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Reclaiming City Street for People:

Design Guangzhou Racecourse Under Shared Space

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ABSTRACT

Streets are designed for various uses, but today's city streets are designed with the use of cars in the first place, creating a car-oriented street style. Such a street enables vehicles to pass quickly but also brings a threat and negative experience to pedestrians and non-motorized vehicles on the street. The diverse functions of the streets are also reduced; narrow sidewalks and poor pedestrian systems not only make it difficult for people to stay on the streets and develop other activities but even the fundamental right of passage also is not guaranteed. However, the primary user of the street is people, and the right of people to use the street should be enhanced and reclaimed for people.

Consideration of this issue has attracted much attention in recent years, and people-oriented street design approaches have emerged. The Shared Street concept creatively proposes that people and cars share the privileges of using the street, thus increasing the privileges of people on the street. Therefore, from this concept, this paper explores how to expand the scope of sharing, from the sharing of people and cars to the sharing of public and private, to expand the space of the street and provide people with diverse places to experience street life. This paper takes the Guangzhou Racecourse site as the design research object. It integrates literature research, comparative research, and case studies to explore the optimal design of urban street space from the pedestrian perspective and design a people-oriented street.

This paper is divided into four sections as follows.

In the first part, the research background is described, the development of urban street design in China is sorted out, and related concepts are defined; the result of domestic and international research on the concept of shared streets is summarized, and the purpose and significance of the research are clarified, and the structure and framework of the researchers organized according to the idea of raising problems-analyzing problems-solving problems.

The second part summarizes and draws on excellent examples of urban shared streets and shared space construction in China and other countries to provide a reference basis for the design research part.

In the third part, design strategies are proposed. From street design to urban design discusses

the design methods when the street design is a priority in urban design and how to incorporate the concept of sharing in street design to create a people-oriented street.

In the fourth part, the theoretical research is applied through the urban design proposal for the Guangzhou Racecourse. Through the specific design solutions, the design research is conducted to provide a people-oriented street design solution for the urban development of the Guangzhou Racecourse.

Keywords: Shared Space, Street Design, Planning and Design Strategies, Guangzhou

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Chapter1 Introduction

1.1 Background

Since the reform and opening up, China has entered an era of rapid development, the theme of this era is efficiency and convenience, and the result is that the city street is becoming a fast traffic-oriented city space. While achieving remarkable progress through rapid urbanization, there is also a series of problems, such as traffic jams, crowded urban centers, environmental pollution, etc. Traditional urban planning and urban design that followed the principle of efficient development are accustomed to car-oriented street design, and the concept of car-oriented is constantly squeezing people's right to use streets; therefore, there is a phenomenon that the lane is too wide and inconvenient for people to pass through. Pedestrians must use underground passages or overpasses rather than the ground space, which is the space that once belonged to pedestrians. In addition, with the increase in the stock of motor vehicles, the parking space for motor vehicles is becoming increasingly insufficient and the parking space continues to occupy the pedestrian space, which continuously reduces the environmental quality of the pedestrian space. Not to mention, a wide driveway is flanked by narrow sidewalks, which are common in cities.

Faced with these problems, in recent years, everyone has gradually realized the importance of green travel. People-oriented street space design is changing the status quo of vehicle-oriented design. City streets are part of city public life. Good street space is conducive to improving residents' green travel, improving the walking experience, and enriching street public lifestyles to ease the pressure on urban public space use. Creating pedestrian-led street spaces is important for city dwellers and urban development.

1.1.1 The Importance of Pedestrian-oriented Streets

The street is an important part of a city; it is part of our daily life. It is like the vein of a city; the street plays the role of transportation in a city's daily production and life. At the same time, the street space is also an important public space in the city. Every resident's daily life is about constantly from a starting point to a destination, whether it is from home to work, from home to a transportation station, or from school to home. These places in daily life are all connected by the streets, and these necessary activities are completed through the streets. In addition to carrying traffic functions, streets also carry the role of providing public living places. Many

other activities are happening on the streets like we take a leisurely walk on the street, vendors setting up their stalls selling on the street, children playing on the street, people taking rest on street seats, artists performing on the street, etc. A series of optional or social activities are taking place on the streets. Jan Gehl believes that when outdoor areas are of poor quality, only strictly necessary activities occur. When outdoor areas are of high quality, necessary activities take place with approximately the same frequency – though they clearly tend to take a longer time, because the physical conditions are better. In addition, however, a wide range of optional activities will also occur because places and situations now invite people to stop, sit, eat, play, and so on. In streets and city spaces of poor quality, only the bare minimum of activity takes place. People hurry home. In a good environment, a completely different, broad spectrum of human activities is possible.^[1] Therefore, the quality of street space is closely related to the behaviors of residents in the street space.

Table 1. The types of activity we can observe in a street

From Gehl (1987)	From Carr et al. (1992)
Necessary	Going to work/Shops Deliveries Working on a property/car
Optional	Hanging out Sitting Reading Playing Gardening
Resultant social	Talking and listening Observing

(Source: Gehl, 1987. Carr et al, 1992)

Pleasant street space will promote the occurrence of walking. Many elements on the street can improve the service level of the street for pedestrians. For example, the complete coverage of the street trees can provide shade that can improve the psychological and physiological feelings of walking. The vehicle-flow adjacent to the sidewalk is at a low speed that can bring a higher sense of security to pedestrians on the sidewalk. The frontage side of interesting can bring fun to walk and reduce the boring on road. A varied walking space can shorten walking time psychologically. The physical conditions of streets directly affect the choice of residents' travel and transportation modes. To create a pedestrian-oriented street space, we need to pay attention to the physical conditions of a street to make sure it is suitable for people to use.

Pedestrian-oriented streets mean more walking and slow traffic, which means less car travel and fewer emissions. It can bring some relief to the urban problems that our city is currently facing. On May 31, 2022, the National Development and Reform Commission held a press conference, indicating that the total number of vehicles in China has reached 307 million, surpassing the United States and ranking first in the world. Cities are facing serious traffic congestion, and the exhaust emissions from cars have also brought serious harm to the urban ecological environment. There has been a broad consensus to change the car-oriented mode of street design and creating a street space suitable for pedestrians is becoming the mainstream idea of street design. Shared Space Street as an approach of street design is aimed at reducing the vehicle volume and improving the priority of pedestrians on the street.

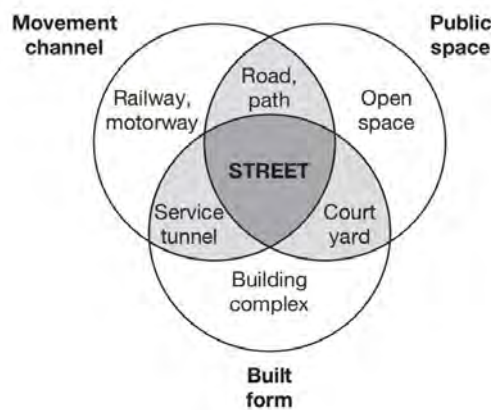


Fig. 1-1 Elements of the street
(Source: Steven Marshall, 2005)

While the city is developing, the development of streets has ushered in another problems. As Guiqing Yang said in *Urban Social Psychology*, Street life is also an important part of people's memory and emotions about the city. With the disappearance of these streets, the connection between people and the memories closely related to the city are disappearing. ^[2] The emergence of shared streets also preserves people's street life to a certain extent, taking streets as public spaces, enriching the functions of streets, and satisfying people's psychological needs for preserving city life memory.

1.1.2 The Development of Street Design in China

The most profound impression people have on a city is the street style of the city.^[3] The design of city streets directly affects the appearance of the whole city. Domestic research on street design started late, while many foreign street design theories are still faced with the

problem of translation when applied in China, resulting in a series of problems in urban streets, the quality of space cannot meet the needs of residents. These questions are a constant reminder of the need to think about street design. It can be said that the transformation of humanized streets in China is still in the preliminary stage. It can be seen from the national policies and the guidelines for urban street design issued in the past decade that the street design that gives priority to pedestrians and considers slow walking is attracting attention.^[4]

Small block, Dense Road network mode

In the late 1980s, the city street was regarded as a public social place by the new urbanism. The city street and public life were refocused to create a street space belonging to the citizens for people to achieve the purpose of face-to-face communication. "Small block, Dense Road network" is the urban space planning mode summarized by New urbanism in the process of American urban planning and construction. The "small block, dense road network" mode increases the public activity area in the street, which has obvious advantages in improving the quality of life, business atmosphere and land value.

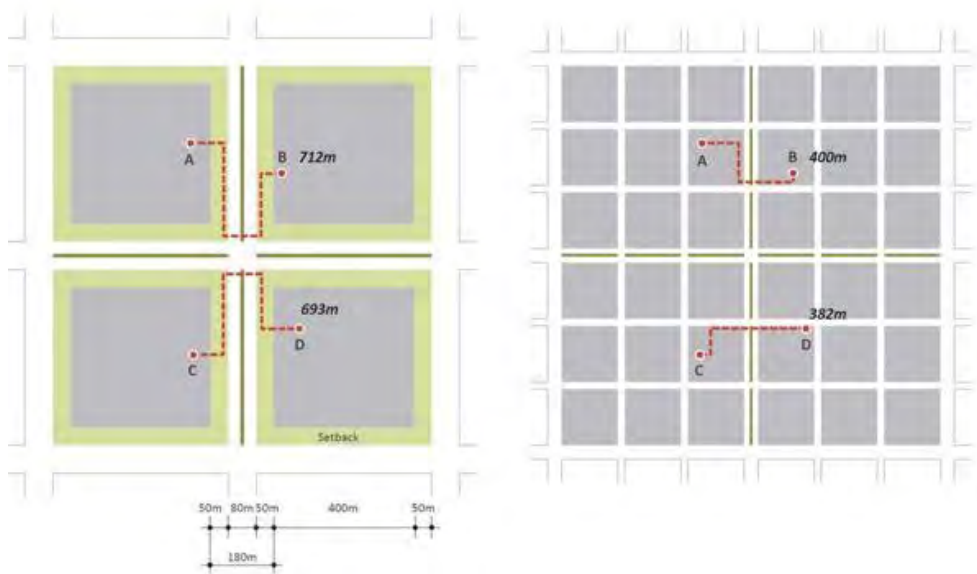


Fig. 1-2 Comparison of access distances under large scale, sparse road network and small scale, dense road network conditions
(Source: WANG Zhigao, 2015)

The concept of new urbanism was introduced into China at the beginning of this century as a good medicine to deal with the disorder spread and scale imbalance in the rapid urbanization of Chinese big cities, and it was practiced in many urban areas. Domestic research on "small block dense road network" focuses on land development, block scale and stability, and

humanized dynamic streets. In terms of national policies, in February 2016, "Suggestions on Further Strengthening Urban Planning and Construction Management" clearly proposed: We should strengthen the planning and construction of blocks, specify the area of new blocks in different levels, and promote the development of living blocks that are open and convenient, with proper scale, complete supporting facilities and harmonious neighbors.^[3] Establish the urban road layout concept of narrow road, dense road network. The 2018 "Urban Comprehensive Transportation System Planning Standards" (GB/T 51328-2018) requires the implementation of the "dense road network in small blocks" and the opening of blocks. Road system planning will try to meet the diversity of the route of transportation organization, shortest distance and the maximization of road network capacity, and to provide as many options as possible for the urban traffic organization, the road system according to the characteristics of the different parts of the city activities to carry out the "small blocks, narrow roads, dense road network," the idea, especially in the dense urban centers of population and employment. According to the Guidelines for Planning and Design of Slow Traffic in Shanghai issued in August 2020, the new city construction will follow the design concept of overall planning, focusing on characteristics, demonstration and leadership, highlighting characteristics, high efficiency and intelligence.^[4]

We will encourage the layout of urban roads with narrow roads and dense road networks. We will add slow traffic systems to newly rebuilt roads and open up public corridors to break down bottlenecks in the road network and form a multi-level and interconnected all-terrain slow traffic network. A greenway system that gives priority to recreation and fitness; Relying on historical streets, create historical and humanistic charm blocks; The public block activities are integrated into the walking space to create new blocks such as functional compound vitality blocks.

Complete Street concept

As the reflection to the "car" street development model, how to improve people on the Streets of priority, all kinds of street design concept began to appear, Complete Street this concept originated in the United States in the 1970 s, emphasize to meet all the current and future demand for the traveler, not just on drivers. The definition given by the National Coalition for Complete Streets in the United States is: Complete streets are designed and operated to provide safe access for all users. Pedestrians, cyclists, motor vehicle drivers and bus

passengers of all ages, as well as all persons with disabilities, can travel and cross streets safely. Building complete streets means that transport authorities must change the priority they have given to cars and ensure safe travel for all.^[5] Street guidelines for the use of pedestrians, non-motor vehicles, etc., on the streets have emerged in various places. As Beijing 2011 compiled by the Beijing urban pedestrians and non-motor vehicles transportation system design guideline. Jiangsu province in 2013 compiled by the city walking and bicycle traffic planning guidelines, especially in Beijing in 2013 compiled by the rational utilization of the urban road space, Beijing urban road space planning and design guidelines, in view of the way to distribute too tilt to motor vehicles, As a result, walking, greening and public service space are constantly crowded into the problem, and a fine planning, design and management method of urban road space is proposed, which stipulates that the width of non-motorized lanes should not be less than 2.5 meters and the width of sidewalks should not be less than 2 meters.

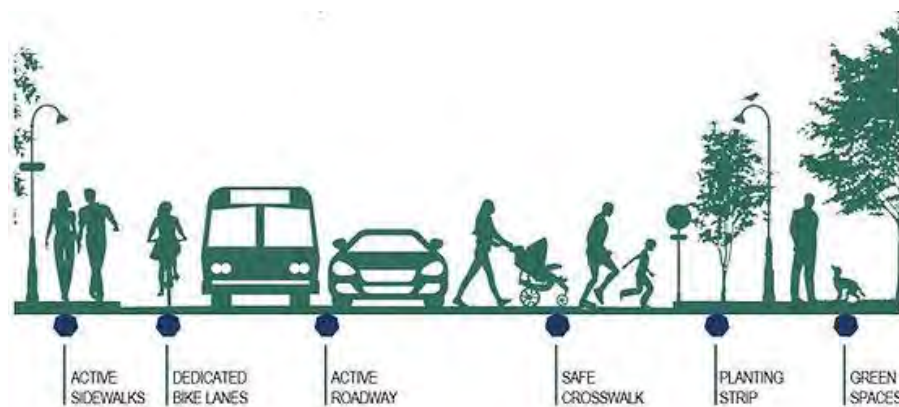


Fig. 1-3 What is a complete street?
(Source: NCDOT's Complete Streets Policy Update, 2021)

In recent years, different transportation modes such as sidewalks and slow space have been taken into consideration in street design, and street furniture has also appeared to enrich the specific design requirements and guidance of street experience. In Nanjing Street Design Guidelines, the people-oriented design concept is emphasized. In street design, the needs of non-motorized and pedestrian access and activities along the street should be fully considered, and the non - rights should be clarified priority for motorized and pedestrian access.

Shared Street concept

Streets sharing theory is that the street is part of the material and social living environment, it

is also for the car, social activities.

It will be used for communication and civic activities. The fundamental idea of the shared street system is to construct a unity, emphasizing community and residential users. Pedestrians, playing children, cyclists, parked vehicles and moving vehicles share the same street space. Even if these uses contradict each other, the actual design puts the motorist in a secondary state that is actually safer than the layout of the average residential street. Redesigning the physical surface of the street, it creates social and physical dominance for pedestrians. The "liberation" of the walking environment merely incorporates car traffic into a fully integrated system; it is not an anti-car policy. Through the concept of street sharing, the priority of pedestrians on the street is enhanced, the social function of the street is enriched, more social behaviors take place on the street, and the role of public life is enhanced. Taking streets as public Spaces can alleviate the shortage of urban public resources to a certain extent.



Fig. 1-4 Commercial shared street environment
(Source: Urban Street Design Guide, 2021)

Many theories on street planning and design originated from developed countries in Europe and the United States, and there is an absorption process of "introducing Western theories - reflection - Chinese characteristics" on the development path. As for the concept of shared streets, China is still in a stage of theoretical absorption and reflection. More studies focus on summarizing the spatial design concept of shared streets, summarizing refining the design strategy of shared streets, and putting forward targeted reflection. In general, the idea of shared streets has caused us to rethink and pay attention to street design. According to

Shanghai Street Design Guidelines, shared streets and fully paved intersections are encouraged in the traffic measures to improve the slow traffic experience.



Fig. 1-5 Shared street in Copenhagen, Denmark
(Source: Google)

The shared street does not adopt the traditional human-vehicle diversion measures such as isolation, cancels the height difference of curbs, and carries out the entire pavement, so that pedestrians, non-motor vehicles, and motor vehicles share the street space. Commercial streets with small vehicle flows and branches dominated by slow traffic can be built into shared streets. The concept of the shared street makes the street space in the residential area more lifelike, enhances people's status as street users, and is more concerned about the use of pedestrians, including children, on the street. At the same time, the shared street can further reflect the place spirit of traditional streets. However, this model also has a particular limitation, only suitable for space capacity requirements that are not high, residential properties, and commercial street space.

Conclusion

Since the beginning of the 21st century, street design has developed in the direction of people-oriented, slow-walking, and environment-friendly. These are regarded as vital sources of street vitality.

From the classification of streets, we can feel that the functions of streets are more abundant than before. The industrial standard of the People's Republic of China, Code for Urban Road Engineering Design (CJJ37-2012), has explicit provisions on the classification of urban roads

in "3 Basic Provisions".^[6] According to their position in the road network, traffic function, and service function along the route, urban roads can be divided into four grades: express road, main road, secondary road, and branch road. The basis of grading is to consider the traffic functions carried by the streets, and now there are more standards for distinguishing the different streets. For example, in the "Shanghai Street Design Guidelines", the street classification considers the activities along the street, landscape features, etc. It divides the streets into five categories according to their functions: life service streets, commercial streets, landscape leisure streets, traffic streets, and comprehensive streets. According to the "Nanjing Street Design Guidelines", the streets are classified according to different standards. According to the traffic level, the streets are divided into four grades: traditional express road, main road, secondary road, and branch road. The streets are divided into living streets, traffic streets, comprehensive streets, and service streets according to the functions of the land and buildings along the streets. Street-type positioning is the premise and basis of street design. Street width and section, facilities, and the greening selection and layout must be combined with street-type practical design.

To realize the fundamental transformation from car-oriented to people-oriented, it is necessary to systematically consider slow traffic, static traffic, motor traffic, and street activities to shape urban streets into high-quality public spaces and revitalize street life. The concept of street design can be said to be multifarious, and the concept is constantly updated with the development of The Times and social development. In the face of the complex status quo of urban development, no concept can completely guide the whole design. Each concept needs to be adjusted and reflected with the specific objective reality. By introducing the concept of shared streets, we may find an urban design method that balances the contradiction between people and cars and benefits the construction of street life. At least through thinking and trying, we can bring some inspiration to street design.

1.1.3 Research Objects

1.1.3.1 Guangzhou Racecourse as the design research object

The design research object of this thesis is located in the Racecourse in Guangzhou, China, adjacent to the Zhujiang New Town in Tianhe District, Guangzhou.



Fig. 1-6 Location of the racecourse

1. Current Situation in Guangzhou

As a representative of China's rapid development, Guangzhou is facing certain problems. By the end of 2021, the resident population of Guangzhou was 18.81 million, an increase of 70,000 people year-on-year, and the urbanization rate was 86.46%. The household population at the end of the year was 10.115 million, with an urbanization rate of 80.81%. The total resident population in the six central districts decreased by 250,000, including a decrease of 112,000 in the Liwan District. The resident population of the five outer districts increased by 320,000, the most significant increase of 146,000 in the Panyu District. In 2021, Guangzhou's gross regional product was RMB 2,823.2 billion, an increase of 8.1% year-on-year. Meanwhile, the value added of the primary industry was 30.6 billion yuan, up 5.5% year-on-year; the value added of the secondary industry was 772.3 billion yuan, up 8.5% year-on-year; and the value added of the tertiary industry was 2,020.3 billion yuan, up 8.0% year-on-year.



Fig. 1-7 GDP and growth rate of Guangzhou in recent years

(Source: 2021 Guangdong Province Traffic and Travel Report)

By the end of 2021, the number of motor vehicles owned in Guangzhou was 3.309 million, an increase of 230,000 units year-on-year. The number of minicars (including microcars) owned was 2.666 million, an increase of 184,000 units. Guangzhou has 142 cars per 1,000 people, lower than Beijing (240), Shanghai (160), and Shenzhen (171).

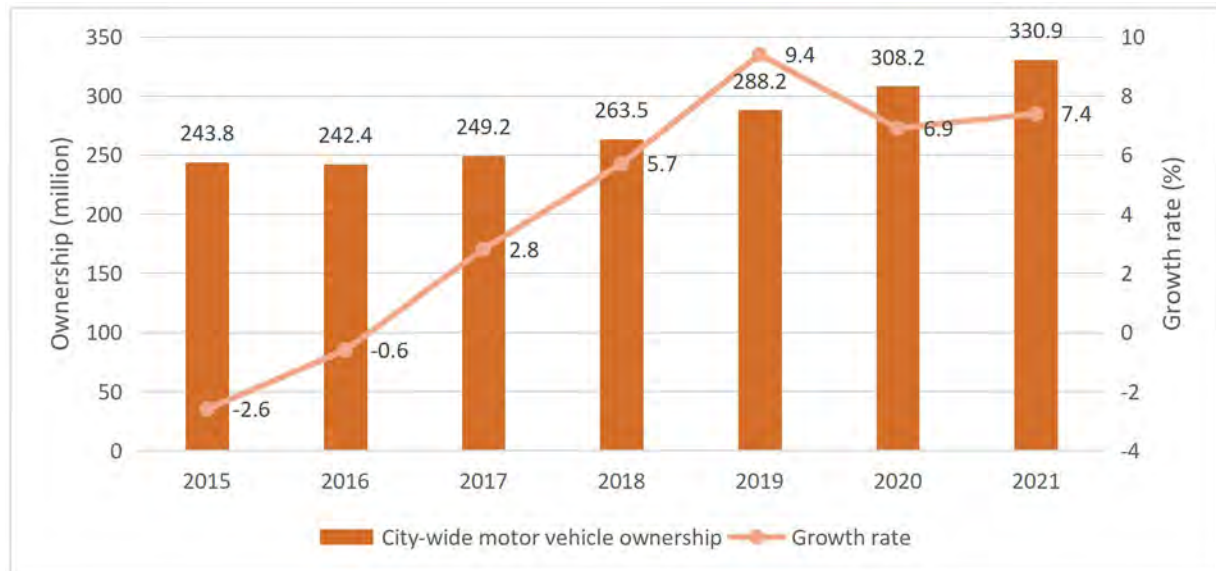


Fig. 1-8 The development of motor vehicles in Guangzhou
(Source: 2021 Guangdong Province Traffic and Travel Report)

In respect of transportation needs. The total number of all-mode trips in the city is 44.78 million per day, an increase of 8.7% compared to 2020, which has returned to the average in 2019; the total number of motorized trips is 24.13 million trips per day, an increase of 5.1%. The total number of all-mode trips in the central city is 27.24 million trips/day, up 14.5% year-on-year; the total number of motorized trips is 12.54 million trips/day, up 11.3% year-on-year. Non-motorized travel in the central city is proliferating, reaching 5.18 million trips/day, an increase of 42% and 15% compared to 2019 and 2020, respectively, including 2.04 million trips/day by electric bicycle, a rise of 51% and 33% compared to 2019 and 2020 respectively, gradually becoming one of the essentials of travel for the public.

