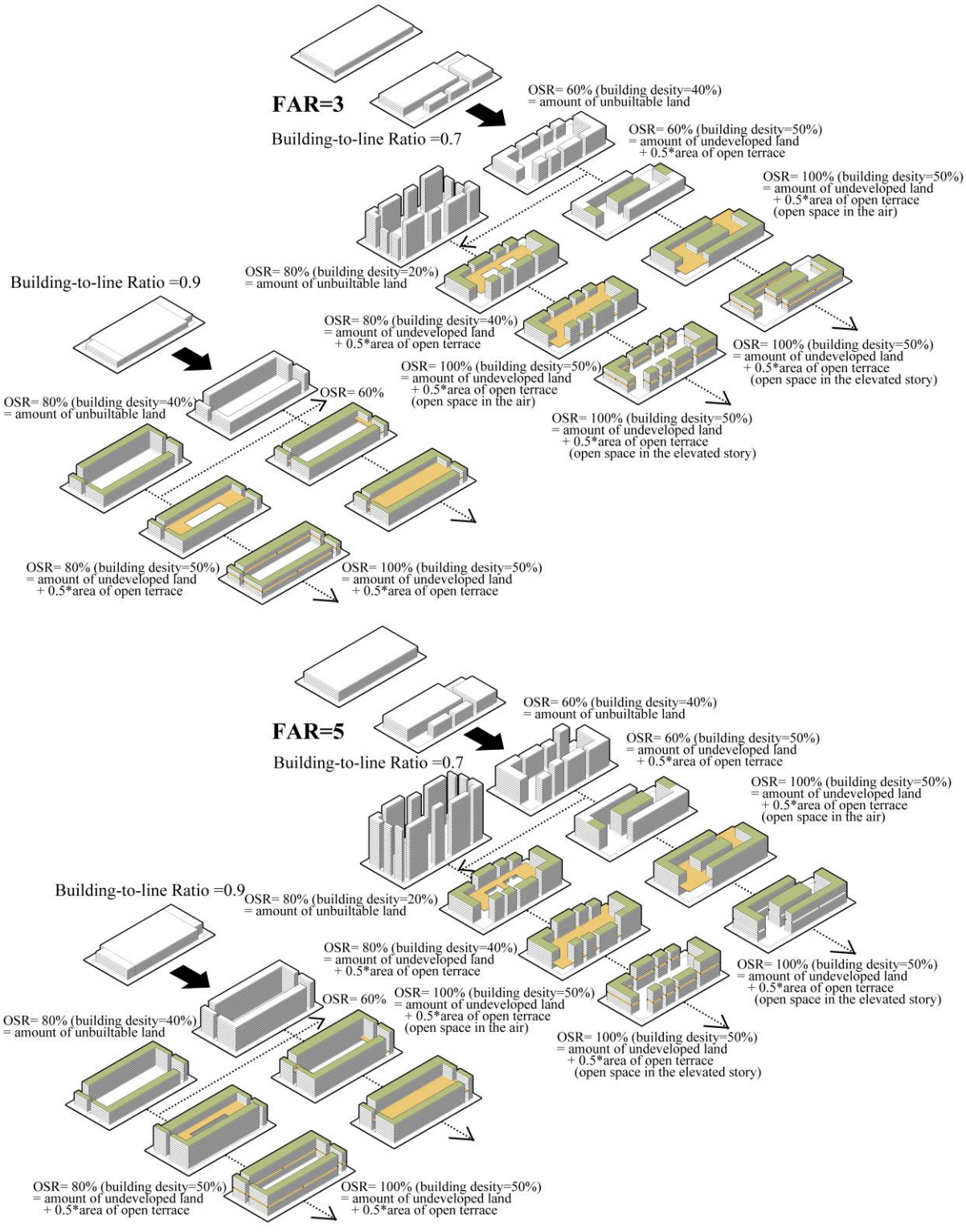


Fig. 4-4 Urban form controlling in the fictitious plot

This thesis then selects three block forms that meet the above controlling requirements and also integrate the factors of practicality and aesthetics as the motif of the block

podium (Fig.4-5). They are continuous perimeter buildings with a building-to-line ratio of 70% and 90% when the open space ratio is maintained at 100% and scattered perimeter buildings with enclosed atriums, sky decks, and building overheads.

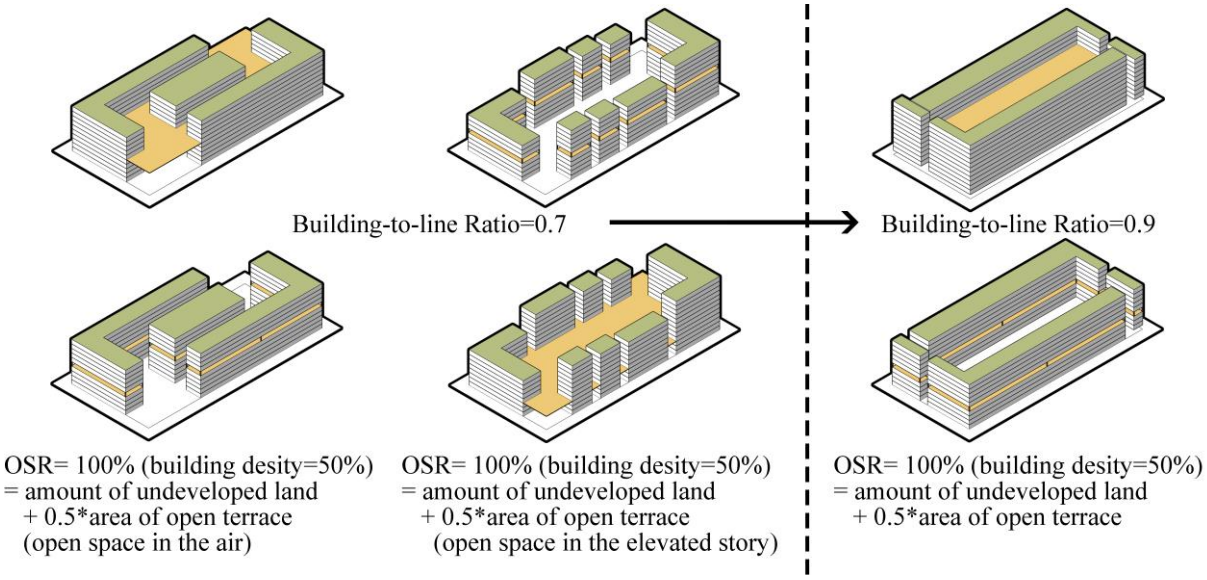


Fig. 4-5 Suitable urban form controlling as motif for the podium

4.2.2 Mixed land use

The mixed use of land and buildings is the spatial vehicle containing diverse activities, which can be the foundation of accessibility and vitality sources in a CAZ. In the context of urban regeneration in China, the high-density areas of many metropolitan centers do not contribute to the functional improvement of the cities. In the case of the transformation of a city central area, the emphasis should not only be on the value of their density growth but also on whether it encourages the dense growth of functional structures that may provide functional benefits to the area.

In terms of spatial scale, mixed land use exists on the regional scale, the plot scale, and the building scale. At the macro-regional scale, mixing refers to intermingling different functional areas to form an urban area with comprehensive functions, such as mixed-use zoning and mixed development strategies. At the plot scale, mixing is the coexistence of land with different uses to form a diverse urban environment. The micro-building scale refers to the mixed development of individual plots or spaces within

buildings. In terms of the object of mixing, there are two categories of mixed land use in the broad and narrow sense; mixing in the narrow concept is the mixing of different functions, while mixing in the broad concept is multidimensional and includes the mixing of different spatial scales, building heights, construction ages, etc. in addition to functions. This thesis focuses on the mixed use at the plot scale and building scale of compact urban development, where the mixed use at the plot scale is diverse and compatible, and the mixed use at the building scale is reflected in the mix of functions in horizontal and vertical directions.

Diversity of mixed land use

Land use of the compact urban development in CAZ requires a high degree of intensification, which can be understood in terms of the differences in land use, the degree of connection and accessibility between the land of different uses, and the opening of the interface to the city. The principle of mixed land use is expressed abstractly in a hypothetical plot, where distinct color blocks represent different functions. Still, the plots do not imply specific areas, so the sizes of other color blocks have only symbolic meanings.

- Diverse uses of land(Fig. 4-6)

Fig. 4-6 More diverse types of land use

The more types of land use there are in the plot, the smaller the proportion of the area of each land use to the total area of urban land use, and the more scattered they are,

the higher their diversity will be, which also leads to a more compact plot layout. The type of land use increases in the plot shown on the right, and the proportion of each land use to the total size of land use is smaller than that on the left, reflecting that the Racecourse is more compact.

- Accessible layout of the plot (Fig. 4-7)

Fig. 4-7 More accessible layout of the plot

The higher the density of the plot layout, the more roads per unit of the plot area. The shorter the distance between different adjacent uses, the more compact the plot layout is and the higher the accessibility. The white line in the figure indicates the traffic connection between different use, and the colored blocks indicate the land use. Compared with the future Racecourse on the right, the layout of the current Racecourse on the left is more scattered, with weaker traffic connections, accessibility, and longer distances between the uses, which is not in line with the characteristic of proximal and convenient infrastructure in a compact city.

- Intensification of plot area (Fig. 4-8)

Fig. 4-8 Intensification of plot area

When the perimeter of the urban land area is the same, the smaller the total area of land and the greater the length of the common boundary between different uses, the more compact the plot will be. The area of colored uses and perimeter of the plot is the same for the left and right figure. At the same time, the future Racecourse on the right has a smaller buildable area and more extended boundaries between different types of use, resulting in a more compact and diverse plot layout.

- Active boundary of plot (Fig. 4-9)

Fig. 4-9 Active boundary of plot

The more the number of land use, the more flexible the combination of uses and their boundaries open to the city, the longer the common boundaries adjacent to a different use, and the more compact and diverse the plot will be. The perimeters of the plot in the left and right figures are the same, but the total area in the right figure is larger. The right figure splits the large single-use plot into a combination of small multi-use plots,

and the boundaries between different uses are also more extended; the interface that opens to the city has more variations, which comprehensively indicate the characteristics of a compact. However, the size of individual use should not be as small as possible but reasonably set and adjusted according to the actual functions and scope of served areas.

From the above-illustrated analysis of how to make a more compact plot from mixed-use, it is clear that one of the essential connotations of achieving compact is to gain as much diversity as possible within the same area. More prosperous functions, closer connections, and more flexible layouts and boundaries are all expressions of the interaction and conjugation of diversity and compact. The more compact city, the more diverse city.

Compact urban development is one factor that promotes urban diversity, or urban diversity can be seen as an external representation of compact urban development.

Compatibility of mixed land use

Mixed land use is a new land use classification in China's national context, based on the new national standard. Land use compatibility is a method for guiding the functional mixing of land use in the detailed regulatory planning stage based on the new national standard classification, using land use property as the logical judgment condition to guide the functional mixing of land use. Both are planning instruments that lead to the optimal functional integration of urban land at the stage of detailed regulatory planning. Mixed land use provides the strongest direction in terms of the intensity of the functional mix of land, while land compatibility and buildability are interrelated and complimentary at all levels of planning and management implementation, guiding urban land to become more diversified and denser[102]. However, it is crucial to

[102] Xu J T, Zhu J H, Wang J A. A Study on Planning Guidance of Mixed Use of Urban Land at Home and Abroad [J]. Journal of Human Settlements in West China,2014,29(03):66-71.

emphasize that the ratio of different land uses in mixed land use has neither been controlled nor given a clear legal standing. The ratio is merely a process accounting requirement, not a governing element in the text or plan[103]. The actual distribution of land should adhere to the criteria of non- or low-negative impact on each other, equivalent environmental needs, and mutually beneficial functional applications.

Drawing on the experiences of compatibility of mixed land use in Hong Kong and Melbourne, as well as the principles of no or low adverse impacts on each other, similar environmental requirements, and mutual benefits of functional uses, this thesis attempts to propose simplified guidelines for a more compact urban vision of compatible land uses under the Chinese National Standard (Table 4-5).

Table 4-5 Guidelines for compatibility of commonly used land

Land Usage **Main category**	**Sub category**	**Encouraged mixed use of land usage**	**Tolerable mixed use of land usage**
R (Land for residential)	R1(Ⅰ class land for residential): well-equipped, good environment, with low-rise residential mainly	-	-
	R2 (Ⅱ class land for residential): fairly complete facilities and environment, with many, medium, high-rise residential mainly	B2, B3, B9 A2, A3, A4,	B1, M0, A1,A3
	R3 (Ⅲ class land for residential): shabby residential with poor facilities and environment in need of renovation, including dilapidated houses, shanty towns, temporary housing sites, etc.	B1, B3 G1, G2	M0, M1, W1

[103] Wang D, Yin Z X, Yu X T. International Experience of Mixed Land Use: Models, Measures and Effects [J]. Urban Planning International,2019,34(06):79-85.

Land Usage Main category	Sub category	Encouraged mixed use of land usage	Tolerable mixed use of land usage
A (Land for administration and public service)	A1 (Land for administration): party and government organs, social organizations, institutions and other offices and related facilities	R2, R3, A, B, G1, G2	M0, M1
	A2 (Land for cultural facilities): public cultural activities such as libraries and museum	B3	R2, R3
	A3 (Land for education and scientific research): institutions of higher learning, secondary specialized schools, middle schools, primary schools, scientific research institutions and their affiliated facilities, including land for students' living in independent areas allocated for schools	R2, R3, A3, M0, M1	B1, B9, W1, W2
	A4 (Land for sports): sports stadiums and sports training bases, does not include the land for sports facilities specially used by schools and other institutions	B3, B9	R2, G2
B (Land for commercial and business facility)	B1 (Land for land for commercial facility): Commercial and catering, hotel and other services	R1, R2, A, B2	W
	B2 (Land for business facilities): finance insurance, art media, technical services and other comprehensive office	R2, R3	B1
	B3 (Land for recreation and health facilities): recreation and health facilities	B2	R2, R3, G2 M2, W1, W2
	B4 (Land for municipal utility outlet):	R, A, B	M

Land Usage Main category	Sub category	Encouraged mixed use of land usage	Tolerable mixed use of land usage
	Retail refueling, gas, telecommunications, postal and other public facilities business network		
	B9 (Land for other service facilities): spare-time schools, private training institutions, private clinics, funerals, pet hospitals, car repair stations and other service facilities	W	R2, R3
M (Land for industrial)	M0 (Land for new industrial): research and development, creativity, design, testing, pollution-free production and other links and supporting facilities	W1, B2, B1	R3, B3
	M1 (Ⅰ class land for industrial): Industrial with basically no disturbance, pollution or safety hazard to the residential and public environment	W1, W2	M2, B3
	M2 (Ⅱ class land for industrial): Industrial with fair disturbance, pollution and potential safety hazards to the residential and public environment	-	W1, W2
W (Land for logistics and warehouse)	W1(Ⅰclass land for logistics and warehouse): logistics and storage with basically no disturbance, pollution and potential safety hazards to the living and public environment	M0, M1, W2	B1, B2, B3
	W2 (Ⅱ class land for logistics and warehouse): logistics and storage with fair disturbance, pollution and potential safety hazards to the residential and public environment	M1	B1, B2

Land Usage Main category	Sub category	Encouraged mixed use of land usage	Tolerable mixed use of land usage
G (land for park and square)	G1 (Land for park): green space open to the public, with the main function of recreation and functions of ecology, beautification and disaster prevention	-	R, A, B, M, W
	G2 (Land for square): urban public activity place with functions of recreation, commemoration, gathering and hedging	-	R, A, B, M, W

Mixed use in buildings

The life of CAZ stems from the abundance and diversity of activities temporally and geographically. The activities carrier is the densely populated metropolitan area, and the collecting and mixing functions in building spaces are the most intuitive manifestation of diversity and inclusion. The kind and number of primary attracting functions, the spatial aggregation and mixing of functions, and the multi-temporal occurrence of activities are all the essence of diversity for vitality. Promoting the CAZ's functional benefits, which can lead to compact urban development, is facilitated by creating a nice place with vitality within the CAZ.

The functions of the building are mainly mixed in the spaces of vertical direction by layering. The diverse building functions mainly include three categories of residence (R), production service (B), and living service, where the residing service category can be understood as the functions of commercial (C) and public welfare service (P)[104]. The common functional mixing patterns of central areas include mixing of residence

[104] Tang W. Mixed Land Use Research of the Chinese Urban Central Area [D]. Nanjing: Southeast University, 2014

with living service (CR), mixing of production service with life service (BC), and mixing of public welfare service with life service (PC).

Mixing of residence with living service (CR) is widespread and constitutes the bulk of mixed land use in the central area and the whole city. The living services mentioned here include retail commerce, food and beverage services, rental, and entertainment services, basically the same as commerce. Commerce is directly related to the daily life of urban people as same as a residence, which makes CR the most effective mixing for the quality and environment of living in the central area. Regarding morphology, CR in the central area is a product of modernism urbanization, where the boundaries between the residence and commerce are relatively clear. To ensure the privacy of the residence, the entrances and vertical traffic of the two functions are often separated (Fig.4-10).

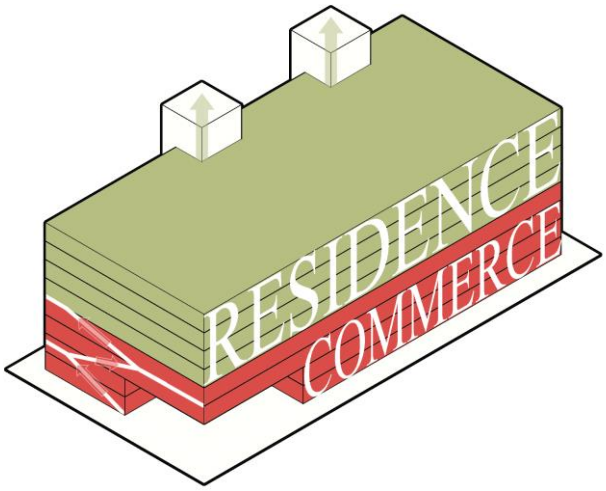


Fig. 4-10 Inner transportation of CR

In terms of function, the grade of the commerce is related to the type of surrounding active residents. Thus, the two functions have consistency in the functional hierarchy, which indicates the seldom situation of high-end commerce mixed with low-end residence or high-end residence mixed with low-end commerce. In terms of spatial distribution, the specific distribution location of CR is mainly influenced by the type of commerce business. The larger the scale of commerce business and the higher end of the hierarchy, the more core the location where the mixing mode of CR may occur.

Unlike the widely distributed CR, mixing production service with life service (BC) contains objects that are dominant functions in the central area and mainly occur in the hard core of the central area. Except for some large corporate headquarters, bank headquarters, or star hotels that occupy separate plots, most businesses share the cost of land development and operation through BC. In addition, the population density of production services decreases sharply at night; thus, mixing with commerce promotes land use for multiple hours and reduces the waste of space. In terms of morphology, production service requires less privacy and security than the residence and often shares traffic cores and underground parking facilities with commercial components vertically (Fig.4-11).

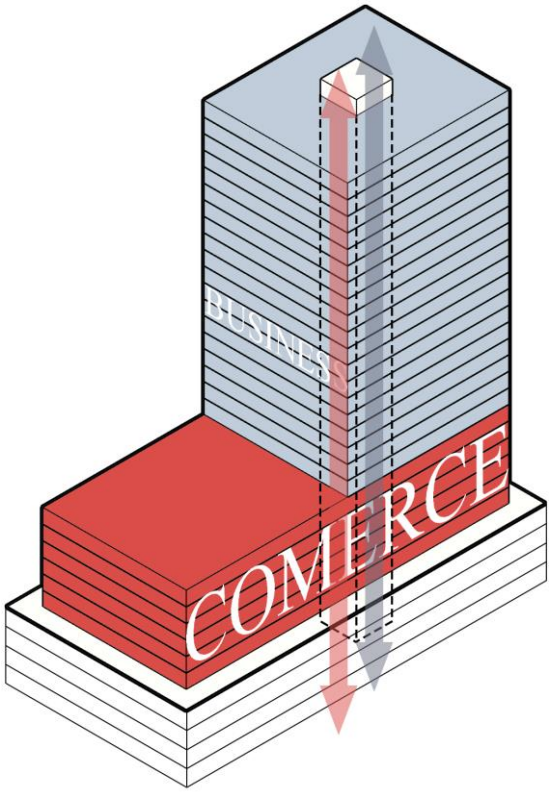


Fig. 4-11 Inner transportation of BC

In terms of function, due to the spatial characteristics of the production service, frame structures are mostly used in buildings of CB, so the commerce of living services can have relatively large openings, such as supermarkets and shopping malls. There are

mainly three production services appearing in the CB: finance and insurance, trade consulting, and hotels. The first two share office space with similar characteristics, where the trade consulting are mostly leased office buildings, and mixing with commercial functions can enhance the conditions of supporting facilities for the trade consulting. The latter type of hotel requires commercial space such as restaurants, cafes, and kiosks, which are generally located on the ground floor or podium. Some hotels open these original internal facilities to the public to serve the city. In contrast, others transfer commercial facilities and the space to others for better operation, which can be defined as mixing. In terms of spatial distribution, CB is more concentrated toward the hardcore in the central area than CR. Whether it is business, hotel, or commerce, the larger and higher-end the facility, the stronger the gathering and the more it can benefit through the gathering effect.

Mixing public welfare service with life service (PC) is the only one of the three common government-led development mixings. Although the total amount of PC is not much in the current central area, some public service facilities, especially cultural and sporting facilities such as museums, libraries, and stadiums, are starting to adopt market mechanisms to participate in operation and management to relieve the pressure of financial input. The introduction of commercial facilities can provide supporting services for venues and balance the operating income and expenditure through sales revenue. In terms of function, as the main body of the PC, public welfare services include administrative offices, medical and epidemic prevention, cultural services, research and education, and sports and fitness. Most commerce is extensions of the main public welfare service, such as commercial facilities mixed with stadiums, sporting goods stores, gymnasiums, etc., and commercial facilities mixed with museums may be tourist restaurants, souvenir stores, etc. In terms of morphology, the form of administrative offices, research, and education spaces are similar to the form of production service. What is more remarkable is the ample span space of cultural and sports venues, which need outdoor gathering space such as a square left through

the building setback. Thus, mixed commerce can rarely be arranged directly on the street (Fig.4-12), and the attractiveness to the episodic population is weakened. In central Chinese cities, very few public welfare facilities are involved in mixed land use. As the structural level of the central district rises, the average share of PC area in the whole central district area keeps decreasing, implies the changing process of the scale of public welfare service facilities from small to large and the distribution from scattered to concentrated. The pursuit of fantastic imagery of public welfare service facilities ignores the essence of these facilities being open to the public.

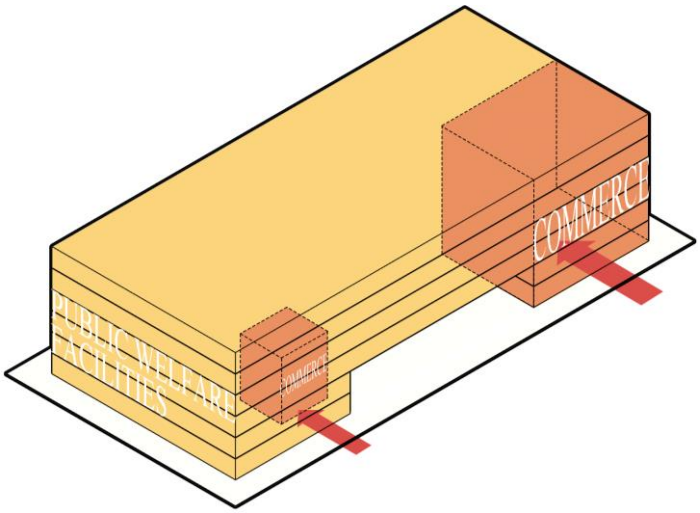


Fig. 4-12 More opening commerce of PC

Diverse and inclusive activities in CAZ

The CAZ differs from the CBD due to the CAZ's emphasis on tourism and public culture as its major appeal beyond commercial offices, which necessitates that it be able to provide services for diverse populations. Thus, Inclusion and particularity must be considered while designing a varied and heterogeneous urban function.

7*24 space usage, one of the characteristics of CAZ derived from CBD, may significantly enhance urban life. Consequently, depending on the features of people's activities at various times, different tidal functions may be established in the same area in CAZ, or functions with vastly different use situations can be set in separate places.

The CAZ in London enhances the shopping and entertainment aspects of the tourist industry to create a year-round leisure tourism destination (Fig. 4-13). West End and Knightsbridge are the primary retail districts throughout the day in London. Oxford Street, the retail district in London's West End, is the UK's most famous shopping street, with over 300 of the world's greatest shopping complexes along its 1.25-mile length, attracting 30 million tourists annually from across the globe.

Fig. 4-13 Vibrant day and night, CAZ in London's West End

Sources: https://mp.weixin.qq.com/s/ZJNKb6rKO6X9AFY-6Tekvw

The London CAZ aims to create a cluster of nighttime businesses inside the nighttime economy. For example, Trafalgar Square provides nightly performances to lengthen visitors' stays. The West End of London attracts 200 million people annually to its 3,000 nighttime establishments illuminated by neon lights. The majority of London's roughly 5,000 bars are located in the CAZ. In addition to creating 100,000 employments in London, the nighttime economy generates £26.3 billion (2017) in income. With the addition of the night economy, the Financial District has gained new vigor. According to a study for the Financial City CAZ and Canary Wharf CBD, talented young

individuals choose to work in Financial City, where the quality of life is higher and more diverse, rather than in Canary Wharf.

As a result, when deciding on functions to adapt to China's compact CAZ, existing business and consumption habits and the degree of public cultural development in the city where the design is located should be considered. The functions that can satisfy various service groups and be used 7*24 hours will be set up. Well-developed live house performance and nightlife in Guangzhou, as an example, will have a considerable effect on the CAZ function selection in Guangzhou. However, buildings or public spaces with diverse uses have varied forms. Methods like motif deformation should manage the design so that the image of the compact CAZ can pursue changeable unity in diversity.

In conclusion, mixed use in both plots and buildings, horizontal and vertical, can lead to a more compact and vibrant vision with suitable function (Fig. 4-14).

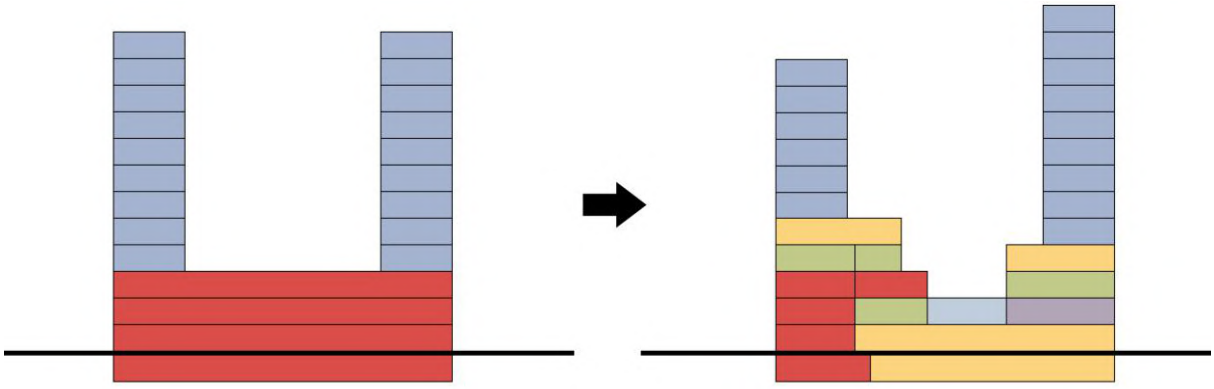


Fig. 4-14 From single use to mixed use

4.2.3 Concentrated and scattered public spaces

Compact in exchange for more public space rather than only economic benefit, they can be concentrated or scattered urban green areas or activity plazas that form the intermediary between mixed functions and the mitigation of high-density environments in a distinct hierarchy system to create a richer publicness. Meeting the critical premise of proximity, accessibility, and convenience of public infrastructure, the common prominent connotation of compact cities and CAZs is the balance of business and other

functions such as residential, cultural, and sports recreation. They have both different forms of space and different levels and tenure of publicness; for example, cultural and sports facilities for public services have the strongest publicness, meaning that they are accessible to all, while business facilities are public only to those who work in them, and residential spaces are more private. Setting up more diverse public and open spaces of different degrees and greenery between different functions can bring more attraction and comfort than traffic roads. The ambiguous public areas in Hong Kong indicate publicness at different times and degrees.

Attributes of public and private

Concentrated public space has the benefits brought by aggregation. Still, the excessive concentration of large space may lead to the lack and loss of vitality of the other public space of buildings and streets. Scattered public space is more proximal and accessible in terms of physical distance. Still, scattered public space in a high-density environment is prone to turn into a vacancy that loses vitality and cohesiveness due to its excessive scattering, lack of management and boundary, plus the lack of continuity in combination with transportation facilities, making it difficult to realize the compact vision of self-sufficient community living within the plot. Human nature's pursuit of green space, sunlight, and health make it meaningful to create rich public spaces in systematic buildings and urban spaces.

The construction of the public space system can compensate for a variety of land use and tenures of public spaces, such as shared pedestrian corridors, 24-hour plazas, and non-profit or profitable active public open spaces, which are in between private business spaces, residential spaces, and commercial and public service facilities [105](Fig.4-15). This measure is a transition between public and private attributes and complements the urban spatial system. It also requires public space governance to

[105] Chen C Y, Xiao D W. Building Medium Space System in Lingnan Cities[J]. New Architecture,2009(02):79-83.

clarify and enrich the tenure issues of such spaces. The compensation of a compact CAZ should be judged first by the publicness of its public open space and infrastructure. Those that are publicly owned, open to the public, and highly participatory have the publicness. The public space in the central area where all people can use and enjoy contains accessibility and participation. Encouraging citizens to move around nearby can better utilize the public benefits of socially shared resources under compact urban development. Generally speaking, most public spaces in urban central areas are open to the public, but the degree of openness varies, and so does the impact on their public benefits.