The proportion of individual motorized trips (including cars, cabs, motorcycles, etc.) in all modes of travel in the central city is 22.3%. The ratio of green travel (including public transportation and slow-moving traffic) is 77.7%, which the highest in China's mega-cities. Among green trips, public transportation accounted for 23.8%, down 9.6 percentage points from before the epidemic, while non-motorized (walking, bicycles, and electric bicycles) accounted for 53.9%, up 9.8 percentage points from before the epidemic, with bicycles and electric bicycles accounting for 2.7 and 2.3 percentage points respectively, with a significant

increase in cycling. The proportion of motorized travel in the central city is 52% by public transport, which is one percentage point higher than in 2020 and has not yet returned to the pre-epidemic level. Public transport development is facing new challenges.

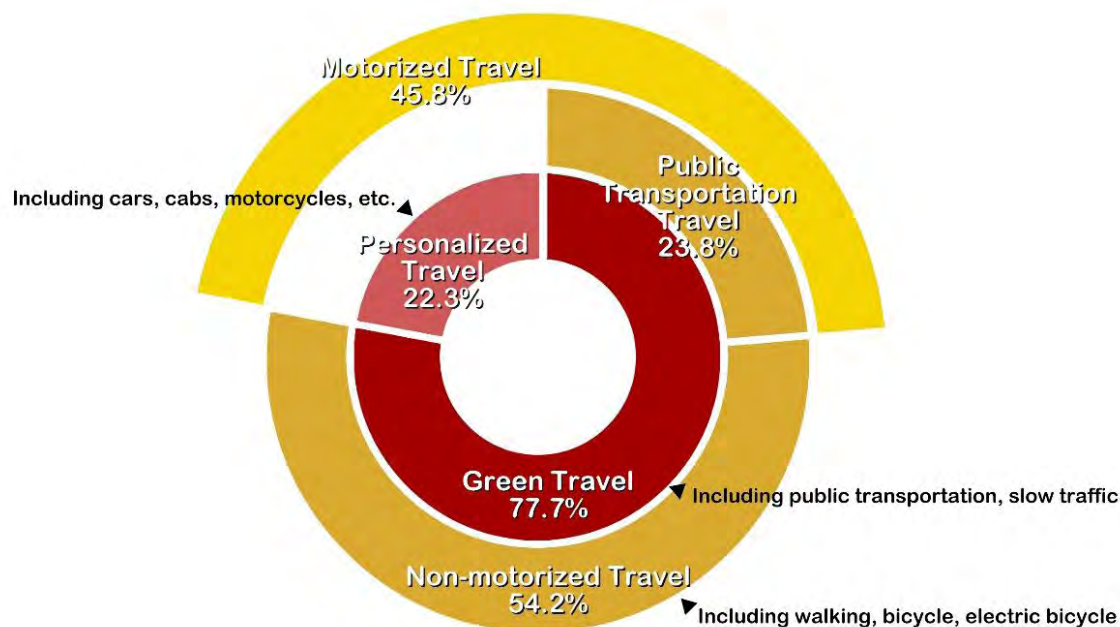


Fig. 1-9 Travel mode

2. General introduction of Racecourse

And racecourse site has also undergone its renewal. In the 1990s, Tianhe Racecourse was the second largest racecourse in Asia after the Hong Kong Shatin Racecourse and the only one with gaming properties in mainland China. By the end of 1995, from the central government to the local government, several documents were issued emphasizing the suspension of the gambling horse racing held by the Guangzhou Jockey Club. In the end, in 1999, the Guangzhou Racecourse announced the suspension of the game. The once bustling racecourse has finally come to an end. After five years, the headquarters of the racecourse made a comeback, took over the racecourse again, and establish Auto City, which is divided into three business segments: catering, sports and entertainment, and auto city. But the business has not been booming and closed in 2014.

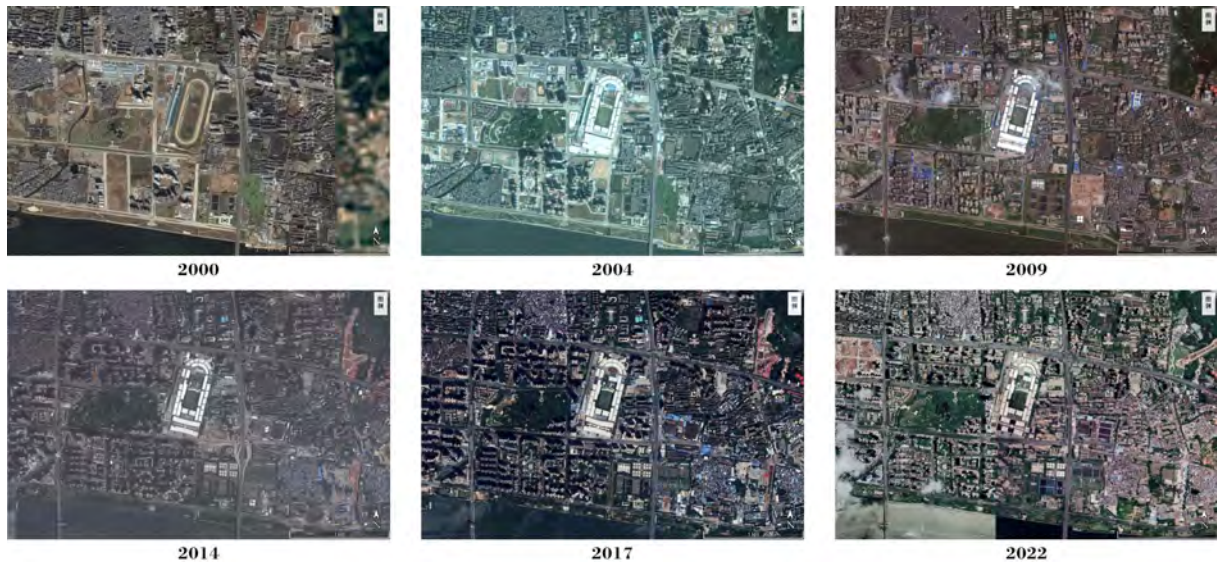


Fig. 1-10 The development of the racecourse from 2000 to 2022
(Source: Google Earth)

At present, only the outer part of the racecourse is rented out, mainly for home furnishing, catering, sports, and entertainment. It has become a remaining plot of the city. The development process has left many historical memories and a series of practical problems here. The general space blocks the connection between north and south, east and west, resulting in poor traffic; the parking space occupies the main outdoor space, resulting in a low quality of street space.



Fig. 1-11 Aerial view of the current status of the racecourse
(Source: Google)

Although the catering business in the plot is booming, customers do not have an excellent outdoor space for activities. All these problems affect the future development of this place. Through the research of this plot and the transformation of theoretical application, it aims to explore the way of a people-oriented street space design to improve urban space.

3. The significance of the racecourse as a design object

As a design object, the racecourse has several significances. First, the existing functions of the site are mainly commercial and residential, two crucial and relatively high functional combinations in urban design. The conclusions drawn from the research on this site have certain universality and reference significance for future design work.

Inside the racecourse, the existing functions are mainly commerce, and this commerce is mainly based on two significant industries of the catering industry and the sports industry. In particular, the business of the catering industry is booming, with popular restaurants such as Song Hot Pot and Jiu Mao Jiu Northwest Cuisine forming the racecourse gourmet business district, attracting many diners. There is no cold season in the entire catering business district, and there are still long queues in front of the hot pot restaurant in the hot summer.

The catering industry has drawn many people to the site, keeping the racecourse bustling during mealtimes. There are various types of communities outside the racecourse, including Shipai Village, an urban village in Guangzhou, located in the north of the racecourse and separated from the racecourse by Huangpu Avenue, and a group of high-end communities in the south separated by Huacheng Avenue. The west side is also close to the densely populated modern community. It can be said that the racecourse is located in a place that is surrounded by communities of different sizes, types, and inhabitants, and people of all classes live in this place. How to coordinate the contradictions in the plot and provide a better living environment and social place for different types of residents has become a significant problem that should be solved in the racecourse design.



Fig. 1-12 Restaurants and Communities

The second meaning is that the racecourse has serious traffic problems, and street design has become the key to solving the problem. Considering street design as a starting point and a design focus for urban design is essential. This design can also be an opportunity to examine the importance of street design to urban design. The racecourse covers a massive area of 380,000 square meters, equivalent to 53 international standard football fields.

The internal traffic is not directly connected to the external city roads, blocking traffic in north-south and east-west directions. There are subway stations on the north and south sides of the racecourse. The Tancun Station on the south side usually has a massive flow of people during the morning and evening rush hours. Many electric vehicles and bicycles are parked at the entrance of Tancun Station, most of which are parked by nearby residents when they arrive at the station for transfer. Bicycle parking is another pressing issue when it comes to solving transportation transfers. The racecourse plot can be said to have no slow-moving system. Outside or inside the plot, it is not very friendly to pedestrians and lacks greenery, not enough walking space, and no continuous bicycle lanes. Not to mention improving street quality, this venue does not even have streets. It is no exaggeration to describe this place as occupied by vast open spaces.

From the south of Huangpu Avenue to the north of Huacheng Avenue, from the east of Machang Road to the west of Tancun Road is abrupt and blank. The blank means that the street design on this site has the opportunity to start from scratch; it does not have an original condition, which brings a chance to start from scratch for the street design. The traditional urban design does not take the street as the starting point of the design. Here, we have the opportunity to try the urban design that starts from the street.



Fig. 1-13 Street condition

The third meaning is the shared street theory. The location of the shared street has certain limitations, and it is more suitable for commercial streets and residential areas with little traffic. For the current situation of the racecourse, the internal traffic is mainly static, so that the street can be set as a shared street. Of course, after connecting the internal roads of the site with the urban roads, these streets will bear greater traffic volume. At this time, the traditional shared streets may cause traffic congestion problems. How to innovate the model of shared streets, or how to extract its ideas and apply them to streets with a large traffic volume, has become a vital point of this research on shared streets. The answers to these two questions are the meaning of this research.

Can shared street theory bring some inspiration to our city streets? The answer is inspiring. The purpose of the shared street is to reclaim city streets for people so that people can become the primary users of the street again and change the current car-oriented situation on the street. A people-oriented street is also our expectation for the street in China now. Through the design of the racecourse, to solve the traffic problem of this site, use the shared street theory in the street design, and finally enrich the shared street theory by this design.

1.1.3.2 Shared Space Street as theory research object

The difference between shared space design theory and other street design methods is that shared space, as a comprehensive street design method, reiterates the diverse functions of public streets, including place functions, changes in public needs, and expectations from motorized traffic. Shift to sustainable and safe transportation for all users. The particularity of shared space compared to typical urban public space is that it not only designs and manages motor vehicle activities (relatively low-speed operation) but also integrates different space

users in the road traffic system in the whole society.

The origin of the "shared space" theory can be traced back to the integration of road users integration mentioned in Buchanan's report. And then, it developed in the form of shared streets in the living area of the Netherlands, which can be seen in the United Kingdom, the Netherlands, New Zealand, the United States, and Israel. The application and research of this theory and the domestic discussion of this theory are still less.

In this thesis, the shared space theory is chosen as the theoretical research object for the following reasons.

1. The importance of street design

High-quality street design is significant. As a large part of the city, a street is an important place for residents' daily life. The current street design in China is car-oriented, ignoring the pedestrian's need for safety on the street and the feeling of walking. To address this problem, shared streets that integrate traditional street life and traffic mobility are getting more attention as pedestrian-friendly development.^[7] The research on shared street theory can provide help for our street design in the future.

2. Shared Space Street in China

There are few studies on shared street theory in China. As a developing country in China, many design theories are imported into China from abroad, which requires a process. The introduction of theories also requires an inevitable translation process to adapt to different national conditions. The shared street theory is not new since it was put forward, but there is still less discussion about it in China, and it is worth our discussion.

3. The expansion of Shared Space Street

Third, there is room for a rich complement of shared street theory. The boundaries of shared streets are expanded with the number of shared spaces, and different shared spaces can be designed for different types of streets. These spaces are summarized and integrated, and the concept of sharing is integrated with the street design to form a new street design guide. Such a study helps to enrich the shared space street itself on the one hand and provides a new direction for thinking about street design.

1.2 Research Aim

In the second chapter, the article will sort out the shared space theory and the discussion on

the shared space theory in a different country. Clarifying the origin, development, and current discussion focus of the shared space theory, the purpose is to elaborate on the shared street theory in detail and to discover the blanks and difficulties of this theory in China. The third chapter will select shared street construction cases in different regions, including Auckland, New York, Barcelona, and Shanghai. Comparing the different practices chosen by these countries in street construction provides references for the racecourse street design in Guangzhou. In the fourth chapter, based on the theoretical research and case study in the previous chapters, an innovative street design strategy is proposed to guide the urban design of the racecourse site. The fifth chapter is about the display of the specific design. Considering the specific analysis of the site to make an urban design plan for the racecourse. In general, the research objectives of this paper can be summarized as follows.

Firstly, it sorted out the theory of shared streets and the development process. Secondly, forming a street design strategy under the concept of shared streets. Thirdly, providing urban design solutions for Guangzhou Racecourse.

1.3 Concept Definition

1.3.1 Shared Space Street

The narrowly defined shared space street concept

As the city developed, more and more problems showed up: urban land shortage, traffic congestion, insufficient resources, and high carbon emissions. The government and urban planners realized that it was necessary to rethink the city design principles. Thus the definition of street broadens from a space served the vehicles to a public space. Moreover, the concept of reclaiming city street for people are increasingly valued. In this context, the idea of Shared Space Street emerged. It aims to break down the boundaries between cars and people on the street, thus highlighting the dominant position of pedestrians. The standard interpretation of Shared Space Street is “A street or place designed to improve pedestrian movement and comfort by reducing the dominance of motor vehicles and enabling all users to share the space rather than follow the clearly defined rules implied by more conventional designs.” [8]

In general, sharing between vehicle users and pedestrians should occur in the street's carriageway area, not the sides of the street, which should mainly be the preserve of pedestrians.



Fig. 1-14 Shared Street in Bogota, Colombia
(Source: Google)

According to the London transport department, they listed the features of shared space, tangible indicators of sharing include : pedestrians occupying the carriageway; increased levels of social interaction and leisure activity; people spending longer in the street (evidence of an enhanced sense of place); drivers and cyclists giving way to pedestrians; pedestrians crossing the street at locations, angles, and times of their choosing; and drivers and cyclists giving way to one another. ^[1]

Shanghai Street Guidelines gives an example of the application of a shared street in Shanghai, Yuanmingyuan road. This road is located at the "waitainyuan" at the confluence of the Huangpu River and the Suzhou River. The road is 15 meters wide and less than 500 meters long. There are several elegant modern historical buildings along the road. Yuanmingyuan Road adopts the shared street model, with pedestrian areas on both sides. There is no height difference between the two areas, which are distinguished by strips and isolation piles to prevent motor vehicles from entering the sidewalk. The pavement is paved with small rough ashlar, reducing the vehicle's speed. The thesis also stresses that the core idea of shared streets is that by transforming motor vehicle areas into mixed-traffic areas, drivers can be more responsible for their behavior, drive more carefully, and behave more like pedestrians.

The American scholar Eran Ben-Joseph summarized the guidance on the construction of shared streets in different countries (including the Netherlands, the United Kingdom, Japan, and Israel) and gave the definition and related concepts of shared streets. He believed that

shared streets had the following characteristics: It is a residential, public space; Through traffic is discouraged; Paved space is shared by pedestrians and cars, with pedestrians having priority over the entire street; Walking and playing are allowed everywhere; It can be a single street, a square (pr other form), or a combination of connected spaces; Its entrances are clearly marked; There are no conventional, straight stretches of pavement with raised curbs, and pavement (carriage way) and sidewalk (footway) are not rigidly demarcated; Car speed and movement are restricted by physical barriers, and by deviations, bends, and undulations; The area has extensive landscaping; The area has street furnishings.^[9]

In general, a shared street, in the traditional sense, blurs the boundaries between cars and people, reduces the car's speed, and makes it behave closer to the state of a pedestrian. To realize the shared street between people and vehicles, improve the degree of freedom and prioritize people, and enrich the forms of activity on the street. From the guidance opinions of various countries on the construction of shared streets, many believe that shared streets should be located in residential areas with less traffic and have stricter construction requirements. Therefore, the idea of sharing streets has certain limitations in its application.

The expansion of the Shared Space Street concept

The concept of Shared Space stresses road user integration, focused on motor vehicles and pedestrians. Therefore, street design under the concept of Shared Space considers the design of carriageway and space on both sides of the road; that is to say, the ground-level design is concerned. While the street space was more than this one level, this concept of Shared Space also needs to be replenished. The sharing has happened between people, motor vehicles and people, and different spaces on this street. Road user integration and street space integration happened in the newly defined shared street.

According to the definition of street space, the street can be divided into four components, ground plane, roadsides, building wall, and canopy. Space integration can occur between these four component, depending on the different spatial forms required for sharing activity. For example, the shops open the space along the street to the public for sharing, which creates an integration between the street ground space and the ground floor space of the building. This shared space belongs to the shop building and the street space. Space integration is the foundation of function mixing, promoting user integration. The concept of urban spatial

integration has also been constantly mentioned in urban planning. Spatial integration can help alleviate the problem of urban resource shortage. It is not only in line with the principles of the Shared Space Street concept but can also be a supplementary instruction of the Shared Space Street concept on the spatial level.

In this thesis, the corresponding space form of a shared street will be obtained according to the sharing activity of pedestrians at the site (Guangzhou Racecourse). Finally, these forms of shared space are summarized to supplement the concept of Shared Space Street.

Sharing can also happen between private and public. From the narrow definition of Shared Space Street, we can tell that sharing happens in public spaces. All these activities happen in public spaces within the road reserve. Shared Space Street seeks to balance the needs of people using the public realm to travel by different modes, provide pedestrian amenities, support local businesses, and foster neighborhood interactions. Nevertheless, the shortage of urban resources is a constant reminder that such sharing is not enough. The practice of sharing private space and private property is beginning to emerge, and a sharing economy and a sharing city are emerging. If you share something with another person, you both have it, use it, or occupy it. You can also say that two people share something. That is the definition of “share” in Collins Dictionary; from this meaning, we can say that “share” is sharing something private.

Outside the road, the reserve is the building vested with property rights. Shared space on the street expands when shared events occur in buildings with property owners along the street or on private open land.

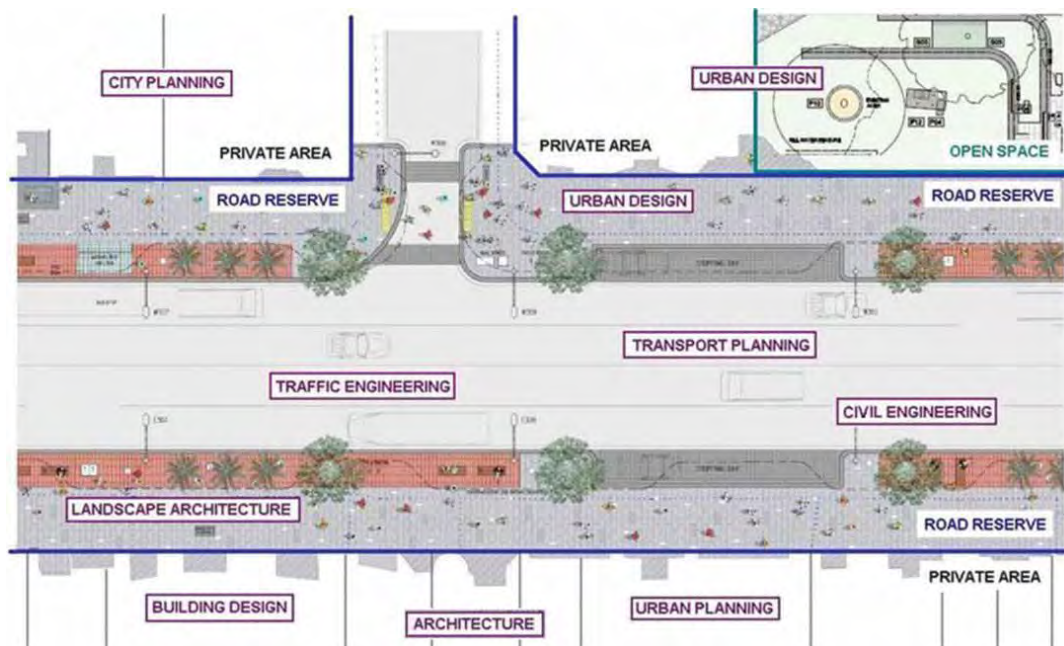


Fig. 1-15 Multi-disciplinary knowledge within and outside the road reserve in urban areas
(Source: Auttapone Karndacharukm, 2014)

The thesis expands the theory by enriching the design strategy of shared streets into a three-dimensional space perspective. In the past, the design strategies of shared spaces were often based on the geometric relationship between the distribution of road sections and plane layout. With the expansion of the definition of streets, the concept of shared streets should also be expanded. In addition, the traditional definition of shared streets is suitable for residential or commercial areas with little traffic. Facing the area where the site is located, a series of urban roads, such as Huangpu Avenue, Huacheng Avenue, and Machang Road, have large traffic flows. When applying shared street concepts, there are certain contradictions. Therefore, how to use the concept of shared streets for roads with significant traffic flow is a point that this research will focus on it. Chinese streets are very different from European countries. Just like the racetrack, Huangpu Avenue is eight lanes wide, which has created an insurmountable division between the north and south plots. Connecting the north and south plots is a complex problem that traditional shared street design strategies cannot solve. However, the idea of shared streets works. The concept of the shared street will be expanded in this paper and combined with the current situation of the racecourse to form a shared street model suitable for China's national conditions.

Privately owned public spaces, also known by the acronym POPS, are spaces dedicated to public use and enjoyment and are owned and maintained by private property owners in exchange for bonus floor area or waivers. POPS come in many shapes and sizes, both outdoor and indoor, and offer a variety of amenities. POPS are the result of City zoning regulations aimed at ensuring the densest areas of our city offer a measure of open public space and greenery.

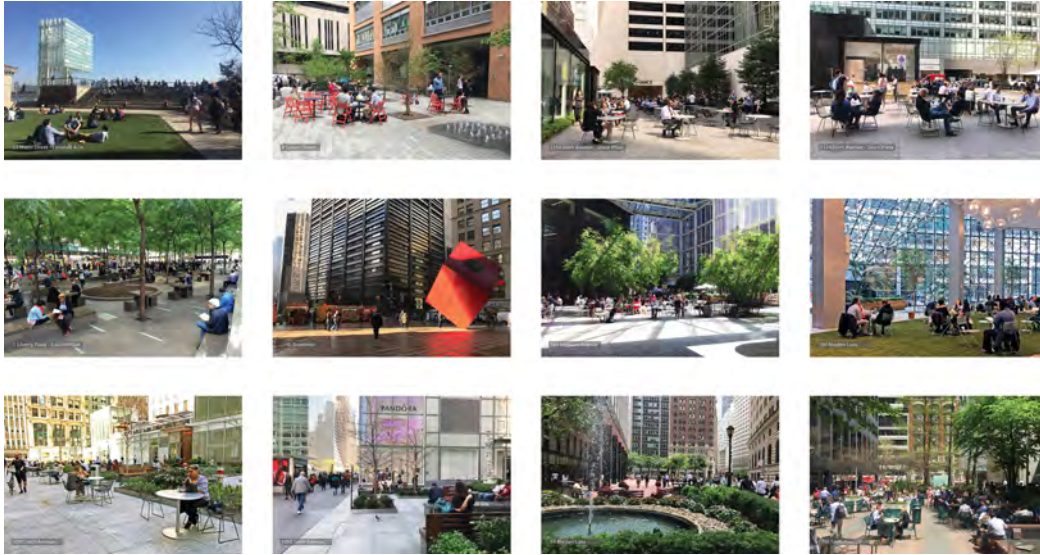


Fig. 1-16 POPS cases

(Source: City of New York, 2022)

The POPS Program dated to 1961 when New York City's Zoning Resolution was last overhauled. Then an innovative program, POPS, has stood the test of time, and today there are more than 590 POPS, mainly in Manhattan's dense urban core. When first introduced as a zoning tool, the program allowed developers to build more usable space (also known as floor area) or receive special waivers for a building if they also created plazas or arcades open to the public.

Since 1961, other types of outdoor and indoor spaces have been introduced in the Zoning Resolution. The Department of City Planning expanded the program and refined amenities and operational standards to meet public needs, changing tastes, and technological advances. Today, two specific types of POPS, public plazas, and arcades can be built in exchange for the bonus floor area.

POPS must be provided and maintained by the property owner in perpetuity according to the regulations they were built and any City approvals.

1.3.2 Street Space

Talking about street space, we usually picture an image of a road with running cars flanked by two sidewalks and two rows of buildings clinging to the sidewalks, respectively.

The narrowly defined street space

Street and road have similar meanings, but “one particular feature of the road or the thoroughfare which is incompatible with the street is the movement of fast-moving or heavy traffic with all its engineering requirements.” For example, on fast road and highway roads, there are often no sidewalks on either side of these roads; in this space, the vehicle is the protagonist. While the primary function of the street is as a part of the city's public space, it emphasizes the dominant position of people in it. The street is a space that can be used as a social place, and traffic is only one of its functions.

In Global Street Design Guide, the street is defined as “the basic unit of urban space through which people experience a city. They offer space for movement and access and facilitate a variety of uses and activities.” In Streets & Patterns, Steven Marshall considers, “A street can be seen as a road that happens to have an urban character; or as an urban place, that happens to serve as a right of way.”^[10] In China, street space has the exact definition, and street space is often associated with public space. In Shanghai Street Design guidelines, “Street is the most basic public product of a city, a public activity place most closely related to urban residents, and an important spatial carrier of urban history and culture.”

The expansion of street space

There is already a broader definition of street space. The functions of streets have expanded from traffic and walking to social interaction and urban public life. In this definition, the street space discussed in this article, referring to the definition of a street in the Global Street Design Guide, includes the following elements: sidewalks, public transport facilities, infrastructure services, street furniture, building edges, traffic lanes, auxiliary lanes, bicycle facilities, green belts.

As Jane Jacobs says in *The Death and Life of America's Cities*, "When we think of a city, the first thing that comes to mind is the street, and when the street is alive, the city is alive, and when the street is dull the city is dull."^[11] The relevant elements are limited to the two-dimensional plane in the narrow street space context. However, the impact of street space on the city exists in three-dimensional or even four-dimensional space. Therefore, when we consider street space, we need a broad definition of it to help us better design the street space.



Fig. 1-17 The sidewalk room
(Source: City of New York, 2013)

In recent urban design guidelines, there is an ordinary consciousness about broadening street space's definition and design range. In *Active Design: Shaping the sidewalk experience*, published by New York City, they consider the street space not in a 2-dimensional way from a planer's view, but "Judging from the pedestrian perspective, the sidewalk is conceptualized as a room with four planes." They argued that the street space includes the ground plane, which is the traditional consideration in street design, and also includes roadsides, building wall, and canopy.

When defining street space, in *Global Street Design Guide*, there is also mentioned that "A street is the basic unit of urban space through which people experience a city. Streets are dynamic spaces that adapt over time to support environmental sustainability, public health, economic activity, and cultural significance."

In conclusion, this thesis considers the street space in the material form not only relating to the ground level but also the 3-dimensional space outside the building edges, the extension of the street to the interior of the buildings, and the public space connected by the streets. The functions of street space include the essential crossing, stopover, rest, social activities, play, and carrying the culture and history of the city.



Fig. 1-18 Composition of the street
(Source: Global Street Design Guide, 2021)

1.4 Methodology

This thesis follows the logic of identifying the problem, posing it, and solving it. The purpose of this thesis is to explore the human-centered approach to street design. The author's view is presented through a theory-to-practice process. The diagram below has been developed here to facilitate a visual presentation of the research logic of this paper.

This framework consists of four significant points: the theoretical foundation, reference cases, design strategies, and design solutions. This paper is based on the theory of shared streets and incorporates the relevant design principles of POPS (Private Owned Public Space) as the theoretical basis for design research. The shared street theory emphasizes the integration of people and cars, thus enhancing people's priority on the street. At the same time, POPS opens up privately owned spaces in the city for public use, increasing the public space for citizens. These spaces are different from ordinary public spaces in that they are privately owned and maintained, but they are still accessible places that people can reach directly from the street. In this sense, the street space is also expanded, and the public living space for citizens is enriched. This theory can also help expand the shared street theory itself so that the shared street can be enriched into a shared space for people and cars and a shared space for public and private.

The case of Shared Streets, a shared street renovation project in Auckland CBD, New Zealand, and POPS, a POPS program in New York, USA, was chosen to guide the design. Also, selecting a street renovation program in Shanghai, China, to understand the strategy of street

design in China.

Generating design strategies guided by theories and reference cases includes three main areas - street design to urban design, shared streets, and people-centered streets. The streets are classified before design, and different design strategies are given according to the classification.

Finally, urban design solutions are discussed for Guangzhou Racecourse, and urban design solutions are generated according to the proposed strategies.

The detailed framework diagram is shown below.

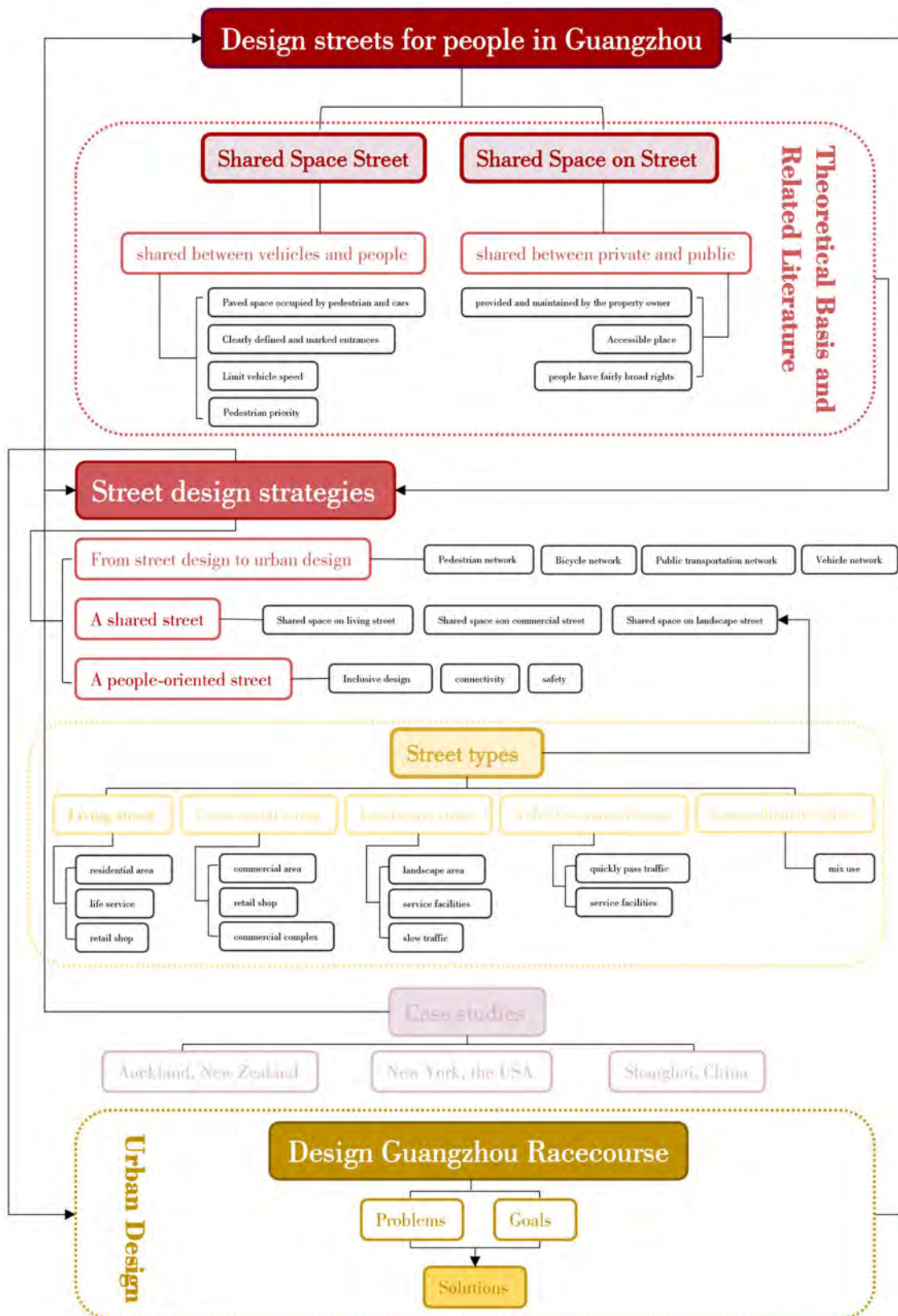


Fig. 1-19 Research framework

Chapter2 Theoretical Basis and Related Literature

2.1 Relevant Research Overseas

2.1.1 The Origin of Shared Space Street

Environment area

Shared Space was developed from the concept of road user integration. It was during the late 1960s that a philosophical concept of an 'environment area' was published in *Traffic in Towns* by Buchanan.^[12] This concept was raised against the backdrop of massive forecast growth of car ownership at a relatively early stage of the Motor Age in Britain.

The so-called traffic problem had two distinct aspects in urban areas at the time. The first is the frustration of door-to-door accessibility, a considerable benefit a motor vehicle can provide. The second is the destruction of the living environment. The main manifestations are danger (especially to pedestrians), anxiety, noise, pollution, vibration, and visual intrusion. These aspects together cost the community much money. These two aspects often conflict, complicating the issue: improving accessibility and the environment may worsen, and vice versa. Buchanan suggested that in these areas, there should be no extraneous traffic, and consideration for the environment should dominate over the use of vehicles. These environmental and accessibility issues can be sorted out with only one principle. This is a gradually formed a consideration that takes precedence of the environment over the movement and parking of vehicles in units or areas within a town. These may be called "environmental area".

The corollary is to have a road network in which more prolonged vehicle movements are concentrated from one location to another. This principle can be roughly likened to the corridor and room system of a large building.

Environmental areas must enable people to live, work, shop, and wander reasonably safely and comfortably. Road network design needs to meet capacity needs and serve the environment, not the other way around. This would be achieved by using a road hierarchy and traffic management measures so that traffic passes by residential areas. That is the cellular concept; based on this concept, local distributors or access roads would incorporate shared spaces where the road space not only serves the functions of mobility and accessibility but also functions as a destination or a place to stay and move around within an environmental area.

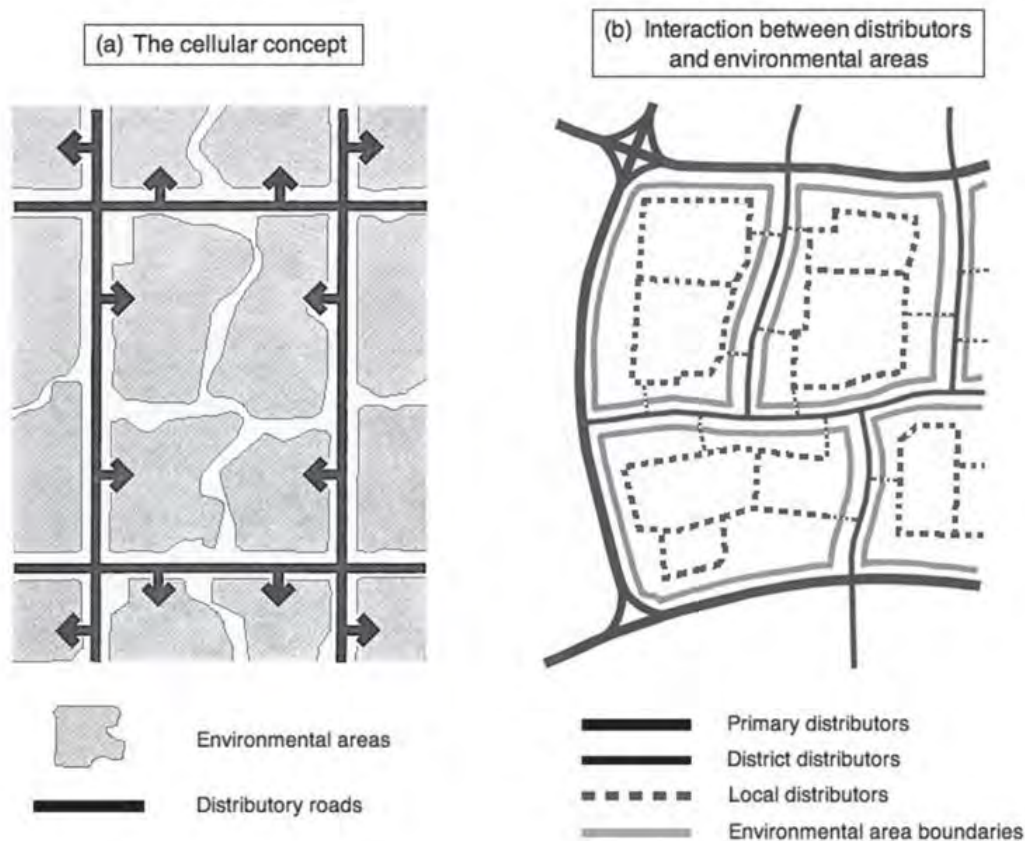


Fig. 2-1 The cellular concept, comprising distributor roads and environmental areas
(Source: Buchanan et al. 1963)

However, the Buchanan report does not propose a specific proposal for how to use urban streets to achieve mixed use between motor vehicles and other road users, nor does it discuss the possibility of sharing street forms. In contrast, the report proposes a design approach based on large-scale planning and urban redesign based on integrating land use (mainly through buildings) and transportation access to address the city's transportation problems.

The report suggests that redeveloping no-go vehicle zones in urban areas to completely separate motorists from pedestrians would be costly and impractical. The bottom line is that none of the Buchanan Report's conclusions are highly desirable; none tend to suggest that there are any easy and cheap solutions to the town's traffic problems. While explaining the rationale for the complete separation of motor vehicles from pedestrians in an environmental area is not practical, the report states that "at a critical value, the mixture of motor vehicles and pedestrians is not a serious hazard." Thus, the environmental principles of the report paved the way for the concept of shared spaces to emerge.

Woonerf

The first experiment of the multi-function road concept was in the Netherlands in the form of a shared street in a residential area. Professor Niek de Boer of the University of Emmen raised the concept of Woonerf, which views the street as a social space rather than just a channel for vehicular mobility.

In the late 1960s, Joost Vahl and his colleague from the Planning Department of Delft conducted the first trials of the Woonerf concept, integrating motorized traffic and social living spaces.^[13] The experiment aims to address safety issues between vehicles and children playing on city streets and to integrate vehicle traffic into social living spaces.

Through the physical transformation of the street, woonerf provides space for vehicles while fully meeting the needs of the residents. The main goal of woonerf is to change the way streets are used and to improve their quality of life by designing residential streets for people, not just traffic.

On one-way streets, pedestrians, cyclists, and motor vehicles share a street; however, pedestrians have priority over cars. The street was designed with no clear separation of space for pedestrians and cars (i.e., no continuous curb), so motorists were forced to slow down and drive carefully. Limiting vehicle speeds improve residents' sense of safety and promote greater public space use. This action provides more space for new features on the street, such as street furniture (such as planters, driveway trees, and benches) and social areas, bringing more people to the street for walking, cycling, playing, and mutual communication. In other words, a woonerf turns the street into a livable and attractive environment for all kinds of activities.



Fig. 2-2 Woonerf
(Source: Google)

After this successful experiment, the government of the Netherlands approved of this concept and made guidelines and rules for the shared street. The shared residential street in the Netherlands with the following typical design and operational characteristics: Pedestrians have priority to use the full width of the road while drivers are urged not to drive faster than walking speeds. There is little demarcation between carriageway and footpath. The entire width is often constructed in a continuous surface with special pavers. Through vehicular traffic is discouraged. Vehicle speeds and flows are restricted by street design (e.g., horizontal curves and the location of bollards and parking spaces). There are streetscape elements to encourage users to stay within the space. The access points to the residential shared street area are clearly marked.

According to urban theorists looking at urban shared spaces with a semiotic approach, woonerf is an example of a democratic and livable street. Anne Moudon expresses the theory of democratic streets in her book *Public Street for Public Use*: streets that are not pro-automobile-orientation but create a space to reach a fair balance with other street users, such as pedestrians and bicyclists, and emphasize safety and comfort in the same way as livable streets.^[14] Moudon describes woonerf as an example of a successful democratic street.

Also, Donald Appelyard's book *Livable Streets* gives a short description of woonerf: You can walk easily anywhere in a woonerf, and children can play freely anywhere. Drivers should not

keep pedestrians from moving just as pedestrians and children should not keep vehicles from moving. Parking is possible only in places where a P sign is written on the ground. ^[15]

Finally, in Christopher Alexander's book *A City is Not a Tree*, he compares the relationship of trees in natural and organic cities to half-lattice patterns in artificial and designed cities to achieve the appropriate shape of the city. He sees woonerf and urban traffic calming on regional streets as an example of this semilattice approach, in which the street is both a traffic element and a social and psychological component. ^[16]

Home zone

In the UK, the term 'Home Zone,' coined in the early 1990s by Barbara Preston, is the English expression of a Woonerf in the Netherlands.^[17] According to research by Appleyard and Cox, there is a subtle difference between the two: the Dutch "woonerf" emphasizes creating a sense of place. At the same time, the British "home zone" focuses more on easing traffic and reducing accidents. However, both concepts encompass formal and informal spaces for children's play and social activities.

According to *Home zones: A planning and design handbook* by Mike Biddulph, we can understand the Home zone this way: A home zone is a residential street in which the living environment predominates over any provision for traffic. It is an environment where the design of the spaces between homes provides space for motor vehicles but where the broader needs of residents are also fully accommodated. This is achieved by adopting street design, landscaping, and highway engineering approaches that control how vehicles move without restricting the number of vehicular movements.

In a home area, where people share former traffic lanes and sidewalks, if properly designed, vehicles can only travel at top speeds slightly faster than walking speeds (under 10 miles per hour). This means that other things can be introduced into the street, such as play areas for children, more extensive gardens or plantings such as street trees, bike parking, and facilities such as seating where residents can meet. Specifically, designing a home zone is mainly based on the following principles; these principles are derived from existing and established principles of urban design and also from advice on home zone design originating in both the Netherlands and Germany: Make the home zone fit into its context. Plan new housing to create variety and a focus on the street. Make the home zone attractive and easy to understand. Use the design to encourage very slow driving. Create a green landscape. Design the landscape to support activity in the street. ^[18]

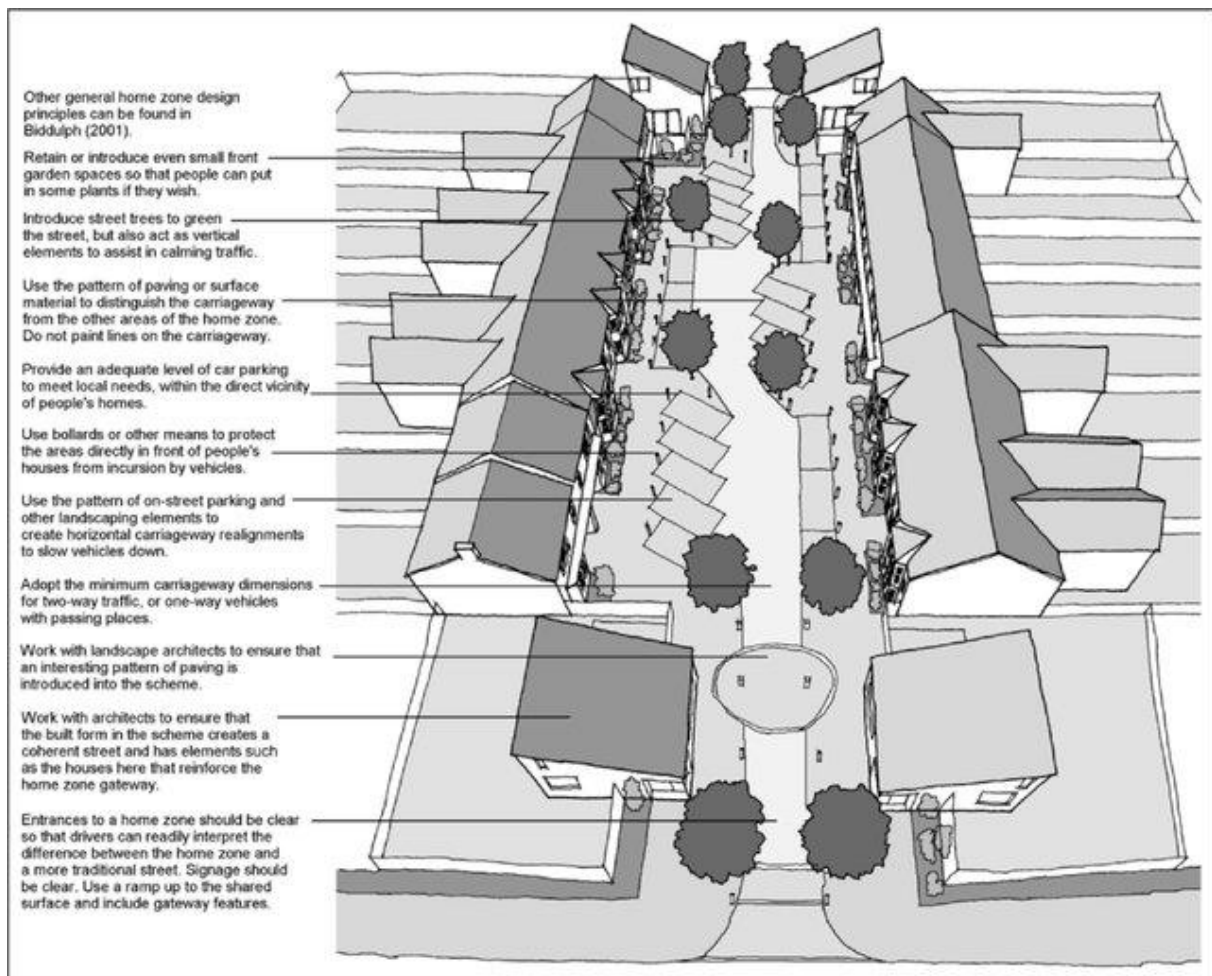


Fig. 2-3 The design attributes of a home zone scheme
(Source: Mike Biddulph, 2003)

Ideally, it should also contribute to improving the quality of the urban environment and help to increase demand for urban living. As such, the home zone treatment aims to provide qualities that make streets both livable and democratic, to use the language of both Appleyard and Francis referred to above.

2.1.2 The Development of Shared Space Street

Shared Space Street in different countries

The successful implementation of Woonerf in the Netherlands has led to expanding shared streets from residential to commercial areas and town centers. The specific terms for these two types of streets are called Winkelerf and Stadserf in the Netherlands, respectively. Subsequently, in the 1970s, this Woonerf concept influenced the design of streets in the residential area of other European countries such as Denmark, German, and Switzerland.