Fig. 4-16 Private sculptures in public space

Therefore, this thesis adds that semi-public spaces can respond to the ongoing activating public space vitality. Public spaces are transformed into semi-public spaces with specific responsibility by encouraging private enterprises to use public green spaces for profitable commercial activities. Semi-public spaces can also promote urban vitality by continuously enriching the functions of pedestrian spaces. For example, installation art sculptures representing corporate culture can make the public space in the central business district an art space while showing the corporate culture (Fig. 4-16). Whether the public, semi-public, or private, more involved stakeholders can keep more eyes on the spaces in the city for the continuous activation of urban vitality.

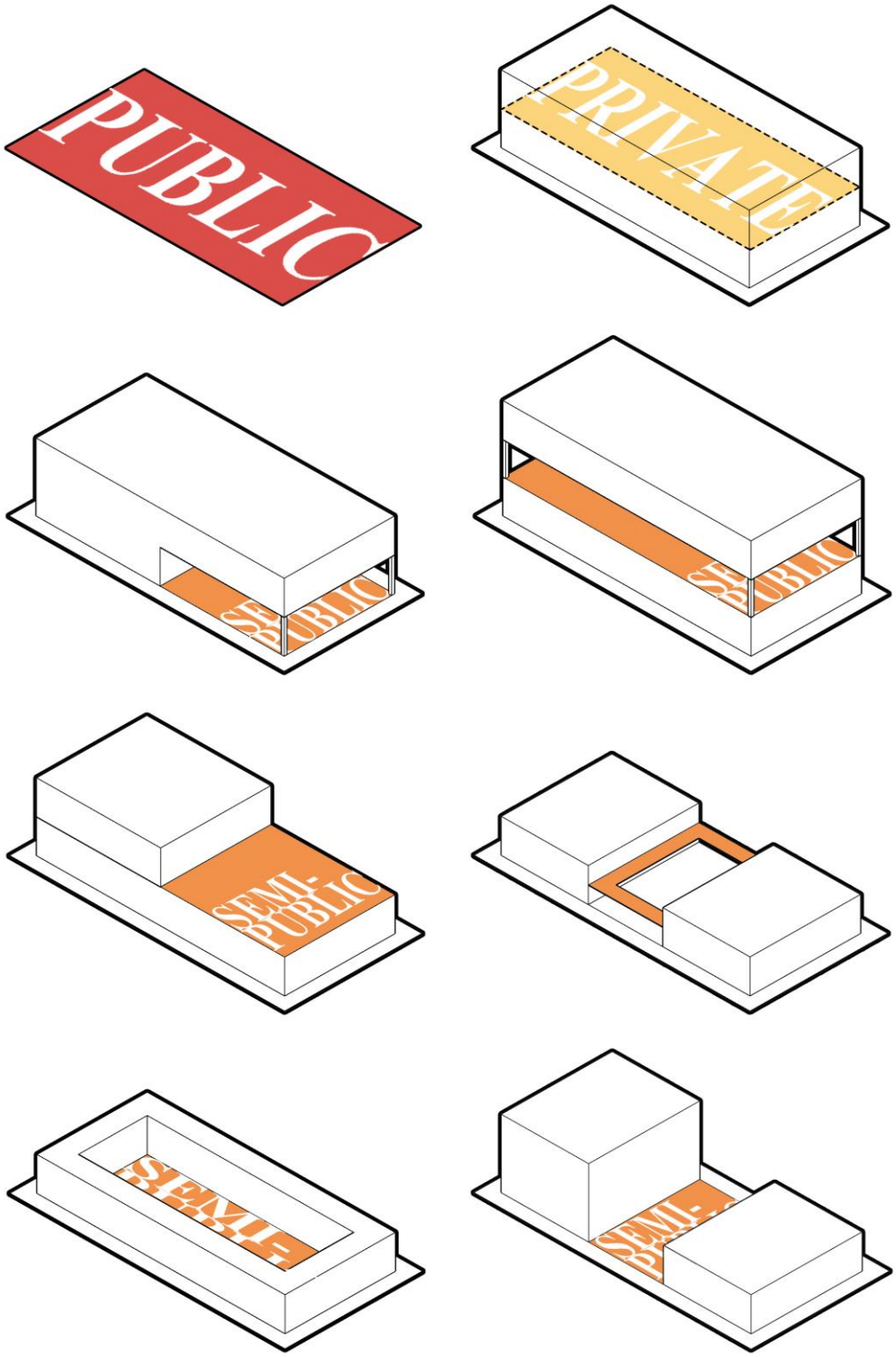


Fig. 4-15 Public, private and semi-public spaces

Functions of mediation and compensation

This thesis advocates centralized and scattered public spaces for China's compact cities, including scattered but continuous intermediary spaces system and centralized

compensated public open spaces. Compared to public spaces open to all with less privacy, semi-public spaces can be understood as intermediary spaces that keep the balance between openness and privacy（Fig.4-17）.

It is essential to reduce the environmental pressure, such as insufficient green space, excessive dense space, etc., brought by high-density through strengthening the continuity and integration of intermediary public space systems with urban functions in the compact CAZ.

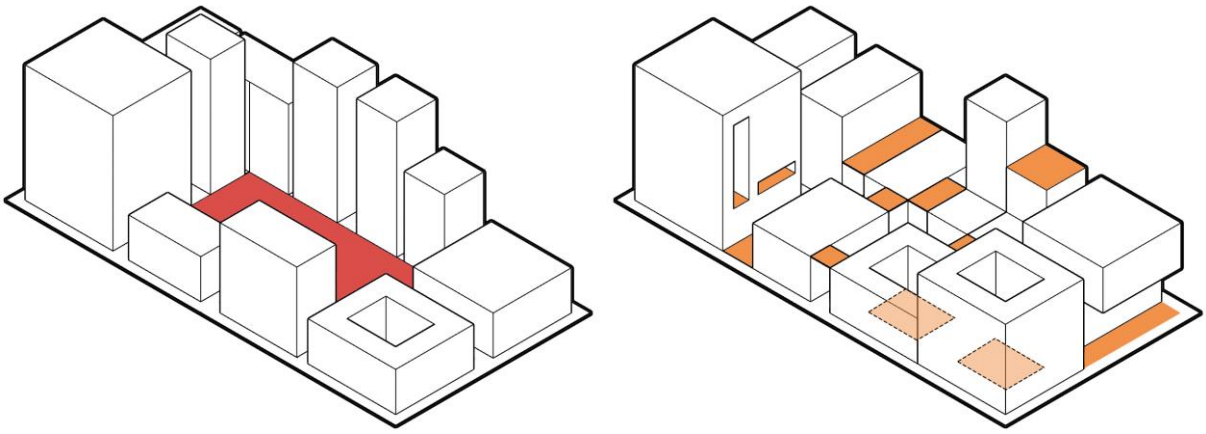


Fig. 4-17 Spaces of compensation and mediation

For China’s increasingly large and dense urban central areas, intermediary public spaces such as Qilou and elevated floors can serve as a buffer and relief. Qilou in Guangzhou provides a half-inside and half-public gray space, which weakens the tension of high-density urban interfaces and creates a multi-level street system with the functional significance of infiltration and buffering. On rainy days, the commercial street under the Qilou can be opened as usual, and the pedestrians can be protected from the bad weather; the space connecting Qilou also allows citizens to walk between the buildings. The 18 kilometers of arcades in Turin, of which 12.5 are interconnected, are the largest pedestrian area in Europe. From the original, it is for real’s convenient to walk down to the Po River without getting wet, even when it rained. The elevated floor can build a comfortable half-indoor and half-outdoor space so that the tired

citizens can take a breath through a half-architecture, half-nature space, to obtain the emotional experience of spiritual release.

Experience of Hong Kong's special attention to the integration of intermediary spaces and urban functions in dense cities has made the places where ordinary citizens communicate in their daily lives. The system of intermediary spaces forms a buffer between the urban space of different attributes and tenure, creating a flexible transition between the noisy and the quiet, allowing citizens to have a peaceful and comfortable living and resting environment in the high-density city, creating a rich physical space while maintaining a compact social bond.

Accordingly, centralized compensated public open spaces can maintain publicness and benefit from aggregation, with more possibilities and scenarios for use. Central Park in Manhattan and Zhujiang Park in Tianhe CBD leave quiet and gentle green spaces in the central areas of high-density cities (Fig. 4-18), bringing a momentary deceleration of high-pressure urban life.

Fig. 4-18 Central Park, Manhattan and Zhujiang Park, Guangzhou

as compensation for the dense surrounding area

Imagine if the population density of urban greenery on weekends is higher than on commercial streets. Is it not more important to call for green and eco-friendly places in urban life? Public spaces in central and peripheral areas of cities in China have invariably become virtual spaces for leisure, sports, and interaction. They have even become fashion icons and internet-famous spots. Concentrated public spaces are

becoming a necessity for Chinese citizens and a standard part of modern public services that represent the degree of civilization. Expanding the supply of public open spaces and building a large number of public spaces and green spaces to meet the needs of various people and outdoor activities can improve the livability and attractiveness of cities. Allocating expensive land resources to build public open spaces in densely populated central areas can also enhance the overall economic benefits of the central areas by improving the quality and value of the surrounding environment and properties.

In the context of China's urban transformation, public space and infrastructure systems in the city central area should pursue size and availability and have higher requirements. Only systematically constructed public activity spaces with diverse tenure can strengthen the compact benefits of CAZ and realize the more affluent material culture and spiritual civilization needs of the citizens (Fig.4-19).

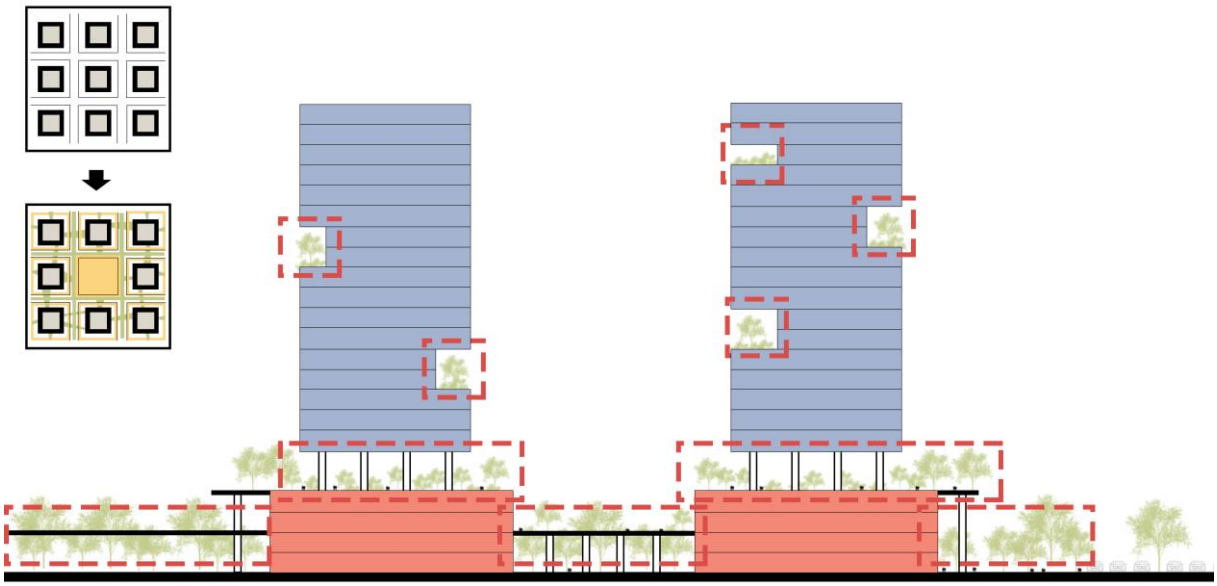


Fig. 4-19 System of mediation spaces

4.2.4 Vertical pedestrian- oriented transportation

The compact urban development and CAZ promote public and pedestrian-oriented transportation modes and require that transportation provide a variety of paths for

citizens to reach public facilities. This thesis proposes to increase the density of the road network, return the dominance of motor vehicles to pedestrians, and build a three-dimensional pedestrian and public transportation system to bring the streets back to the daily activities of citizens in the vision of compact and vitality.

Vertical pedestrian-friendly system

Walking is irreplaceable in people's daily life regardless of the development of motor vehicles. Moderate walking is not only beneficial to the health of residents but also plays a vital role in solving the problem of interchanging between different modes of transportation. The impact of motor vehicles on the environment is increasing, and the pedestrian-friendly system can effectively limit the number of car trips and achieve energy saving and environmental protection, as one of the original aims of the compact city.

The pedestrian system is coordinated with urban buildings and public facilities, and the pedestrian system's continuity emphasizes the pedestrian system's clear hierarchy and network. A complete pedestrian system should be a unified network system composed of points - lines - surfaces, connecting buildings, streets, greenery, public spaces, and ancillary facilities. The connection between the street and the external space of the building, as well as the relationship between the pedestrian system and the urban transportation interchange system, should be strengthened in the continuous pedestrian system, and intermediary spaces such as building atriums, outer corridors, and overpasses are as important connecting spaces (Fig. 4-20). The formation of pedestrian system continuity is conducive to expanding the walking range of residents and providing them with accessibility to various urban facilities. The successful construction of a safe, comfortable, fluency, and convenient pedestrian system is essential in enhancing urban vitality.

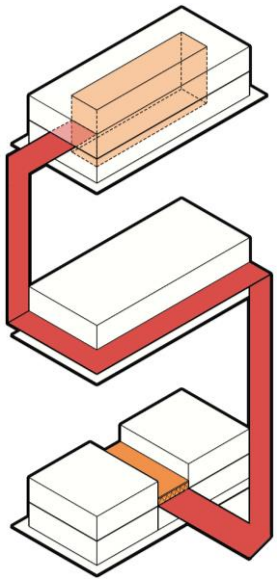


Fig. 4-20 Pedestrians as connection

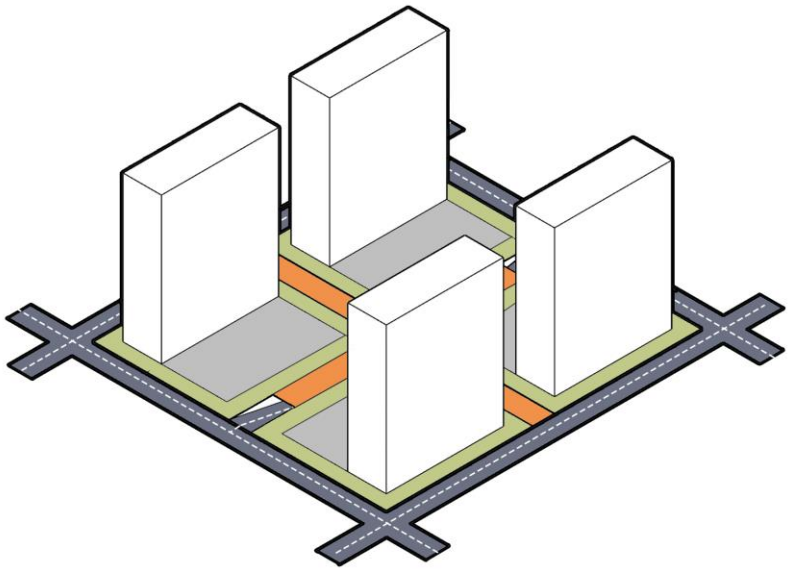


Fig. 4-21 Under passing motorized road

The high degree of mixing and clustering of urban spaces and functions implies the inevitable development of vertical cities, and the three-dimensional effect of buildings provides the basis and necessity for the three-dimensional development of urban transportation and the establishment of three-dimensional walking methods such as in the underground and the air is an important part of future urban development. With the intertwining of architecture, motorized traffic, and space development, three-dimensional pedestrian traffic can effectively connect various urban functions and meet the needs of citizens' daily life. However, walking on the ground is still the essential layer, so the current vehicle-dominated ground traffic should be given back part of its road sovereignty to pedestrian traffic, such as under passing motorized roads or designing adjacent functionally compatible inter-plot roads as well-landscaped sidewalks, etc. (Fig.4-21).

Efficient ground public transportation

Increasing the road network's density is essential to efficient transportation on the ground. However, the well-known model of small building blocks and dense road networks is not entirely appropriate for compact urban development in terms of

excessive building setbacks and too many intersections. A dense road network based on 100m*100m blocks should be oriented to inter-area bus routes and contain a pedestrian network, with local inter-plot roads serving as pedestrian streets, reducing the number of intersections in the block and forming more compact plots (Fig.4-22).

Inter-area buses that specifically serve CAZs and surrounding areas need compact CAZs with shorter operating distances and cycles, denser stop layouts, and convenient interchange with other public transportation bus routes to ensure their proper efficiency in compact and vibrant urban centers as a substitute for more private cars.

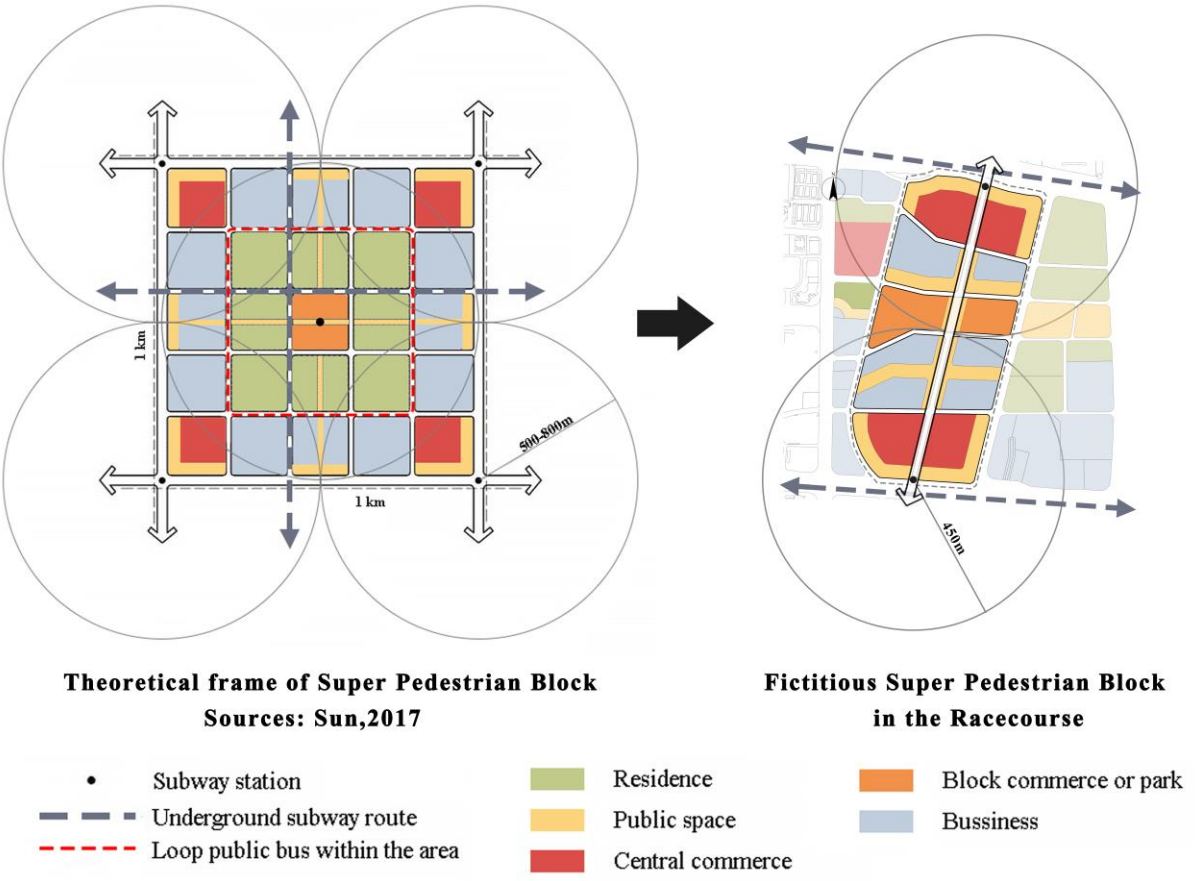


Fig. 4- 22 Preliminary public transportation and plots' partition of the Racecourse

Motorized roads should yield more right-of-road to pedestrian and bus lanes. Nowadays, motorized roads are increasing in width and number of lanes to meet the development of private cars. The lack of determination of priority status for public transportation has led to occupied bus lanes, resulting in road congestion and a severe

lack of pedestrians. Therefore, measures such as under passing motorized roads to return the ground to pedestrians and public spaces or setting up bus lanes to reduce the road area occupied by private cars (Fig. 4-21).

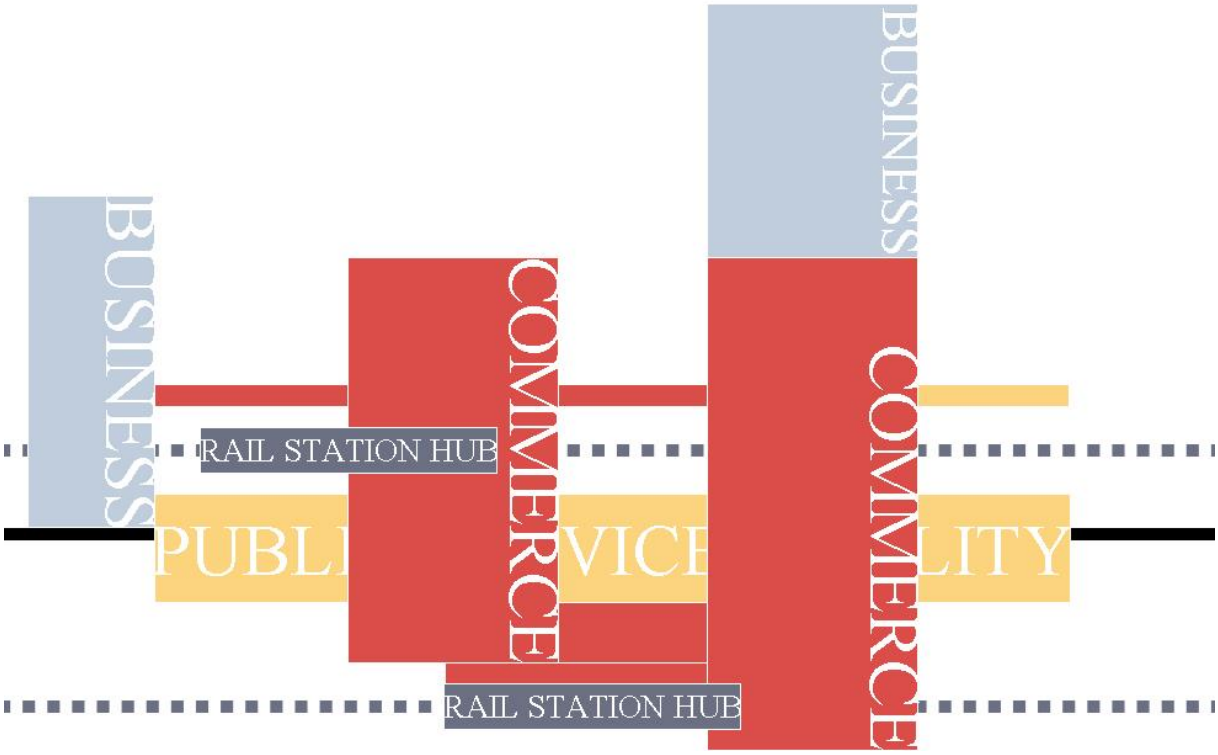


Fig. 4-23 Intensive development of rail transit hub

Intensive rail transit hub

A rapid rail transit system can be a good solution for urban high-capacity transportation and ease the traffic pressure during peak hours. Urban rail transit in this paper mainly refers to the subway. The reasonable comprehensive arrangement of public bus and subway layout can effectively save land resources and limit the travel of private cars towards a more accessible compact CAZ.

Intensive development in and around rail transit hubs meets with the high pedestrian flow and the highest development value of the hub. Complexes using underground space based on the hub or direct connections from the hub to surrounding high-rise towers through channels or corridors can be the most practical ways of intensive development. Attractive uses of commerce, hotel, business, and public services are

usually mixed in the hub plot, especially in the central area. The 24-hour vitality of the hub can thus be guaranteed through vertical layering control of the buildings and other methods of mixed-use in building scale (Fig. 4-23).

4.2.5 Urban forms to support diverse activities

CAZ functions are numerous and heterogeneous, and the attractiveness of different types of functions varies. Hence, CAZ frequently begins with specific significant functions as point resources to drive further growth. This section mainly considers the four types of activities for Zhujiang New Town summarized in 1.1.2, including innovative and creative industry activities, eco-health activities, sport and leisure activities, and fashion and culture activities. The sequent analysis will start by proposing the morphological motif for the view of compact and vibrant urban blocks. Then the forms will be generated by layering according to the functional needs, and the functional mixed use will be placed into the hypothetical blocks.

Motif of forming

In contrast to 4.2.1, where extreme forms are derived and controlled by indicators, generating form by motif is an abstract logical approach to organizing forms in different vertical levels to realize better theoretical concepts rather than meeting practical constraints.

This section proposes that like the principle of organizing and classifying public spaces through public and private attributes in 4.2.3, building in the compact block can also be divided into public, semi-public, and private spaces, in addition to semi-public spaces that act as intermediaries or compensation. Fully public spaces include streets, activity spaces, and green spaces open to all citizens. The private spaces include inwardly building spaces such as business, commerce, and residential spaces with corporate ownership, and activity spaces and greenery enclosed by building spaces. The publicness of these private buildings is public to a specific group of users. Semi-public spaces are intermediary spaces that link public and private spaces, such as shared

pedestrian corridors, Qilou and arcades, and non-profit or profitable active public open spaces between compact business, residence, commerce, and public service facilities (Fig. 4-15).

In terms of the figure-ground relationship, public space is the ground outside the building figure, privately owned buildings are the enclosed inward figure, and semi-public space is the part that spans between the two. Given the proposed buildings-to-line rate in 4.2.1, the appropriate form for the underlying floors of a compact block should be the peripheral building to combine the inner courtyard and leave some spaces for the block entrance. The semi-public space on the underlying floors is mainly reflected in the pedestrian street formed by the inward setback of the building facade along the street.

Based on accessibility and convenience, as well as the characteristics of mixed-use buildings, the block of the compact CAZ should develop more in the vertical direction. Therefore, there can be enlarged intermediary spaces as the middle above the underlying peripheral buildings. For example, the entire peripheral building can use the roof on the underlying floors, form more semi-public spaces between different building functions, and act as an intermedia between the basement and the upper buildings.

In addition, the upper floors can form the staggering volume of high-rise buildings, horizontally scattered small volume buildings, or buildings with backward terraces, depending on the function. For example, the business requires more floor area on the upper floors. At the same time, the commercial complex is fond of more flexible buildings with backward terraces or dispersed small volumes to provide more platforms for external activities in the building, which can be closely connected to the specific activities in the building.

In summary, the motif of forming the compact urban development in CAZ consists of 3 levels with more evolution depending on their functions and attributes (Fig.4-24).

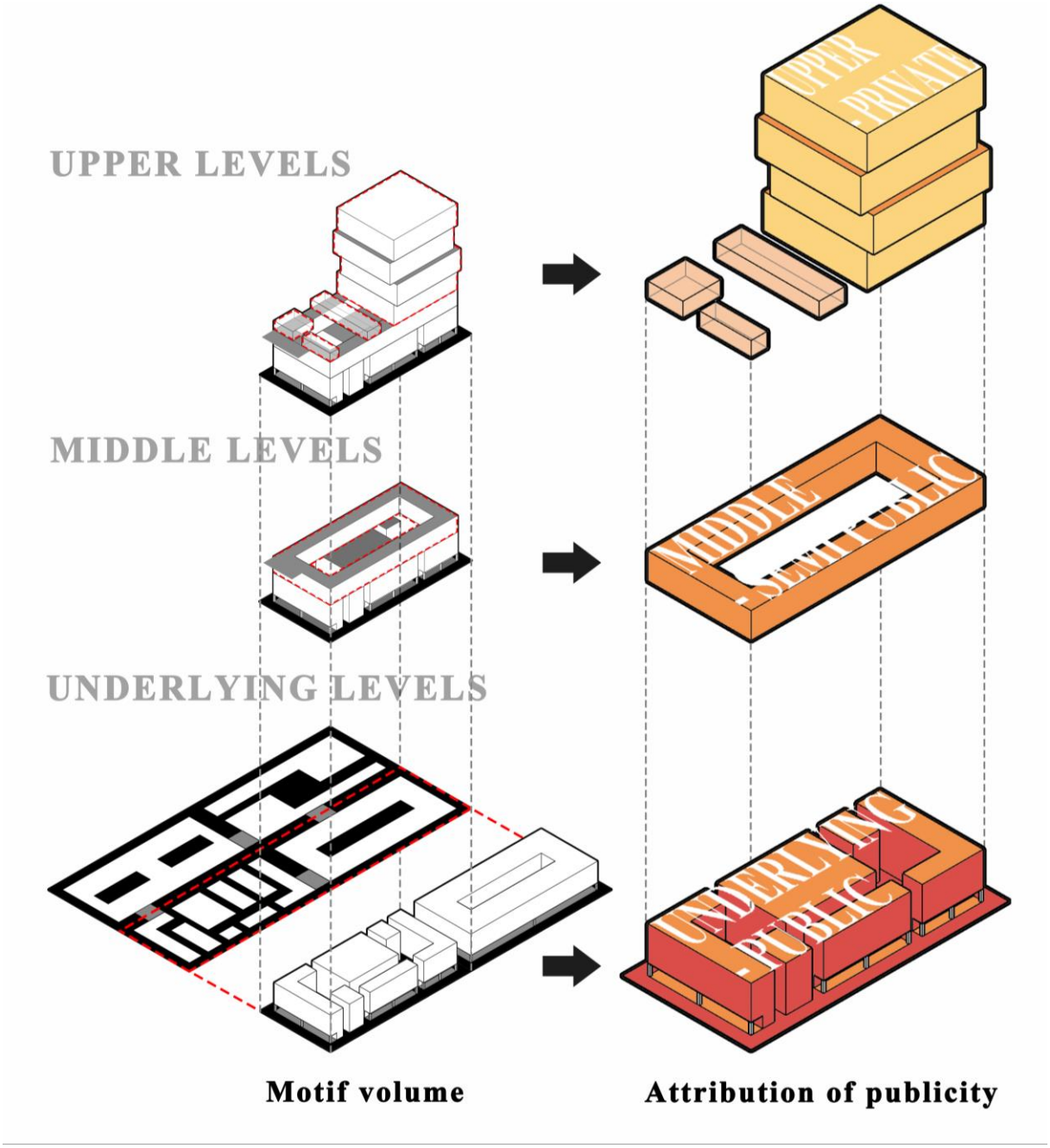


Fig. 4-24 Motif and attributes of form

Form follows function

Based on the four types of activities that have been summarized as more needed in Zhujiang New Town, including innovative and creative industry activities, eco-health activities, sport and leisure activities, and fashion and culture activities, this section has extrapolated the morphology of the different functional blocks that may be formed.