In Denmark, there is a play, and the rest area gave way by vehicles to pedestrians; the speed

of cars on this street is limited to 15km/h. In this area, there are no boundaries between vehicles and pedestrians. ^[19]

In German, there are also streets designed under the woonerf concept, called ‘play street’; in Switzerland, these kinds of street are called ‘encounter zone,’ and the limit speed there is 20km/h.

In the UK, the term ‘Home Zone,’ coined in the early 1990s by Barbara Preston, is the English expression of a Woonerf in the Netherlands. A home zone is a residential area where the design of the spaces between homes provides shared space for all users, including motor vehicles and other road users, with the broader needs of residents, including pedestrians, children, and cyclists, being fully accommodated. This is achieved by adopting approaches to residential layout design, landscaping, and engineering that acknowledge the needs of pedestrians while also controlling the speed, but not necessarily the number, of vehicular movements.

In Israel, in these shared streets, the alignment is in the form of a chicane and is broken with trees, designated play areas for children, benches, and flower beds. The intention is to create some discontinuity in the path of moving vehicles by bending the alignment, thus forcing motorists to slow down considerably. ^[20]

A ‘shared zone’ was also applied except for residential areas in New Zealand and Australian retail streets. The idea of shared streets is being used everywhere, with different solutions for slowing cars or improving street activity.

Table 2-1. Overview of selected shared concept

Terminology	Jurisdiction	Decade	Land use	Objectives	Design features	Comments	References
Shared Street Woonerf (Woonerven as a plural)	The Netherlands	1960s	Residential	(1)To integrate vehicle traffic into social residential space (2)To enhance liveability	(1)Shared, level surface with special paving across the full road width (2)Trees, bollards and parking spaces used to restrict vehicle speeds (3)Gateway treatment with legal signage	(1)A woonerf often referred to as a calmed street due to its main objective of calming vehicular traffic (2)Subsequent design from the 1980s includes safety areas, exclusively for pedestrians (3)Design speed of walking speeds with frequent traffic restraining measures (4)Vehicular traffic subordinated to pedestrians	Ben-Joseph (1995), Hass-Klau (1990), Nio (2010), Pharoah and Russell (1991), Quimby and Castle (2006), Russell (1988) and Southworth and Ben-Joseph (2003)

SCUT-POLITO co-run program master thesis

Winkelerf & Stadserf	The Netherlands	1970s	Activity centres	(1)To improve economic viability, community interaction and quality of life	(1)In principle, same as a Woonerf	(1)The original Woonerf regulation was replaced by Erf regulations to reflect wider land-use applications (2)While the term 'Woonerf' applied to residential streets, 'Winkelerf' and 'Stadserf' for shared streets in shopping areas and city centres, respectively	Karaay (1986), Kraay and Dijkstra (1989), Pharoah and Russell (1997) and Quimby and Castle (2006)
Rest and Play/Shared Area	Denmark and Germany	1970s	Various, predominantly residential	(1)To improve street environments for pedestrians and playing	(1)In principle, same as a Woonerf where the entire road area designed for rest and play	(1)The concept emphasises no distinction between carriageway and footpath (2)Speed limit of 15km/h	Kjemtrup and Herrstedt (1992) and Russell (1988)
Encounter Zone	Switzerland	1970s	Various, predominantly residential	(1)To improve street environments for pedestrians and playing	(1)In principle, same as a Woonerf	(1)Posted speed limit of 20km/h	Sauter and Huettenmoser (2008)
Home Zone	UK	1970s	Residential	(1)To integrate vehicle traffic into social residential space (2)To enhance liveability and environmental quality	(1)In principle, same as a Woonerf, however many home zone do not incorporate level surface across road corridor	(1)Before the implementation of pilot home zones, traffic-calming measures were used to control vehicle speeds	Ben-Joseph (1995), Biddulph (2001, 2003), Clayden et al. (2006), DCC (1991), Hass-Klau et al. (1992) and IHIE (2002)
Shared Street	International	1980s	Residential	(1)To improve road safety (2)To minimise environmental effects, e.g. noise and emission	(1)Similar to a Woonerf, with some specifying alternating vehicle path or chicane treatments	(1)Shared street design in Israel specifically incorporates a safe zone free of vehicles on either side of the shared street, which provides for the disability and other vulnerable users (2)Design speed of 15-20km/h	Ben-Joseph (1995), Blik (2010), Craus et al. (1993), Ichikawa, Tanaka, and Kamiya (1984), NACTO (2013) and Polus and Craus (1988,1996)
Shared Zone	Australia and New Zealand	1980s	Various	(1)To increase safety for pedestrians and cyclists (2)To improve public amenity	(1)In principle, same as a Woonerf	(1)Shared zone in Australia has a compulsory speed limit of 10km/h while the 10km/h speed limit in a New Zealand shared zone is optional	Austroroads (2008b, 2009b), Kamdacharuk et al. (2013), NZTA (2009) and RMS (1987,2012)

Shared space	International	1980s	Various, predominantly activity centres	(1)To improve street environments and road safety (2)To provide a better social interaction and sense of community and place	(1)In principle, same as a Woonerf, but design outcomes vary between jurisdictions (2)Linear alignment of street and vehicle path often encouraged for improved legibility and urban form (3)Emphasis on de-clutter and removal of traffic control devices (giving rise to the term 'Naked Street')	(1)Hans Monderman applied the Woonerf concept of integration in towns and villages (2)Shared space concept became internationalised largely due to a European Shared Space project in the 2000s (3)The term sometimes describes a calmed street with a focus on CSD and social interaction	DfT (2009, 2010a, 2011), Hamilton-Ballie (2008a, 2008b), Kaparias, Bell, Miri, Chan, and Mount (2012), Karndacharukt et al. and Shared Space (2005, 2008a, 2008b)
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(Source: Auttapone Karndacharuk, D.J. Wilson, Roger Charles Malcolm Dunn, 2014)

Traffic calming practice

The successful application of Woonerf promoted the development of road traffic balance design in the Netherlands and gradually derived various methods of traffic calming. Traffic calming techniques have developed to apply not just to individual residential streets but to whole areas of towns, main traffic arteries, villages, shopping streets, and town centers.

What is traffic calming? Different people have given different definitions as it is associated with various policies and planning. The definition given by Pharaoh and Russell, considering the close connection with environmental improvement, defines it as 'the attempt to achieve calm, safe and environmentally improved conditions on streets. Traffic calming focuses on street safety, livability, and other public goals by altering street alignment, installing barricades, and other physical means to reduce vehicle speed or transit traffic. ^[21]

Table 2-2. Overview of traffic calming concept

Terminology	Jurisdiction	Decade	Land use	Objectives	Design features	Comments	References
Calmed Street Woonerf (as Traffic Calming)	The Netherlands	1970s	Residential	(1)To improve road safety, especially by vehicle speed reduction (2)To reclaim vehicle space for other road users (3)To	(1)Various physical calming measures, e.g. speed humps, raised platforms, carriageway narrowings, chicanes, gateway treatments, rumble strips	(1)The Woonerf design evolved from a shared street with design separation between vehicles and pedestrians (2)High cost of shared, paved street	Ben-Joseph (1995), Hass-Klau et al. (1992), Kjemtrup and Herrstedt (1992) and Pharaoh and Russell (1991)

				improve street environments	and change in surface material	contributed to the invention of certain physical calming measures and lower speed limit areas	
Stillereje/Silent or Quiet Road	Denmark	1970s	Residential	(1)To improve residential street environments	(1)Various physical calming measures	(1)Urban roads where 'living' has priority are designed with maximum speed of 30 km/h (2)'Quiet Road' forms part of wider traffic calming and speed management concepts	Kjemtrup and Herrstedt (1992) and Pharoah and Russell (1991)
Verkehrsberuhigung/Traffic Calming	Germany	1970s	Various	(1)To improve street environments (2)To reduce motor vehicle dominance	(1)Various physical calming measures, e.g. vertical and horizontal deflections	(1)According to Hass-Klau (1990), the traffic-calming concept initially included pedestrianisation and shared streets, and later expanded to an area-wide concept, including 20mph (32 km/h) speed zones	Brindle (1991,1992), Hass-Klau (1990) and Pharoah (1993)
Traffic Calming	UK	1970s	Various	(1)To reduce vehicle speeds (2)To reallocate carriageway space for other activities (3)To improve street environments and quality of life	(1)Various physical calming measures	(1)Policy framework for traffic calming involves classification of urban roads into living, mixed-priority and traffic areas (2)Shared streets are included in a wider traffic-calming application	CIHT (2005), DCC (1991),Harvey (1992), Hass-Klau and Bocker (1992) and Pharoah and Russell (1991)

(Source: Auttapone Karndacharuk, D.J. Wilson, Roger Charles Malcolm Dunn, 2014)

Traffic calming does not imply traffic reduction. Traffic mitigation measures can and often are part of broader traffic control policy, but many programs do not intend to reduce traffic. In

one or more streets in a district or a residential area, slowing down can divert traffic to other routes or even be enough to reduce the overall traffic volume slightly. However, unless combined with the framework of a comprehensive traffic restriction policy, this localized traffic reduction will not significantly impact the overall level of motorized traffic. This distinction is essential for precise analysis; thus, the definition of traffic calm means that traffic restraint is resisted. In addition, traffic reduction programs aim to "improve local accessibility" by preserving or restoring relatively direct routes to properties - sometimes, for example, restoring one-way streets to two-way traffic.

Compared with the traffic isolation design of closed roads and one-way traffic systems, the traffic integration orientation of traffic calming has a relaxed rather than restrained impact on traffic. To expand, the specific goals of traffic calming are mainly as follows: to improve road safety; to reclaim space (from the carriageway) for pedestrians, cyclists, and 'non-traffic' activities; to improve pedestrian mobility and reduce the barrier effects of traffic; to promote greater feelings of security, particularly among residents, pedestrians, cyclists, and others engaged in 'non-traffic' activities such as shopping, or play; to create environmental improvements, sometimes in order to promote local economic activity.^[22]

Different countries have different development in traffic calming. Due to different policy backgrounds and national conditions, they have made different regulations and development for traffic calming. The consensus is that traffic calming has these characteristics; the first is to reduce the speed of motor traffic to reduce its harmful effects in the built-up area. The second distinguishing feature of traffic calming is its link with the character and function of the road or street.

Slowing traffic measures in some countries have now been consolidated into a coherent framework combining slowing and function prioritization. This framework is practically manifested in the re-division of urban roads into two categories, one that prioritizes traffic and the other that prioritizes "living." For example, the former generally has a speed limit of 50 kilometres per hour, while the latter has a speed limit of 30 kilometres per hour or less. Figure 2-4 shows the Danish classification, which has now been incorporated into the revised road standard. Therefore, speed and street functions are the basis for defining the urban road class and the traffic function.

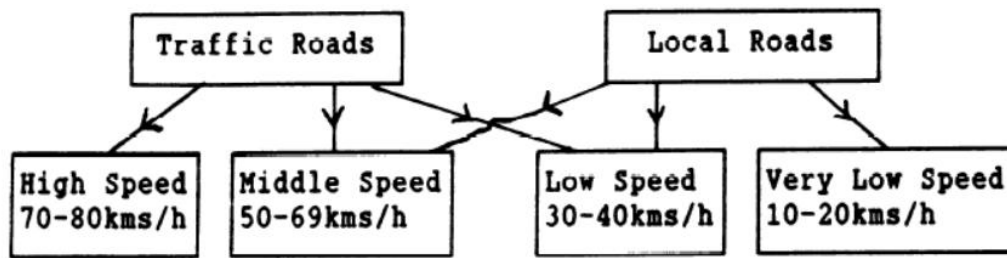


Fig. 2-4 Urban road classification, Denmark
(Source: Tim M. Pharaoh, John R. E. Russell, 1991)

The third aspect of traditional practice being discarded is the insistence on continuous traffic networks. The traffic calming framework, which evolved then, represents a significant departure from the traditional approach to environmental management inspired by Buchanan in the 1960s.

2.1.3 Current Focus of Shared Space Street

1. Research status

The development of shared streets has been practiced many times. After the street is renovated or completed, the discussion on the shared street focuses on the establishment of the evaluation system after the implementation, the coordination of the relationship between people and vehicles in the shared street, and the direction of future optimization.

Evaluation system

Develop an appropriate evaluation process that considers the various attributes that affect the effective use of public space, which is vital for shared streets.

New Zealand is a country that has conducted in-depth research on street design and has relatively advanced development of shared streets. The application of the shared street concept in New Zealand is influenced mainly by the European Shared Spaces Project and related research by the UK Department for Transport. A street shared by motor vehicles and pedestrians has a clear legal status as a shared area, and the Land Transport Rule 2004 defines it as a road used by pedestrians and motor vehicles.

Auttapone Karndacharuk proposed an all-encompassing process, using both quantitative and qualitative research methodologies, for the performance evaluation conforming to the purposes of the city center shared space. He developed a new safety analysis method for Road User Interaction and Conflict Analysis (RUICS) to assess safety performance in his research.

Contrary to the conventional idea of traffic event continuum, where interaction (potential conflict) is an indication of a potential crash, the findings of the RUICS analysis of the before (2010) and after (2011 & 2012) data from the Elliott Street site pointed out that the more user interactions in a shared space, the lower vehicle speeds, thereby resulting in less likelihood of injury or fatal crashes in the event of a crash.

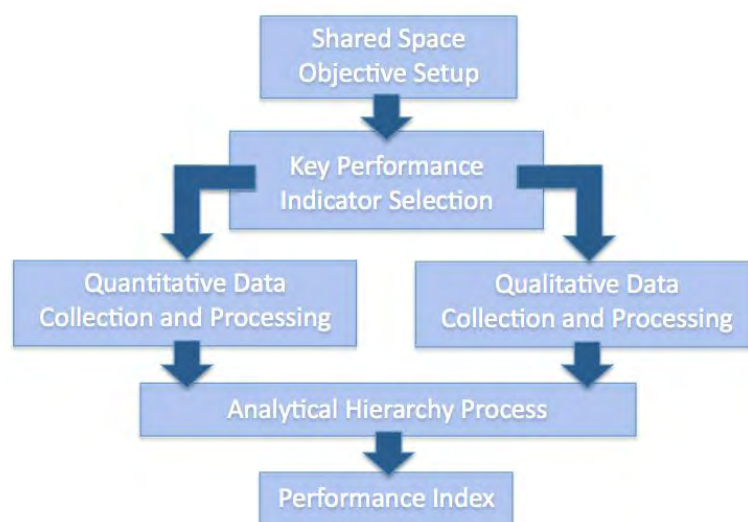


Fig. 2-5 Shared space evaluation framework with a goal of performance index
(Source: Auttapone Karndacharuk, D.J. Wilson, Roger Charles Malcolm Dunn, 2013)

Also, in another paper, Auttapone (Aut) Karndacharuk, Douglas J. Wilson, and Roger C. M. Dunn present a framework to thoroughly evaluate the performance of a public urban road in a shared space environment. A framework incorporating an Analytical Hierarchy Process is proposed to analyze the processed data to obtain a performance index universally applicable to evaluating shared spaces in different street environments.

The framework will be tested using before and after data collected from the shared space implementation projects in Elliott, Lorne, and Fort Street areas in Auckland, New Zealand. For this evaluation framework, quantitative performance indicators are those indicators that can be measured objectively, such as type, number, speed, and density of street activities/space users. The primary quantitative data collection method is a video survey from which pedestrian and vehicular data can be extracted along with the use of space and streetscape facilities based on various periods of the day, week, and weather conditions. ^[23]

Another article, Analysis of Pedestrian Performance in Shared-Space Environments, presents pedestrian-related performance measures developed under a multifaceted methodological framework to evaluate the success of shared-space schemes on the basis of study areas in the

city center of Auckland, New Zealand. ^[24]

Pedestrian-vehicle traffic conflicts

Shared streets aim to share street space between people and cars, breaking the boundary between the two, and the significant difference in speed between them leads to a natural conflict between them, and how to reconcile this conflict has become a critical point in the study of shared streets.

In England, there is a paper focusing on the conflicts between people and vehicles on shared streets, which is *Analysis of pedestrian-vehicle Traffic Conflicts in Street Designs with Elements of Shared Space*, by Ioannis Kaparias, Michael G. H. Bell, Weili Dong, Aditya Sastrawinata, Amritpal Singh, Xuxi Wang, and Bill Mount. In the paper, the PVCA method is modified to more accurately reflect the characteristics of the shared space: on the one hand, the systematic process of identifying conflict occurrence is defined, and on the other hand, the process of grading conflict severity is fully quantified. The improved PVCA approach was then applied to a case study in London, using video data before and after the Exhibition Road site was reconstructed from a traditional two-lane road to a modern design with shared space elements. The results of the comparative analysis show a general decrease in traffic conflict rates as a result of the redesign but also highlight specific issues that may require additional analysis. In Lebanon, the same attention was paid to the role of human-vehicle interaction on shared streets. ^[25]

Hassan Obeida, Hoseb Abkariana, Maya Abou-Zeidb, and Isam Kaysic conducted the design, analysis, and results to investigate the interaction between drivers and pedestrians in a mixed street environment of a driving simulator experiment.

Ninety-six students from the American University of Beirut (AUB) participated in experiments conducted at the Transportation and Infrastructure Laboratory of the American University of Beirut. This study looked at driver-pedestrian interactions from the driver's perspective, quantifying the effects of different scenario variables on participants' driving behavior. The Kruskal-Wallis test showed that drivers behaved statistically significantly less aggressively when approaching pedestrians when their speed was low when curb stops were not allowed, when crosswalks existed, and when the number of pedestrians crossing the street was high.

A discrete choice model for the drivers' yielding behavior was also developed as a function of

different predictor variables. Five of the six predictors considered (in addition to gender) had statistically significant effects on yielding behavior, particularly the effects of on-street parking, the number of pedestrians crossing the street, and approach speed. The model is then used to assess the impact of policy variables on the probability of the driver's return. The results of this study enrich the current knowledge and understanding of driver behavior and their interaction with pedestrians, particularly by examining the impact of previously unaddressed scenario variables. This will help planners to propose and evaluate safety measures and traffic calming techniques to reduce the risk to pedestrians. This study also confirms the effectiveness of driving simulators in studying driver-pedestrian interactions.

Sense and nonsense of Shared Space Street

Shared space streets help enhance residents' daily living environment and help pedestrians to enhance their priority on the street. However, is there an unreasonable side to shared streets? Such irrationality may be the result of misapplication. Therefore, when developing concepts related to shared streets, many scholars have started to think dialectically about shared streets.

Ben Hamilton-Baillie, talked about the inspiration for the shared street. He considers the potential for shared space principles to prompt a new approach to designing, managing, and maintaining streets and public spaces in cities, towns, and villages. Drawing on well-established examples from various countries, the author examines the outcomes of schemes that deliberately integrate traffic into the social and cultural protocols that govern the rest of public life. Using the skating rink as an example to explain the shared street concept, he states, 'Regulating the activity through precise rules and controls would destroy the dynamic interactions essential to the process. Humans are obviously complex and adaptable creatures!' This analogy helps to illustrate the contrast between assumptions and predictions about the outcomes of complex human interactions and real-life empirical observations. This has particular relevance to shaping public space, as our streets and public spaces, the public realm, are configured based on assumptions of traffic behavior and road safety. Drawing on case studies, observations, and practical experience from numerous European street design projects, he outlines a new approach to the centuries-old challenge of coordinating the movement of people and traffic. The superiority of shared streets is highlighted.

Prof. Jürgen Gerlach, Rob Methorst, Dirk Boenke, and Jens Leven discussed the shared street's limits. Investigating case-study areas reveals that improved traffic safety might

generally be achieved. At the same time, conflicts have also arisen, revealing that there are requirements and limits on the range of applications.^[26] The article concludes by concluding that Shared Space makes sense if urban upgrading of the sensitive street and open space is a primary objective of the plan. Shared Space has its limits, primarily concerning traffic volumes and the length of potential sections. Moreover, it is hard to deal with all the requirements of a particular situation. Shared Space projects struggle with such difficulties just like all other design principles aimed at creating streets for connections, access, and accommodation.^[27]

Shared between private and public

The red line of the building site marks that property rights own the land within the scope, and beyond the red line of the building site is the public street space. Imagine if the owner of the space within the red line of the building site shared this space with the public so that everyone could use the space beyond the street space. For example, if the owner of the space on the ground floor of a store, which initially belonged to the store, designed this space as an open recreational space with a few seats, all the people who pass by can use this space without having to go into the store. People passing the street can step directly into this leisure space without obstacles. Is such a space a shared space on the street? I think so. In the past, shared space streets emphasized the direct sharing between people and cars, and the sharing occurred within the road reserve. With the emergence of the sharing economy and the promotion of the concept of sharing city, many shared offices, shared gyms, and a series of shared spaces emerged beyond the red line of the road.

In this thesis, the focus will be on expanding the shared space of the street, expanding the boundary line of the shared space, and exploring different forms of shared space by considering the different building functions on different types of streets. For example, in commercial-type streets, both sides of the street are mainly commercial functions. These commercial complexes occupy more significant sites, which may cause some obstruction to the pedestrian crossing. By implanting shared space in commercial buildings and opening part of the privately owned land to the public, the street space will be expanded, and pedestrian crossing will be more convenient, bringing foot traffic and potential consumption power to the stores.

The form of shared space will be different for mainly residential streets. One of the defining

aspects of the structure of a settlement is the nature of and the relationship between its public and private space. A private space might be described as a space that is owned and maintained by a single individual, family, or institution. Public space is not only in the public domain but also in public ownership. Space, that is, which is assigned to and maintained by the community, whether in the form of the parish, the town, the city, or the state. As citizens, we need both. We need spaces within our lives that are entirely under our control and that we can reserve entirely for our use. Nevertheless, we also need spaces we can share with our neighbors, spaces we hold in common and for which we assume mutual responsibility.

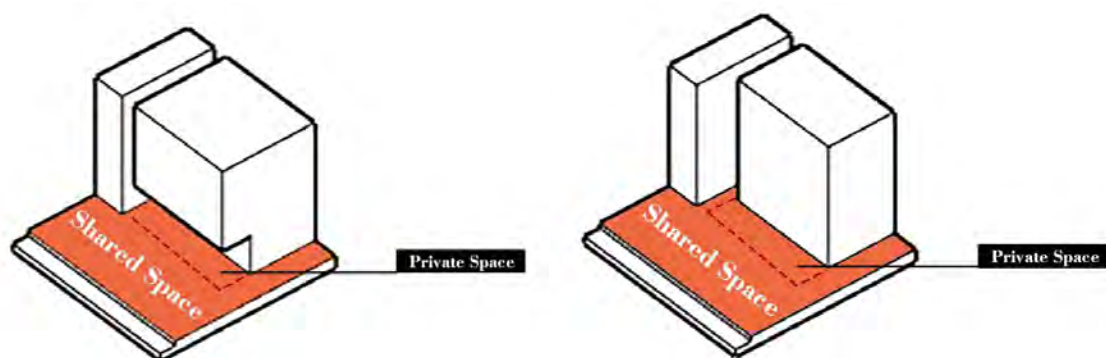


Fig. 2-6 Shared space scope

2. Application status

Auckland

The application of the shared space concept in New Zealand has been heavily influenced by the European Shared Space Project and related research by the UK Department for Transport. Streets shared by motor vehicles and pedestrians have a clear legal status as shared areas. The Land Transport Rule 2004 defines it as a section of roadway used by pedestrians and motor vehicles. The following provisions control equal priority interactions between different users. Vehicles must avoid pedestrians when entering, traveling, and crossing shared areas. Pedestrians in the shared area should not unduly impede vehicular traffic.

Auckland Council has rolled out a number of upgrade projects through initiatives, such as the City Centre Masterplan, to help create the world's most liveable city. Auckland has implemented a comprehensive Shared Space program in its city center over the past years. Since 2011, new shared spaces have opened on Darby Street, Lorne Street (outside the Auckland Library), Fort Street, Jean Batten Place, Fort Lane, and Totara Avenue West in New Lynn.

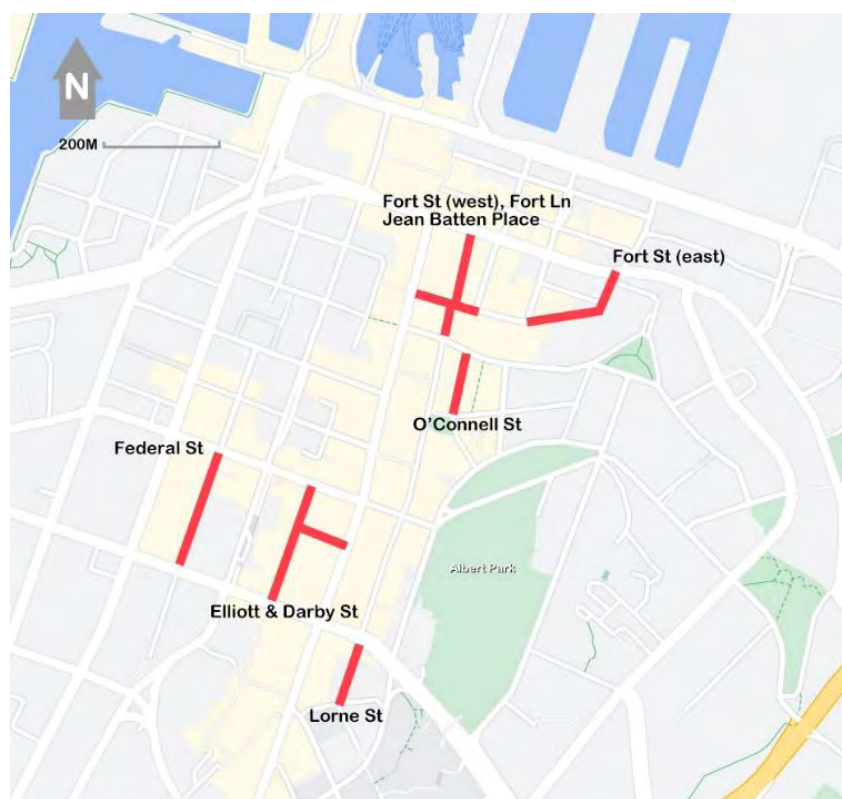


Fig. 2-7 Location of shared streets

Auckland Council has carried out post-evaluation work on all shared space projects, demonstrating the following impacts of the Shared Space program.

Increases in pedestrian volumes from between +10% and +140%. Reductions in car volumes from between -14% and -54%. Reductions in car speeds by -15% to -29%. Retail spending increased from +27% to +439% (for hospitality spending on Fort Street).

Auckland Council commissioned a post-evaluation report for the Fort Street shared space project. The key findings from this report were: that 91% of users and stakeholders were highly complimentary about the new shared space, compared to 17% before. Over 75% of property owners determined that it was valuable being sited near or adjacent to shared space. Foot traffic has increased by 50% during peak hours (comparing pre-works in 2008 to post-works in 2011). Almost half of those surveyed (49%) would visit the area more often as a destination in its own right. There are noticeably fewer vehicles (-34%), and they are traveling at slower speeds. Users and stakeholders (100%) agreed that traffic delays did not affect their business.



Fig. 2-8 Shared streets before and after
(Source: Auckland Council, 2022)

One of the keys to this project's success was the stakeholders' support. A target rate for downtown businesses funded the project, and immediate conversion of the pedestrian space was considered too far. For practical reasons, 'Shared Space' was chosen instead of 'Pedestrian Space' because almost all shared spaces, except Jean Batten Place, have access and commercial service functions. It is impractical to prohibit vehicles from entering. However,

the biggest strength of the program is the activation of the street by pedestrians and businesses, which was simply not feasible in their former car-dominated state.

The Sky City complex, anchored by the Sky Tower, Casino, and Convention Centre, occupies an entire city block and presents a largely blank face to the street funded \$5.5 million (or 55%) of the cost of the Federal Street shared space project precisely so that it could open itself up to the street, and generate more revenue for itself at the same time. Another element of space activation is the work undertaken by the Shared Space Project Manager during the construction phase to ensure that the space is activated immediately upon completion of construction, working with adjacent property owners to maximize the opportunities provided. An example is working with these businesses to ensure permits for street dining, including liquor licensing, are in place when the shared space opens. This was particularly evident in O'Connell Street, where around five separate businesses opened up to the street very shortly after the shared space opened.

What also caught my attention was Auckland's work on urban project announcements. The official website of Auckland Council publishes the government's planning projects, and all the projects are introduced so that people can be informed of the planning projects in time and explained in detail. From the planning of the city's future to the transformation of the streets, you can feel the changes in the city little by little. In addition, Greater Auckland is an independent volunteer-run analysis and advocacy platform for improving the quality of our cities. Formerly transport blogs provide evidence-based debate on urban form, transport, housing, design, and public space. You will be able to discuss the construction project on the website.

San Francisco

In promoting the construction of shared streets, San Francisco has issued a manual, Shared Spaces Manual, which is a comprehensive overview of the goals, policies, procedures, and guidelines for the Shared Spaces program. The Shared Spaces program allows San Francisco residents, community non-profit organizations; small business owners; and art, entertainment, and cultural organizations to activate the public realm for community-focused purposes and commerce.

Streets and sidewalks make up about 25% of urban land area and are an integral part of people's daily lives. In the mid-20th century, many roads were widened to create more car

space. Because people have moved away from a single model due to the dominance of transportation in cities around the world, San Francisco has helped residents change the public right-of-way by developing programs to accommodate the diverse needs of all users of the public realm.

By exploring the potential of urban streets and sidewalks, the Shared Spaces Program seeks to balance the need for people to use the public realm to get around in different ways, provide pedestrian facilities, support local businesses, and promote community interaction. The Shared Spaces program builds on the People's Place legislation passed in 2016 and draws on lessons learned from the temporary emergency response program established during the 2019 coronavirus disease pandemic.



Fig. 2-9 People are enjoying the Shared Space street closure on 18th at Castro Street.
(Source: SFMTA, 2022)

The goals of this program include these nine aspects: simplify the city's toolbox, prioritize equity & inclusion, phase implementation with economic conditions, encourage arts, culture, & entertainment, balance curbside functions, maintain public access, efficient permit review & approval, clear public input procedures, and coordinated enforcement. To facilitate the construction of shared spaces, the manual classifies shared spaces into the sidewalk, parking lane, roadway, and private property, depending on the location of these spaces.

The Shared Spaces program allows for the use of these places mentioned above for different activities, including but not limited to outdoor seating and dining, personal services, merchandise display, entertainment, art, performances, not-for-profit, or other community-serving activities or events. To ensure the safety of all people using the public right-of-way,

including Shared Spaces users, you must follow a series of guidelines and regulations when implementing your Shared Space. These are some of the best practices for any type of Shared Space: fire safety and emergency access, accessibility, sightlines & visibility, movability and portability, and traffic safety and airflow.

The manual gives a site design diagram for different shared spaces, including the dimensions, place, and safety considerations. What is more, all Shared Spaces must be fully accessible to and useable by people with disabilities. Persons with disabilities should be able to use all amenities in the parklet.



Fig. 2-10 Site design diagram for sidewalk shared space
(Source: City & County of San Francisco, 2022)

At the same time, in order to regulate the construction of shared spaces, different application construction procedures are required for different types of spaces. For example, in the case of the sidewalk, parking lane, and private lot, the first step is to check with neighbors, and then the second step takes about 30 days for application submission and interagency review. The next step is a 10-day posting, and for the private lot is seven days. After this is done, they can receive approval, deploy and operate.

So far, over 1,700 free Shared Spaces permits have been issued throughout San Francisco to help businesses move outdoors. The city maintains an interactive map showing the locations and status of all the proposed and approved locations. The map is designed to make it easier for people to find Shared Spaces, check on a permit status, or simply track the program's progress.

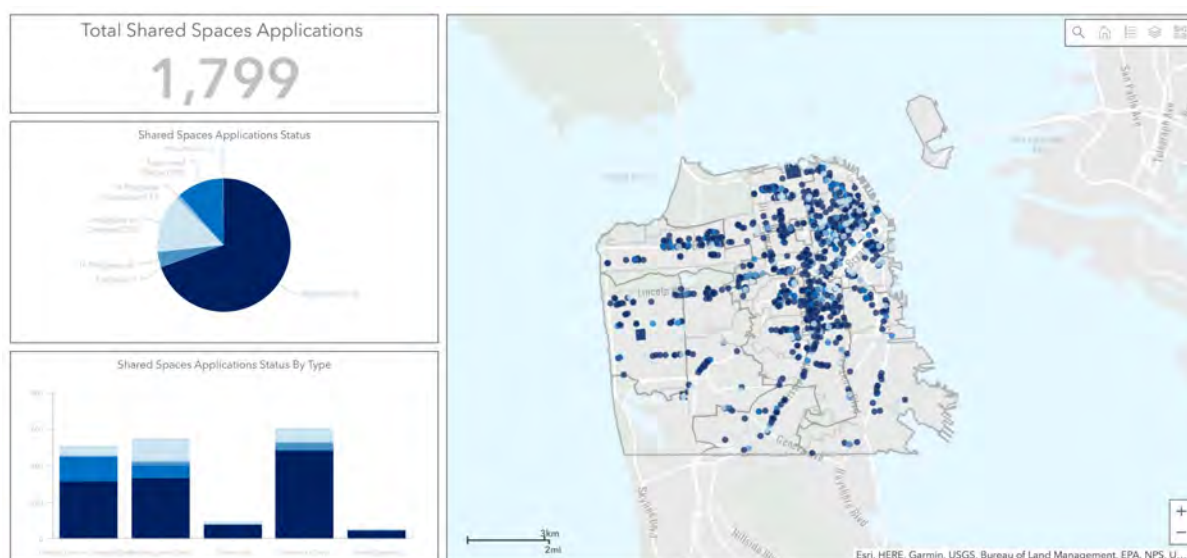


Fig. 2-11 Total shared spaces applications end September 2022
(Source: City & County of San Francisco, 2022)

2.2 Relevant Research in China

We are constantly making changes to change the dilemmas facing our cities and our streets. In 2012, the Ministry of Housing and Urban-Rural Development, the National Development and Reform Commission, and the Ministry of Finance issued the "Guiding Opinions on Strengthening the Construction of Urban Walking and Bicycle Transportation System," requiring large cities and megacities to develop walking and bicycle traffic to solve the problems of short and medium distance travel, and the connecting transfer with public transportation. Small and medium-sized cities should focus on developing walking and bicycle transportation as the primary mode of transportation. In 2014, The State Council issued the "National New Urbanization Plan (2014-2020)", which emphasizes people-oriented and proposes improving urban walking conditions and the slow travel system. In 2017, the Ministry of Housing and Urban-Rural Development issued the "Guideline Opinions on Strengthening Urban Repair Work for Ecological Restoration," proposing to improve residents' travel conditions and encourage urban residents to travel by foot and bicycle.

2.2.1 Research Status

Shared Space Street in China

China's street design started late, and the car-oriented road design has led to a flood of big roads in China today, and the problems exposed by such streets have gradually emerged and

attracted attention over time. As a result, the idea of giving the streets back to pedestrians is starting to gain attention. The international introduction and application of the shared street concept have drawn the attention of the Chinese street design field and the urban design field.

Although the concept of Shared Space Street is not widely used and promoted, it is attracting people's attention now. Shared Space Street is introduced in Shanghai Street Design Guidelines, which also introduces a specific case – Yuanmingyuan Road. In addition, there are also many scholars in China have expounded on the construction of the shared street and specific design strategies. For example, Xinyue Wu summarized the spatial design concepts and methods of shared streets and formed a shared street space environment index system and design guidelines in the article "Study on Environmental Index System and Design Guidelines." The application of shared streets to the domestic environment faces a certain degree of difference in national conditions. However, the concept of shared streets may bring more inspiration to our future street design.

Due to the late introduction of this concept in China, the focus of current research has been on the consideration of the use of shared streets in different types of blocks. These studies mainly apply shared streets to historical districts, living neighborhoods, commercial streets, and other locations and consider the model of shared streets to build up a shared street suitable for Chinese streets.

Table 2-3. Collation of the application and study of shared street theory in China

References	Objectives	Design features	Main content
Wang Liucheng, Wang Shanshan, Liu Junrui (2022)	(1)Solve the problems of Shanghai's old neighborhoods	(1) Use traffic calming measures to reduce vehicle speeds within the neighborhood (2)Use paving and landscaping to promote the integration of people and vehicles	(1)The development of shared street theory in foreign countries and China (2)Consideration of the adaptation of Shared Space Street theory in old neighborhoods (3)Exploring the model of shared street space in old neighborhoods
Huang Qiushi(2017)	(1)Summarize the design concepts, principles, evaluation methods, and tools for living street space and vitality. (2)Propose optimization strategies and design methods for community-based living street spaces	(1)Meet the space needs of all kinds of people in the street (2)Shared over time, planning 24-hour street events	(1)Exploration and practice of shared street theory (2)3D spatio-temporal characterization of streets (3)Community-based living street space construction and vitality creation method based

			on three-dimensional shared street theory
Zhang Kan, Yao Dong(2022)	(1)Exploring whether the shared street concept can enhance the vitality of commercial streets	(1)Mixed pedestrian-vehicle traffic (2)Use traffic calming measures to reduce vehicle speeds	(1)Shared street renovation practice in China (2)Street user perception evaluation
Wu Xiaowu, Liang Xuejun, Lv Xiaoxi(2021)	(1)Building CBD image through street design	(1)Cityscape control (2)Shared space creation (3)Transportation optimization (4)Green landscaping	(1)Case studies of shared streets in business centers at China and abroad (2)Shared street construction ideas
Guo Jing(2020)	(1)Enhance the quality of the street (2)Energizing neighborhoods with urban vitality (3)Preserve the scale of streets and alleyways in the ancient city	(1)Designation of restricted motor vehicle areas (2)Ease transit traffic (3)The interior of the old city maintains a "narrow road, dense road network" format (4)Build a "rail+bus" travel-based transportation system (5)Differential parking	(1)Current development of the ancient city (2)The use of shared streets in the street design of ancient cities

Shared space in urban design

The concept of sharing is valued worldwide and has profoundly impacted the field of urban development and construction. At the international level, the Third United Nations Conference on Housing and Sustainable Urban Development (Habitat III), a virtual conference for urban development, has set "Right to the City and Cities for All" as a vision for future urban development. It is a vision that embodies equality of rights, diversity of needs, sustainable development, and shared responsibility.

Shared development is also a popular topic of discussion at the annual urban planning conferences in China. In 2018, the academic community exchanged views on "sharing and quality" and actively discussed topics such as building shared cities and developing a sharing economy to improve the functioning of cities. In 2018, the academic community exchanged views on "sharing and quality" and actively discussed topics such as building shared cities and developing sharing economy to promote social justice while improving the efficiency of urban operations.

The sharing economy is arguably leading the world in China, and the successful promotion of bicycle sharing in China has changed how urban residents travel daily. Bicycle sharing is now commonplace in China and is an integral part of daily life for residents. The presence of shared bicycles has become an indispensable part of the urban design process. Similarly, the emergence of shared spaces, such as shared offices and shared communities, has brought a

new direction to urban design.

Table 2-4. Collation of the application and study of shared street theory in China

Land use	Space types	References	Objectives of applying the theory	Design strategies	Main content of research
Residential	Public space	Liu Huijun (2022)	(1)Provide new ideas and tools for community renewal	(1) Delineate the community sharing hierarchy (2)Shared facilities for shared functions (3)Green space sharing for all ages (4)Time-shared parking spaces (5)Age-friendly and child-friendly building sharing (6)Cloud-based sharing of community services	(1)Research and practice related to the concept of sharing and the renewal of settlements (2)Research and analysis of the current situation of residents' needs (3)Practical research based on sharing strategies (4)Renewal strategies for public space in settlements based on the concept of sharing
multiple	city center public space	Huang Zhongshan(2020)	(1)Improve the urban open space system and realize the healthy development of the open space system (2)Releasing idle urban land resources and achieving efficient use of land resources (3)Meet the increasing public demand for outdoor activities and realize the "sharing" of open space	(1)Identify typical types of "shared spaces" in cities (2)Implementation of guarantee mechanisms	(1)Urban space sharing strategy and mechanism under the construction of open space system (2)Urban "Shared Space" landscapes based on the reconstruction of open space system design
Commercial	Commercial complex	Wang Xiaoli(2020)	(1)Enhance the spatial efficiency of commercial complexes (2)Improving the vitality of urban public space	(1)Adjusting the scale of the shared atrium	(1)Status of commercial complexes (2)Adjusting the scale of the shared atrium
Business	Co-working space	Wang Min(2020)	(1)Improve efficiency (2)Guiding people to experience a better way of production and life	(1)Space functional layout design (2)Space type and space form design (3)Space shape form and color design (4)Furniture selection and arrangement	(1)Co-working model overview (2)Co-working space design ideas under the concept of shared value

Recreation	Pocket park public spaces	Zhao Lei, Chen Yan, Zhang Jianjian(2021)	(1)Exploring the design method of outdoor shared space for old and young	(1)Security and accessibility (2)Functionality and Shareability (3)Comfortable and user-friendly (4)Edutainment and science education	(1)Usage status of pocket parks by older and younger groups (2)Pocket Park design ideas for shared spaces for young and old
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2.2.2 Application Status

Chinese street design has gradually realized the importance of a people-oriented approach to ensure pedestrians' right to use the street. There is no shortage of good street examples in today's urban streets.

The street construction in Shanghai can give us some reference. Shanghai is also a leader in the application of the shared streets theory. The Shanghai Slow Transportation Planning and Design Guidelines guide the scope, planning, and content of Shanghai's slow transportation planning in six areas: "building a continuous and complete slow transportation network, constructing a composite three-dimensional slow transportation system, creating a convenient and efficient connection system, refining and improving the slow transportation design, innovating the quality of the slow transportation system, and shaping a new slow transportation landmark with quality characteristics.

According to the requirements of the Guidelines, in the central city where the supporting facilities are basically well established, secure public access will be opened, focusing on the slow traffic connection and communication between the two sides of the waterfront and building a pleasant waterfront space; the slow traffic connection with public transportation will be developed appropriately around the ferry terminal, and the research will deepen the planning of slow traffic across the river, giving full play to the advantages of the waterfront greenway and green park space in the central city and other areas, using the internal roads of such leisure space to strengthen its close connection with municipal roads, so that they assume part of the passage function. Actively explore and establish new types of neighborhoods such as "shared streets" and "time-sharing pedestrian streets," create a vibrant humanistic atmosphere, form historical and humanistic charming neighborhoods, neighborhood harmonious and safe neighborhoods, and functional composite vibrant neighborhoods, etc., revitalize the space of slow-moving traffic resources and optimize the general public The city's livable environment is optimized.

"Shared Street + Riverside Living Room" Suzhou River Hongkou Section

The Hongkou section of the Suzhou River, nearly 1 km from the Waibaidu Bridge to the Henan Road Bridge, is located at the intersection of the Huangpu River and Suzhou River, a city necklace, and is a very representative waterfront shoreline of the Suzhou River. The Waterfront District Comprehensive Enhancement Project, a shared street and a comfortable riverfront walkway upgrade and renovation of the Hongkou section of North Suzhou Road after implementing the motor vehicle prohibition.

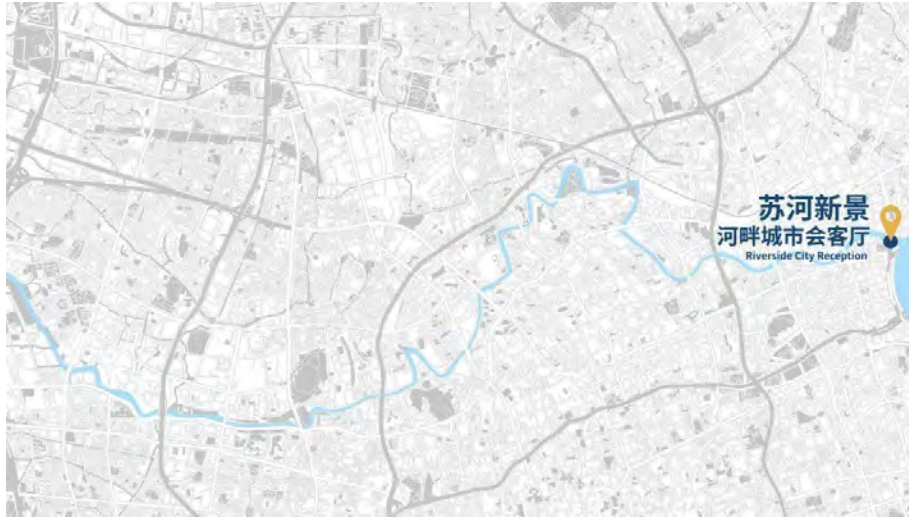


Fig. 2-12 Location of suzhou river hongkou section
(Source: Baidu)

From Waibaidu Bridge to North Henan Road, this 900-meter-long section of the North Suzhou Road riverfront space is designed as a "shared street and riverside living room," taking in the skyline of Lujiazui and the stunning scenery along the Bund.

The Hongkou District section of the Suzhou River has unique advantages regarding riverfront resources and cultural heritage. However, the existing waterfront walkway space is too narrow, with local breakpoints. With the sightline blockage of the flood control wall, the overall waterfront space is poorly landscaped and experienced, causing the public to be near the river but unable to see it. Based on the principle of respecting the site's memory, the planning strategy of sharing, coherence, and vitality will be adopted, hoping to transform this originally ordinary municipal road into a shared street and return the street space to slow traffic.

Sharing is creating a shared street based on the prohibition of motor vehicle traffic on North Suzhou Road (Hongkou District section) to realize a unique riverfront street space. Following the strategy of guaranteeing slow traffic flow and safety as advocated in the "Guidelines for

the Construction of Public Spaces on Both Suzhou River (Central City)," the municipal roads along the river should gradually divert motor traffic to create conditions for realizing the riverfront slow traffic space. It is recommended that motor vehicles be banned from the road sections where conditions exist. North Suzhou Road, after the ban on motor vehicles, the road space back to slow traffic to create a shared street space along the river. The original only 1.2-1.4 meters of the riverfront corridor was widened to more than 3 meters; the public provides a comfortable, leisurely, "slow life" riverfront street space.

That is, to open up the breakpoint along the river walkway, to achieve everywhere can "see the river." The original closed parking lot and the office building of the maritime office are located inside the flood control wall of Suzhou River, which makes the river walk along the Suzhou River inaccessible to the public, and they can only go around from the municipal sidewalk. The closed maritime office building will be replaced with public service supporting functions, forming a service space that is "accessible, interpretable and experienceable." After the break, all the riverfront space along the line is vacated and raised along the river sightseeing platform, and the height difference between the flood control wall to maintain at about 1.2 meters so that the public can feel the charm of the Suzhou River waterfront 360 degrees without obstacles.