According to the methods in 4.2.2 for different mixed-use buildings, and combined with the different forms proposed in the previous section, the mixing of functions can be refined to different volumes based on vertical layering motif, such as vertically mixing by following floors of the building, staggered mixing cooperates with staggered building volume, and interspersed mixing of individual volumes (Fig.4-25).

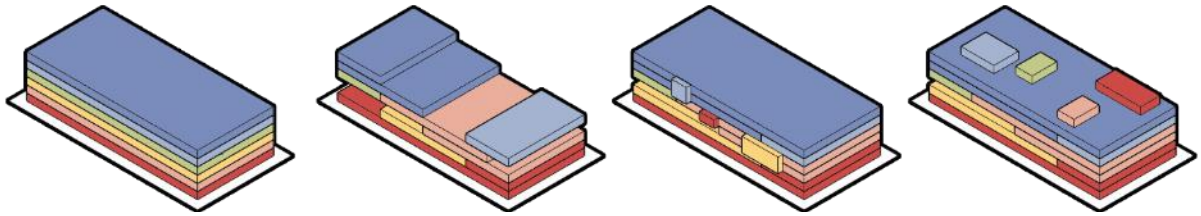


Fig. 4-25 Mixed-use in different forms

Innovative and creative industry activities require a headquarters business block and shared innovation block, whose functional mixing is mainly mixed by building floors and interspersed volume.

The headquarters business block is dominated by high-end business offices and includes various commercial services. The underlying enclosed peripheral buildings may consist of retail, food & beverage, and cultural commerce. The buildings in the middle level enclosing a full circle contain cultural and leisure functions, which can be combined with the roof garden on top of the underlying floors to form more active places. The upper floors of the high-rise buildings accommodate sports and leisure activities in part connected to the middle floors and create a vertical business community in combination with the upper business (Fig. 4-26).

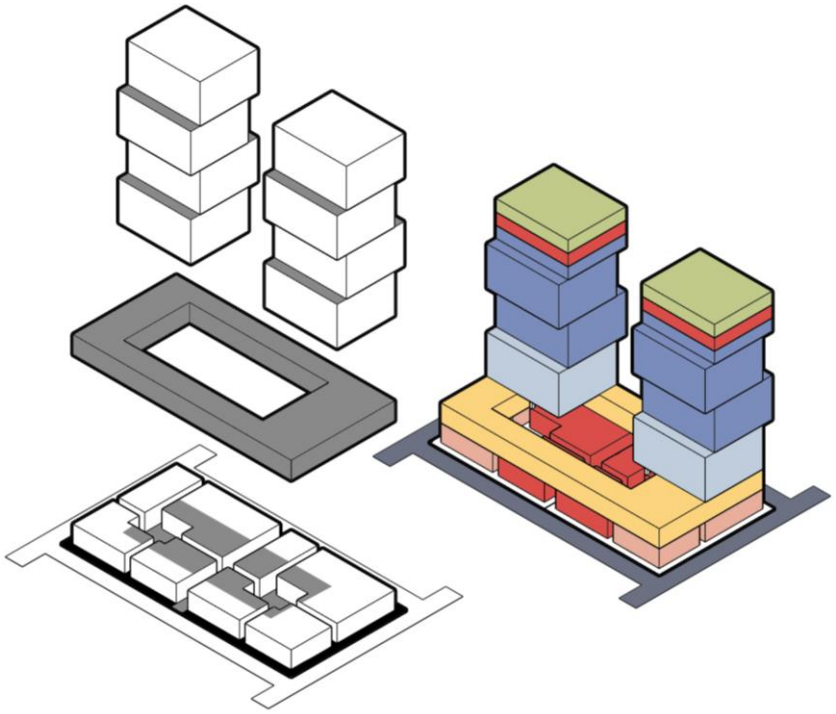


Fig. 4- 26 Form and function of the headquarters business block

The underlying floors of the shared innovation block are the sharing apartment; thus, the building-to-line ratio has accordingly reduced the enclosed volume and created a juxtaposition of building volumes to provide more internal sharing space within the apartments. The middle floors provide recreational functions through the scattered building volume. The upper floors share offices, providing more accessible office spaces for the people living in the underlying apartments (Fig.4-27).

Eco-health activities require unique eco-recreation blocks and intermediary spaces dispersed among all other blocks. The eco-recreation block has a unique morphology and vitality, surrounded by other dense blocks. There are compensated vast urban green spaces on the ground, and the activity platforms and pedestrian corridors between the surrounding buildings are constructed in the air. The vitality of this block comes from the diversity of activities generated by people in the public space, so it can absorb more geometric shapes such as circles in addition to the square-based architectural prototype to meet the possibility of diversity in form. There can be

seasonal commercial activities during the holidays organized on the activity platform, and small, independent assembly buildings are set to accommodate more flexible functions (Fig. 4-28).

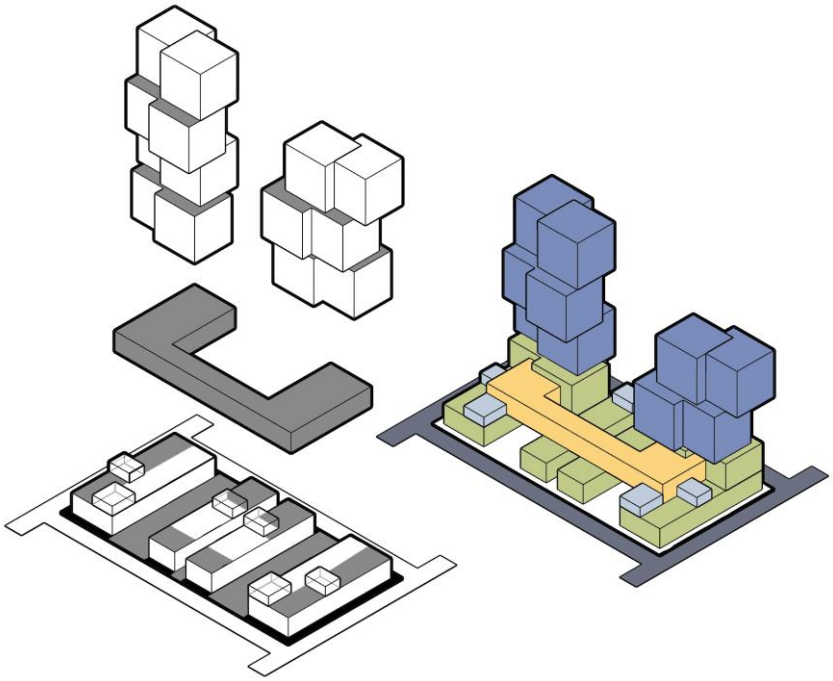


Fig. 4-27 Form and function of shared innovation block

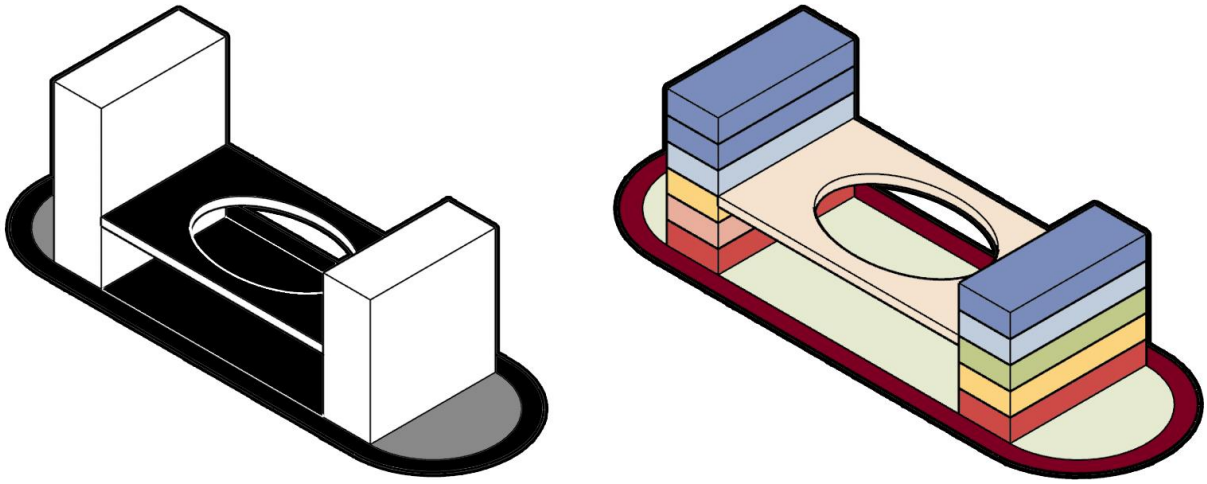


Fig. 4-28 Form and function of eco-recreation block

Both sport and leisure activities and fashion and culture activities are essentially distinctive commerce. They can therefore be distinguished according to more symbolic functional position, specifically including the sports complex connected with the rail

transportation hub, the integrated cultural industries service block in which public welfare combined with innovative cultural industries, the fashionable and trendy block for high-end consumption, and the fashion and culture commercial block with a collection of flagship and concept stores.

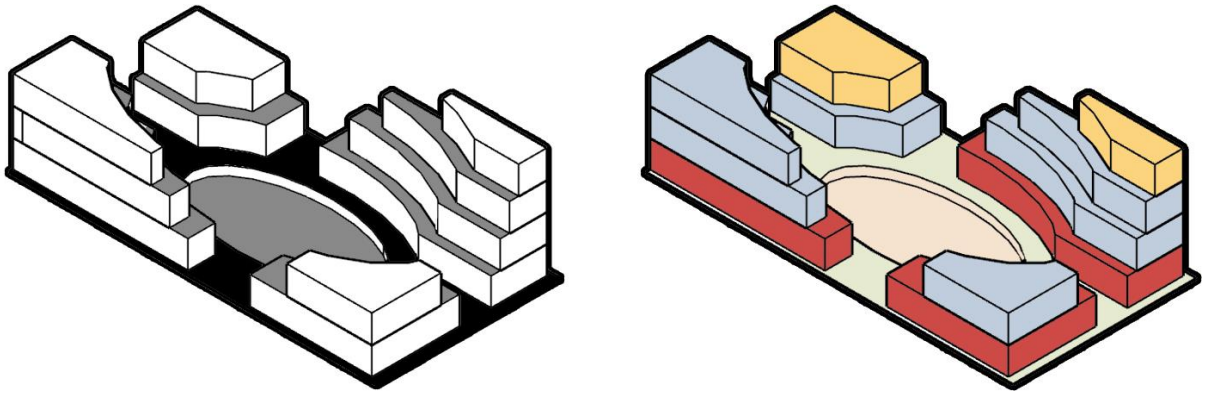


Fig. 4-29 Form and function of sports complex block

In the sports complex block, the ground floor is partially sunken into a sports activity plaza combined with underground commerce spaces, and decentralized volumes are set up around the plaza to connect the hub entrances. The underlying floors of the decentralized complexes contain retail and professional sports venues, while the upper floors contain niche sports venues or clubs with leisure and recreation businesses (Fig. 4-29).

The underlying floors of the integrated cultural industries service block maintain the peripheral buildings and form different commercial buildings and internal commercial streets and atriums, while the middle floors contain public welfare service facilities as a transition between the underlying commerce and upper cultural industries. The cultural and creative industry on the upper floors forms the industrial chain that gathers business, exhibition, and performance functions and therefore requires both high-rise and scattered small-volume buildings (Fig. 4-30).

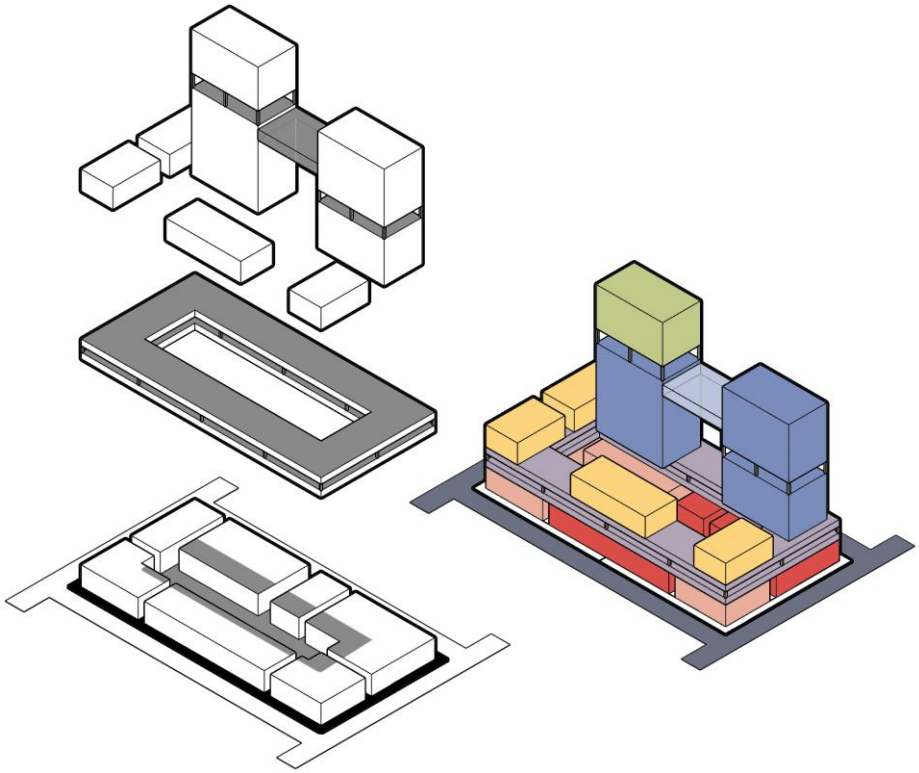


Fig. 4-30 Form and function of the integrated cultural industries service block

The fashionable and trendy block for high-end consumption maintains the peripheral buildings on the underlying floors with commerce and the complete peripheral buildings on the middle floors with youthful cultural and leisure functions and rooftop activity platforms. The upper floor accommodates single fashionable and trendy stores in small scattered volumes to form a more diverse appearance (Fig. 4-31).

The flagship and concept stores are generally located on the critical interface for the urban of the CAZ. They must attract consumers and create more public space with their unique architectural forms and facades. Therefore, the underlying and middle floors of the fashionable and cultural commercial block maintain varying degrees of peripheral buildings with high-end retail, while the upper floors adopt a building form with a backward terrace to create more interesting and independent public spaces (Fig. 4-32).

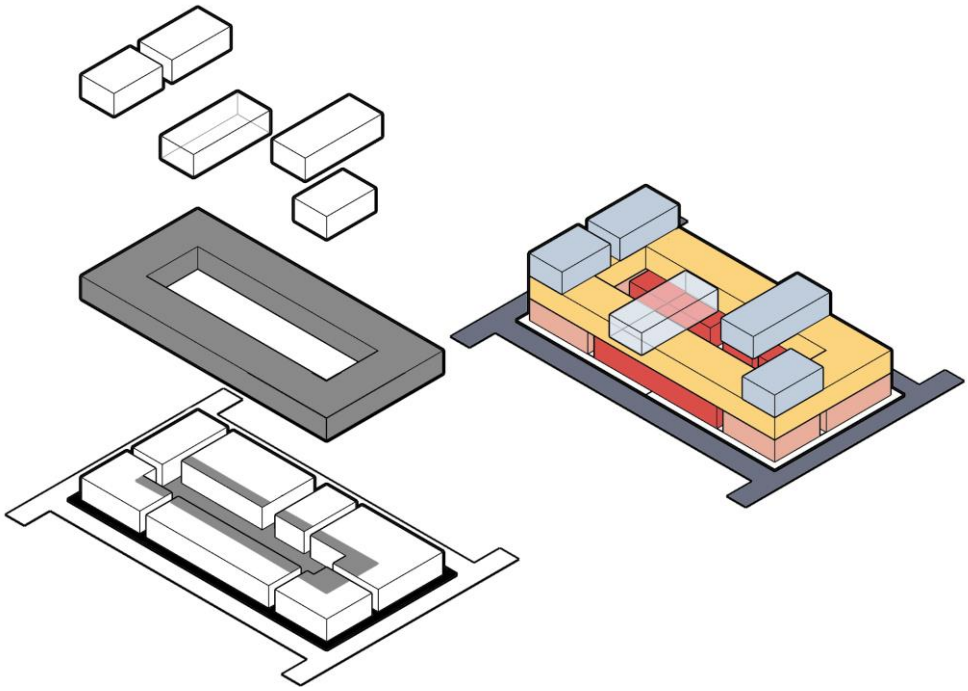


Fig. 4- 31 Form and function of the fashionable and trendy block

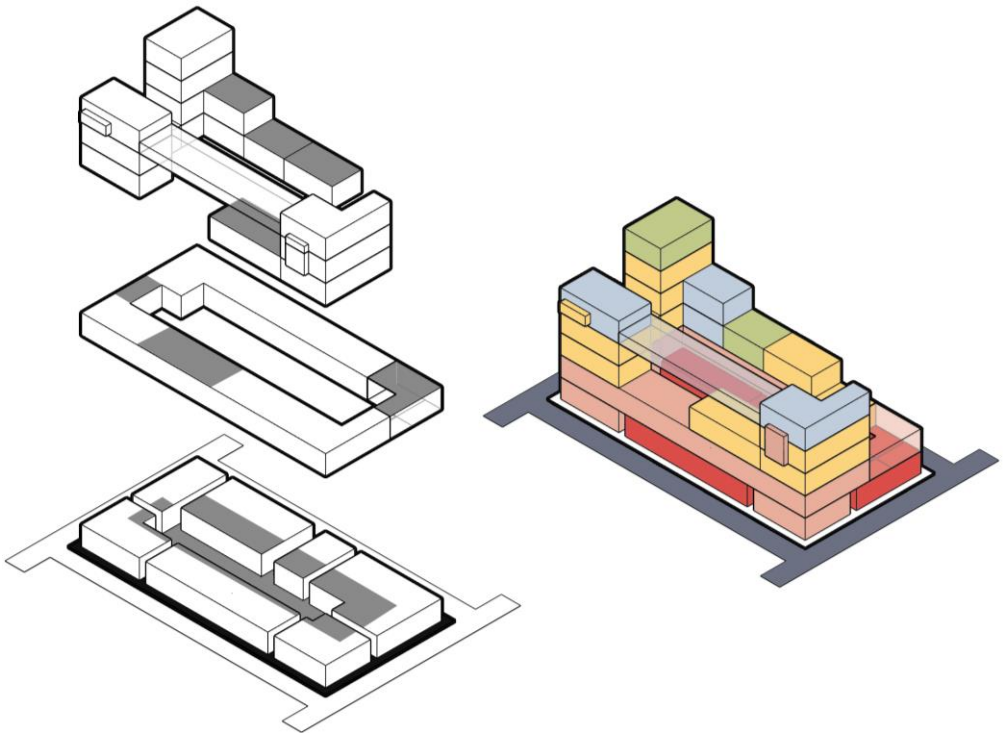


Fig. 4- 32 Form and function of the fashionable and cultural commercial block

The mixed-use in these blocks includes staggered mixing and interspersed mixing to highlight crucial spaces and other special functions better.

In general, the principle of form follows function is derived from both a generalization of the characteristics of compact urban development and empirical summaries. The different forms of blocks with various dominant functions form the diversity in the new vision of compact urban development and vitality, which comes from the agglomeration effect of the compact urban development and will eventually be filtered by human needs to create a continuous vitality.

4.3 Summary

Chapter 4 summarizes the improvement strategies for the Racecourse with more compact and vitality based on the literature review and case study.

Improved characteristics of compact urban development in Guangzhou are presented to mitigate the negative impacts of high-density, which has important implications for compact urban development in high-density city central areas in China.

Five improvement strategies are presented based on improved characteristics of compact urban development in Guangzhou and adapted to the actual site conditions of the Racecourse, forming the initial core design imagery. The first strategy is to control urban form within and between the plots through indicators of FAR, OSR, and Building to Line Ratio. The second strategy is mixed land use in terms of diversity and compatibility of mixed land use and mixed-use buildings. The third strategy is concentrated and scattered public spaces with public and private attributes and mediation and compensation functions. The fourth strategy is vertical pedestrian-oriented transportation, and the fifth is urban forms supporting diverse activities through motifs.

Chapter 5 More Compact, More Vitality: Urban Design of the Racecourse

This chapter illustrates an urban design for the Racecourse based on the previous analysis of how to establish a new version of compact urban development and vitality for the city central area.

As functions are selected by the needs of the citizens, a more compact urban area results in a more diverse range of activities, invigorating the population. This chapter uses the title “more compact, more vitality” as a manifesto for the urban design of the Racecourse. The first section analyzes the combination of the current site condition and the design objective that the compact urban development and vitality of CAZ can provide and derives a spatial structure from this analysis. Based on the morphology and attributes summarized in chapter 4, the second section provides a more specific master plan and relevant analysis. The third section covers the activities, functional areas, and imagery of each block based on an estimate of the population and the functional areas required for adjusting the blocks’ functional areas.

This chapter’s design accomplishments are a practical and final summation of the preceding section’s theoretical and design strategies, which will hopefully result in a new vision of compact urban development and vitality for the Racecourse.

5.1 Site Contextualization and Corresponding Aim

5.1.1 Area analysis surrounding the Racecourse

The Racecourse is surrounded by a diverse urban ecological system, although the landscape views of the site are poor. On the south side of the Racecourse, the Pearl River and the green belt along the river are separated from the high-rise residential buildings, making it difficult to see the Pearl River from the ground level inside the Racecourse. Zhujiang Park appears to be close to the Racecourse to the east, but high-rise office buildings to the east of the existing design area obstruct the view.

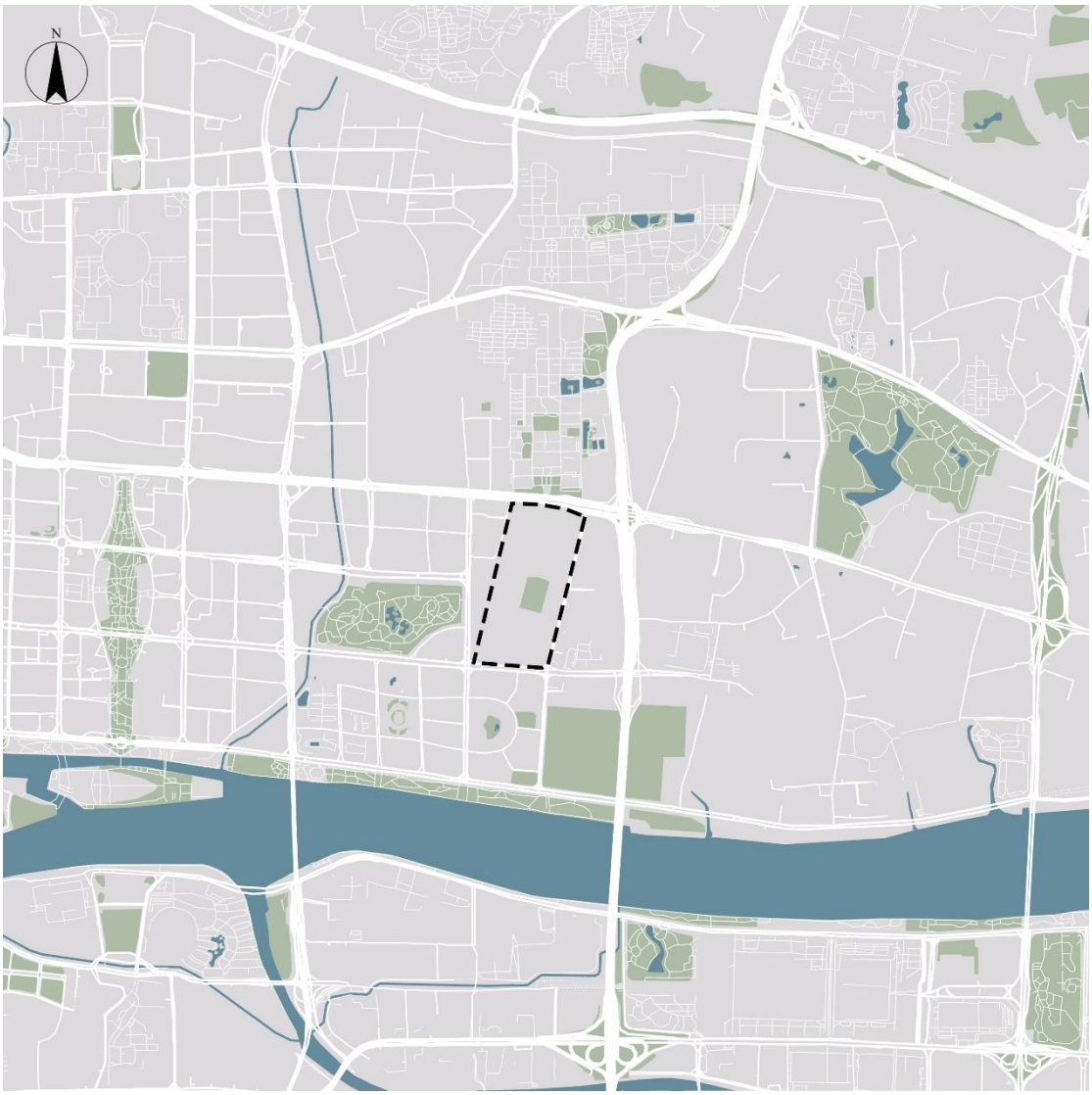


Fig. 5-1 Ecological system

Overall, the Racecourse is already bordered by a number of major urban parks and squares, including Zhujiang Park, Tianhe Park, and Huacheng Square, as well as the Pearl River and its riverine landscape belt. Therefore, the future design does not necessitate the creation of a new urban park, but rather provides for a combination of green space and other functions.

As the Racecourse is situated on the outskirts of the Zhujiang New Town Central Business District, it is surrounded by urban expressways and major roads to the north and west, but the design area is not well served by external vehicular traffic. The Racecourse interrupts the east-west traffic grid of Zhujiang New Town, resulting in the

M Block, where the design area is located, being the largest block in Zhujiang New Town while having no specific interior function. The future design should begin by connecting the east-west routes, thereby dividing the design area into blocks of proper size. Then, more vehicular traffic on the perimeter of the Racecourse will be required, along with enhancements to pedestrian traffic. In addition, the viaduct to the north of the Racecourse gives the north side buildings a sense of oppression.

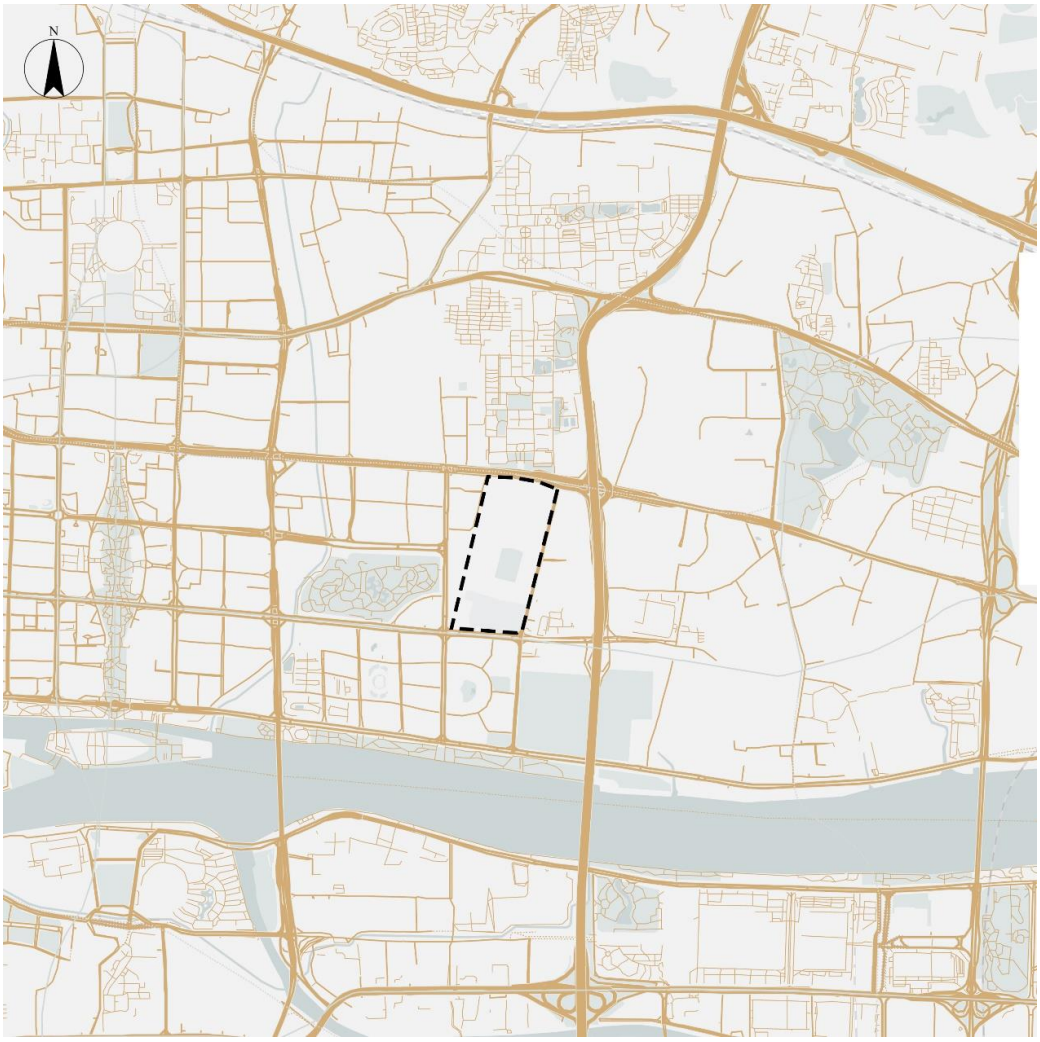


Fig. 5-2 Transportation system

The Racecourse is flanked by high-rise residential districts, with Jinan University to the north and Zhujiang Park to the east, while the design area itself is a vacant space in the city central area with no obvious purpose. Sporting venues such as golf courses and tennis courts occupy a large area within the former horse track of the Racecourse

but are only accessible to paying members. Other attractive functions such as food and beverage are concentrated in the area along the street, causing the central area to be completely lost while the food and beverage function itself is hardly an agglomeration. In addition, the Racecourse's area of 38 hectares should be used for a more diverse range of functions.