Vitality, i.e., enhancing waterfront interaction, the riverfront walkway, and shared street space work together to create a comfortable and humanized riverfront space. The street space combination of shared street + riverfront walkway enriches the public space level and spatial dimension of the riverfront, providing the possibility of multiple slow walking experiences. Barrier-free ramps connect the two spaces to enhance the interaction of spatial experience and create a comfortable slow-moving riverfront space.



Fig. 2-13 Aerial view of Suzhou River
(Source: Baidu picture)

The Hongkou section of the Suzhou River adopts a planning structure of four sections along one bank, with the most beautiful riverside as the backbone, creating four distinct sections and shaping beautiful riverfront space, providing the public with an excellent place to stroll along the riverbank and enjoy the riverfront scenery and urban beauty.

The Shanghai Tower Vitality Garden section, which opens up the breakpoint of the river walkway, relies on the high-quality resources of Shanghai Tower and Waibaidu Bridge to shape the landmark space of "the most Shanghai memory" of Suzhou River; the closed parking lot and office space are replaced with public open space to better return the river to the people and enhance the riverfront strolling experience. Here, the public can open up their vision on the 360-degree barrier-free waterfront platform and look out over the beautiful scenery.



Fig. 2-14 Shanghai tower vitality garden section
(Source: Baidu picture)

Suning Baolijia Hotel rest view section, sitting on the Bund and Lujiazui beautiful scenery, can sit in the north and south, waterfront view. It will become an unforgettable and famous riverside living room. Postal building style display section, the original blocking line network obstacles will be removed, restored, and show the national treasure of historic architectural resources.



Fig. 2-15 Suning Baolijia Hotel rest view section
(Source: Baidu picture)

The characteristic style section of the Riverside Building is based on historical residential buildings and enhances the commercial business on the ground floor. As a popular location for film and television dramas, the Riverside Building was the location of a film company in the 1930s. The integration restores the historic architectural style, coordinates the modern living atmosphere, and experiences the city's beauty through time and space. Cross-fertilization with the wind characteristic road section, joint efforts to create a multi-functional complex of dynamic riverfront space, the scale is pleasant and warm humanistic riverfront space, ecological benefits of the most refreshed green riverfront space.



Fig. 2-16 Riverside building section
(Source: Baidu picture)

2.3 Conclusion

With the development of society and the change in travel modes, there are also different stages of the changes in the function of streets. The first is the Medieval "Walking Age": Streets are designed on a human scale, making it easier for residents to walk, with smaller block distances, lower buildings on both sides, and streets primarily used as pedestrian

passages and public spaces; Horse-drawn carriages began to develop in Europe in the 16th century, and became popular in the second half of the 18th century.

The shape of the streets in the "carriage age" changed: the scale of the streets was enlarged, the streets were widened, the distance between the blocks increased, the function patterns of the streets were complicated, the pedestrian paths and Wheel lanes began to separate, and the pattern of street network layouts changed; The rise of the two industrial revolutions made the use of electricity popularized, and street design entered the era of trams and automobiles: the street became the street-facing interface of a large number of commercial buildings on both sides, which greatly enhanced the public space for people to communicate and move. Due to the rapid increase in the flow of people and vehicles, its function as a traffic space is also enhanced;

The popularization of automobiles in the 20th century brought fundamental changes to urban streets: urban streets have been entirely popularized by grade, a large number of "big roads" criss-cross the city, the function of streets as public space has declined sharply, and the function of traffic has become leading.

Today, the traffic-dominated streets expose many problems, and there is a renewed emphasis on returning the streets to their essence and back to pedestrians. Simply transforming the street into a pure pedestrian street cannot adapt to today's streets that carry multiple modes of transportation. The emergence of shared streets provides another answer to street design. With deepening the discussion and practice of shared streets, the concepts and design patterns of shared streets are constantly being improved and optimized. The discussion of shared streets in various countries also focuses on this, and the concept of shared streets is adjusted and optimized in different directions. These attempts have reference significance for countries worldwide to use the concept of shared streets. The beginning of street design in foreign countries is earlier than in China, and its extensive discussion and practice can inspire street design in China. At the same time, the problem of translation in application also arises in the context of different national conditions. The urban street environment is complex, and no design formula can be directly applied. The street design needs to be adjusted according to its environmental conditions. What remains unchanged is the design concept it contains—people-oriented. Therefore, the summary of this cutting-edge research is the basis for the next application.

2.3.1 Theoretical Problems

There has been a consensus on improving the quality of street space, and the research on streets at home and abroad has also changed its concept. Among them, in terms of improving the right of way for pedestrians, the shared street theory improves the priority of pedestrians by blurring the right of use between pedestrians and motor vehicles. The shared street theory can be traced back to Buchanan's report, which proposed the concept of road user integration and then developed it in Germany with the concept of shared space in residential areas. Presently, foreign research on shared streets mainly focuses on the implementation and application of shared streets, post-construction evaluation and corresponding reflection, and many implemented projects. Domestic research mainly focuses on exploring shared streets' connotations and construction strategies. There are a few specific cases of shared streets. There are differences in national conditions, and how to translate the shared streets into the domestic environment remains to be explored.

The main problems:

The application of urban design guided by shared street design theory has not been formed;

There are more macro studies on the humanized design of streets, and less attention to the micro and details;

A large number of studies on street space and human behavior tend to be qualitative descriptions, and quantitative studies are relatively lagging behind.

At present, there are no shared street design guidelines suitable for domestic conditions, specific design strategy research, and corresponding evaluation systems. Based on the existing theoretical research results, a complete design guideline suitable for domestic conditions is summarized, which is helpful for the advancement of domestic theoretical research on shared streets and the construction of shared streets.

The goal of theoretical research is to summarize urban design guidelines for shared street guidance. Through the establishment of shared streets, the quality of urban street space can be improved, the functions of urban streets can be enriched, the problem of urban land shortage can be alleviated, and the walking comfort of urban street space can be improved. The streets' vitality, in turn, enhances the city's vitality. A high-quality walking environment and a complete slow-moving system can attract residents to green travel, thereby reducing motor vehicle travel and achieving the goal of low-carbon and environmental protection.

2.3.2 Significance

Street life should be informative. People on the street can do basic activities, walking, stopping, shopping, etc., and additional activities such as talking, resting, and eating. Make public life more prosperous and enjoyable. Moreover, for these activities to happen, the street space form needs to be able to adapt to these activities. Street space is limited and needs to be expanded appropriately. This is where the theory of shared streets needs to be applied to inform street design.

The development of street design in China is relatively late, and the discussion of street design theory can provide a little reference for the development of street design in China. Shared streets address the conflict between people and cars and enhance the power of people on the streets. While the primary users of streets are supposed to be people, today's street design mainly considers the use of cars. Using these street design theories, we return the street space to people's use. Therefore, the shared street theory is critical. The study of shared streets in Chinese street design is still lacking and needs to be explored more.

On the other hand, the publicization of private space is providing more public space for city residents. As the population increases, the problem of scarce urban resources becomes increasingly severe. Opening up private space for public use alleviates the problem of tight land use to a certain extent. These spaces are different from public spaces in the traditional sense, although they are also spaces that urban residents can step directly into and reach directly from the city streets; the difference is that these spaces are designed and maintained by private landowners.

There is also less research on private owned public space in China. It is very meaningful to explore more about such space.

But there is no shortage of successful examples. For example, stores set back the first floor space, which can be used as an outdoor dining space for pedestrians, a resting space, and a space that can be used without entering the store for consumption. Or commercial complexes that open their atrium gardens for public use by designing the garden entrances to connect with the street so that the public can step directly from the street into the atrium gardens without entering the interior of the commercial complex. As shown in Figure 2-17, the atrium space of Guangzhou Parc Central is both an atrium for the commercial complex and a park for the city.



Fig. 2-17 Guangzhou Parc Central
(Source: Google)

The integration of privately owned public space into street design enriches the space of street design on the one hand and expands the theory of shared street design on the other. Discussing from the perspective of street design, the public space design of street design is explored more systematically. The privately owned public space also steps in from the street, so it can also be said to be part of the street space. Considered in conjunction with street design, exploring different shared spaces depending on the type of building on the street can provide a new direction for private property owners.

In this paper, based on the above considerations, the urban design of Guangzhou Racecourse is used as a design research object to provide a shared street design solution for the humanized design of the street of the racecourse. I hope the design scheme can provide a little reference for future urban design of street space design. Also expand on the shared street theory. To provide direction as well as reference for street design theory in China.

Chapter3 Case Studies

3.1 Select Principles

Shared Streets aims to enhance the priority of people on the street and create a people-centered street space that enriches people's street life. Therefore, when selecting cases, not only cases of shared streets in the traditional sense (i.e., enriching the function of streets by integrating people and vehicles and reducing vehicle speed) were chosen, but also cases of shared spaces that enrich the public space of cities by opening private spaces to public use.

Furthermore, in the case selection of shared streets, the focus was on selecting shared street cases in the city center, as the site of the latter urban design proposal is located in the downtown area of Guangzhou. The site situation is more similar, and the reference meaning is more substantial. In addition, the case selection mainly considers selecting countries with more mature theoretical studies. It can provide a better reference for design solutions.

Due to space limitations, this chapter focuses on two case studies, namely, the shared street design of the Auckland Central Business District, the privately owned public space program of New York. In addition, many relevant streets and public space design cases were studied, such as Barcelona Superblock, San Francisco Shared Space Project, the Shanghai Urban Bloom project, etc.

3.2 Case

3.2.1 Auckland, New Zealand

Auckland Council is rolling out a number of upgrade projects through initiatives such as the City Centre Masterplan, to help create the world's most liveable city. Since 2011, new shared spaces have opened on Darby Street, Lorne Street (outside the Auckland Library), Fort Street, Jean Batten Place, Fort Lane and Totara Avenue West in New Lynn. Auckland's Shared Spaces were reasonably successful in terms of safety, amenity and operational performance. The Auckland Council website includes before and after shots and a detailed report on how shared spaces are performing in terms of foot traffic, vehicle speeds, customer spending and perceptions of the area. An operational safety review of the Shared Spaces in the Auckland CBD was undertaken at the request of Auckland Transport. The review outcomes was presented at the IPENZ Transportation Group Conference 2017.

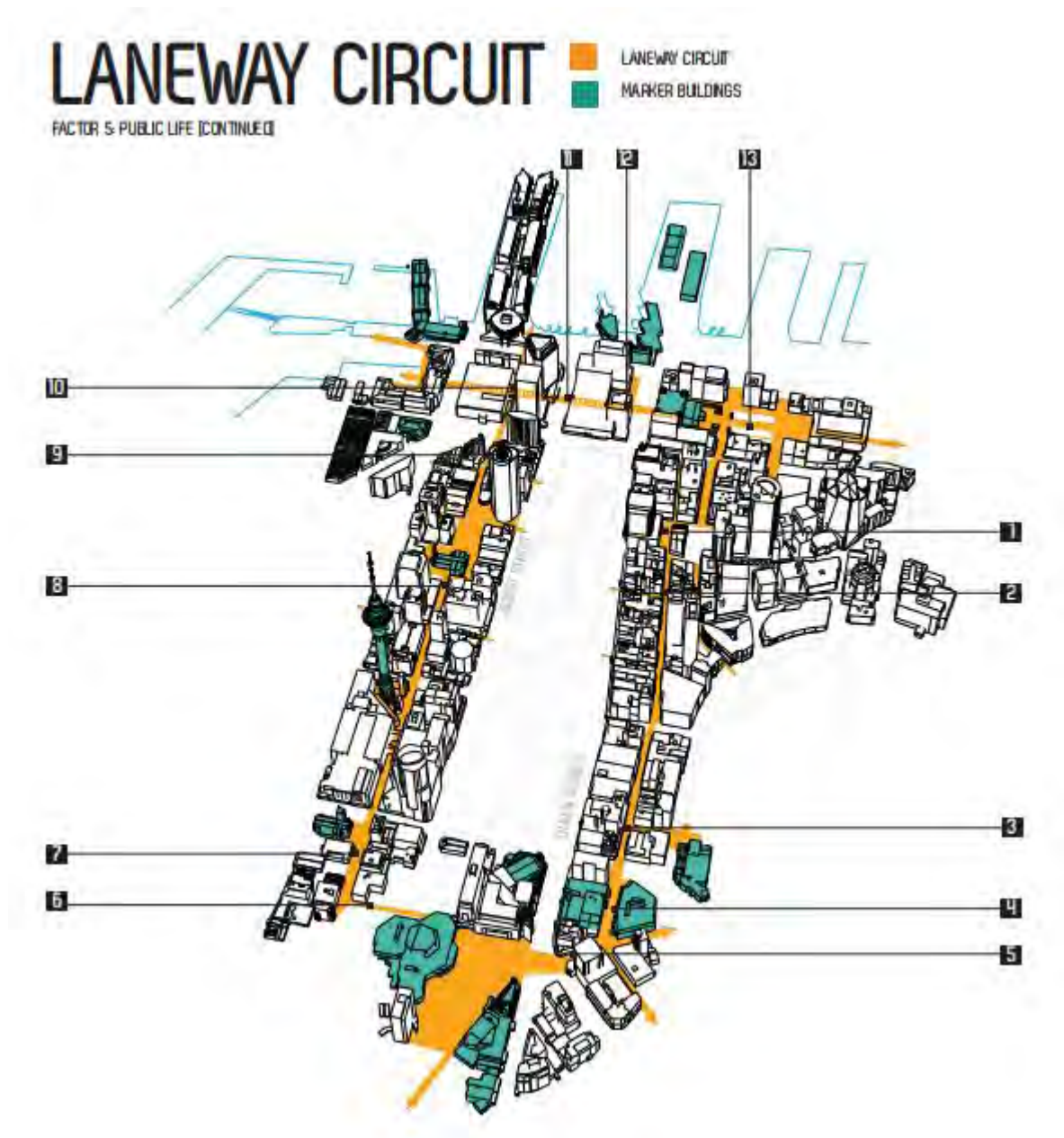


Fig. 3-1 Laneway circuit
(Source: Auckland Council, 2012)

3.2.1.1 General introduction

Shared Spaces are public streets or intersections that are intended to be shared by people and motorists in a consistent low-speed environment, with no obvious physical separation between the various road users. ‘People’ would include pedestrians, cyclists, and persons with mobility or vision impairment.

In Shared Spaces, traditional demarcations such as road-marking, signs and kerbs are replaced with a level paved surface and urban streetscape design, minimising separation between

pedestrians and vehicles.

Shared Spaces have been implemented in a number of streets in the Auckland CBD and West Auckland in recent years. There are currently eight Shared Spaces in Auckland: Elliott Street & Darby Street; Lorne Street; Fort Street (including Fort Lane and Jean Batten Place); Federal Street; O'Connell Street; Totara Avenue; McCrae Way; and Westgate Town Centre (Te Pumanawa Square). The first Shared Space (Elliott Street) was created in 2011.

The Transport (Road User) Rule 2004 defines the term Shared Zone¹ as: “A road that has been designed to slow traffic and give priority to pedestrians. Drivers give way to pedestrians who, in turn, should not impede traffic.” ATCOP² describes Shared Spaces as: “Shared spaces within the public road space (as opposed to open space or private area) where all road users (including pedestrians, cyclists, vehicles and the disabled) are encouraged by design to legally interact, share and occupy the same public space”.

Furthermore, ATCOP states that Shared Spaces should “...attempt to limit vehicular dominance, volumes and speed. Traffic calming measures, such as lateral shifting of horizontal alignments, and street closures, can be employed to restrict vehicular movements and speeds. Based on the walking speed criteria, the recommended design speed should be 10km/h”. An Auckland Council bylaw prohibits parking within a Shared Space. Loading is permitted within a Shared Space, unless specifically restricted with appropriate signage. ATCOP recommends loading activities be restricted to time periods when pedestrian demand is lower.



Fig. 3-2. Location of shared streets
(Source: GDCL, 2021)

3.2.1.2 Common design elements and desired design features

Based on ATCOP and the layout of existing Shared Spaces in the Auckland CBD, Shared Spaces in Auckland have generally been designed to exhibit the following common features: Gateway treatment. A paved surface and legal signage (Shared Zone) at the entry and exit, to clearly indicate the area encompassing the Shared Space. Generally,

Shared Spaces have been designed to minimise legal signage and designed to be self-explanatory for users. Level textured surface. Level block paving materials across the width of the street, with no kerb, encouraging pedestrians and motorists to share the space. It is generally accepted that textured block paving encourages slower vehicle speeds. Accessible zone. A narrow area along the length of the Shared Space, on both sides of the Shared Space (adjacent to building frontage), that is clutter free and provides enhanced amenity for pedestrians, particularly the visually- and mobility-impaired. The accessible zones also include textured paver navigational strips that define the accessible zone, and to guide visually-impaired pedestrians. Activity zone. An area along the length of the Shared Space that accommodates fixtures, such as street furniture, lighting, seating, planter-boxes, art works, cycle

stands, and loading areas. Ideally, street furniture near traffic or loading areas should have sufficient height and bulk to be clearly visible, with seating kept clear of direct traffic or vehicle maneuvering areas. Circulation zone. An area along the length of the Shared Space that caters for shared movement of vehicles and pedestrians. Crossing points for pedestrians are not necessary.

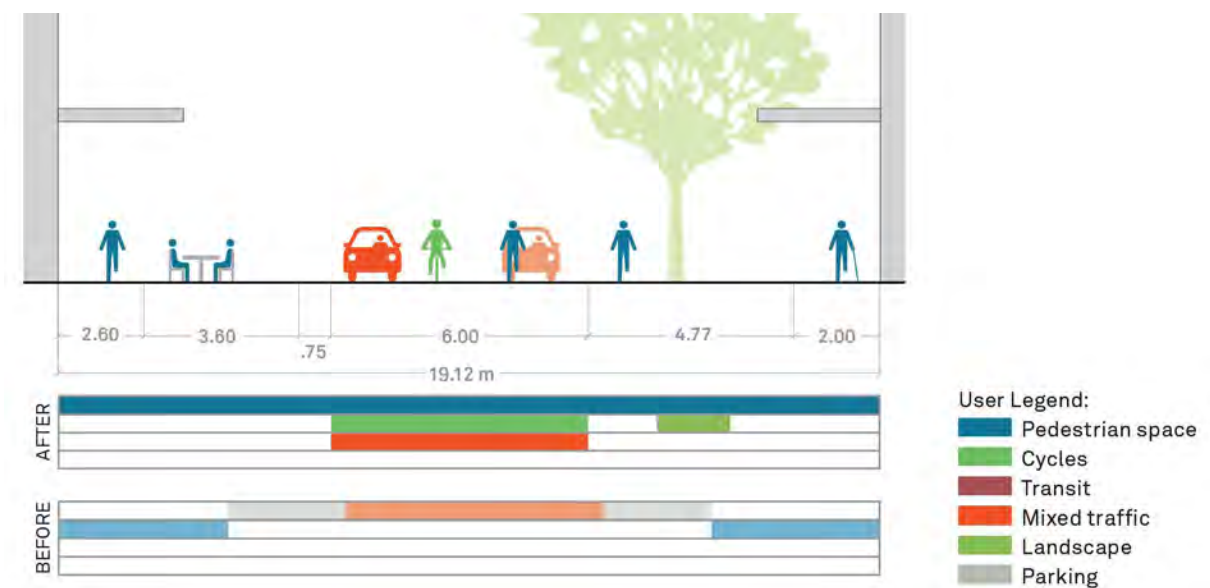


Fig. 3-3. Street cross-section before and after

(Source: GDCI, 2021)

The main objectives of Auckland's Shared Spaces are to reduce vehicular dominance on a roadway and improve the street environment for pedestrians and community interaction. These goals are considered to be assisted by achieving the following design objectives.

Reduced traffic speeds. Reduced vehicle speeds are an objective of Shared Spaces, and a key element to their successful operation. Safe Speed is one of the key pillars of the Safe Systems approach to implementing a safe road system (Ministry of Transport, 2010). Also, the survivability of pedestrians involved in a crash with a vehicle has been shown to increase significantly at impact speeds of 30km/h or lower (World Health Organization, 2013). ATCOP recommends limiting vehicle speeds to 10km/h in Shared Spaces, though for most existing Shared Spaces in Auckland a speed limit of 50km/h applies. Relatively low traffic speeds (below 25km/h) are likely to reduce vehicular dominance, encourage street sharing, and reduce the likelihood and severity of any crashes.

Improved safety. Creating a safer environment should be an objective of all streetscape designs. However, measurements of safety should be based on reported crash statistics, and not on perceptions of risk. Indeed, an element of perceived risk can be promoted as a positive design aspect, as unpredictability and increased awareness of risk can help slow vehicle speeds, resulting in a more useable environment for pedestrians.

Reduced traffic volumes. Relatively low traffic volumes are likely to reduce vehicular dominance and result in a more successful Shared Space. A Shared Space should operate in a manner similar to a Local Road, servicing adjacent properties only, with low amounts of

‘through’ traffic or public parking access. It may be acceptable to have higher traffic flows at peak commuter times, but lower traffic volumes throughout the remainder of the day are ideal when pedestrian volumes are higher. Traffic volumes of around 100 vehicles per hour or less would be ideal. Traffic volumes far in excess of 100 vehicles per hour throughout the day could create issues with respect to motorists dominating a Shared Space.

Increased pedestrian volumes. Successful Shared Spaces generally have high numbers of non-motorists using the space, and thus Shared Spaces need to be located on pedestrian desire lines, and the surrounding land use should attract pedestrians. Food-based activities are considered particularly important for encouraging pedestrians to ‘linger’ within a Shared Space. Art works, monuments and seating can help create focal points that encourage pedestrians to ‘linger’ in an area. Also, night-time activities, such as late-night dining, or cinemas, are important for extending pedestrian activity into the night. Relatively high pedestrian volumes along and across a Shared Space throughout the day increases the likelihood of a Shared Space operating successfully. Hence the need for Shared Spaces to be implemented in town centers, along pedestrian desire lines, and adjacent to active building frontage.

Active building frontage. Active building frontage throughout the day is required on both sides of a Shared Space, to encourage pedestrian movements within and across the Shared Space. Increased pedestrian movement causes increased pedestrian-vehicle interaction, which encourages slower vehicle speeds.

Circulation zone lateral shift. Lateral shift of the circulation zone is desirable to limit straight sections of street and break up long sight lines, thereby encouraging slower vehicle speeds. Research indicates that straight sections of circulation zone greater than 50m in length should be avoided. This can be achieved using street furniture.

Circulation zone narrow width. A narrow circulation lane is likely to encourage slower vehicle speeds due to ‘side friction’ associated with roadside infrastructure. A width less than 5.5m for two-way flow could be ideal for encouraging slower vehicle speeds. Extrapolating this figure, a width of 4m or less would be considered suitable for a one-way Shared Space. Shared Spaces can be narrowed using street furniture such as seating, landscaping, art works, monuments, tree canopies, street lighting, cycle stands, and on-street loading. However, if on-street loading is restricted at most time periods, then it is limited in effectiveness. The visual width of a carriageway can be further narrowed through the use of paving patterns.

Loading or parking. Parking is prohibited in Auckland's Shared Spaces, but loading is permitted unless specifically restricted by signage. In Shared Spaces within Auckland, five minute loading is permitted every day from 6am to 11am. Loading is a necessary service for properties along a Shared Space, and loading is not considered to have a significant adverse effect on Shared Spaces, especially if loading activities are restricted to time periods when pedestrian volumes are low.

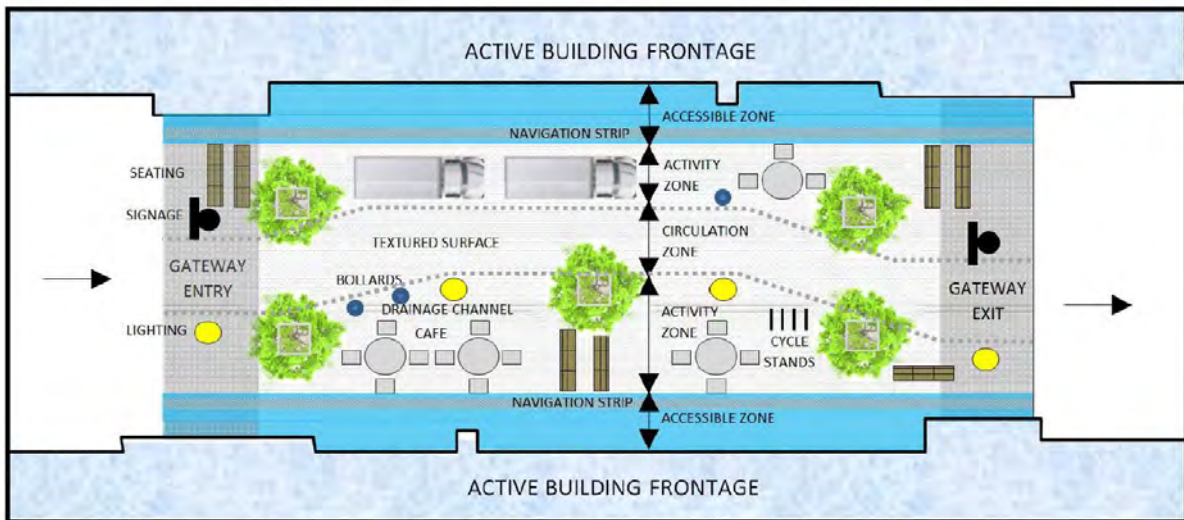


Fig. 3-4 Desired features
(Source: Bruno Royce, 2017)

3.2.1.3 Fort street

Fort Street showcases the important role shared surfaces can play in using street space more efficiently to create new destinations and improved economic performance for adjacent businesses. Fort Street has been widely acknowledged as an international exemplar 'shared space', and since its completion has delivered massive uplift in footfall and turnover for surrounding businesses in the neighborhood.



Fig. 3-5 Fort Street – looking towards Queen Street past Jean Batten Place and Commerce Street
(Source: Auckland Design Manual, 2014)

The term ‘shared space’ refers to the approach of removing any clear demarcation between vehicles and pedestrians, prioritizing the pedestrian and enabling them to ‘share the street in a more equitable and efficient manner. Fort Street is one of several new ‘shared spaces’ implemented in Auckland’s CBD in recent years to enhance pedestrian connectivity, and provide much-needed additional outdoor space for adjacent businesses to capitalize on the underused street space. Fort Street itself is close to the city’s waterfront, and follows the original, pre-reclamation shoreline, linking to some of the city’s earliest streets. In 2008 the Fort Street area was identified as having significant potential for transformation into a more attractive and user-friendly environment. Consequently six streets in the area were selected for receiving a high quality upgrade. The project removed conventional kerbs and installed a single level paving surface across the full width of the street to create the shared space. The work began in 2009 and was carried out in three stages between 2010 and 2013.

Project goals of this project are flowing. Better integrate the area into the surrounding street network. Provide greater pedestrian priority. Create a distinctive public space and provide opportunities for the area to be a popular destination in the city center. Create a space that supports businesses and residents and provides opportunities for a variety of activities. Provide a high quality, attractive and durable street that contributes to a sustainable and maintainable city center.



Fig. 3-6 Looking down Jean Batten Place towards Fort Street
(Source: Auckland Design Manual, 2014)

Design street as public space. After design, there are several changes. First, the creation of a shared space has brought about a significant increase in the numbers of pedestrians who visit the area, up 47% at peak hours. Second, since their introduction the shared spaces have become recognized as places and destinations in their own right, with 49% of people interviewed indicating they would visit the area more often. Third, the shared streets provide more space for pedestrians to move around in, sit in and relax in. Four, the shared spaces provide more space for outdoor activities such as outdoor dining, events and gatherings. Five, the upgrade of the street and lanes to public places has created street vibrancy, boosted local businesses and resulted in significant investment in the area.



Before



After

ig. 3-7 Fort Street 2009(left) and 2011(right) – view from Queen Street end
(Source: Auckland Design Manual, 2014)

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Design for the context, is another key strategy. First, as the Fort Street Upgrade is located in one of the oldest parts of Auckland, the design and materials are both subtle and timeless to

act as a backdrop for some grand historic buildings. Second, the emphasis on creating spaces for pedestrians in this location is wholly appropriate given the precinct's location adjacent to Queen Street (Auckland's High Street), the waterfront and Brittomart, the city's main transport hub. Third, Fort Street as the former pre-reclamation shoreline (historic context) is acknowledged by way of beautiful design elements: e.g. small indentations that capture and retain the water. The use of the coastal native, the pohutukawa also references Fort Street's coastal edge. Four, the street network provides a number of alternative routes for vehicles to avoid Fort Street and surrounding shared spaces, ensuring spaces remain lightly trafficked.



Fig. 3-8 Birds eye view of Fort Street and Queen Street junction
(Source: Auckland Design Manual, 2014)

Design for connectivity is the third strategy. First, the streets and lanes form a visually and materially connected network by way of the use of a consistent palette of materials. Second, the pedestrianization of the Fort Street Precinct enables stronger integration of the area into the surrounding street network. Third, the Precinct now functions as an important, high quality connector, connecting Queen Street (Auckland's Main Street), Brittomart, the city's main transport hub, and the waterfront. Four, walking and cycling connections have been strengthened throughout this area as a result of this shared space project.



Fig. 3-9 Looking towards Queen Street from Fort Street
(Source: Auckland Design Manual, 2014)

The fourth strategy is design for safety. First, the implementation of the shared surface concept- using a continuous paved surface in the material and detailing with out any clear definition of a ‘car area’ or pedestrian area’ forces motorists to slow down to be able to read and respond to the uncertainty of the space. As a direct result of the upgrade vehicle speeds dropped by 5-9 km/hr. Second, the investment in high quality materials, a wide range of quality street furniture and improved lighting invites people to inhabit the spaces day and night. This presence of people helps create a perception of safety and over 80% of Aucklanders surveyed felt safer in the area than they had previously. Third, traffic offending has dropped and no injury or crashes have been reported since completion, highlighting the important role shared surfaces can play in enhancing pedestrian safety.

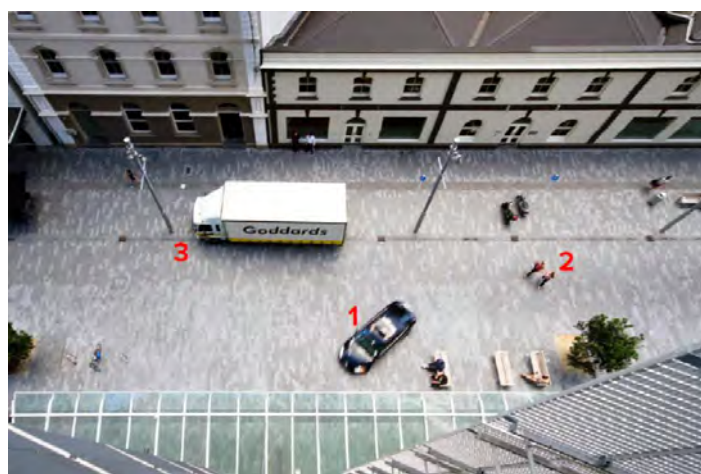


Fig. 3-10 Fort Street – birds’ eye of Fort Street (Queen Street end)
(Source: Auckland Design Manual, 2014)

Design for environmental sustainability is the fifth strategy. First, the layout and detailing of areas adjacent to the building edge has been kept simple to accommodate changing business activities over time. Second, Certain existing historic built elements have been retained and restored including the basement lightwells of heritage buildings. Third, Original kerbs were reused on some streets as well as along Fort Street to edge the tree pits and reveal the lightwells. Four, permeable paving was used around the trees, to minimise storm water overflow and to irrigate the trees.



Fig. 3-11 Looking down Fort Street – Gore Street end
(Source: Auckland Design Manual, 2014)

The sixth and final strategy is that, design and plan streets to be fit for purpose. Firstly, clear, high-level design objectives were set for the project that included providing a high quality, attractive and durable street that contributed to a sustainable and maintainable city center. Second, simple detailing and minimal number of materials used across project to minimize maintenance requirements and maximize flexibility for change. Third, construction methods and materials specifications were rigorously tested and reviewed at key stages to ensure the design was fully appropriate, durable, and flexible. Fourth, comprehensive technical investigations were undertaken of both rigid and flexible pavement construction types, jointing, bedding and finishing issues to ensure the high-quality ground surface would stand up to the demands of heavy vehicles. Five, a combined services trench for utilities has future proofed the project and minimized future maintenance costs. Sixth, a “whole-of-life” approach was taken for all aspects of this project; this included, importantly, a whole-of-life economic analysis.



Fig. 3-12 Fort Street - Gore Street end (left), Fort Lane looking towards Customs Street (right)
(Source: Auckland Design Manual, 2014)

3.2.2 New York City, the USA

The POPS program dates back to 1961, when New York City's zoning resolution underwent its last major overhaul. Then an innovative program, POPS has stood the test of time and today there are more than 590 POPS, most of them located in Manhattan's dense urban core. When first introduced as a zoning tool, the program allowed developers to build more usable space (also known as floor area) or, if they also created plazas or arcades open to the public, to obtain special exemptions for buildings.

Since 1961, other types of outdoor and indoor space have been introduced in zoning resolutions as the Department of City Planning has expanded the program and refined amenities and operating standards to meet public needs, changing tastes and technological advances. Click on the "History" tab above to learn how POPS and its associated zoning regulations have evolved. Today, two specific types of POPS can be constructed, public plazas and arcades, in exchange for additional floor space.

POPS must be provided and maintained in perpetuity by the owner in accordance with the code under which they were built and any city approvals.

3.2.2.1 Design standards

The 2007 and 2009 amendments to the Zoning Resolution made significant changes to the design, amenities, and operational standards for privately owned public space. The amendments introduced a new type of POPS, the public plaza, which replaced provisions for urban and residential plazas. The current design standards are informed by decades of experience and are guided by the following principles.

Open and inviting at the sidewalk. Easily seen and understood as open to the public; conveys openness and maintains clear sightlines through low design elements and generous paths

leading into the plaza; provides seating and amenities adjacent to the public sidewalk. Second, accessible located at the same elevation as the sidewalk; enhances pedestrian circulation. Third, safe and secure. That means, containing easily accessible paths for ingress and egress; also, oriented and visually connected to the street. Four, comfortable and engaging. This point includes promoting use and comfort by providing essential amenities. Besides, accommodates both small groups and individuals with a variety of well-designed, comfortable seating. Balances open areas with greenery and trees and well lit are considered as well.

In addition to these principles, the City of New York also gives design standards for specific matters of design, such as dimension. To ensure spaces of adequate size are provided to serve the public and accommodate the required amenities, the minimum area for public plazas is 2,000 square feet. This minimum size is adequate for small, vest-pocket parks and can comfortably accommodate seating, planting, and other required amenities. Non-bonused open areas not located adjacent to the sidewalk require a buffer between such area and the plaza. For the configuration, their opinion is that public plazas should generally be regular in shape (i.e., rectangular, square, etc). However, to allow articulation of building facades facing onto plaza and flexibility in landscape design, the plaza regulations allow for small areas of the plaza to take the form of alcoves or niches adjacent to the main portion of the plaza. If so designed, the main portion of the plaza is termed the “major portion” of the public plaza and must account for at least 75% of the plaza area. The smaller areas are then considered to be “minor portions” and are limited to no more than 25% of the plaza area. Major and minor portions of the public plaza are generally be held to the same design standards, although major portions are required to meet stricter requirements related to dimensions and visibility, as described below.

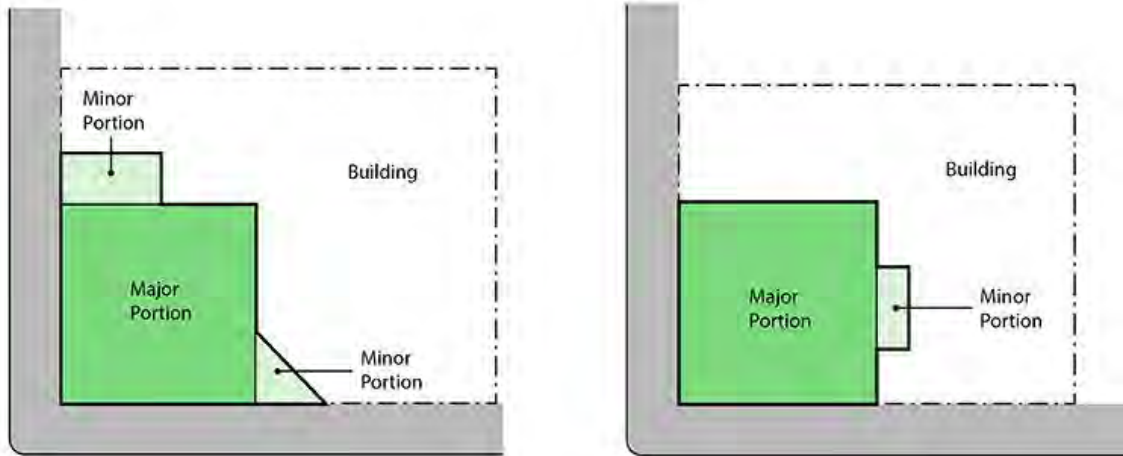


Fig. 3-13 Diagram illustrating the relationship between major and minor portions of the public plaza
(Source: City of New York, 2021)

Major portions of public plazas are required to have average width and depth of 40 feet. To allow for additional flexibility in the configuration and design of the public plaza, up to 20% of the plaza area may be less than 40 feet in depth.

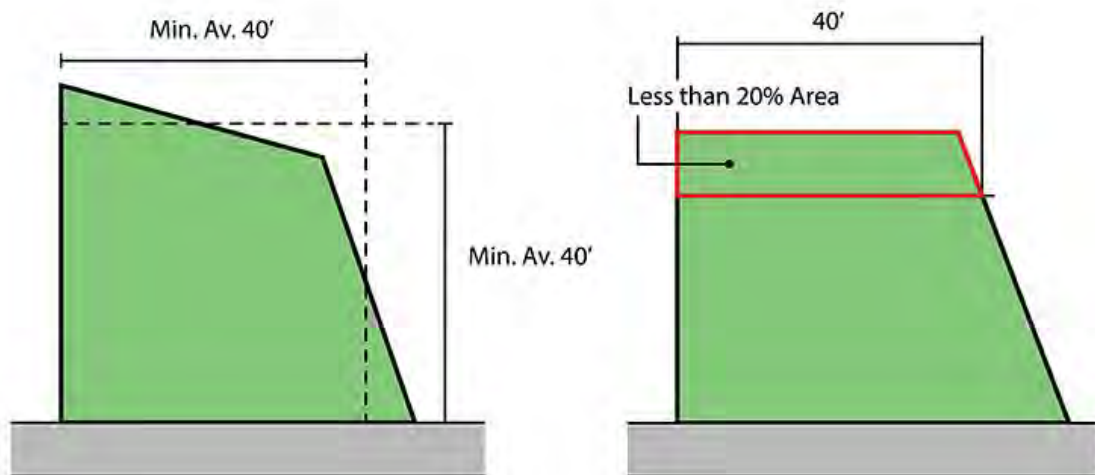


Fig. 3-14 Left: Diagram illustrating how the minimum average dimensions permit flexibility in plaza design
Right: Diagram showing how portions of the plaza less than 40 feet in width may occupy no more than 20% of the plaza area
(Source: City of New York, 2021)

Also, there are standards of local restrictions, restrictions on orientation, visibility, minor portions, regulations for through block public plazas, sidewalk frontages, elevation, steps,

circulation paths, permitted obstructions, seating, planting & trees, lighting & electrical power, litter receptacles, bicycle parking, public space signage, additional amenities, hours of access/ nighttime closing, standards of accessibility for persons with disabilities, kiosks & open air cafes, and uses & walls fronting on public plazas.

3.2.2.2 Water Street

With its 19 million square feet of office space, ready access to public transit, growing residential population, and strategic location between the Financial District and an improved East River waterfront, Water Street has a crucial role to play in the ongoing revitalization of Lower Manhattan. Between the historic Battery Park and South Street Seaport lies Water Street, Lower Manhattan's most important commercial corridor. Once the heart of the New York City waterfront, Water Street has strong access to public transit and is home to over 70,000 employees, a growing residential population, and a generous amount of open space.

Recognizing the critical role POPS plays in defining the character and perception of Water Street, DCP and NYCEDC launched the Water Street POPS Upgrade Program in the summer of 2013. The goal of the upgrade program was to develop design guidelines and implementation strategies for a comprehensive upgrade of the POPS and ground floor of the buildings on Water Street. The upgrades are focused on the area bounded by Fulton Street, South Street, Whitehall Street and Pearl Street, which contains 19 buildings with one or more private public spaces. At over 7.25 acres, POPS represents the greatest opportunity to improve the pedestrian experience along the street. A team of consultants consisting of Beyer Blinder Belle Architects & Planners, Mathews Nielsen Landscape Architects and HR&A Advisors were involved to provide essential expertise in urban design, architecture and real estate.

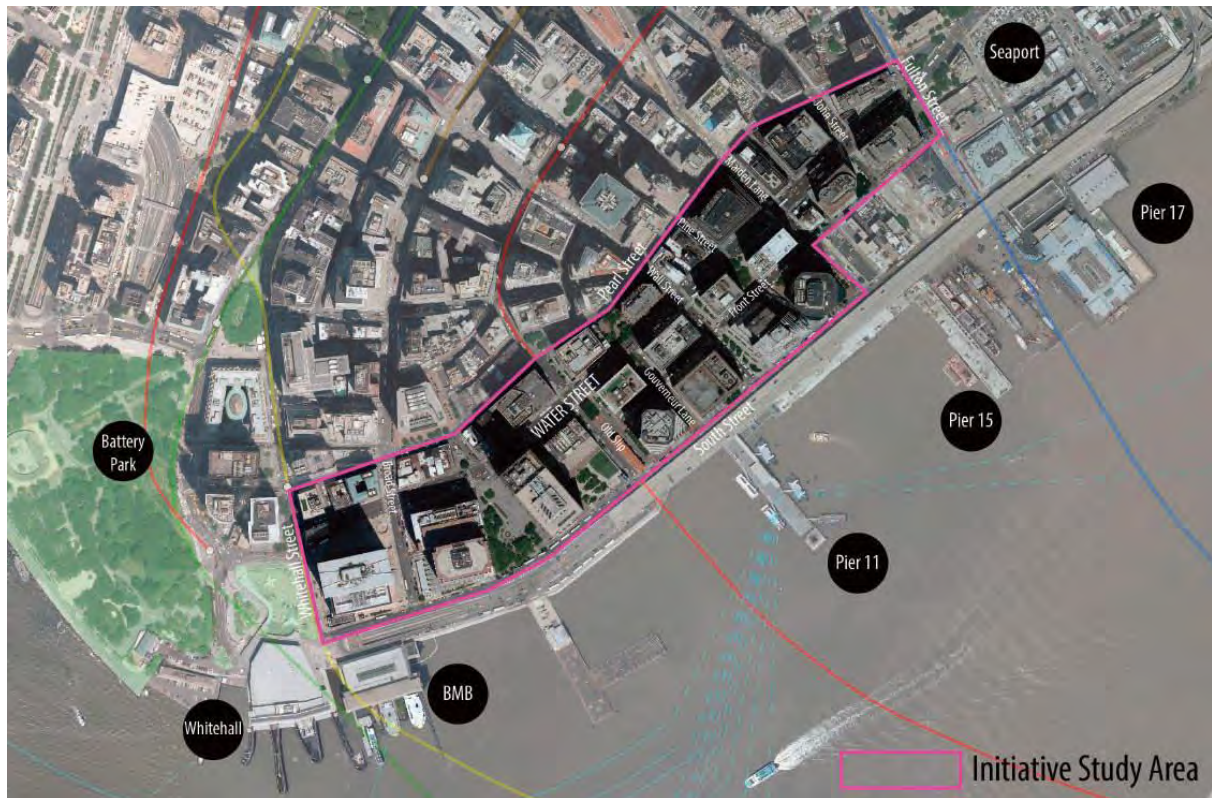


Fig. 3-15 POPS upgrades study plan of Water Street
(Source: City of New York, 2013)

Improvement strategies include tree parts. First is enhancing Water Street's public realm by reimagining the form and function of the privately owned public spaces along the corridor. Second is reactivating Water Street's retail offer to meet the demands of the corridor's changing demographic and urban function. Third is building on other public and private efforts to improve Water Street and Lower Manhattan.

Strong partnerships among the City, property owners, ADNY, and other key community stakeholders will position Water Street as a thriving destination of choice not only for a robust and diversified business base, but also for residents and visitors. A world-class building stock will continue to anchor this destination, which will become more competitive and valuable thanks to an attractive public realm. Two mutually-complementary elements will define this public realm and strengthen Water Street's district identity: first, a well-planted streetscape that shifts the corridor's role from a vehicular thoroughfare to a safe, pedestrian-friendly street; second, attractive and useful privately owned public spaces that provide new opportunities to shop, work, socialize, and relax.

Together, these elements will create new nodes of public activity that combine lighting, art,

seating, and landscaped features that foster a sense of vibrancy and discovery along Water Street.



Fig. 3-16 Pedestrian circulation
(Source: City of New York, 2013)

Despite the high concentration of office workers along Water Street, the Study showed that Water Street does not function as a strong north-south connector for pedestrians. Instead, the pedestrian patterns revealed that evidence of active street life corresponded with the intersection of Water Street and major east-west movements. These intersections are key anchors and destinations along Water Street.

The three intersections—Fulton Street, Wall Street, and Whitehall Street—mark the micro center of “clusters” where the ground floor uses, pedestrian activities, location of building walls, and their relationship to adjacent public spaces together create a pedestrian experience that varies from one cluster to another. Reinventing the entire corridor of Water Street to transform it into a cohesive and distinct avenue may be too tremendous a task at this point, but strengthening the identity of each cluster through improvements in the public spaces and strategic retail infill could contribute to an overall revived identity for Water Street.