Fig. 5-3 Equipped facilities and functions

5.1.2 Land and space usage: from vacant to compact

The Racecourse may be viewed as the vacancy of the Zhujiang New Town in terms of both the morphological scale and the use of the site; thus, the concept of compact

gives a more dense and accessible space, which serves as the basis for the compact urban development of the Racecourse's new vision.

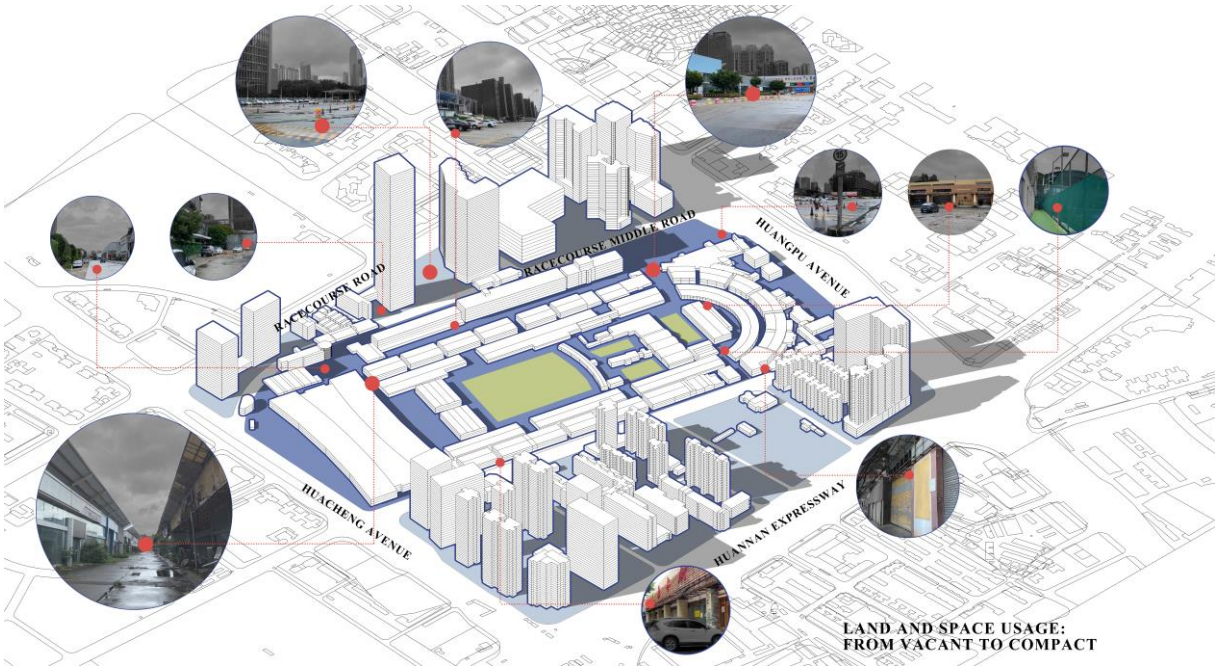


Fig. 5-4 Current land and space usage of the Racecourse

The Racecourse's buildings are merely one to two stories tall but have a large area for each storey. Regarding public space, the Racecourse's outdoor spaces are predominately concrete-paved vague territory as no designated roads or parking. However, parking for motor cars fills a significant portion of outdoor space (Fig. 5-4). Moreover, because the high-value property in the city's heart generates significantly fewer financial benefits than it should, the architectural pattern here has resulted in a considerable waste of urban space.

道路用地	126.6	20.45%
商业用地	80.2	12.96%
居住用地	149	24.07%
公共设施	118.1	19.08%
绿地	126.5	20.44%
市政用地	18.6	3.00%
合计	619	100%

Fig. 5-5 Allocation of different land use in Zhujiang New Town

The allocation of the Zhujiang New Town area has a low amount of commercial land, and the high proportion of enclosed residential land diminishes the overall compact. Thus, a transformation of the Racecourse's land use is essential (Fig. 5-5)[106]. The previous upper-level plan designated the Racecourse as G2, or Land for square, as opposed to commercial, which is a contentious issue (Fig. 5-6).

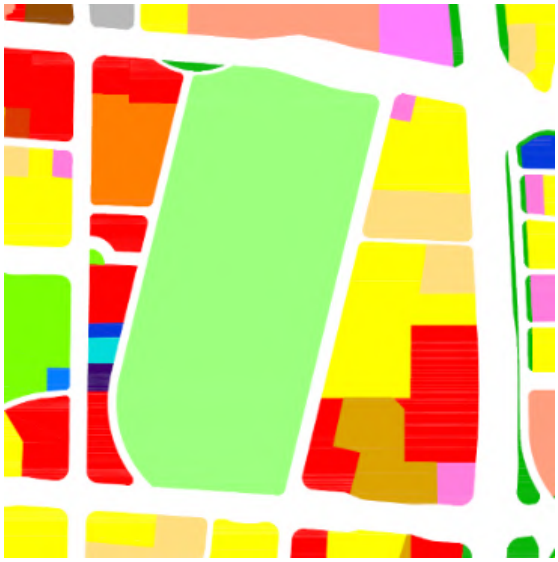


Fig. 5-6 Previous upper-level plan of the Racecourse

On a larger urban area scale, the M block where the Racecourse is located has an entirely different scale and texture than other blocks in Zhujiang New Town (Fig. 5-7). The large shape of the track allows the Racecourse to be identified at a larger aerial scale. This shape is due to the former function of the racecourse, and the buildings of 1-2 storeys have been abandoned already.

As the function shifts in the future design, the distinctive texture, while helping to maintain the site's unique character, needs to be utilized in a more rational way to achieve a density (Fig. 5-8) and FAR (Fig. 5-9) that is more in line with other blocks in Zhujiang New Town, achieving a higher quality of development across the city central

[106] Jin J, Qi K, Zhang J Y, Zhang Y. Quantified Evaluation and Analysis of the Compactness of Urban Center: A comparative Study of Zhujiang New Town of Guangzhou and Centra Hong Kong [J]. City Planning Review,2018,42(06):47-56.

area. The Racecourse now has a building density of less than 20%, with large areas of derelict buildings and open spaces with undefined functions and boundaries. With fewer building levels, the Racecourse also has a FAR of lower than 2.

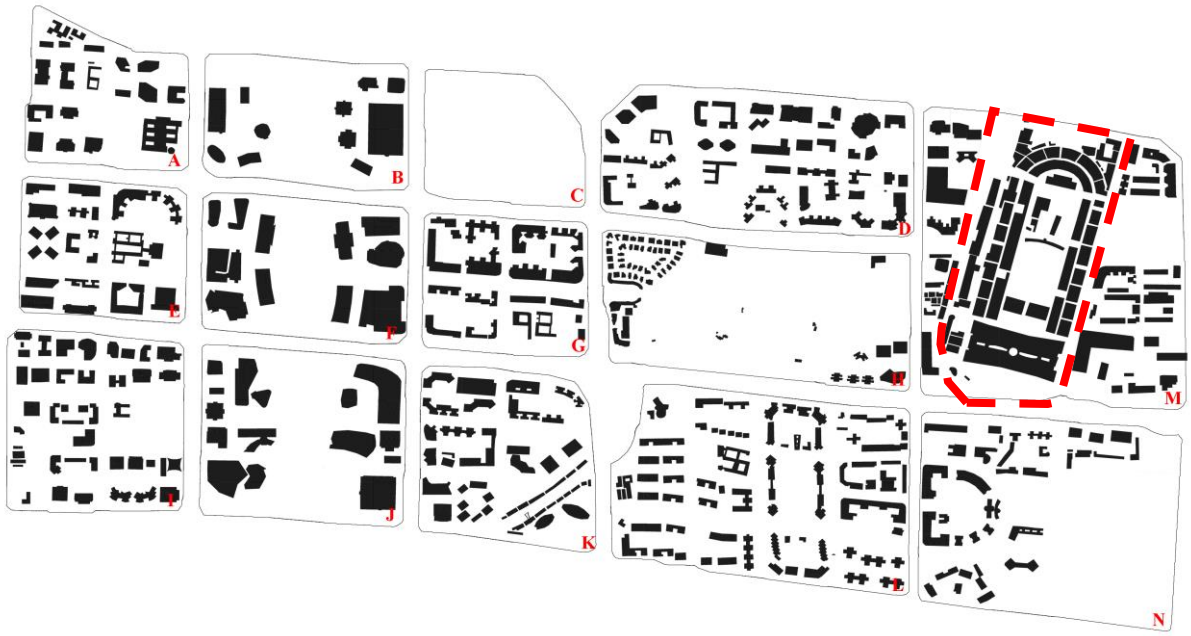


Fig. 5-7 Figure-ground of each block in Zhujiang New Town

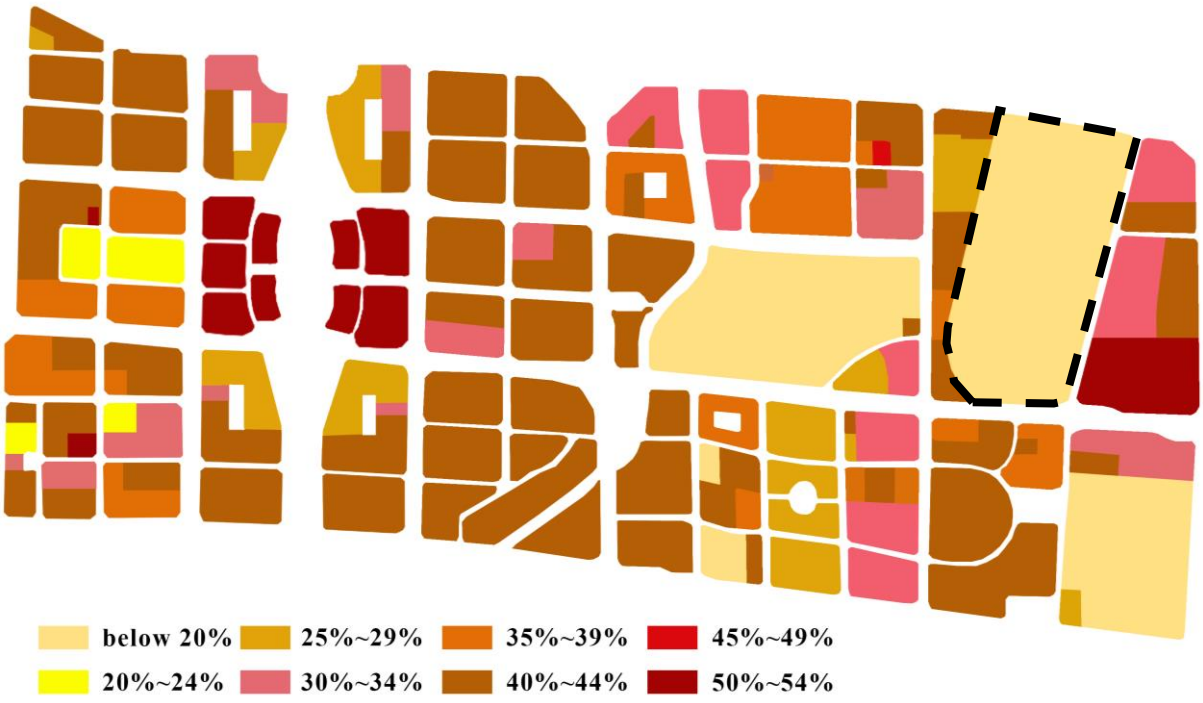


Fig. 5-8 Building density of each block in Zhujiang New Town

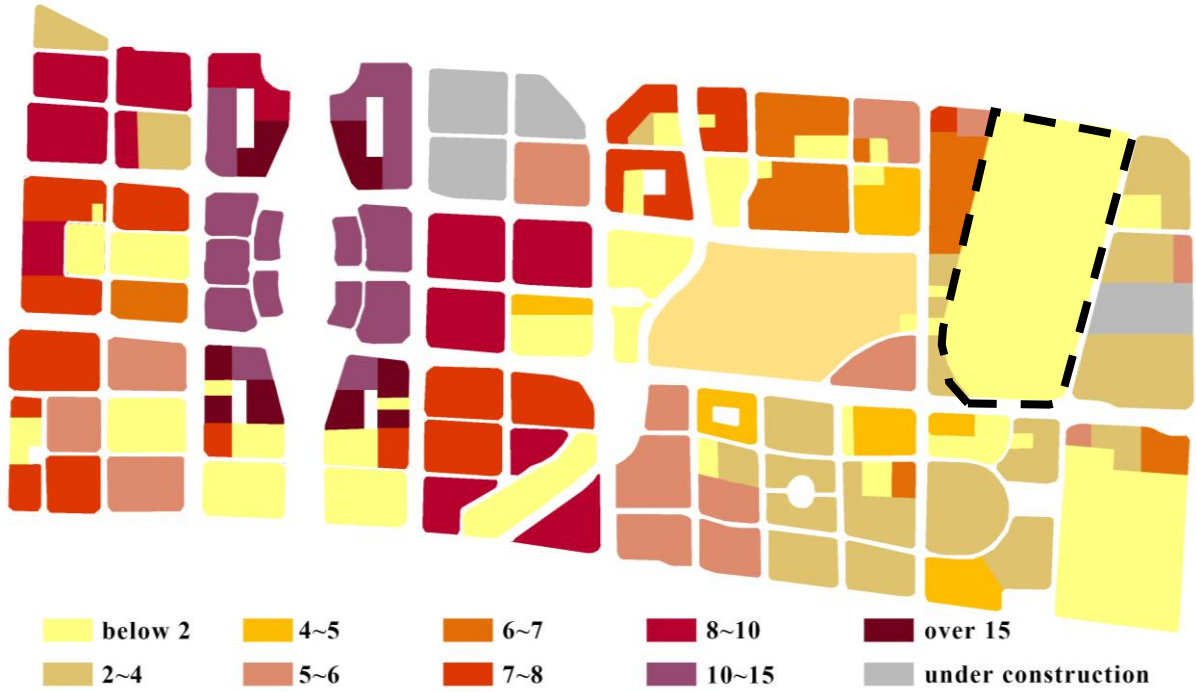


Fig. 5-9 FAR of each block in Zhujiang New Town

Such a large and vacant site pulls down the overall efficiency and value of the city central area.

The concept of compact, with high-density at its core, is vital for the sensible rehabilitation of city center vacancies such as the Racecourse. Its necessity for intensive land use and good accessibility further encourages the three-dimensional growth of the city. The Racecourse must adopt a more compact urban development to support the new vision.

5.1.3 Vitality: from simplicity to diversity

The Racecourse is currently guaranteed to be a source of vitality with food service surrounding the sports activities in the site's center (Figure 5-10), but these are insufficient for its function and vitality, which requires more diversified activities.

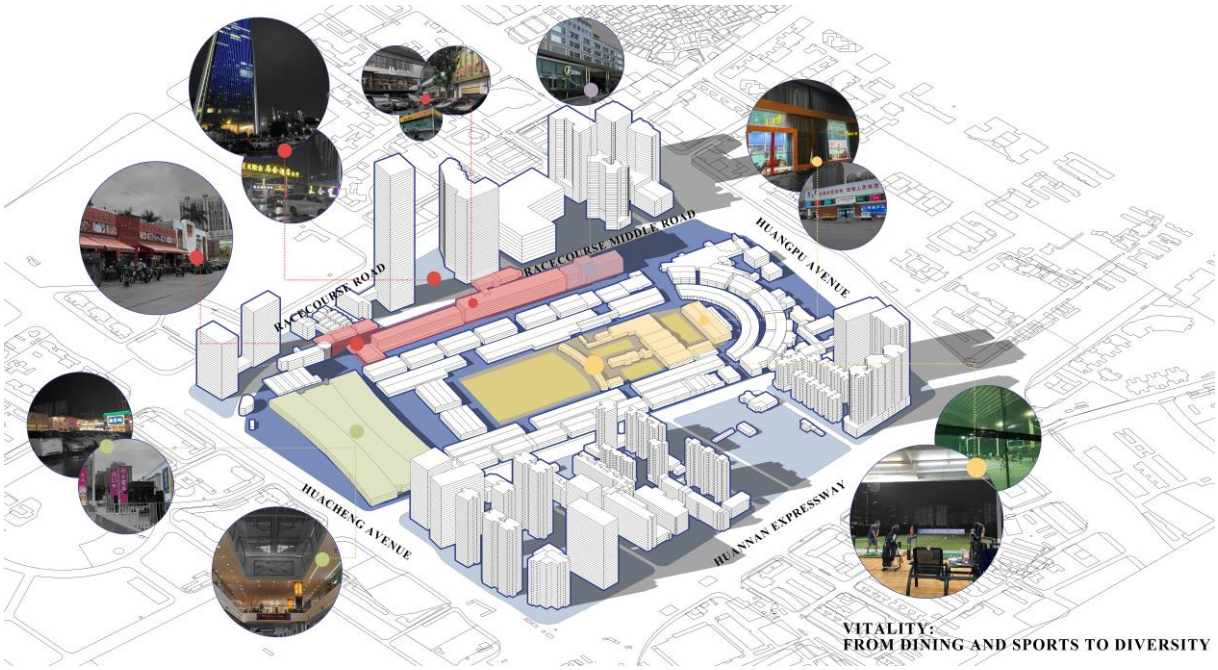


Fig. 5-10 Current commerce of the Racecourse

Before the government banned horse racing in 1999, The Racecourse drew between 30,000 and 40,000 people on race days, when Zhujiang New Town was not yet the city center of Guangzhou. With the cessation of horse racing, the Racecourse lapsed into stillness until 2008, when it was reclaimed by the Head Office of Racing and designated an Auto Trader City. Since April 2014, the Racecourse Auto Trader City has been closed, with several auto companies gradually leaving. Currently, the ongoing Mahui Household mall has become one of the most well-known household supermarkets in Guangzhou (Fig.5-11).

Fig. 5-11 Real situation of commerce in the Racecourse

At the Racecourse, catering services are a highly competitive industry. According to a study based on catering consumption data, the range of catering consumption in the major metropolitan regions of Guangzhou is between 25 and 85 RMB per person, with the Racecourse commercial cluster having one of the city's upper ranks at 76.7 RMB per person (Fig.5-12)[107].

[107] He S H. The study on the Characteristics of Commercial Space Agglomeration in the Inner City of Guangzhou [D]. South China University of Technology,2019.

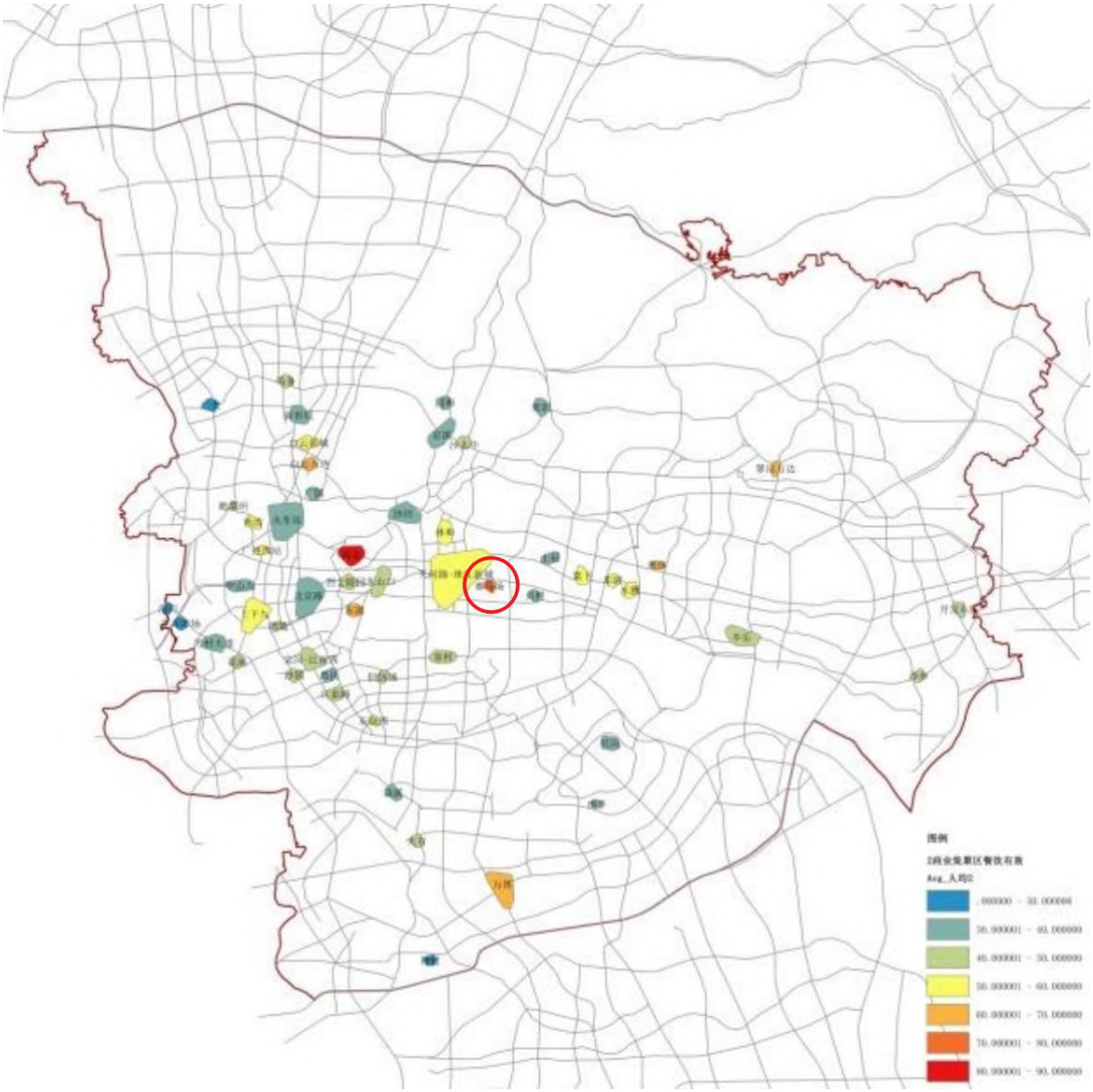


Fig. 5- 12 Consumption difference in Guangzhou

Sources: He, 2019

Aside from this, the Racecourse's professional sports facilities compensate for the absence of big skilled sports facilities in Zhujiang New Town. Although the Tianhe Sports Centre serves as a sizeable comprehensive venue, the Racecourse offers specialist athletic venues such as two-storey golf courses, tennis courts, and badminton courts that draw many inhabitants from the neighboring densely populated residential districts. Nevertheless, the two types of commercial activity are currently focused on a small region of the Racecourse. The Racecourse lacks a clustering effect and must develop more diverse activities to become a compact and vibrant CAZ.

People's actions can be used to select and identify these activities, which form the basis of the new vision for the Racecourse's vitality.

5.1.4 Transportation: from interrupted to connected

A highly accessible pedestrian-oriented transportation system is required for compact urban development and for the CAZ to establish a compact and diversified aggregation of activities. However, the present Racecourse not only obstructs the east-west transport connection of the Zhujiang New Town but also has several internal road disconnected roads.

The Racecourse disrupts east-west routes in Zhujiang New Town to some extent due to the unique urban spatial pattern established by the horse racing track (Fig.5-13).

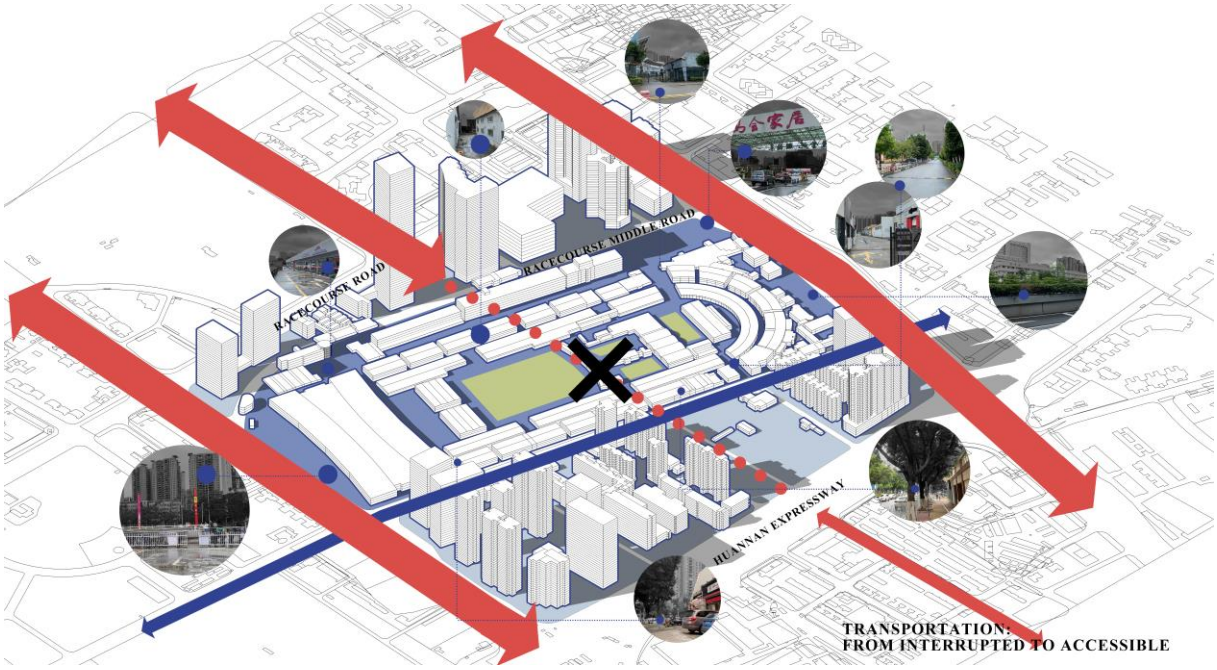


Fig. 5-13 Interrupted transportation in the Racecourse

Zhujiang New Town is initially split by a network of 2 internal east-west roads and 4 internal north-south roads, which are subsequently divided into 4-9 small blocks of 4-5ha by internal roadways (Fig. 5-14). The Racecourse interrupts one of the east-west roads, so diminishing the direct link to the city central area's outskirts. Due to the lack of internal borders and mixing with the site's carriageway, the Racecourse's internal

pedestrians have an uncomfortable walking experience. In contrast, the internal carriageway has reached a dead end due to the closure of the inner region (Fig.5-15).

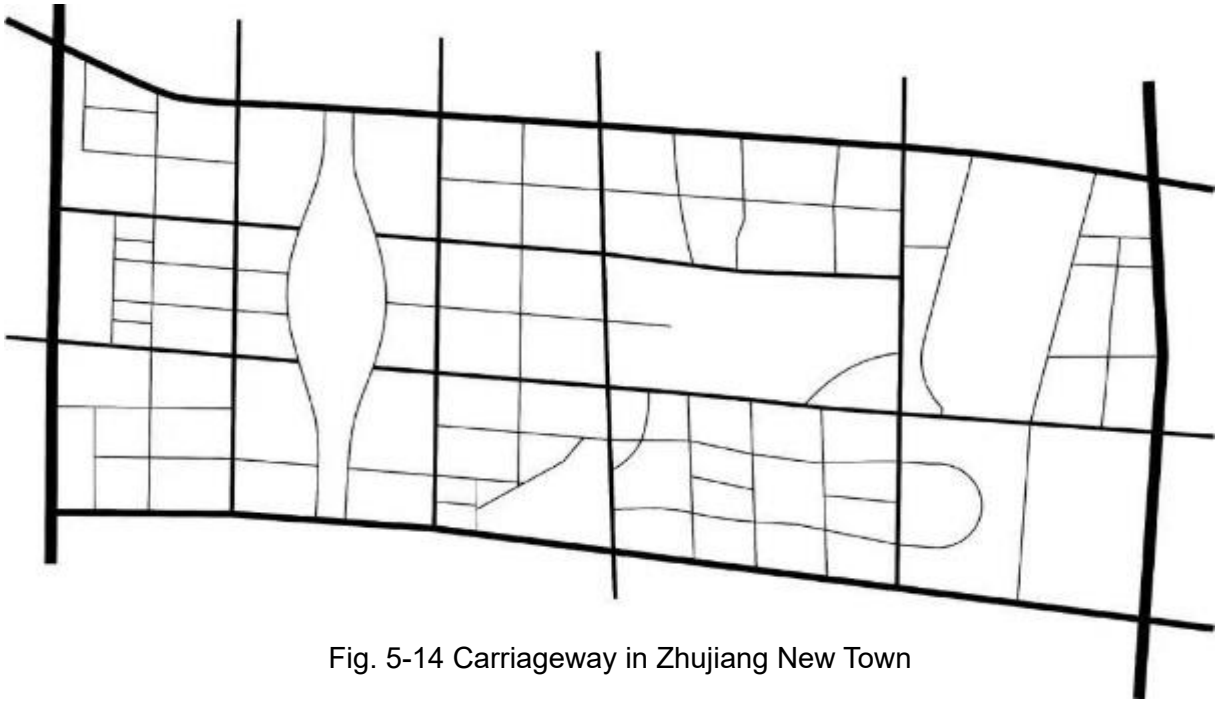


Fig. 5-14 Carriageway in Zhujiang New Town

Fig. 5-15 Internal carriageway and pedestrian in the Racecourse

Pedestrian-led, highly accessible public transport is proposed in the concept of compact as a way to connect various functions and spaces and to reduce travel times and distances to achieve compact urban development. For the more diverse activities

of the future, highly accessible pedestrian-led internal transport and better connections to external transport will ensure that citizens can participate more conveniently.

5.1.5 Open space: from space to place

The Racecourse's open spaces can be subdivided into endless and useless regions that anyone can enter, such as the road and parking lot, and private use spaces that only admit paying customers, such as the sports venue and the commercial district (Fig.5-16). Both the former and the latter have their own spatial or public shortcomings, and both the greenery and the activity places are dispersed haphazardly, making the open space of the Racecourse impossible for actual public activities to occur.

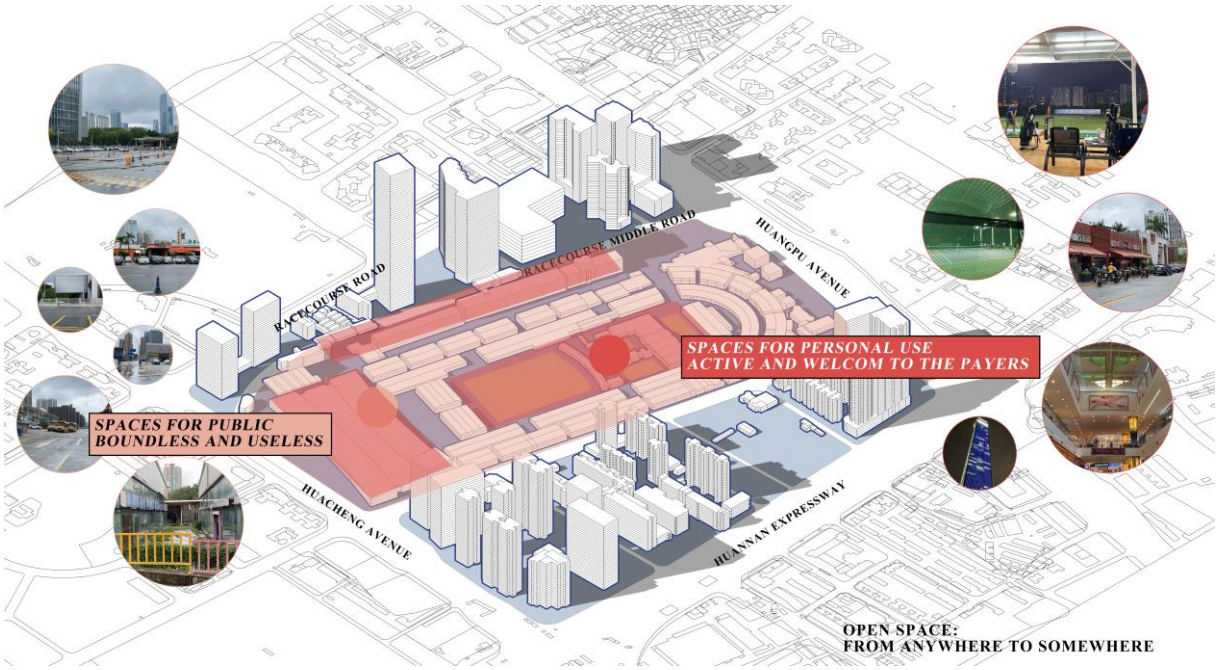


Fig. 5-16 Current open spaces in the Racecourse

Giving open spaces more defined uses, boundaries, and tenure improves their quality and vitality, as well as forming a complete multi-level open space system, which is an essential strategy for mitigating high-density and acting as a mediator between functions in this design thesis, as discussed in section 4.2.3.

5.2 Spatial Analysis

Fig. 5-17 Rendering sketch of the future Racecourse

There are four dimensions discussed in both sections 4.2 and 5.1 as main design components, including urban form, transportation, open spaces, and activities. This section will analyze these four dimensions in the master plan by layering (Fig. 5-17).

Based on the combined effect of the transport system, the open space system, and the use of land, through the improvement strategies proposed in Chapter 4, compact urban development with vitality for the Racecourse was generated (Fig.5-18).

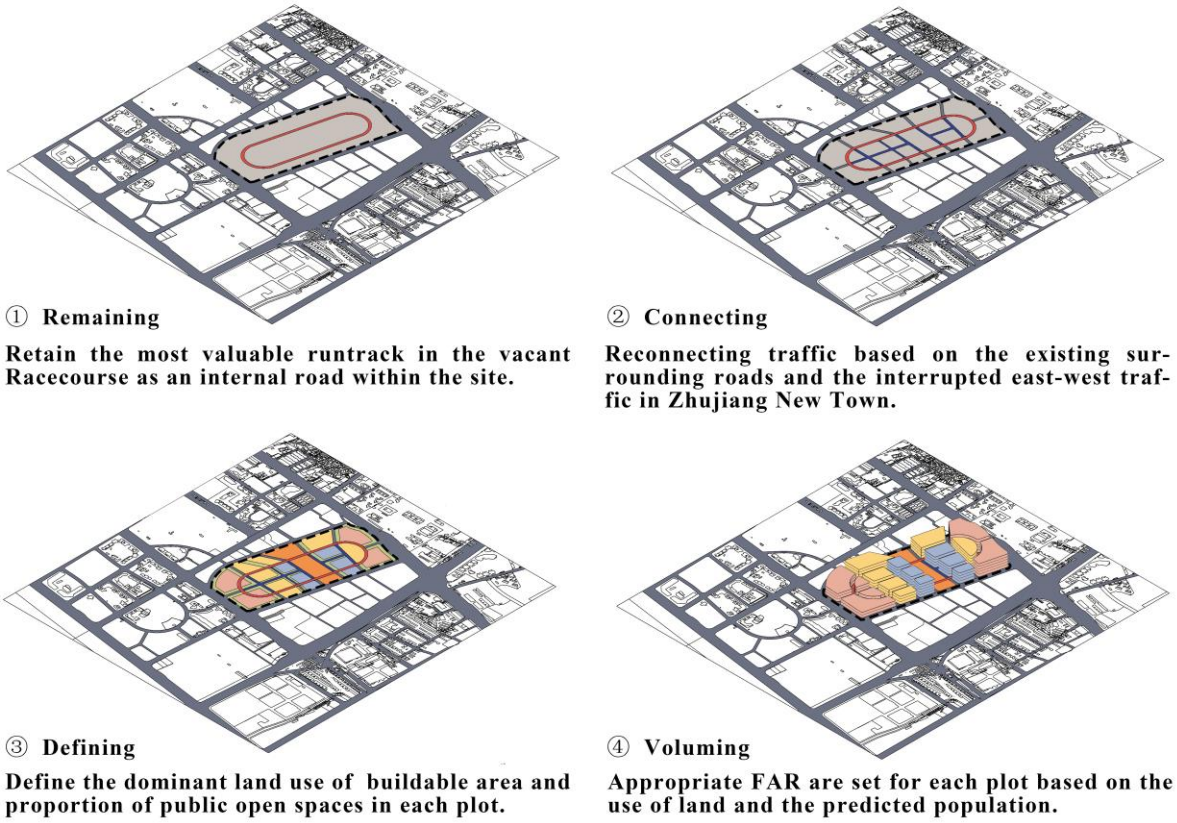


Fig. 5-18 Generating of the future Racecourse

The master plan can clearly depict the buildings, transport system, the open space system (Fig. 5-19). Based on the study of urban form control elements in Chapter 4, the site carriageway width is 15-20m, the block area is basically 40,000-60,000m^2, and other indicators such as FAR, building height, and open space percentage also work together to generate diverse blocks (Table 4-4).

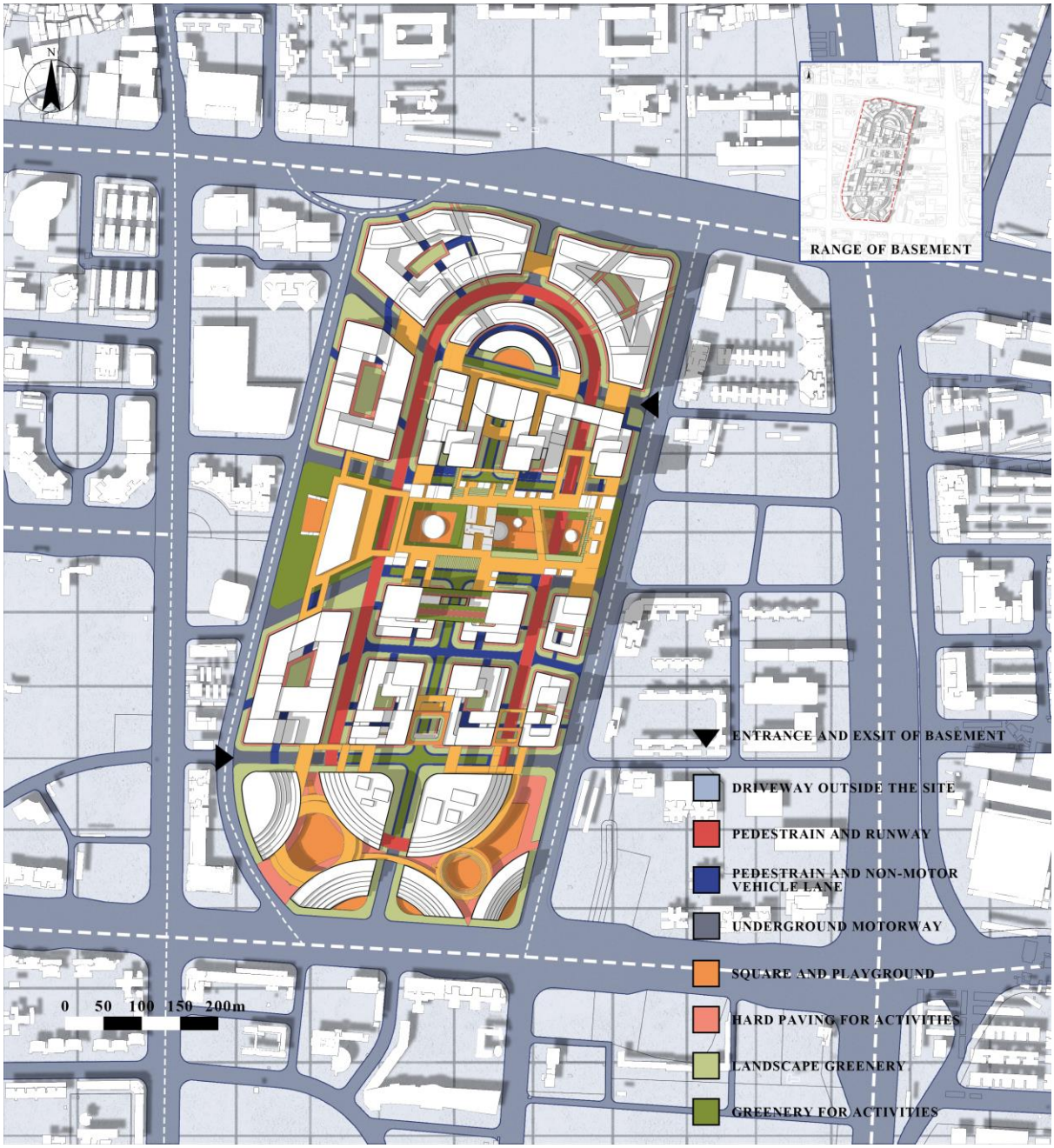


Fig. 5-19 Master plan of the future Racecourse

The urban sections in various directions demonstrate the height management of the site, notably that even the tallest headquarters office tower is lower than the surrounding high-rise residential districts, while the rest buildings are maintained at 50m (Fig. 5-20, Fig. 5-21).

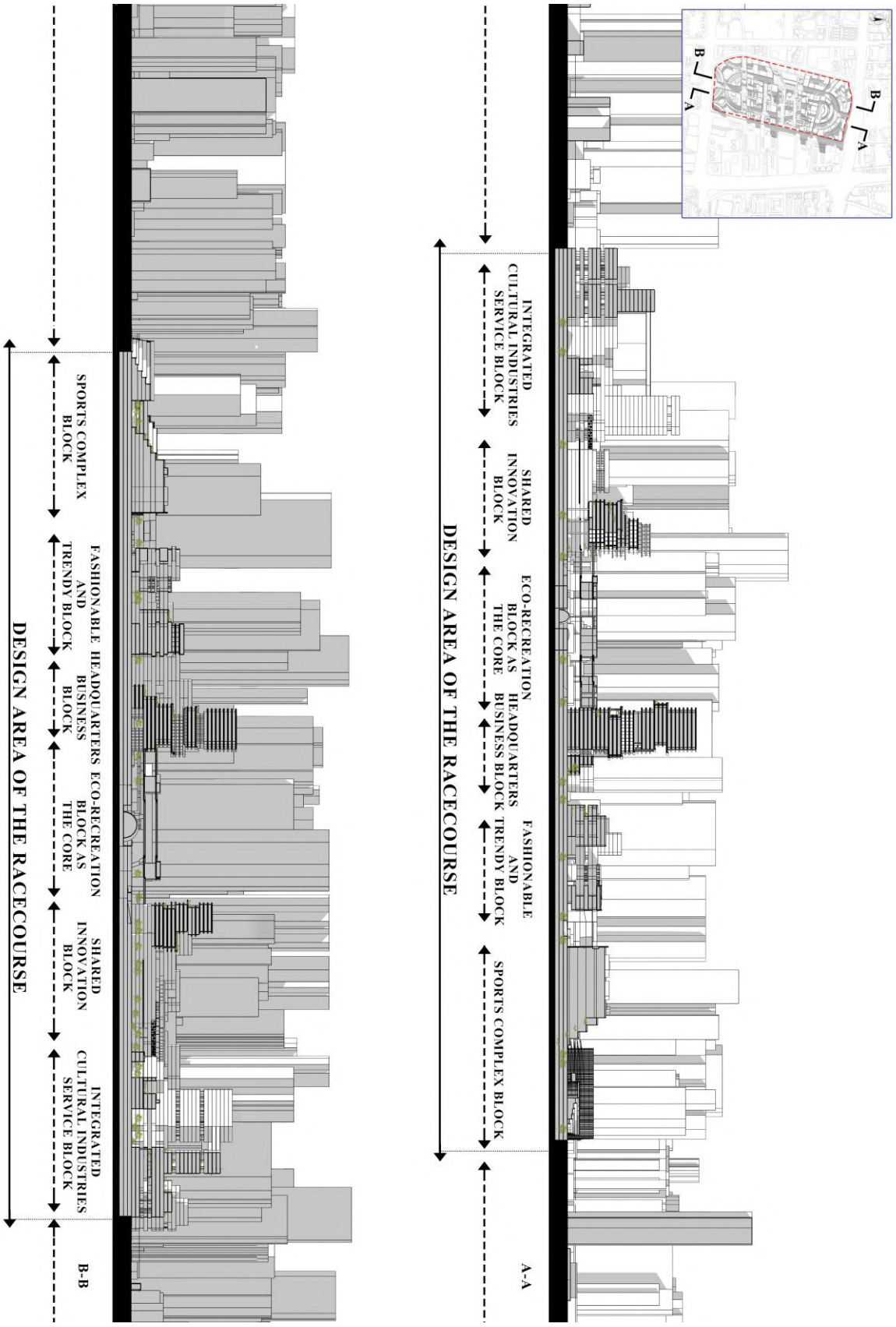


Fig. 5-20 Sections A-A and B-B of the future Racecourse

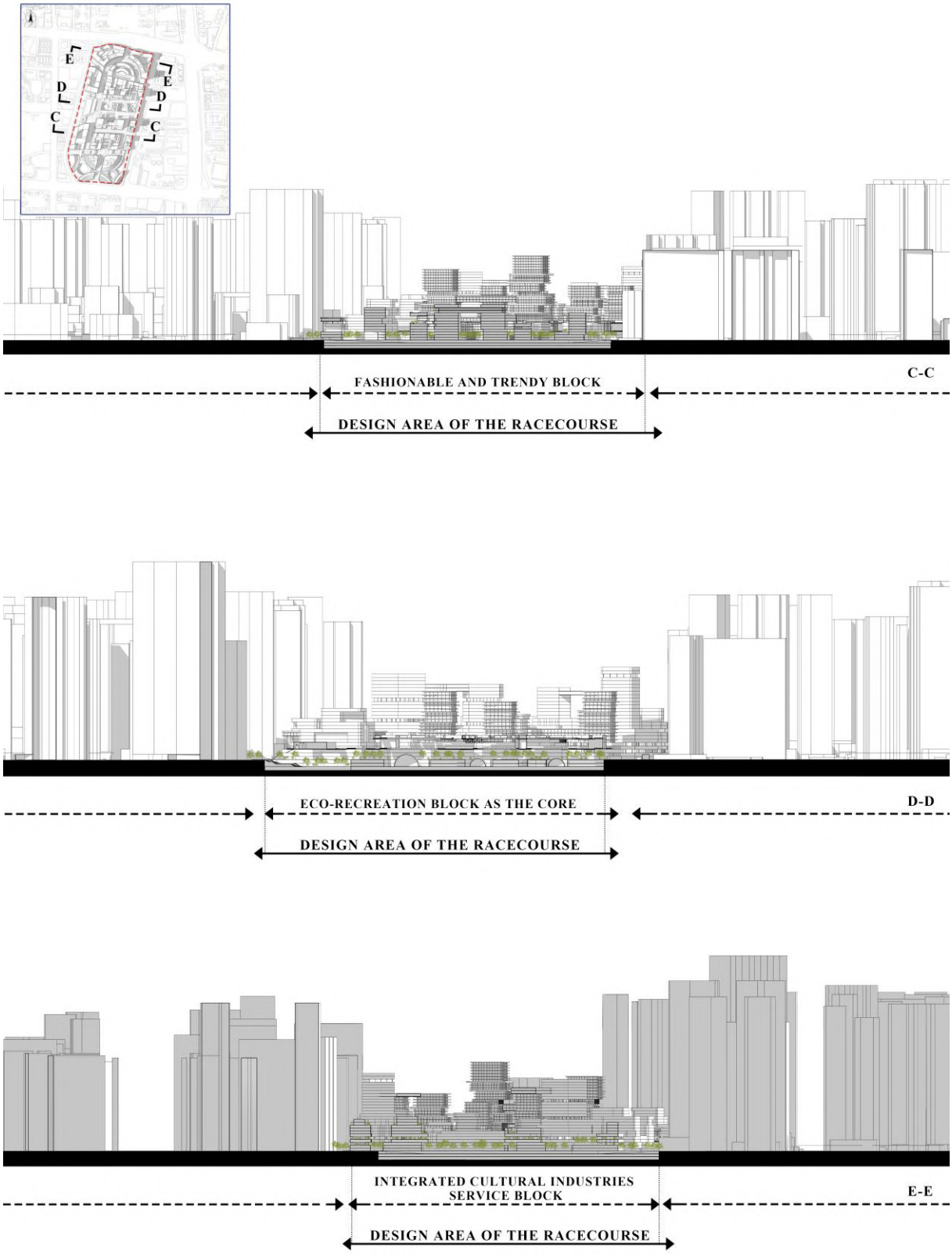


Fig. 5-21 Sections C-C, D-D and E-E of the future Racecourse

5.2.1 Before and after figure-ground comparison

The circular horse track is a legacy of the Racecourse's original unusual urban texture in the designed figure-ground interactions (Fig. 5-22). In the urban grid of Zhujiang New Town, the circular arc spatial prototype possesses a robust morphological personality. The remaining buildings and public spaces are separated by the circular track and the roads on both sides of the property. This design thesis considers the large open space in the middle to be the ground floor green space, which will function as a public space and as a spatial compensation for the surrounding high-density blocks, which is one of the crucial strategies for the localized concept of compact in Guangzhou's high-density central area.

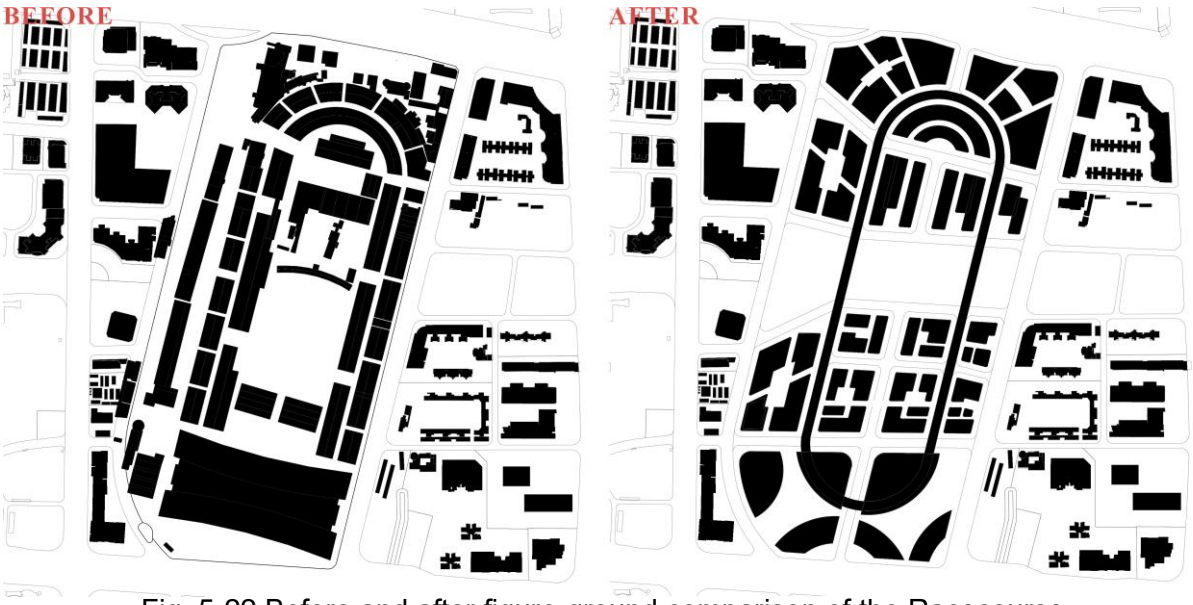


Fig. 5-22 Before and after figure-ground comparison of the Racecourse

Overall, the new vision of the Racecourse makes the buildings on each of the small blocks follow the controlling principles in section 4.2.1 which require a high building-to-line ratio; thus, the open spaces are enclosed. The open space system thus consists of an east-west ribbon of public space in the middle and internal semi-public spaces formed by the pedestrian street that encloses the groups of buildings within each block, the semi-public spaces are also connected to the ribbon of public space. Diverse activities required by distinct groups of people can therefore take place in indoor and outdoor spaces of varying degrees and tenure, enhancing the site's vitality.

5.2.2 Transport system

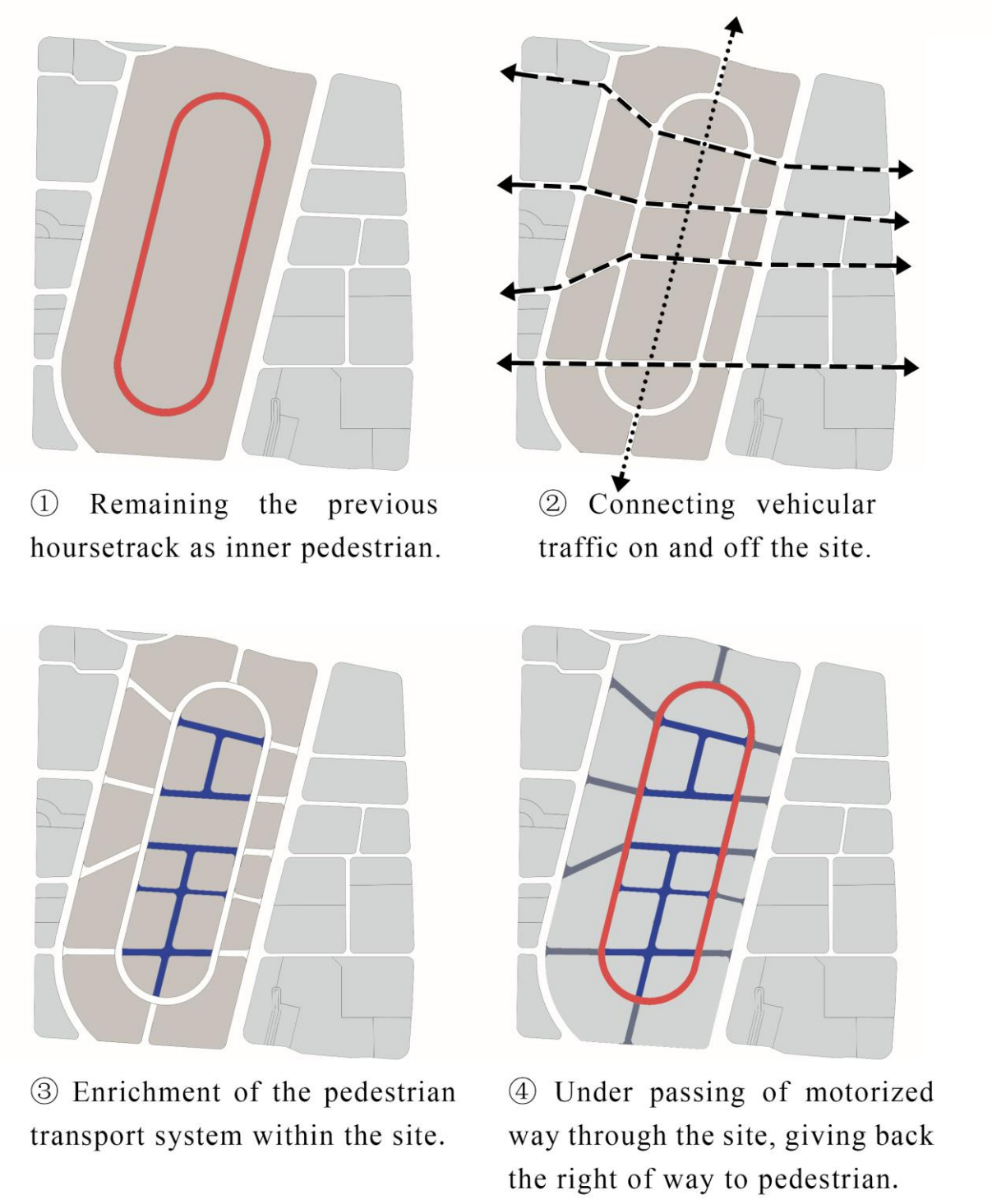


Fig. 5-23 Generation of the transportation system

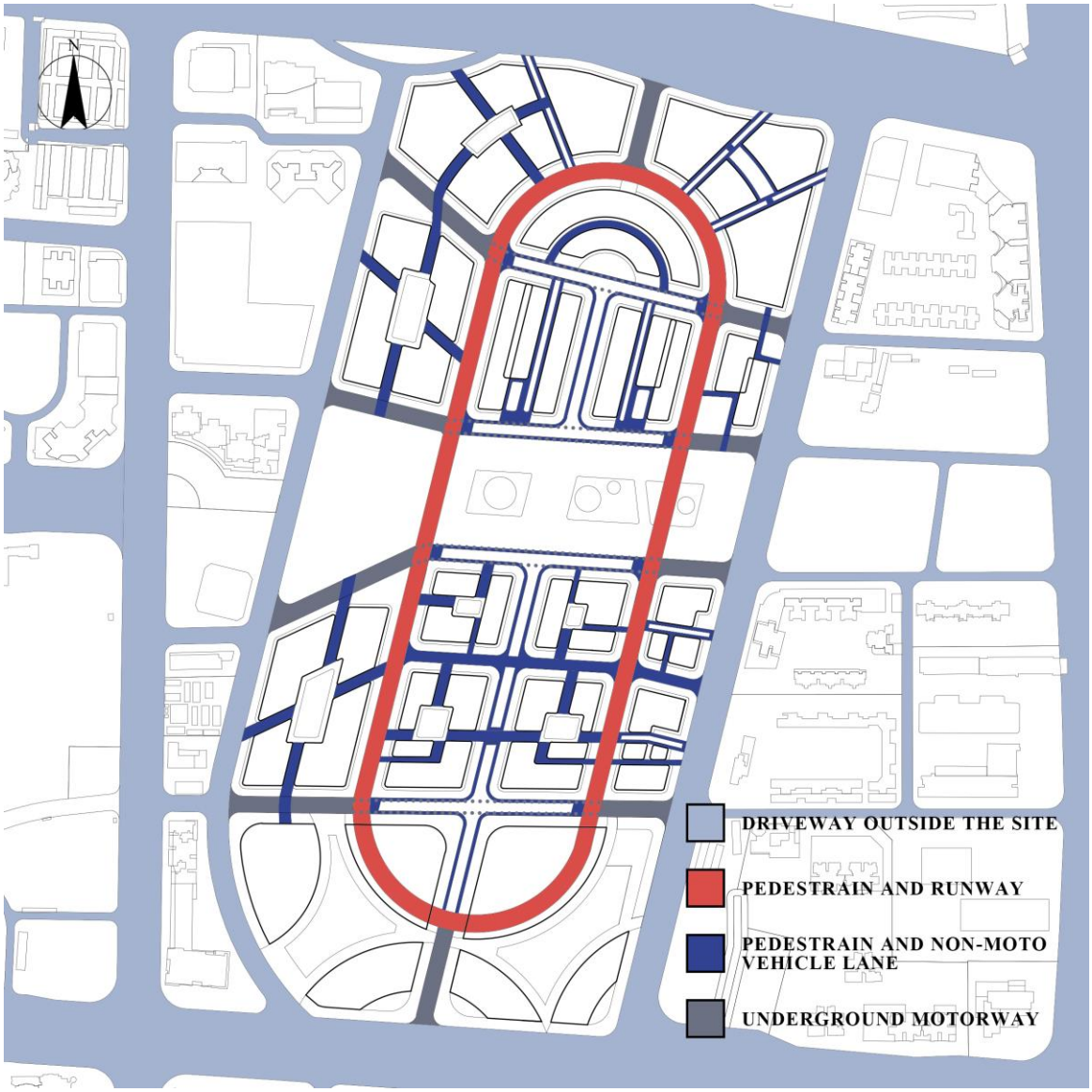


Fig. 5-24 Four levels of the street hierarchy of the future Racecourse

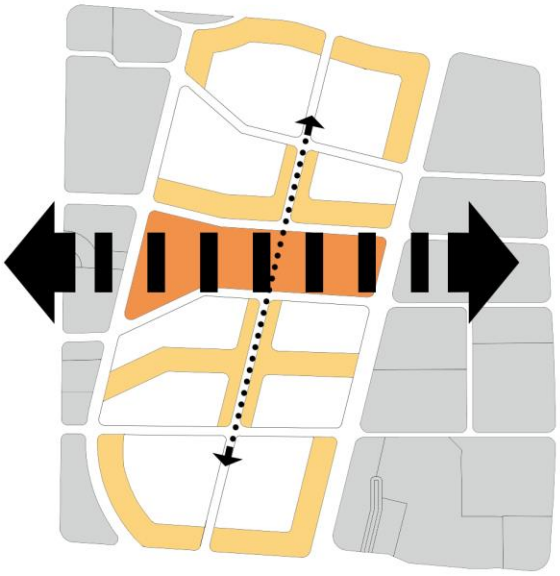
Pedestrians and runways are the core of the original road hierarchy based on the original fabric of the Racecourse (Fig. 5-23), which pedestrians solely use for walking and running and is the barrier that separates the site into semi-public and public functional blocks. The pedestrian and non-motorized vehicle lanes are a transportation system for short-distance movements within the semi-public function blocks that pedestrians and non-motorized vehicles can utilize. The motorized lanes are buried to give pedestrians the right-of-way. Their objective is to connect the east-west roadways on both sides of the site and bolster east-west traffic in Zhujiang New Town.

There are four levels of street hierarchy, including the driveway outside the site, the pedestrian and runway, the pedestrian and non-motorized lane, and the underground motorized lane (Fig. 5-24). The blocks are connected by pedestrian-led public transportation routes, offering a highly accessible and convenient transport infrastructure for compact urban development.

5.2.3 Open space system

The generation of public open space and semi-public open space is closely related to the generation of the transportation system. According to section 4.2.4, the relationship between the transportation system, open space system, and buildable land in each block has been initially explored（Fig.5-25）.

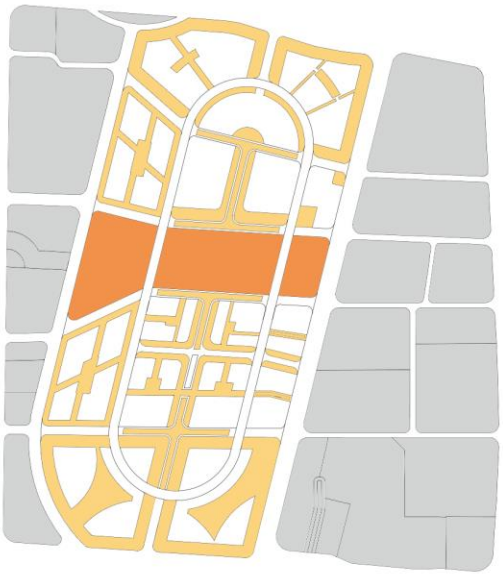
The new vision of the Racecourse contains an open spaces system including squares, playgrounds for activities, landscape greenery, and greenery for activities (Fig.5-26). These spaces have varied attributes of public, semi-public and private, and functions of mediation and compensation according to 4.2.3.



① Preliminary open space distribution according to Fig. 4-22

② Further decentralisation and concentration to suit plots' shape.

③ Formation of semi-public open spaces in the center of the plot serves for certain users.



④ Connecting different levels of public and semi-public open space.

Fig. 5-25 Generation of the open space system

Fig. 5-26 Open space system of the future Racecourse

5.2.4 Land use in block scale

Fig. 5-27 Diverse blocks of the future Racecourse

According to the road-separated blocks and the regulation of a series of development indicators, such as FAR, open space ratio, and build-to-line ratio in section 4.2.1, the entire site was divided into eight blocks with distinct functions and the appropriate indicators (Fig. 5-27, Fig. 5-28). In the following section, a further description of the functions and space of various blocks will be presented.

Fig. 5-28 Compatible and FAR of each block

5.3 Volume Analysis: Diverse Multi-functional Blocks

According to this design thesis's most basic and crucial theoretical concept, the compact urban development promotes the diversity of activities and vitality that will be simulated by filtering the activities by the citizens' needs. On the basic analysis in 1.1.2 of the new migrant population in Zhujiang New Town, four types of activities are selected to form the new vision of the Racecourse, which are innovative and creative

industry activities, eco-health activities, and fashion and culture activities. In 4.2.5, different multi-function use blocks are established, and further designs in the level of land use are presented in this section.

This design thesis estimates and further allocates the area according to the active population of the Racecourse and compares and adjusts it to the FAR specified in 5.3.4 based on these functional settings (Fig. 5-29). According to section 1.2.2, the data obtained from the 7th Population Census Bulletin of Tianhe District, the permanent resident population of Zhujiang New Town is approximately 1 million, with a population density of 160,000 people per square kilometer. Therefore, this design thesis estimates the active population in the Racecourse to be 61,000 at the same population density based on the area of 38 hectares and the future urban functions of the CAZ. After determining the total active population, the active population of each block was estimated and allocated according to its size. The active population is the total population working and permanently residing at the Racecourse defined by this design thesis. Unlike the demographic concept's permanently residing population (i.e., residents), the Racecourse does not have a predominantly residential function. Still, it primarily serves the residents of Zhujiang New Town and visitors, so extrapolating the active population of the Racecourse from the current population density of Zhujiang New Town can be the minimal value.

In addition, this design thesis also estimates the area required per 1,000 people for different functions, including the area of expected business, area of commerce, area of cultural and entertainment facilities, area of sports and leisure facilities, area of housing, and area of public services. The total floor area of each block is estimated according to the different functional ratios, and the total floor area will also be estimated according to the pre-determined FAR. This design thesis considers the functional ratio of the block to be reasonable when the difference between the two areas is not significant.

population density(人/km²)	area of Zhujiang New Town (m²)	permanent resident population of Zhujiang New Town		area of business (Thousand people per m²)	area of commerce (Thousand people per m²)	area of cultural and entertainment facilities (Thousand people per m²)	area of sports and leisure facilities (Thousand people per m²)	housing area (Thousand people per m²)	area of public services (Thousand people per m²)
161290.3226	6200000	1,000,000		4000	2500	1000	3500	3000	0
			fashionable commerce blocks (3&4)	0	8000	8000	4000	0	0
	area of the Racecourse	active population in the Racecourse	intergrated service blocks (2)	4000	4000	9000	6000	2500	500
	380000	61,000	sports commerce blocks (1)	0	6000	5000	8000	0	0

	area of each block	population	FAR	actual building area(m²)	business area(m²)	commerce area(m²)	area of cultural and entertainment facilities(m²)	area of ports and leisure facilities(m²)	housing area(m²)	area of public services (m²)	expected total building area(m²)
block 6	32000	13000	5.5	176000	52000	32500	13000	45500	39000	0	182000
headquarters business block				sharing office 15000	common retail 10000	indoor amusement park 5000	fitting center 20000	youth apartment	15000		
				innovation technology industries headquaters 35000	food and beverage 15000	tea& coffee& pub 5000	niche sports 13000	hotel	15000		
					24 hours' urban living room 7500	special-intrst club 3000	health and leisure 15500				
block 5	39300	10000	4	157200	40000	25000	10000	35000	30000	0	140000
Shared innovation block				sharing office 20000	common retail 12000	indoor amusement park 5000	fitting center 15000	youth apartment	40000		
				innovation and cultural industr	food and beverage 10000	tea& coffee& pub 5000	niche sports 10000	hotel	20000		
					24 hours' urban living room 3000		health and leisure 15000				
block 4	51000	10000	4	204000	0	80000	80000	40000	0	0	200000
					food and beverage 12000	experiental exhibition space 18000	popular sports 5000				
					common retail 8000	immersive performance space 15000	niche sports 12000				
Fashionable and cultural commercial block					first store 10000	chess and card & KTV 12000	health and leisure 15000				
					flagship store 10000	social games space 15000	fitting center 8000				
					trendy fashion brands 10000	special-intrst club 8000					
					trendy retail brands 10000	tea& coffee& pub 12000					
					Fashion buyers' shop 10000						
					creative and cultural product retail 10000						
block 3	45500	7000	3	136500	0	56000	56000	28000	0	0	140000
					food and beverage 8000	experiental exhibition space 5000	popular sports 8000				
					common retail 8000	immersive performance space 10000	niche sports 6000				
					first store 5000	chess and card& KTV 6000	health and leisure 8000				
fashionable and trendy block					flagship store 5000	social games space 15000	fitting center 6000				
					trendy fashion brands 10000	special-intrst club 8000					
					trendy retail brands 10000	tea& coffee& pub 12000					
					Fashion buyers' shop 10000						
block 2	67000	12000	5	335000	48000	48000	108000	72000	30000	30500	336500
				sharing office 13000	food and beverage 13000	experiental exhibition space 30000	popular sports 30000	youth apartment	10000	fundamental public service for living 5000	
				cultural industries headquaters 20000	common retail 10000	immersive performance space 30000	niche sports 12000	hotel	15000	public service for education 10000	
integrated cultural industries service block					creative and cultural product retail 1000	tea& coffee& pub 15000	health and leisure 20000			public service for economy 5500	
					24 hours' urban living room 15000	special-intrst club 18000	fitting center 10000			public service for health 10000	
						social games space 15000					
block 1	68000	9000	2.5	170000	0	54000	45000	72000	0	0	171000
					food and beverage 15000	tea& coffee& pub 15000	popular sports 30000				
					common retail 15000	special-intrst club 20000	niche sports 22000				
Sports complex block					first store 12000	social games space 10000	health and leisure 10000				
					flagship store 12000		fitting center 10000				

Note: The active population in the table is the total population working and permanently residing at the Racecourse. Unlike the resident population (i.e. residents) in the demographic concept, the Racecourse does not have a predominantly residential function, but primarily serves the Zhujiang New Town and visitors, so extrapolating the active population of the Racecourse from the current population density of Zhujiang New Town can be the minimal value.

Fig. 5-29 Area allocation for each block according to predicted population

5.3.1 Sports complex block

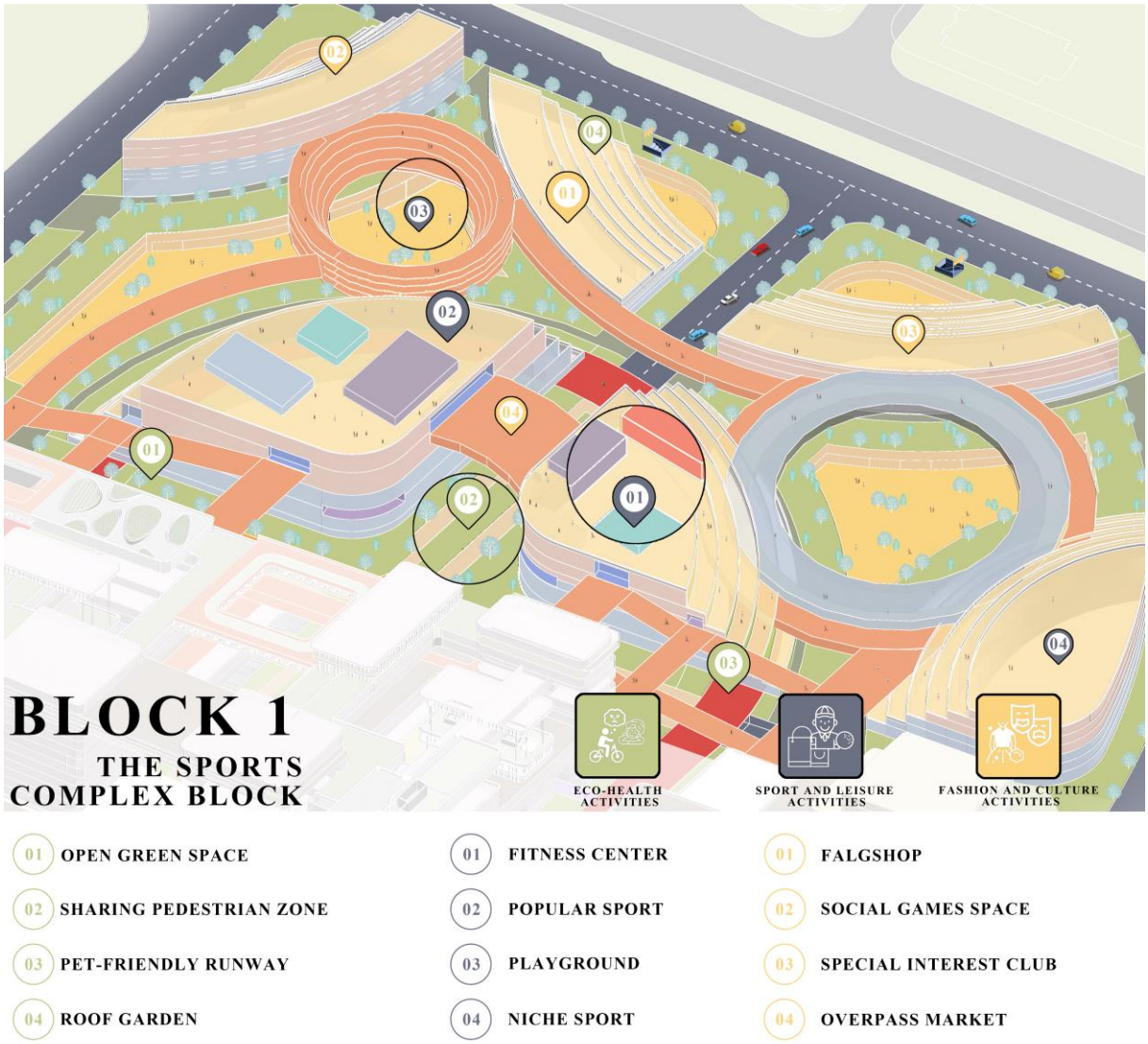
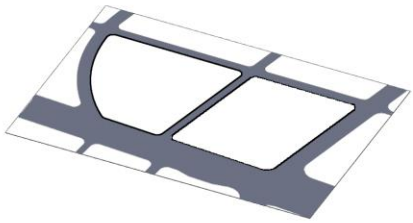


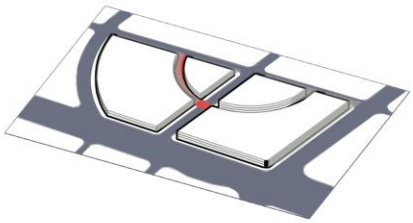
Fig. 5-30 Activities in the sports complex block

This block is directly connected to the Tancun metro station on the site's southern side, enabling rapid and direct dispersion of big crowds. The area has been designed as a stacked, setback building that encloses a sunken activity plaza to provide more open green space to consumers and citizens (Fig.5-30). The venue serves both popular and niche athletic events, as well as retail and leisure enterprises that are complimentary and supplementary (Fig.5-32).

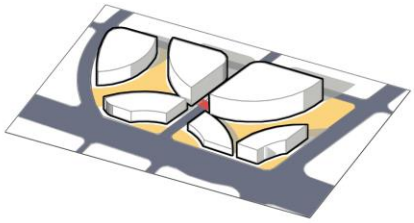
Block 1
Sports complex block



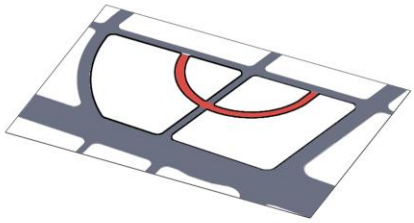
① **Original block 1**
The original block 1 was divided into two plots by the street.



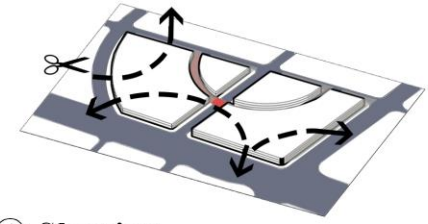
③ **Voluming**
Formation of volumes to meet area requirements based on pre-determined FAR and building setback boundaries.



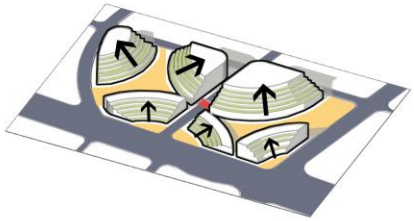
⑤ **Compensation**
Compensating insufficient floor area to dispersed volumes and arrangement of open spaces.



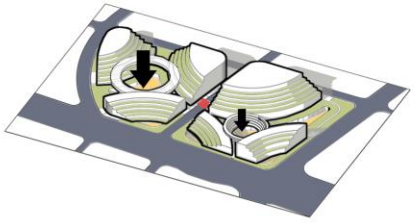
② **Retaining**
Retain and fill the shape of the runway of the Racecourse as a pedestrian path through the plots.



④ **Shaping**
Opening up the building volume to the outside street.



⑥ **Set-back terrace roof**
The roof is set back in accordance with the different landscape orientations to increase the area of green space and open space.



⑦ **Placement the open spaces**
Sunken plazas are placed in the middle between the buildings, with a wrap-around inner block of pedestrian.

Fig. 5-31 Generation of the sports complex block

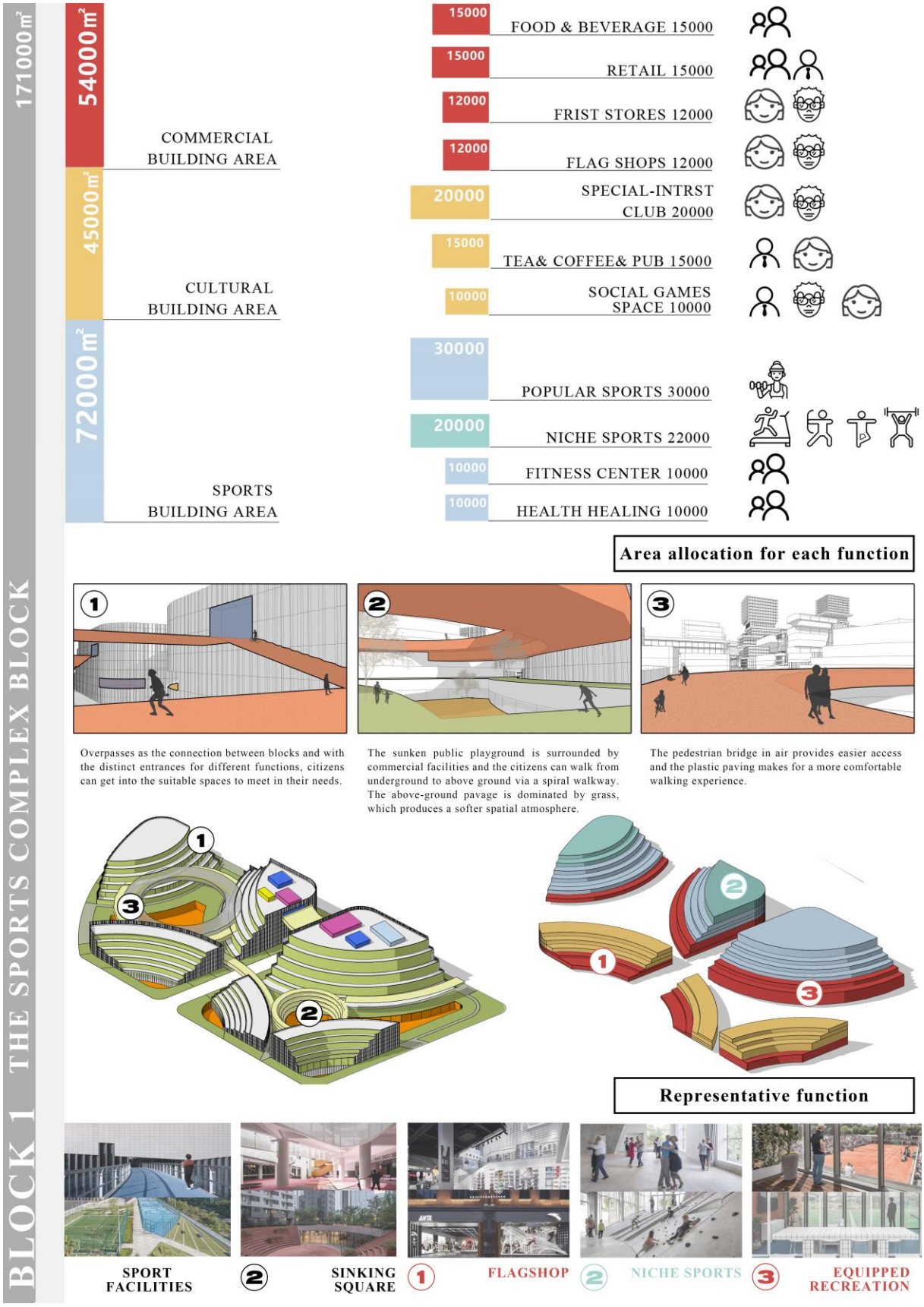


Fig. 5-32 Functions and the following spaces of the sports complex block

5.3.2 Integrated cultural industries service block

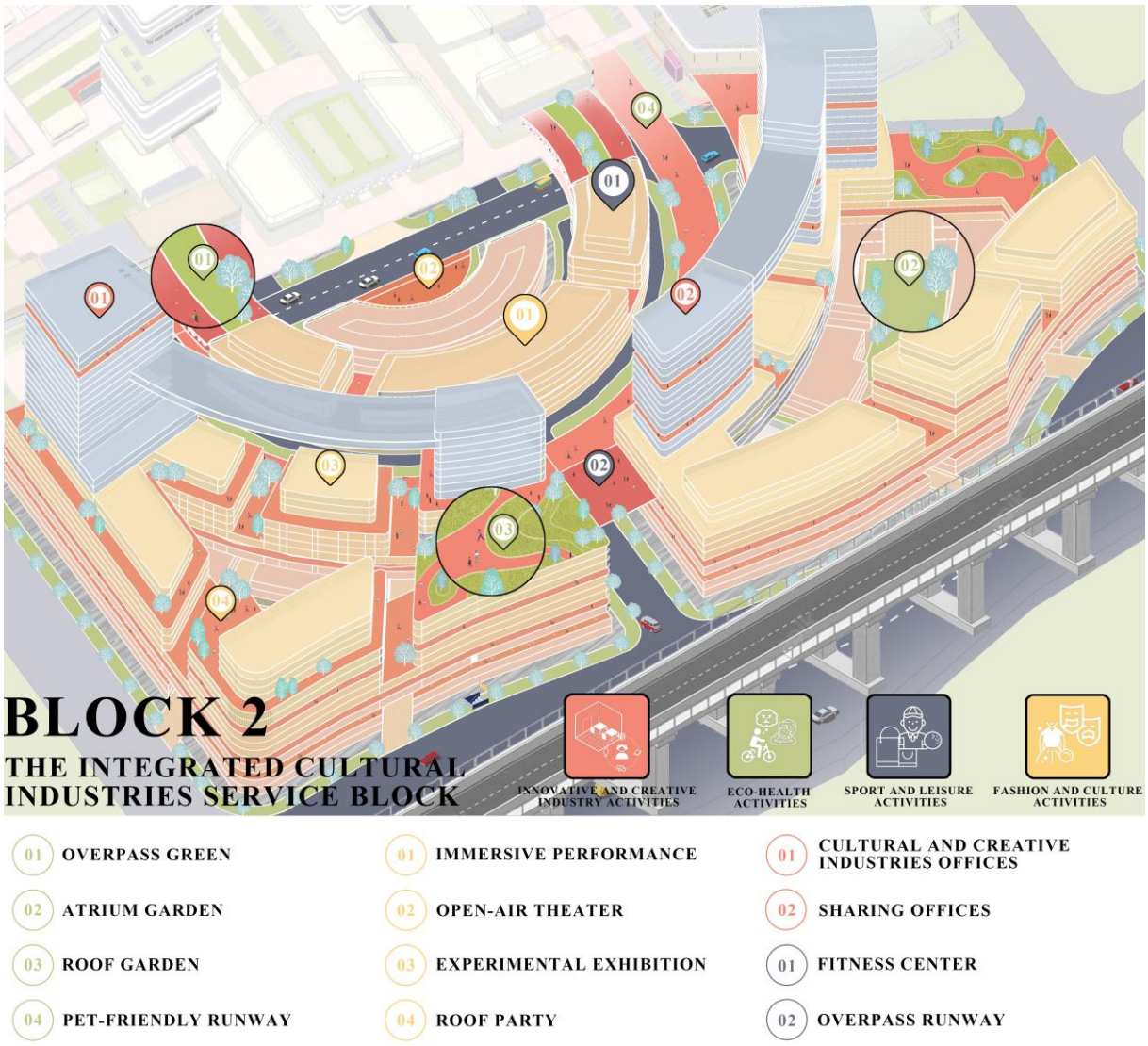
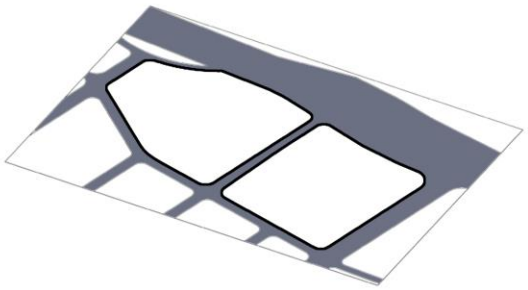


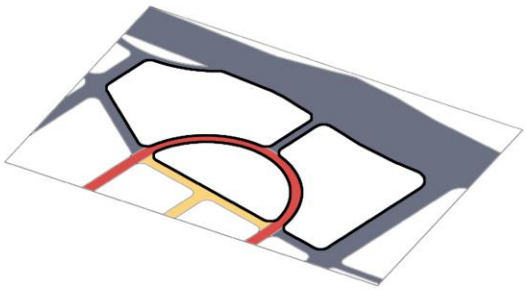
Fig. 5-33 Activities in the integrated cultural industries service block

This block is directly connected to the under-construction Machang metro station to the north of the site; however, the direct exposure to the Huangpu Avenue West Viaduct makes it undesirable to have a significant quantity of outdoor public space. The space comprises an enclosed building volume near the red line, with the building's inner atrium and elevated floor acting as the primary public activity areas (Fig. 5-33). Creative and cultural industry enterprises, high-end specialized exhibitions, and public cultural services for diverse age groups are among the building's functions (Fig. 5-35).

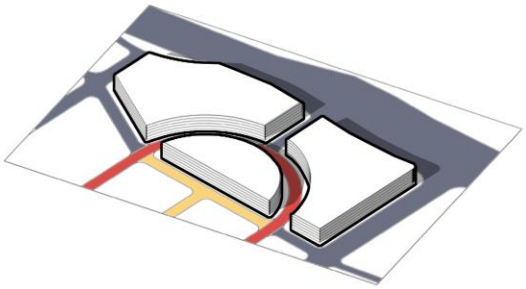


Block 2
Integrated cultural industries service block

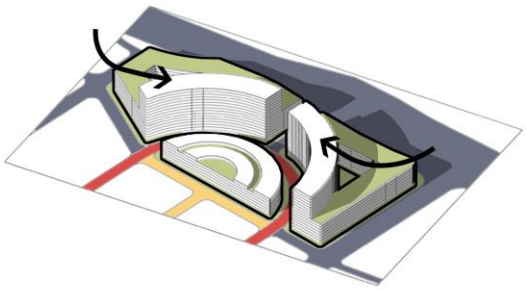
① **Original block 2**
The original block 2 was divided into two plots by the street.



② **Retaining**
Retain and fill the shape of the runway of the Racecourse as a pedestrian path through the plots.



③ **Voluming**
Formation of volumes to meet area requirements based on pre-determined FAR and building setback boundaries.



④ **Shaping**
The building volume towards the overpass are set back to reduce the sense of oppression along the street facade.

⑤ **Scattering**
Scattering single concentrated volumes on the roof to create more open spaces in the air and on the elevated floor.

Fig. 5-34 Generation of the integrated cultural industries service block

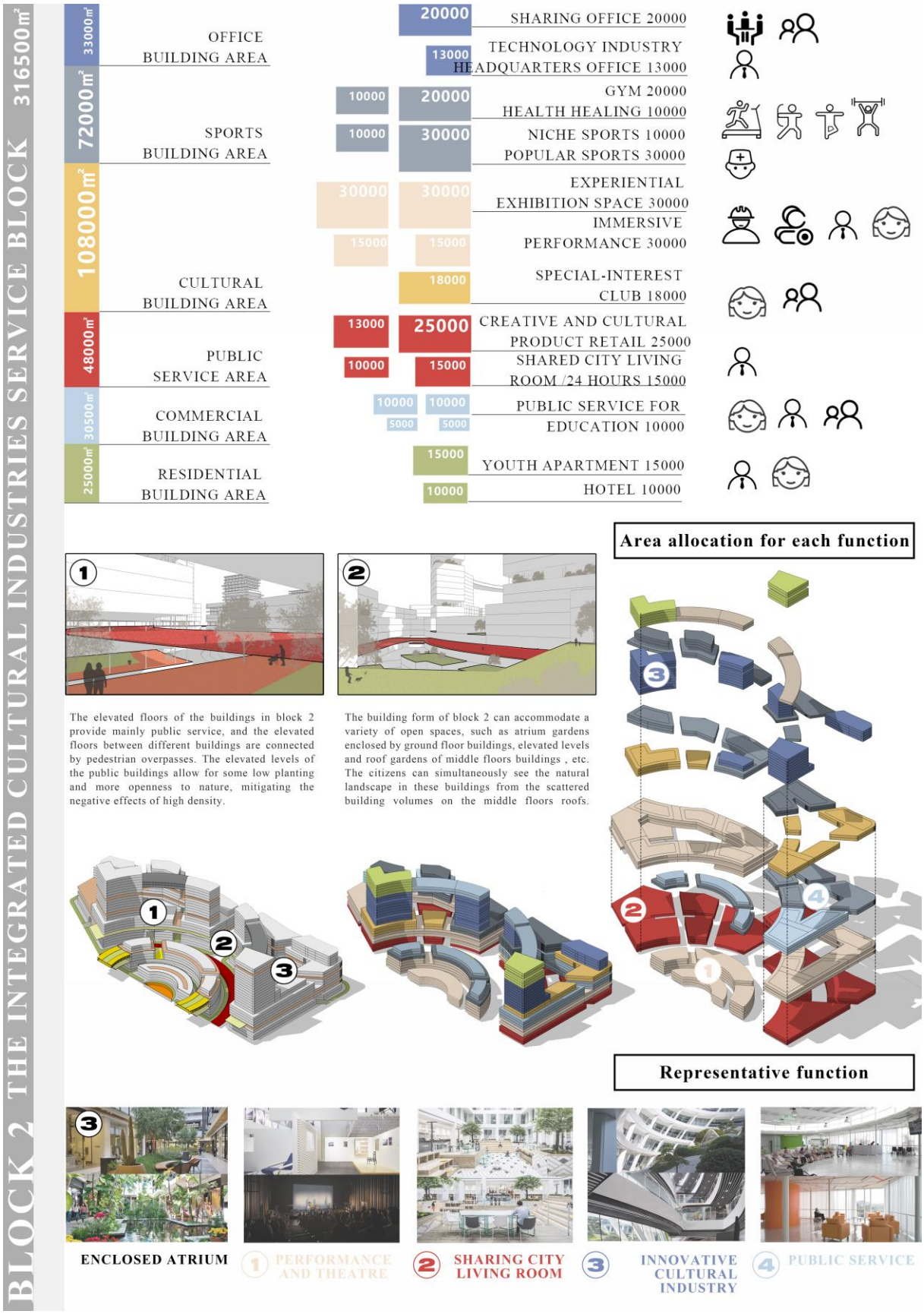


Fig. 5-35 Functions and the following spaces of integrated cultural industries service block

5.3.3 Fashionable and trendy block

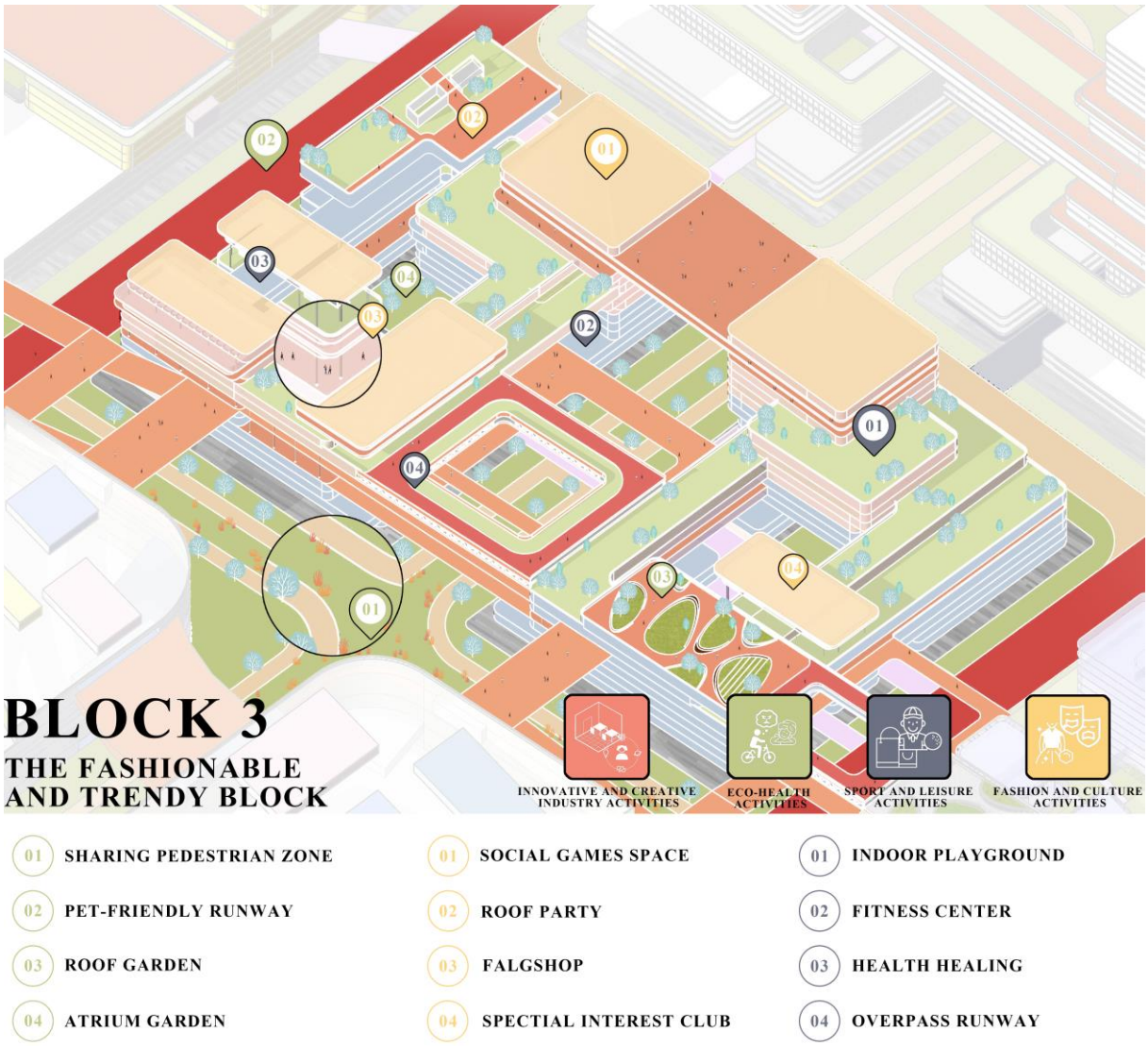
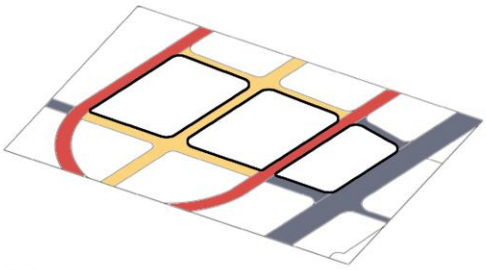
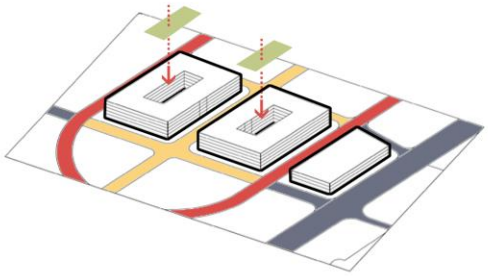


Fig. 5-36 Activities in the fashionable and trendy block

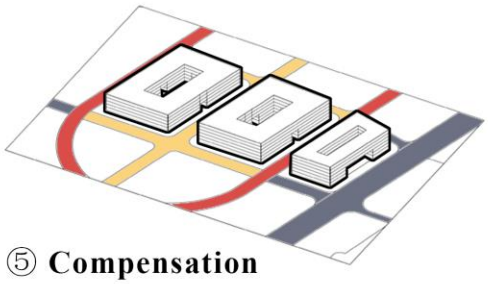
This block is one of the future Racecourse's most significant mixed commercial areas. Its spatial features are the individual building blocks on the top floor of the enclosed building, which can be used for more parties at night, or open-air parties in the roof garden (Fig. 5-36). The function of the building is dominated by trendy fashion and entertainment commerce, attracting young people from Zhujiang New Town and other surrounding CBDs, such as trendy buyers' shops, indoor amusement, and immersive performance (Fig.5-38).



① Original block 3
The original block 3 was divided into three plots by the street.

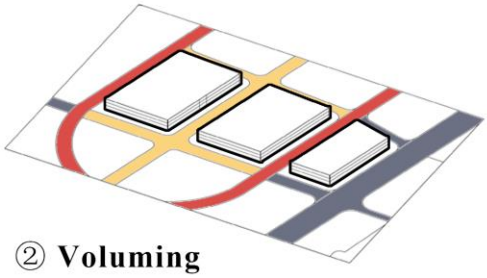


③ Hollowing
Hollowing the atrium at the centre of the building volume as a semi-public open space.

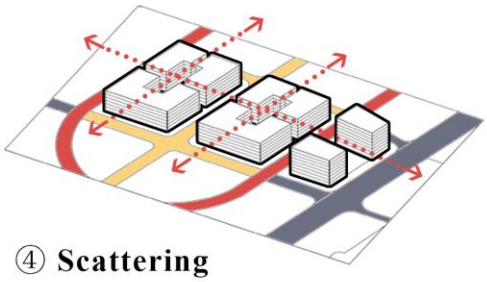


⑤ Compensation
Compensating insufficient floor area to dispersed volumes and arrangement of open spaces.

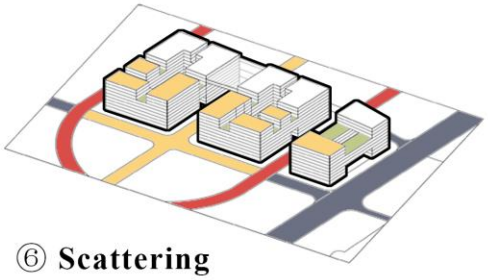
Block 3
Fashionable and trendy block



② Voluming
Formation of volumes to meet area requirements based on pre-determined FAR and building setback boundaries.



④ Scattering
Scattering the enclosed building volumes according to the pedestrian traffic relationships around the block.



⑥ Scattering
Scattering enclosed volumes on the roof to create more open spaces in the air.

Fig. 5-37 Generation of the fashionable and trendy block

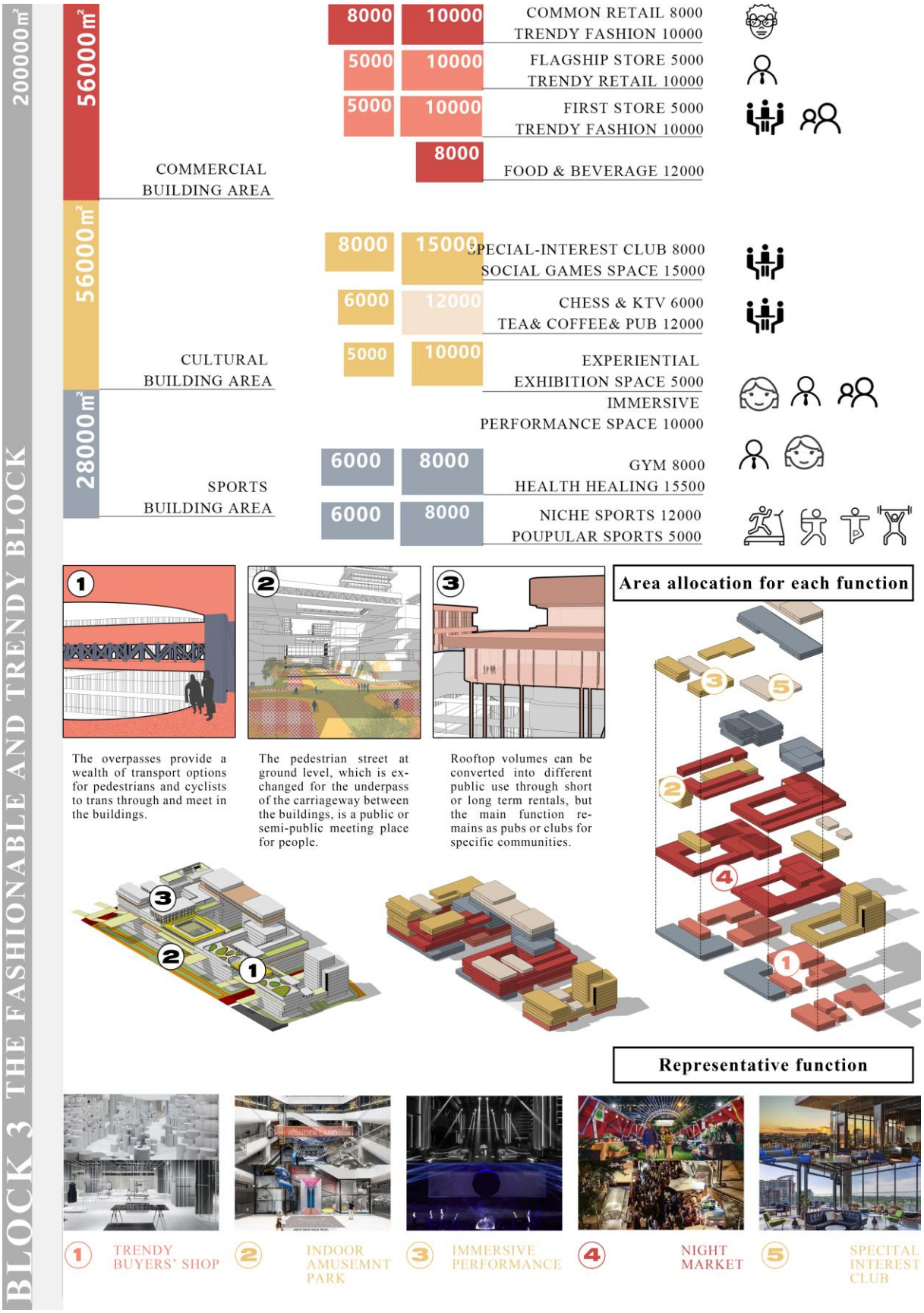


Fig. 5-38 Functions and the following spaces of the fashionable and trendy block

5.3.4 Fashionable and cultural commercial block

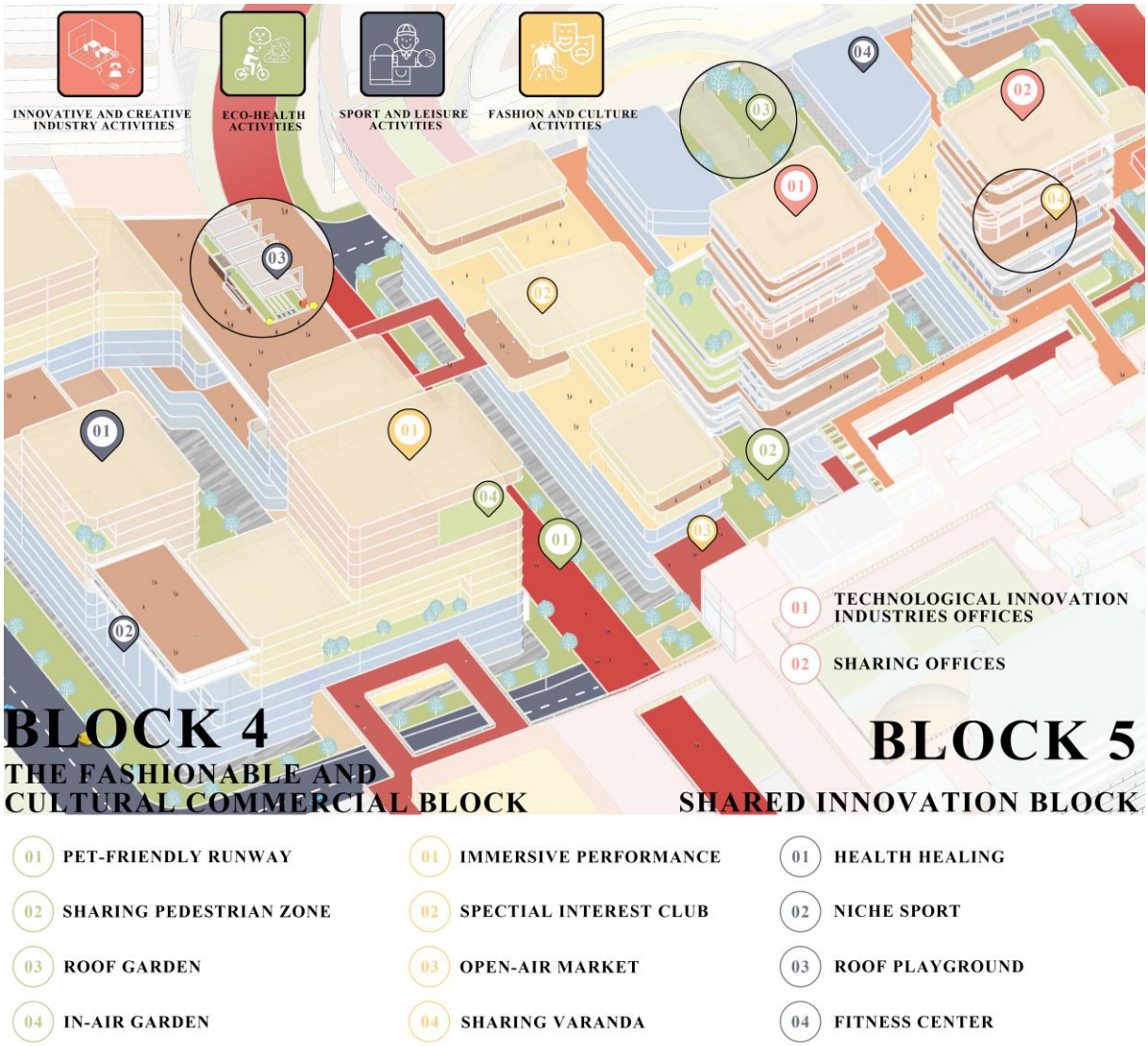


Fig. 5-39 Activities in the fashionable and cultural commercial block

These blocks are situated on both sides of the main entrance on the site's western side and provide sufficient allure through the concentration of flagship, concept, and first shops. The enclosed setbacks in the building form produce more outdoor space at different elevations to provide greenery or party space, and the protruding functional blocks better reflect the mix of functions and the individuality of the shops (Fig. 5-39). The two blocks serve distinct purposes (Fig. 5-41).

The site to the south of the main entrance is connected to the Sports complex block and the Fashionable and trendy block, a complex of flagship stores and the first stores

of fashion or retail brands that are considered trendy. In the meantime, the site's north side is linked to the Integrated cultural industries service block and shared innovation block, a complex of 24-hour recreation such as health recreation and live house serving, shared living, and offices in the shared innovation block.

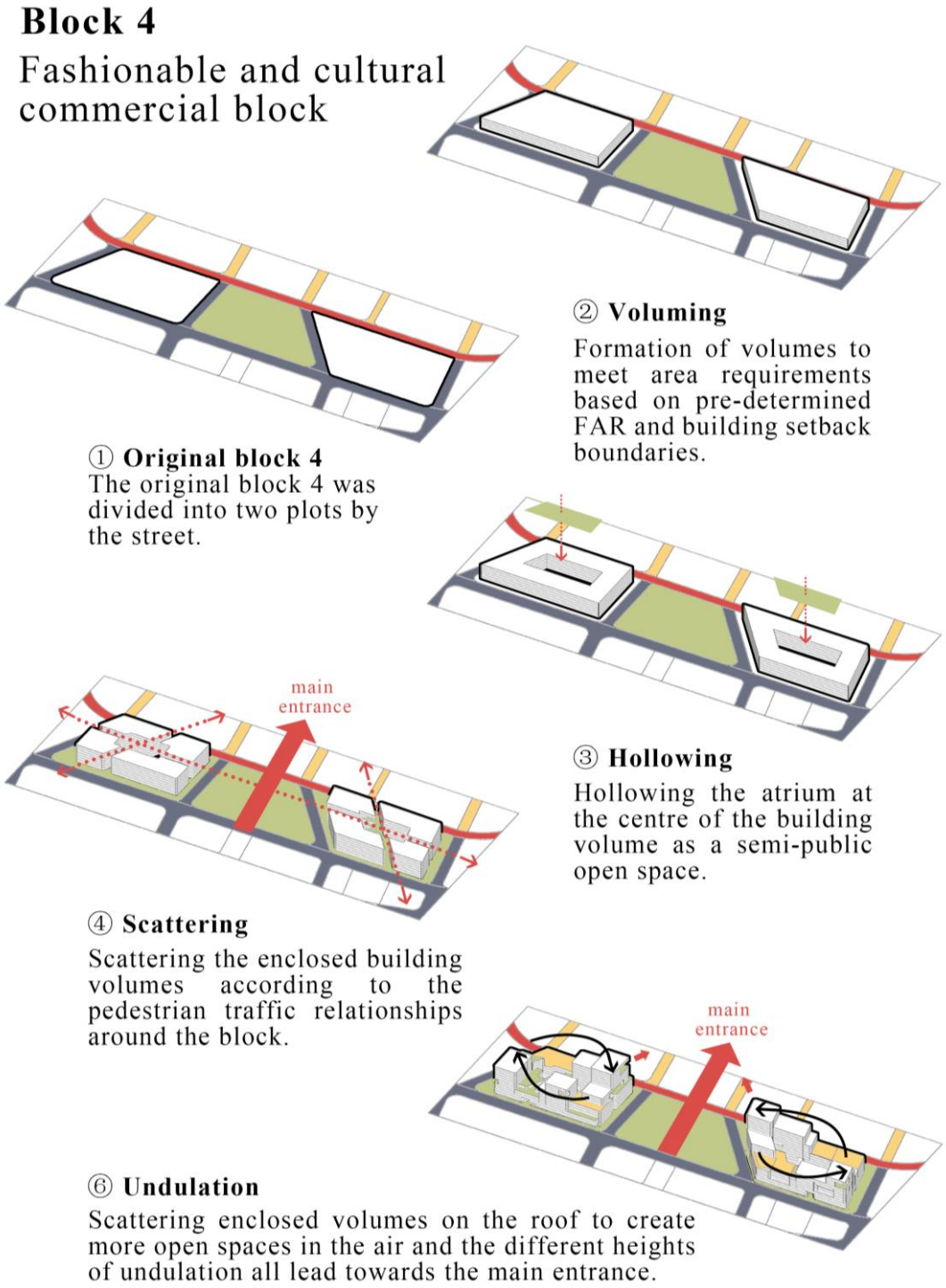


Fig. 5-40 Generation of the fashionable and cultural commercial block

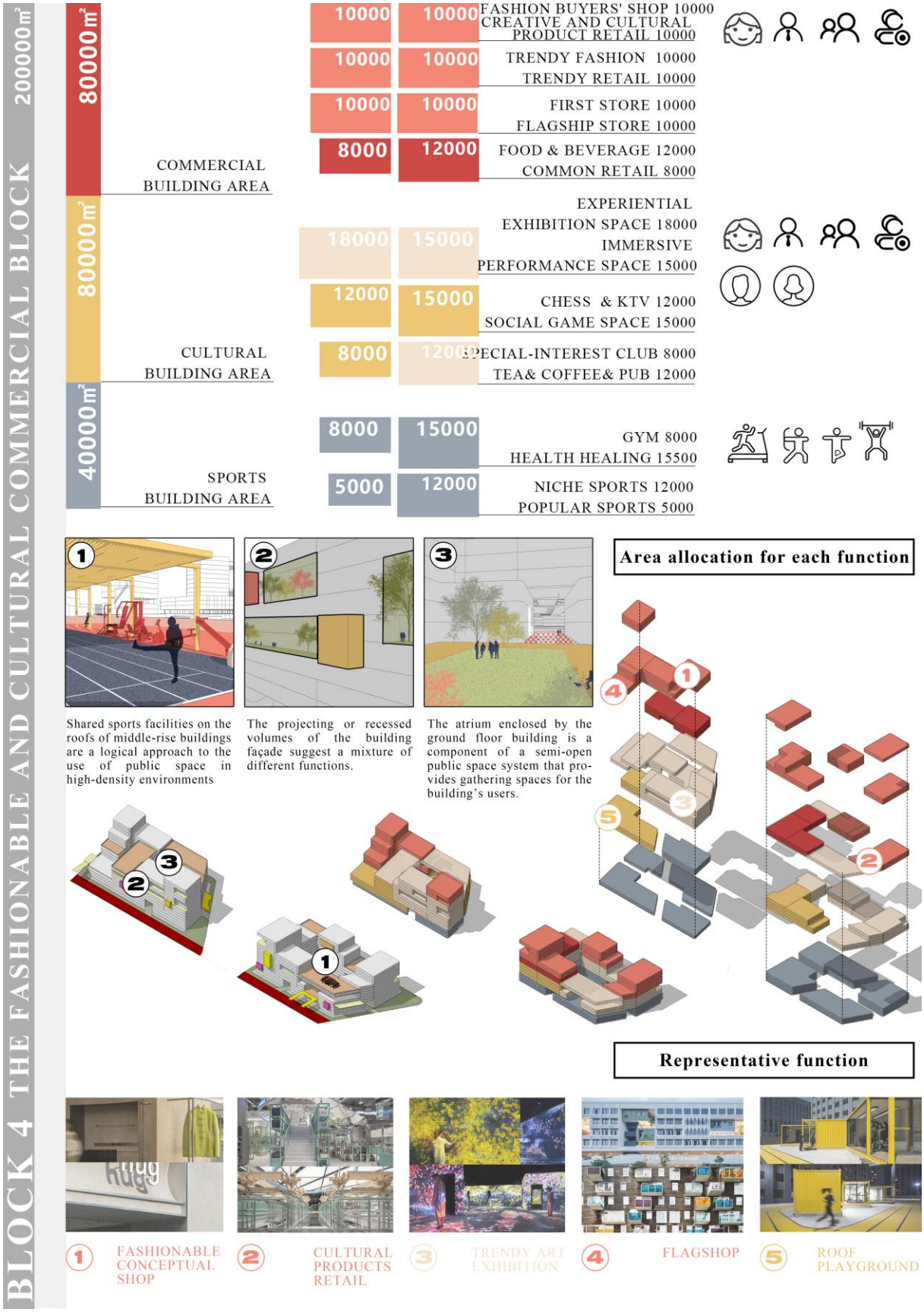


Fig. 5-41 Functions and the following spaces of the fashionable and cultural commercial

5.3.5 Shared innovation block

This block serves innovative start-up companies such as digital and web-related industries and their employees to generate a vertical community to promote social interaction among young people. The small, dispersed blocks and gardens on the top floor allow for bar, party, or sports facility functions, and the ribbon public space between the ground floor buildings can also serve as an urban living room. It is a place for young apartments, interest clubs, and healthy recreation, in addition to shared offices for innovative industrial businesses (Fig. 5-43).

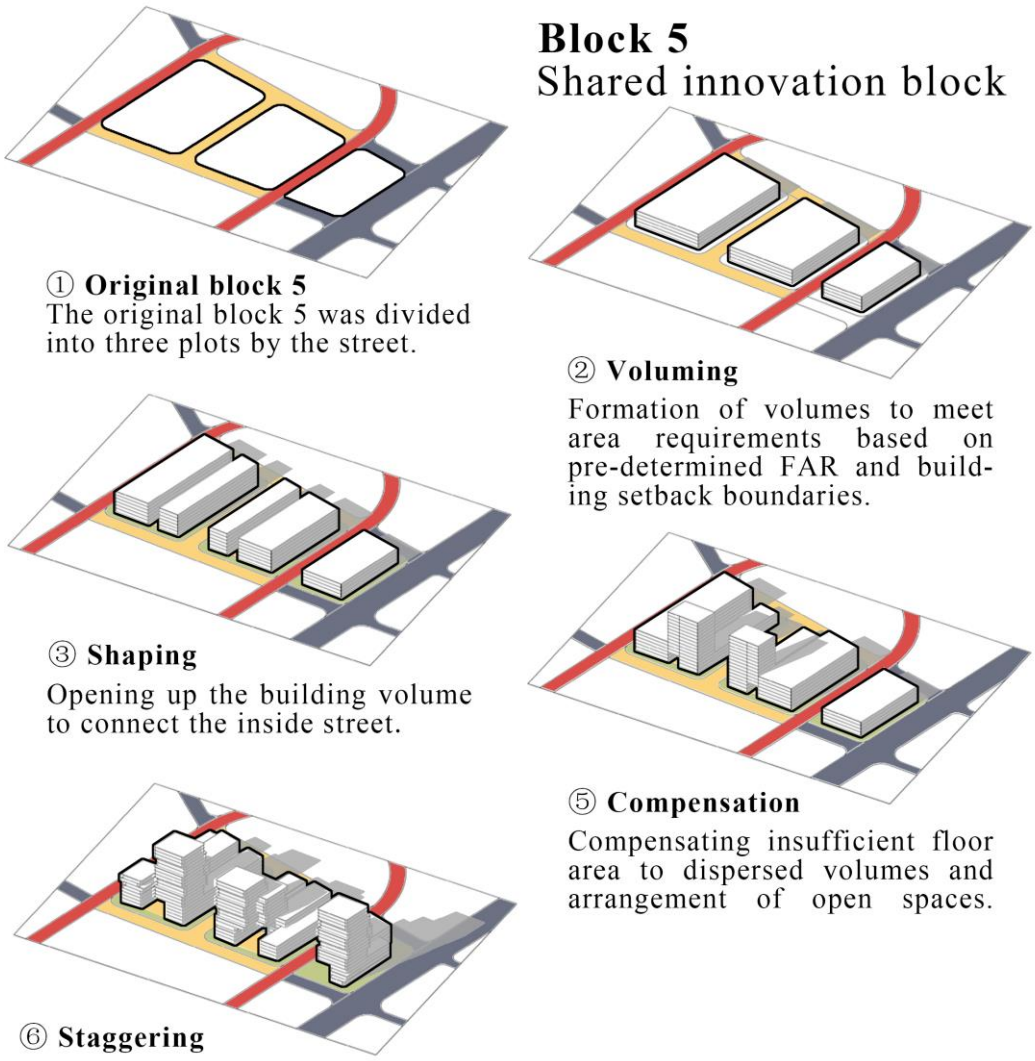


Fig. 5-42 Generation of the shared innovation block

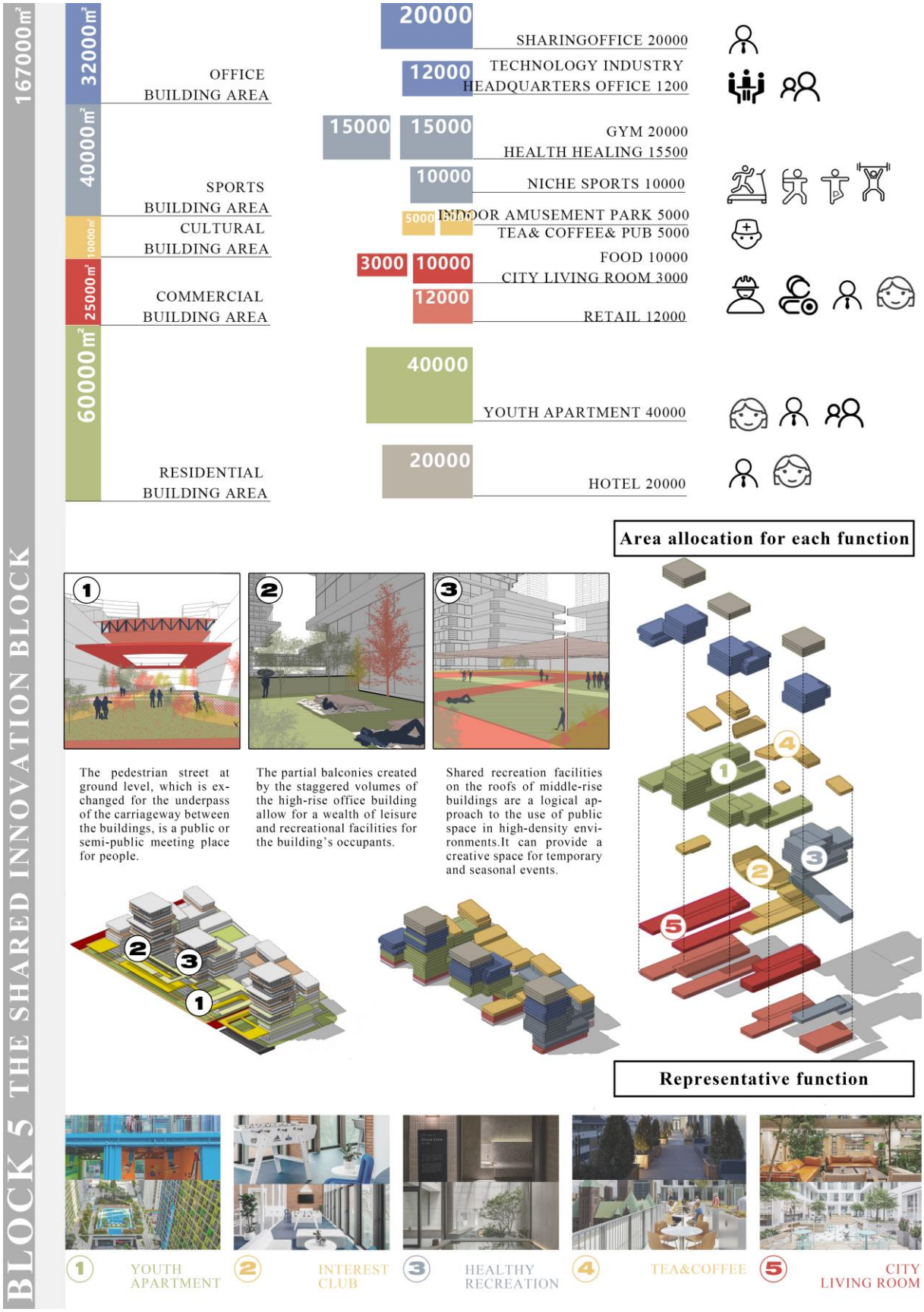


Fig. 5-43 Functions and the following spaces of the shared innovation block

5.3.6 Headquarters business block

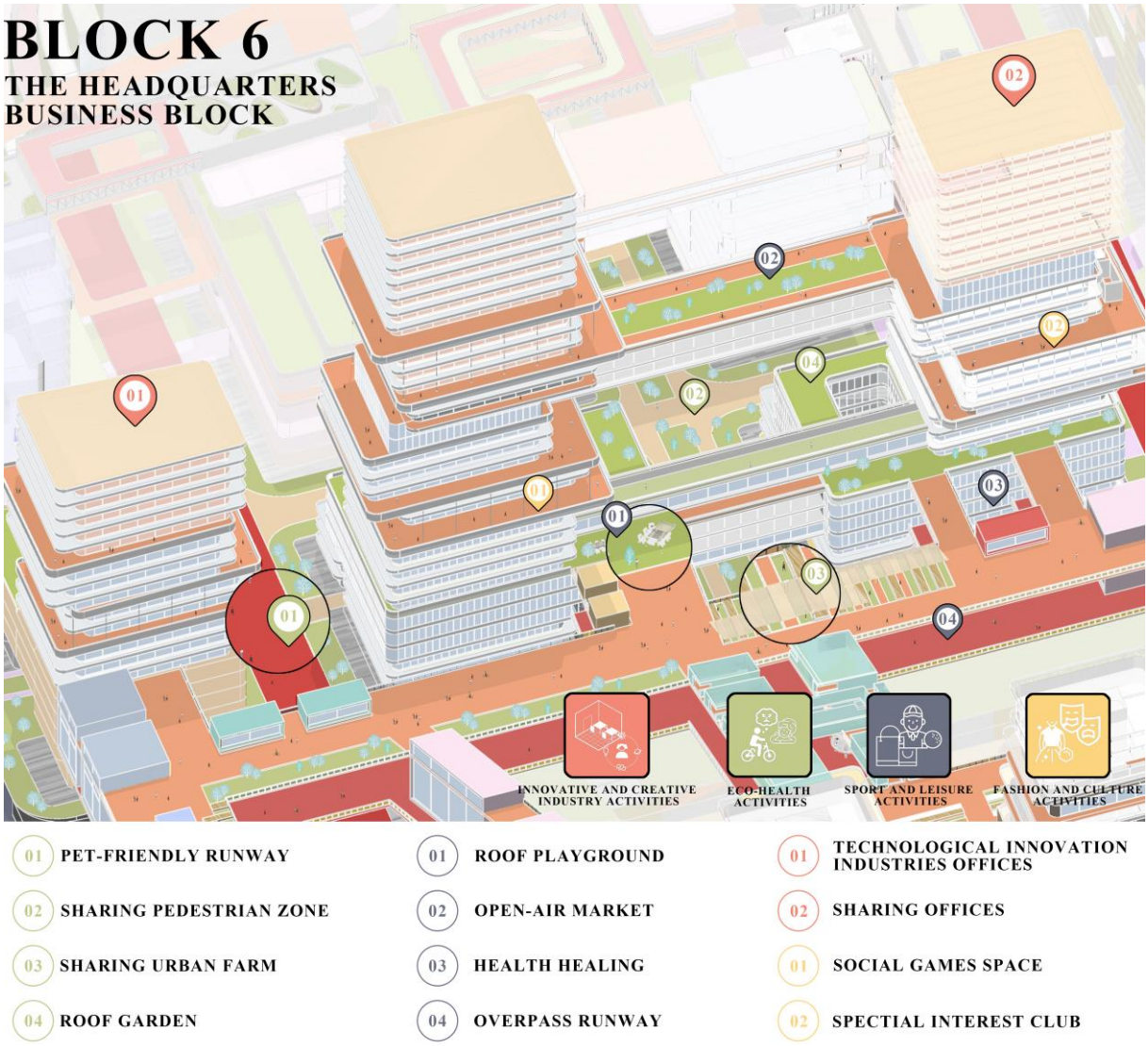
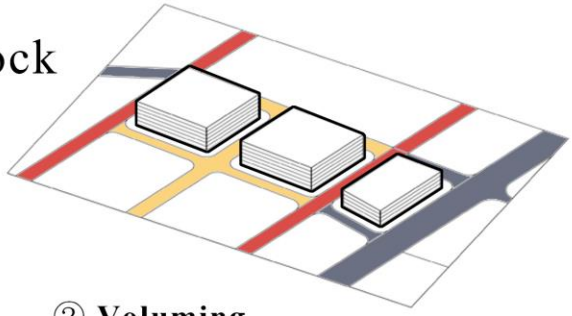


Fig. 5-44 Activities in the headquarters business block

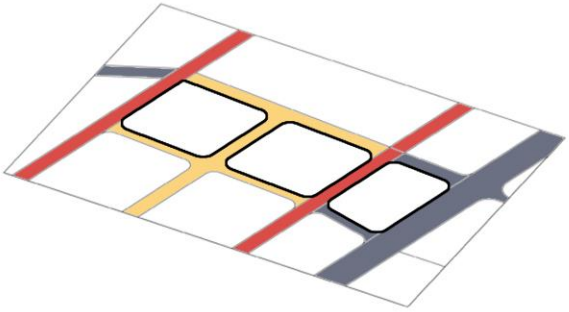
This block caters to affluent businesses with a solid financial foundation. The buildings have an interlaced volume to gain more terraces and are connected by overpasses to improve the concentration of related industries and functional accessibility (Fig. 5-44). The building houses offices for the Head Office economy and supporting facilities such as sports, leisure, and retail (Fig. 5-46).

Block 6
Headquarters business block



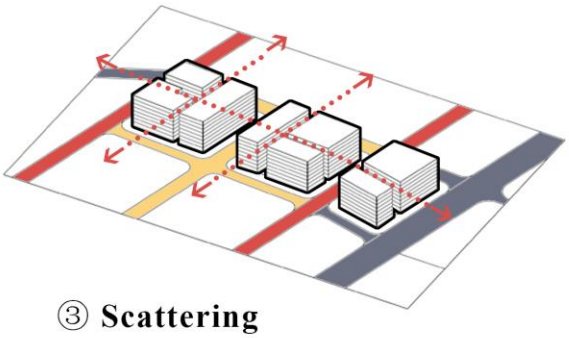
② **Voluming**

Formation of volumes to meet area requirements based on pre-determined FAR and building setback boundaries.



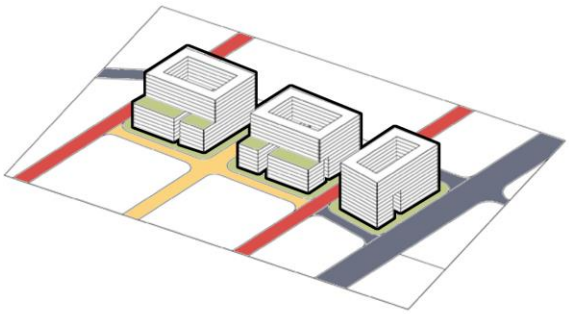
① **Original block 6**

The original block 6 was divided into three plots by the street.



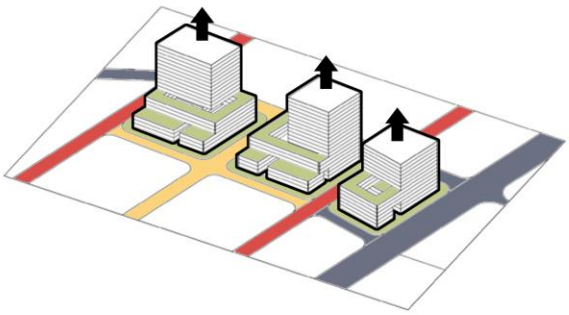
③ **Scattering**

Scattering the enclosed building volumes according to the pedestrian traffic relationships around the block.



④ **Compensation and layering**

Compensating insufficient floor area on the dispersed volumes and arranging the open spaces by the attributes of public, semi-public and private.



⑤ **Concentrating**

Re-concentration of existing floor area on the top to form the headquarters office building. The enclosed building volumes and the dispersed building volumes as podiums allow for a richer range of ancillary commercial and leisure spaces.

Fig. 5-45 Generation of the headquarters business block

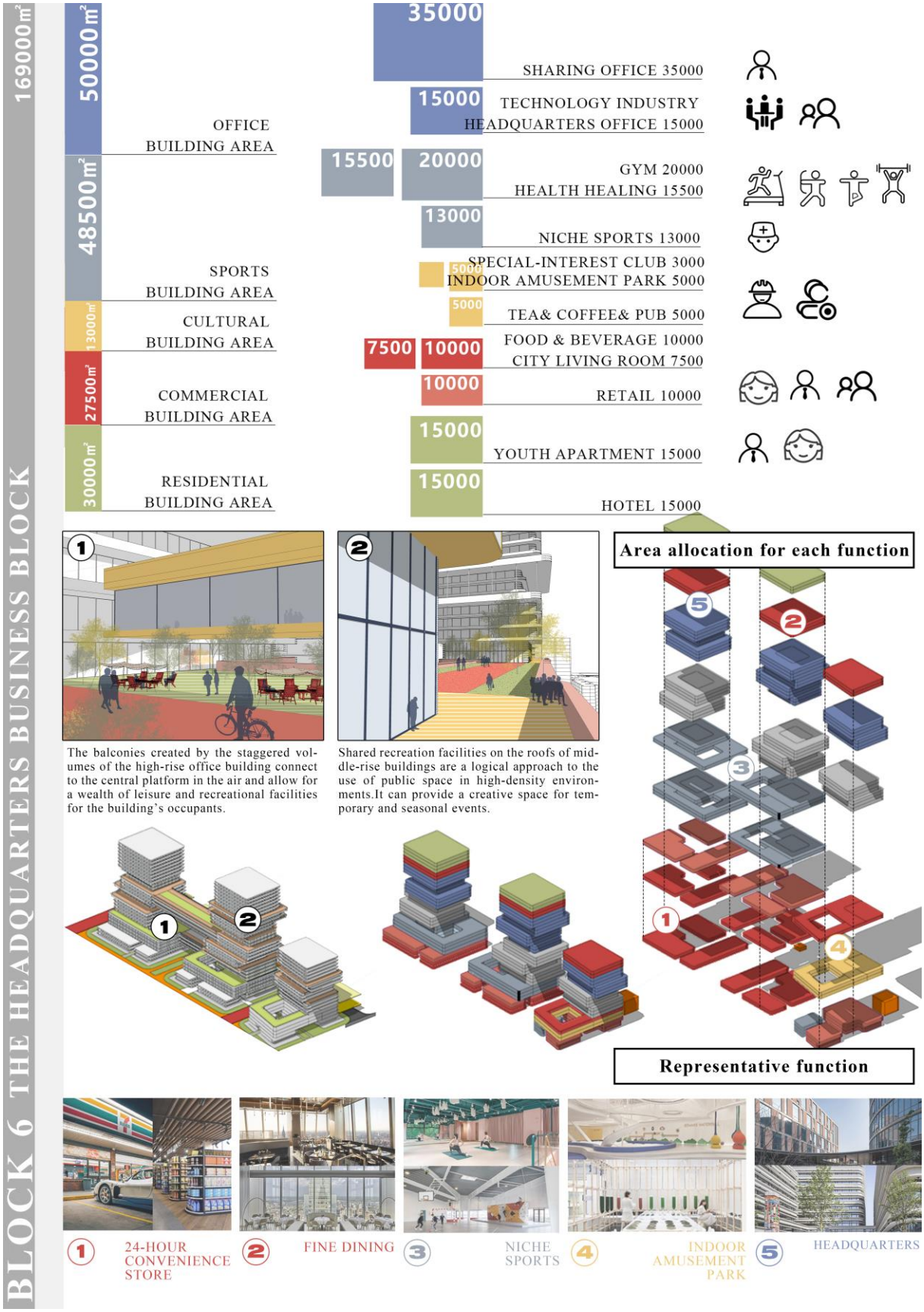


Fig. 5-46 Functions and the following spaces of the headquarters business block

5.3.7 Eco-recreation block as the core

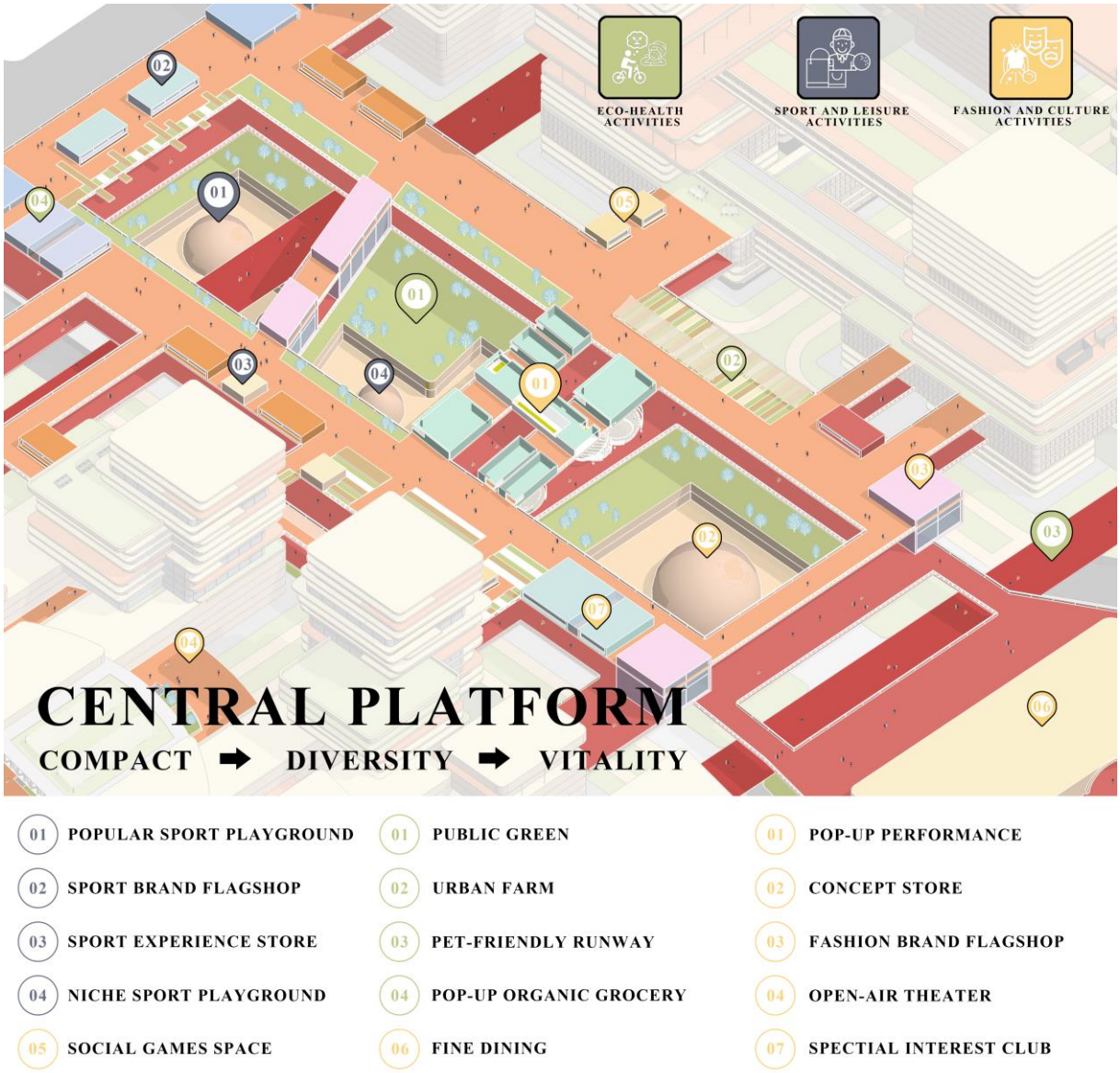


Fig. 5-47 Activities in the eco-health block

This block is the essential attempt of this design thesis to provide concentrated compensation for high-density spaces, with public activity greens on the ground floor and multi-level public activity platforms in the air, which provide continuous activity and vitality day and night. While the street surrounds the ground-level public activity greens, the vast 12m and 24m aerial platforms extend into the adjacent shared innovation block and headquarters business block, as well as the remainder of the block, creating the most remarkable system of overpasses in the new vision for the Racecourse. In

addition, the small blocks on the platforms are prefabricated buildings installed in predetermined slots, with different associated functions around various successive atria (Fig. 5-47).

Fig. 5-48 Activities in the day and night of central eco-recreation block

The public activity greens on the ground floor contribute to a healthy and lively atmosphere at the Racehorse during the day. At night, the public activity greens on the ground floor and the public activity platforms in the air host various commercial and cultural activities, adding to the Racecourse's nighttime vitality (Fig. 5-48).

5.4 Summary

Chapter 5 shows the ideal experimental design for a new version of the Racecourse for compact urban development and more vitality through diverse activities. This chapter begins with a more extensive and detailed investigation of the Racecourse and its surrounding urban environment. It identifies four significant issues: vacant land, interrupted transportation, simple vitality, and boundless open spaces. These are feedback on the thesis's aim and additional validation of its practical importance.

The analysis of the design begins with the general spatial level, including a comparison of the figure-ground before and after, the transport and open space system, and the land use control in blocks. Next, the design analysis focuses on the various functionally dominant blocks derived from the core concept of this design thesis, which states that diverse activities contribute to the vitality of compact urban development, necessitating forms that follow its function to meet the needs of the citizens. The future Racecourse will consist of seven blocks that will serve new migrants in Guangzhou, including the sports complex block, the integrated cultural industries service block, the fashionable and trendy block, the fashionable and cultural commercial block, the shared innovation block, the headquarters business block, and the eco-recreational block as the core. Each block is analyzed in terms of its generation within the site, activity scenarios, and the allocation of each functional area to the predicted population.

Based on the current vacancy, this ideal experimental design of the Racecourse aims to demonstrate a brand new approach to compact urban development for increased vitality in the city's central area through diverse activities.

Conclusion

With the Racecourse as one of the few urban morphological and functional vacancies in Zhujiang New Town, it may be necessary to compensate for and add to the missing urban functions of Zhujiang New Town for the surrounding residents and to find a more consistent urban form for the Racecourse in its location. Therefore, this design thesis aimed to apply the concept of compact against dispersal and sprawl in the Racecourse for the current low-rise building and boundless open spaces. Meanwhile, CAZ is utilized as the container for various activities to generate more vitality in the Racecourse, which might be the advanced version of CBD.

The keywords of compact urban development and vitality may sound common and have been widely accepted in many developed countries. However, there are negative misunderstandings and research gaps about compact in China, the compact urban development in China's metropolitans, therefore, requires a more localized process of erratum and differences. Meanwhile, definitions and quantitative studies of urban vitality are emerging. Still, the qualitative questions of where vitality comes from and how it affects urban form at the level of urban design are more appropriate for site-specific studies. Moreover, is there a relationship between compact and vitality, both of which are expected of cities by citizens or scholars and which have been frequently discussed as concepts in China's urban development over the past decade? What kind of relationships exists? How will these relationships guide design as core concepts? These questions can be explored from a small urban area as an ideal experiment.

Therefore, this design thesis aims to develop a new vision of compact urban development and more vitality for the central area in Guangzhou, the Racecourse, with four sub-aims corresponding to the above problems.

Sub aim 1: Redefining the compact urban development in Guangzhou

This sub aim is intended to better practice the concept of compact in the Chinese context and is centered on mitigating the negative effects of high-density cities. Localization and improvement have been proposed based on Western definitions and controversy through literature review and experience from the case study of Melbourne and Hongkong. In conclusion, redefined characteristics of compact urban development in Guangzhou include appropriate high and middle density and intensity, diverse aggregated activities, and accessible public spaces and transportation. To give more specific guidance on design, these characteristics can be realized through controlling urban form, mixed land use, urban forms adapting to function, vertical streets, and concentrated and scattered public spaces.

In terms of controlling the urban form, this design thesis took FAR, OSR, Building-to-line Ratio, and building height into consideration and divided the values of these indicators into two ranges of high intensity and middle intensity. This is an attempt to reduce the negative effects of high density, including the lack of human scale and excessive building interval, by increasing the proportion of mid-rise and open space blocks. In order to adapt compact urban development to diverse aggregated activities, mixed-use in plots and buildings will provide spatial containers for the aggregation of different functions, while the generation of spatial forms adapted to different functions through a unified motif control provides diversity. In addition, the public space system and the transport system are centered on high accessibility, taking into account the public and private attributes of open spaces and roads, and finally promoting vertical systems that serve the wider public.

Sub aim 2: Producing vitality in the city central area through activities

This sub aim translated the concept of CAZ and vitality into a more practical design content by anticipating the activities required by citizens with the corresponding space forms. Through literature review and case study experience, this design thesis examined the process of how activities in the city central area generate vitality and

defined vitality as an aggregation of activities built on a filter of basic and higher needs of citizens. The richer cultural and entertainment activities fundamentally improve the CBD into the CAZ. Thus, CAZ can be considered as the spatial container of the activities, and urban forms in the design of CAZ should adapt to activities that meet human demands on the block scale.

In predicting the cultural and recreational activities required by the public, this design thesis used demographic data to set the number of the population likely to be active within the design area and profiled the active population based on location analysis to better target possible activities.

Sub aim 3: Clarifying the relationship between compact urban development and vitality

This sub-aim is to clarify the theoretical logic for further design. According to the literature review, characteristics of compact urban development involve aggregation and intensification in many aspects, and these are the primary generation of diversity. And vitality is the social concept or performance of diversity. Therefore, vitality can be considered the product of two separate but related concepts: compact and sequent diverse activities. Diversity of activities is an intermediary between compact and vitality. In short, more compact, more vitality.

Sub aim 4: Designing the new vision of the Racecourse for more compact and vitality

Based on all previous discussions, this design thesis proposed strategies for compact urban development to enhance vitality in urban design. Five main strategies include controlling urban form within and between the plots, mixed land use, concentrated and scattered public spaces, vertical pedestrian-oriented transportation, and block forms adapting to diverse activities. For most strategies, clear indicators or design paradigms are concluded from existing compact cities and CAZ. Further detailed design of the Racecourse towards the new vision of compact and vitality is organized through these strategies.

At last, this design thesis has finished urban design for the Racecourse as the most innovative conclusion; it can be understood as an activities-oriented design developed through compact urban development. The first step is to conclude reasonable activities for the future Racecourse through demographic census data to find the character of the population who is active in the Racecourse and its surroundings. The dense migrant population in Zhujiang New Town is young and well-educated with high consumption. Therefore, activities are concluded as sports and leisure activities, fashion and culture activities, innovative and creative industry activities, and eco-health activities. The second step is the specific design on the master plan level, including form controlled by indicators, open space system, and transportation based on the present situation of the Racecourse. After the plot has been separated into blocks, activities, and functions can be allocated into each block and represented through the area and active population. Building form evolution through motif is the third step to realizing that diversity adapts to compact and activities by developing the whole block form. The future Racecourse will consist of seven blocks that will serve new migrants in Guangzhou, the sports complex block, the integrated cultural industries service block, the fashionable and trendy block, the fashionable and cultural commercial block, the shared innovation block, the headquarters business block, and the eco-recreational block compensates for the compact urban development of the surrounding plots with large open public spaces.

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The innovation points of this design thesis can be summarized as follow.

Redefining the compact urban development in China's high-density metropolis central area. Compared to the original defined concept of compact and compact urban development in the West, the design thesis proposed that it is more important to eliminate the negative impacts and controversy of high density. Thus, approaches such as the addition of appropriate middle intensity and the open spaces for compensation and mediation are utilized in design strategies for the new vision. This is reflected in the Racecourse's future design where the overall FAR was controlled at 3.0, and the initial forms of the blocks were controlled for generating a different dominant land use by the combination of high density (50%) and 7-9 storey blocks and medium density (30%-40%) and 15-18 storey blocks. In addition, the ground floor areas of the eco-recreational block were unbuildable and acted as fully open public spaces, greatly compensating for the compact urban surroundings.

Concluding the relationship between compact and vitality by the diversity of activities as the intermediary and finally transfer theoretical concept into practical design. Most of the conclusions come from the literature review. Still, this design thesis summarized that citizens' needs shall filter appropriate activities for the long last vitality and thus organize the following design by activities suitable for the site. For example, suitable activities are concluded as sports and leisure activities, fashion and culture activities, innovative and creative industry activities, and eco-health activities for the citizens active in the Racecourse.

Summarizing and utilizing the strategies for improving the Racecourse with a more compact and vitality of final design. Although compact urban development and vitality have become common concepts in worldwide urban planning, there is a research gap in combining and translating compact urban development and vitality into block-scale urban design. After clarifying all the definitions, concepts, and relationships in the Guangzhou context, the new vision towards compact and vitality is realized through five strategies extracted from the compact urban development for the vitality by activities-oriented.

Reflection and further improvements are as follow.

The focus indicators and form evolution is not flexible and targeted enough. The more subjective derivation of the form may not get a more objective guide to the design process in urban blocks form generation.

The research on the current situation of Zhujiang New Town and the surrounding population of the Racecourse is inadequate, and the selection and refinement of activities into functions may therefore be inappropriate. In the meanwhile, the correspondence between activity or function and spatial is not sufficiently detailed and is more generic, with a less specific expression of vitality and Guangzhou.

The combination of these reasons has led to the current experimental design being a questionable two-dimensional continuation of the original form of the Racecourse for its real or fictitious future.

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