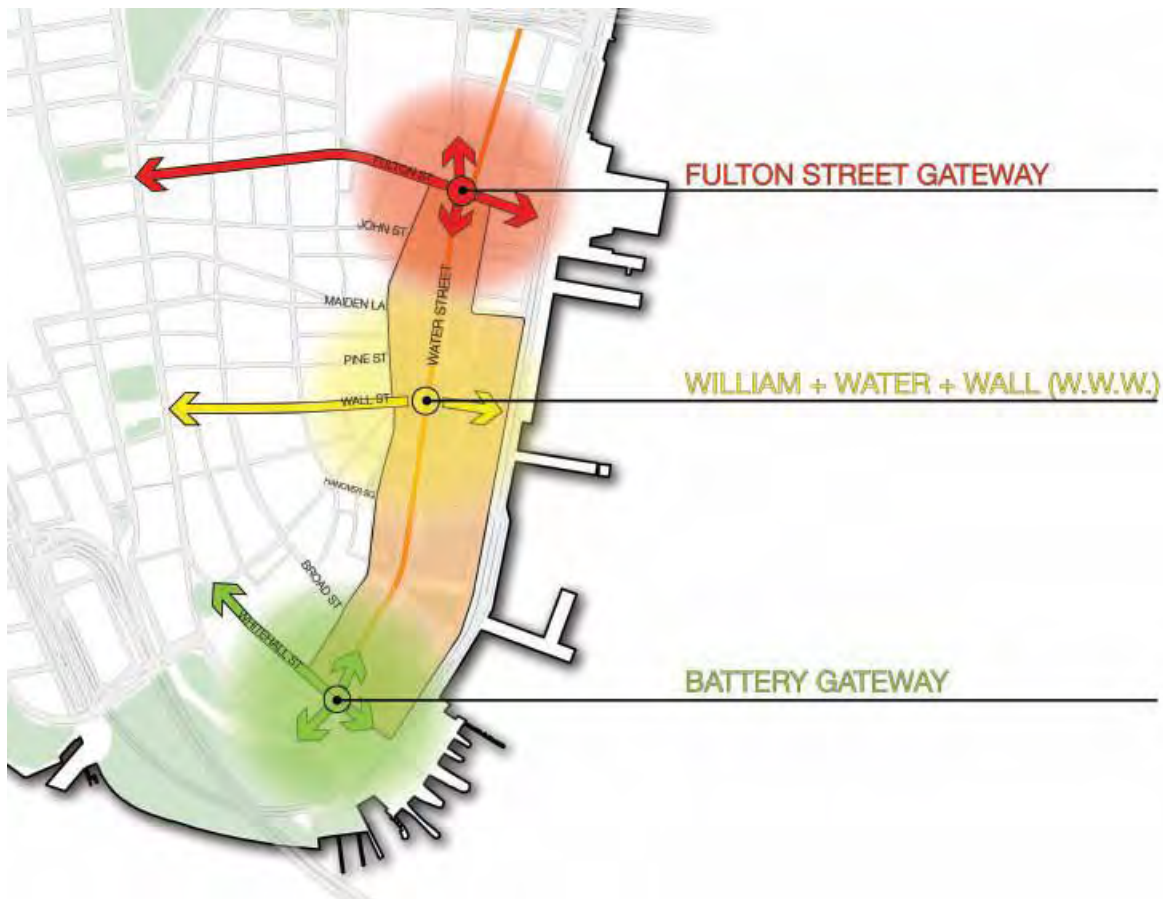


Fig. 3-17 Upgraded spatial structure
(Source: City of New York, 2013)

In developing the design approaches for each of the clusters, four basic design tools were used to guide recommendations: landscape, visual icons, collaboration, and retail. These tools are inherent in many of the public spaces typical of the high density, commercial areas of Manhattan and have proven successful when implemented together.

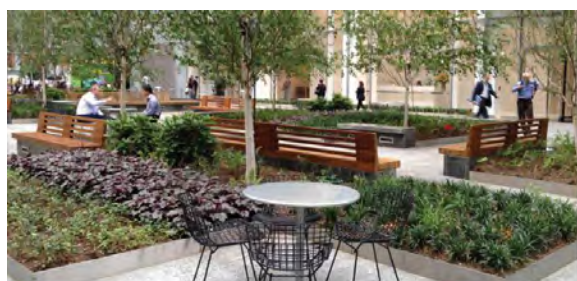
Landscape. Plantings, such as trees, perennials, and groundcover, can soften a space and make it more welcoming. Seating is an important public amenity to create useful and meaningful public spaces. Lighting allows around the-clock activation of a space, as well as improved safety. Quality materials for paving and furnishings contribute to the visual and physical comfort of a space.

Visual Icons. Signage, artwork, interactive installations, and other visual markers help strengthen the identity of a place. Distinctive artwork and landmarks can define a place and create more interest around it.

Collaboration. Public space can serve as a setting for informal meetings and group work. Landscape furnishings such as seating, kiosks, and plantings can be arranged in such a way as

to encourage social interaction and collaboration. Wireless connectivity can also enable such spaces to become meeting places beyond 9am to 5pm.

Retail. Active and transparent retail at the ground floor can increase foot traffic and draw people into POPS. Kiosks and targeted infill of arcades with retail can create new shopping and dining opportunities that attract residents, workers, and visitors alike to Water Street.



Landscape



Visual Icon



Collaboration



Retail

Fig. 3-18 Design tools
(Source: City of New York, 2013)

The Department of City Planning (DCP), the Alliance for Downtown New York (ADNY), and the New York City Economic Development Corporation (EDC) are proposing a zoning text amendment to Manhattan Community District 1's Special Lower Manhattan District (along and near Water Street) to: allow by Chairperson certification and City Planning Commission authorization the infill of existing arcades for retail use and the improvement of existing plazas; allow public events, programs and the placement of publicly accessible tables and chairs within plazas and arcades as-of-right ; continue to allow cafes within arcades by certification. The proposed text amendment would apply to the area generally bounded by Pearl Street and South William Street to the west, Fulton Street to the north, South Street to the east, and Whitehall Street to the south (the "Water Street Subdistrict"). Within this area are 20 buildings with a total of approximately 225,000 square feet of public plazas and 110,000 square feet of arcades that generated more than 2.5 million square feet of bonus floor area.



Fig. 3-19 Water Street POPS Map
(Source: City of New York, 2016)

Arcades are continuous covered areas along a building frontage that are open to a street or plaza, and are free and clear of obstructions. While the Water Street arcades were intended to provide a continuous covered pathway along the street, they set the ground floors away from the sidewalk; are too deep or too narrow; have columns that are too thick or too close to one another; have low levels of lighting; and often dead-end. These issues, together, make the arcades unattractive for pedestrian use and do not contribute to improving pedestrian circulation along the street. Furthermore, by causing the building ground floors to be set back from the sidewalk, ground floor uses have limited visibility and fail to engage passersby, thereby affecting the vitality of these commercial spaces and causing many of the ground floors to be used for unengaging lobby uses instead.

Plazas are public spaces that are open and exposed to the sky and may, depending on the year the space was developed, contain amenities such as seating and trees. The Water Street plazas often lack any planting and are dominated by hardscape; there are few, if any, seating opportunities; are lined with blank walls and lobbies; the largest plazas are too large and do not relate well to pedestrians; and the smallest plazas are too narrow and effectively serve as pedestrian circulation space. These plazas were provided at a time when no amenities were

required; plazas today are subject to improved design requirements that require many amenities such as seating, planting, and retail frontages.

The Fulton Street Gateway marks the northern end of Water Street, at the crossroads of the Fulton Street retail corridor and the South Street Seaport. This intersection is a natural gateway to Water Street, but pedestrian movements are stronger moving east-west between the Fulton Transit Center and the Seaport waterfront. A goal of this gateway is to build on the strong retail character along Fulton Street and in the Seaport area by creating more opportunities for retail and dining experiences that invite people onto Water Street.



Fig. 3-20 Fulton Street gateway plan
(Source: City of New York, 2013)

The buildings in the Fulton Gateway that contain one or more POPS are: 200 Water Street, 180 Water Street, 160 Water Street and 175 Water Street.

The public spaces at 200 Water Street, the majority of which front on Fulton Street, serve as the visual and physical transition between Fulton Street, Water Street, and the South Street Seaport. Moving east along Fulton Street, the wide view afforded by the approximately 3,000-square-foot double height arcade and the 4,000-square-foot plaza offer a clear visual connection to the Seaport and the first sight of Water Street. The strategic location of these spaces offers a tremendous amount of potential for them to serve as the true marker of Water Street.



Fig. 3-21 200 Water Street before & after
(Source: City of New York)

The William-Water-Wall (WWW) node represents the area containing a diversity of public space types, characters, and scales that lends itself to a variety of experiences. The growing residential population to the west meets the established commercial character to the east, creating an area of activity that extends beyond the normal work hours and into the weekend. Wall Street serves as a strong pedestrian connection between the financial core and the waterfront, and the highest concentration of public space along Water Street exists at this node. A goal for this node is to build upon the diversity of public space experiences and to encourage activity beyond normal working hours and throughout the year. Given the many public space types and configurations, each space has the potential to contribute, in its own way, to the identity of an area that encourages meeting, collaboration, and fun.



Fig. 3-22 William-Water-Wall Street gateway plan
(Source: City of New York, 2013)

The buildings in the WWW Gateway that contain one or more POPS are: 88 Pine Street, 100

Wall Street, 110 Wall Street, 75 Wall Street, 95 Wall Street, 111 Wall Street, 10 Hanover Square, 77 Water Street, 32 Old Slip, 7 Hanover Square and 55 Water Street.

The tree-filled plaza at 77 Water Street serves as a key open space link for pedestrians moving between the ferry and water taxi service at Pier 11 and the 2/3 train at Wall Street. The arcade at 77 Water Street has long been a unique space along the street, but, despite its generous size, the space is only lightly used by the public and primarily serves as a pass-through for tenants entering the building lobby. Many elements of the arcade continue to provide a whimsical feel, but in recent years the arcade's moat, which was once a defining feature of the space, has been reduced to a waterless feature.



Fig. 3-23 200 Water Street before & after
(Source: City of New York, 2013)

The Battery Gateway marks the beginning of Water Street at its southern end, at the confluence of State Street, Battery Park, Peter Minuit Plaza, and Water Street. The gateway is filled with open spaces connecting one another from Bowling Green to Water Street. Pedestrian activity is high, with movement from the Whitehall Ferry Terminal, South Ferry 1 train, Whitehall Street R train, and Bowling Green 4/5 trains to destinations in and around Water Street and the Battery. The open spaces on Water Street at this node flank both sides of the street, but provide very limited planting—in stark contrast to the plentiful landscaping found at Battery Park. The opportunity presents itself to continue this green connection across Whitehall Street and onto Water Street in the reimagining of the public spaces in this node.



Fig. 3-24 Battery gateway plan
(Source: City of New York, 2013)

The buildings in the Battery Gateway that contain one or more POPS are: 1 New York Plaza, 2 New York Plaza, 4 New York Plaza. Other open spaces include: Battery Park (DPR), Peter Minuit Plaza (DOT), Whitehall Plaza (DOT), 1 State Street (POPS), Vietnam Veterans Memorial Plaza (DPR).

The monumental building at 1 New York Plaza, recognizable in any photograph of the Lower Manhattan skyline, has an equally unavoidable and expansive plaza at its base. Over 20,000 square feet of the plaza area fronts on Water Street, but this area mostly serves as a pass-through for tenants entering and exiting the building lobby. The existing grade change discourages use of the plaza as a pedestrian pathway to sites further north along Water Street, although the front

building wall location and widening plaza do open views on to Water Street from the south and to the Battery from the north.

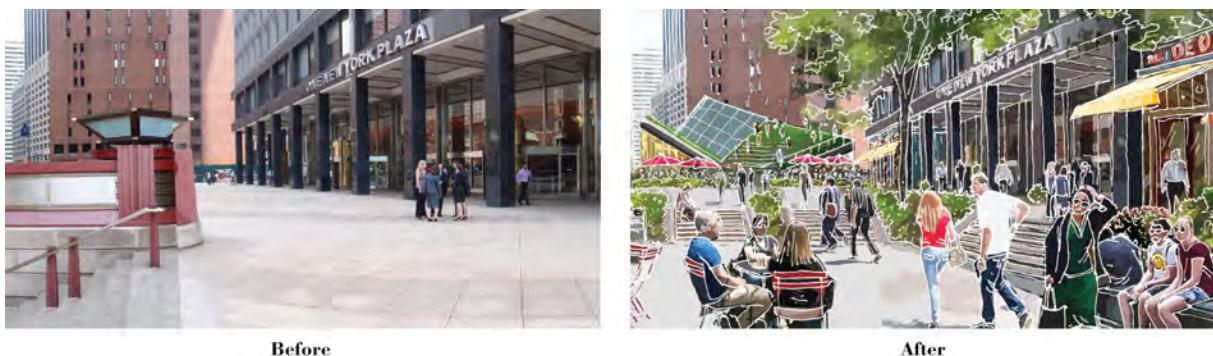


Fig. 3-25 1 New York Plaza before & after
(Source: City of New York, 2013)

3.3 Conclusion

In this chapter, two case studies are selected for specific shared street design and POPS design scenarios, respectively. The cases are studied in depth separately.

The first case chosen is a shared street solution, located in Auckland Central Business District. From the upper level planning of the solution to the specific design strategy. It provides an all-around reference. The second case study is the POPS program in New York. The specific street renovation strategies of the street in detail.

Auckland City has proposed a renovation and enhancement plan for the central business district. The renovated public spaces are linked together through a continuous ring of alleys. This provided the inspiration for the subsequent design. The upgrade of Fort street was designed as a public space to enhance the pedestrian count of the street. The street provides more public space for pedestrians to move and rest in the street. This also brings vitality to the street's businesses. All of this informs my approach to street design. This is a good example of how to design streets better.

The POPS program started with Zoning Resolution, a project that brought more open space to the city. The Water Street POPS program involves different types of open space in the specific street enhancement program. These are used to inform the creation of more public spaces for the street.

Chapter4 Design Rules of Street Under Shared Space Principles

4.1 From Street Design to Urban Design

Street Needs

According to the development history of streets, the different needs of people for streets at each historical stage are broken down into five primary levels, from low to high (see Figure 4-1):

Level 1, safety and health needs: safety for all users, cleanliness and hygiene of the streets, and provision of basic transportation facilities. Level 2, functional needs: meeting all modes of transportation, space for street activities and recreation, and providing various transportation facilities. Level 3, vibrant place needs: creating economic value for the street, encouraging various activities, and promoting a sense of community belonging. Level 4, image personality needs: city image, city branding, tourism promotion, and investment attraction. Level 5, special group needs: pedestrians, bicyclists, people with mobility problems, etc.

The five levels of needs have the following characteristics.

According to the level of ascending, five kinds of needs, like a ladder from low to high. The level of demand for street design in a region is directly related to the level of economic, technological, and cultural development and the level of education of the people in the region. In underdeveloped areas, safety, health, and functional needs are relatively high, while in developed areas, the opposite is the case.

The higher-level needs are reflected when the lower-level needs are completed. The first needs to be satisfied are those related to a person's basic needs, and only after that need is satisfied to do the higher-level needs show their motivational effect.

The five needs can be divided into three levels, among which safety and health needs are in the lower level, functional needs and vibrant place needs are in the middle level, and image personality needs and special group needs are in the higher level, which needs to be satisfied through more interaction with the city.

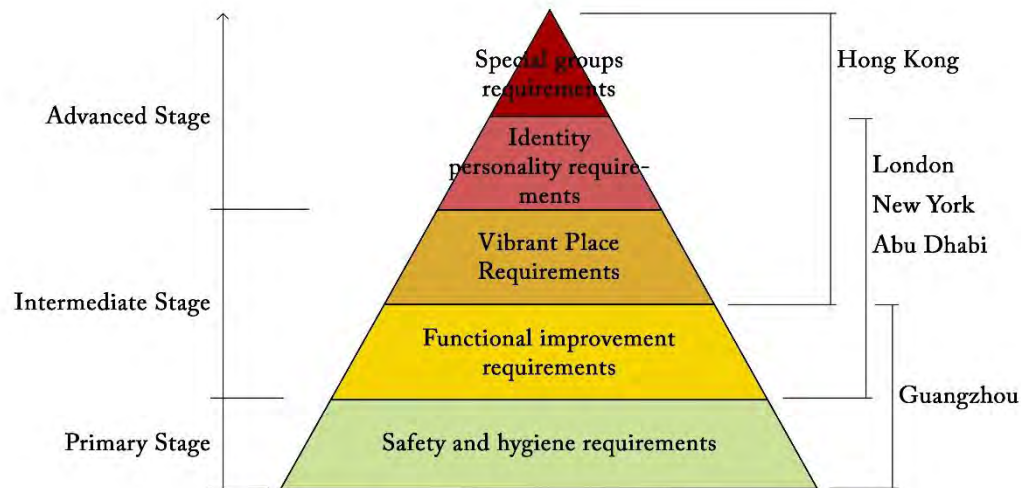


Fig. 4-1 Street Design Needs Pyramid
(Source: Li Wen, Lan Xiao, 2014)

Throughout the world, the latest urban street guidelines are generally developed in a human-centered direction, emphasizing the integration of road facility elements to improve the travel environment and enhance the image characteristics of the city and the travel culture of its citizens. In contrast to the "needs pyramid" of street design, Guangzhou's urban road design and construction have been centered around cars for a long time. However, encouragingly in recent years, it has also begun to focus on people's basic needs again. Guangzhou City clearly put forward: the construction of a clean, tidy, safe, and orderly urban environment is to implement the spirit of the Party Central Committee, the innovation of social governance is the right thing to do, is to practice the 'three strict three real' requirements, to protect and improve the livelihood, is to enhance the image of the city, to create a livable and workable development environment objective Need.

A clean, tidy, safe, and orderly urban environment is the core support of the city's soft power. It is a strong connotation of the concept of green development, not only directly related to people's well-being but also has a fundamental significance in enhancing the city's image, urban charm, and urban competitiveness, attracting high-quality projects and high-end talent to settle and gather. The proposal of 'clean, tidy, safe and orderly' covers five levels of demand from low to high and is the value guidance to promote the transformation of urban roads to urban spaces in Guangzhou. According to the needs of street design and with this goal, we focus on several street designs needed to improve the quality of urban streets.

Street types

Different roadways and street types provide different functions, each unique, and each plays an essential but different role for the surrounding residents. The road design should consider the pedestrian and vehicle traffic functions and focus on the use function of the buildings and activities along the street while ensuring systematic traffic passage. The same road passes through different urban areas' functions, and its cross-section should also have different design arrangements. The activity of the street is highly correlated with the use function of the buildings and ground floor along the street. It is also correlated with the spatial and functional structure of the block. Road levels and street types are classifications based on motor vehicle traffic and activities along the street, respectively, and they can intersect with each other.

The same street type can be paired with different road levels. For example, the landscape recreation street can be a boulevard formed by the primary and secondary roads or a waterfront branch road with a beautiful environment. The corresponding street type will change from section to section for the same road due to differences in function, development pattern, and building form along the route. For example, the corresponding section of a secondary artery passing through a commercial area will become a commercial street. The corresponding section passing through a residential community can become a life service street, and the section near a park water system will become a landscape recreation street.

Due to the vast differences between the two modes of transportation, motorized and pedestrian, in terms of re-speed and fair distance, and the high dependence of street activities on functional facilities along the street, major and minor arterials can often reach over a dozen kilometers in length. In contrast, the street type often changes after a few street segments or even a single street segment.

Street design guidelines for different cities classify street types according to different factors. Shanghai street design guidelines, taking into account the activities along the street, street space landscape features, and traffic functions, the street is divided into five major types of streets: commercial streets, life service streets, landscape and leisure streets, traffic-oriented streets, and comprehensive streets.

The Guangzhou Urban Road Design Manual classifies roads-streets into seven major categories: living, commercial, transportation, landscape, industrial, integrated and specific types. The same road functional type can be matched with different road levels to form a

road-street system containing 23 sub-categories.

Most jurisdictions in the United States classify their streets as 'functionally classified' based on vehicular access and mobility needs. Some states and cities go beyond this classification to classify streets into a broader 'typology' that responds not only to the context of the vehicle network but also to other networks (such as transit and bicycling), land use, and environmental factors. Such a classification is intended to provide a simplified planning framework to expedite the street design process. Due to the complexity of its street network and limited right-of-way, New York City does not currently classify its streets into this category. However, the five following broad street types suggest that the design of streets can be considered in an integrated manner. Some therapies, such as boulevard therapy, have been used extensively in New York City and around the world; other innovative designs, such as Slow Street, have been used successfully elsewhere but have not yet been adopted by New York City.

Most streets are, and will continue to be, variations on the famous general street design - one or more roads open to mixed traffic with sidewalks and curbs. This type of street offers excellent flexibility by design parameters such as speed, allowing for different design and operational characteristics of the street. And one-way versus two-way operation; number and width of travel and parking lanes; use of medians, constraint extensions, and other geometric features; exclusive or preferential facilities for buses and cyclists; and choice of street materials and furnishings. New York classifies streets as General Street, Boulevard, Slow Street, Transit Street, and Pedestrian-Only Street.

Table 4-1 Classification of streets in different cities

City	Document	Type
Shanghai	Shanghai Street Design Guidelines	Commercial street Streets along the street for retail, restaurants and other commercial-oriented, with a certain level of service capacity or business characteristics
		Living and service street Streets along which are dominated by lifestyle-serving businesses serving local residents, small- and medium-scale retail, restaurants and other businesses, as well as public service facilities.
		Landscape and leisure street Waterfront, landscape and historical features are outstanding, along the street set up a concentrated scale of leisure activities facilities
		Traffic-oriented street Streets with mainly non-open interfaces and strong traffic functions
		Comprehensive street Streets with a high degree of mix of street segment functions and interface types, or streets with characteristics of more than two types

Guangzhou	Design Manual Omnibearing of Urban Roads in Guangzhou	Living street	The residential portion of the site, usually located in the urban center, is dominated by lifestyle-serving businesses, small- and medium-scale retail, restaurants and other commercial and public service facilities serving local residents, and the traffic characteristics are mainly access traffic.
		Commercial street	Roads along the road are usually commercial service facilities land, is mainly commercial service facilities of the same kind gathered, with a certain level of service or business characteristics of the road, the traffic characteristics of both through and access traffic
		Traffic-oriented street	This type of road emphasizes traffic characteristics as the main factor, carrying motor vehicles dedicated to medium and long distance through traffic with high speed. The road is dominated by non-open street interface along the road, and large traffic attraction points are restricted or prohibited on both sides
		Landscape street	Along the distribution of park green space, protective green space, waterfront green space and other urban open space land, as well as the historical style features outstanding, set along the road into a concentrated scale of leisure activities facilities. Slow-speed through and in-and-out traffic is the main
		Industrial street	It is mainly located in areas with a high concentration of industrial land and storage land, and is adapted to the loading and distribution needs of wholesale, construction, processing and logistics service enterprises. Traffic characteristics are considered for large vehicle traffic and unloading, with less pedestrian roads
		Comprehensive street	Roads with a higher mix of land types and interfaces, with more diverse land uses along the road than other basic types, supporting a diverse mix of residential, office, recreational, retail and other street services, or roads with characteristics of more than two types, with strong through and access traffic
New York	Street Design Manual	General street	With a mixed roadway, curbs, and sidewalks, General Streets are the most prevalent street design and can be tailored to serve both local and through street contexts
		Boulevard	A wide street with multiple roadways and medians and an emphasis on greening and design quality
		Slow street	A local street which makes extensive use of traffic-calming measures to discourage vehicular through-traffic, reduce vehicle speeds, and green and beautify the streetscape, creating a comfortable environment for bicycling and walking
		Transit street	A street for exclusive or near-exclusive surface transit (bus) use or where transit operations are given priority
		Pedestrian-only street	A street exclusively for pedestrian use

4.1.1 Pedestrian Network

Desirable routes

In a well-planned pedestrian network that features different types of streets with different street patterns. These are walking routes that connect different destinations. Such a walking network ensures that several destinations necessary for daily life, such as schools, local shopping malls, restaurants, transportation stops, etc., can be reached within walking distance. The structural characteristics of urban residents' travel modes are governed by their choice of

travel mode; a combination of factors influences each. Scholar Hu Huaying proposes six factors that influence the way residents travel policy factor, public transportation factor, private transportation factor, travel factor, city layout factor, and socio-economic factor.

While there is no avoiding the use of public transportation or automobiles for long trips beyond their neighborhoods, appropriate street patterns, block sizes, and land features can encourage opportunities for walking and enrich the overall street level. Whether in urban or suburban areas, it should be possible to provide walking options for trips such as from the office or home to the local mall, playground, park, or other local services, without needing vehicle travel.

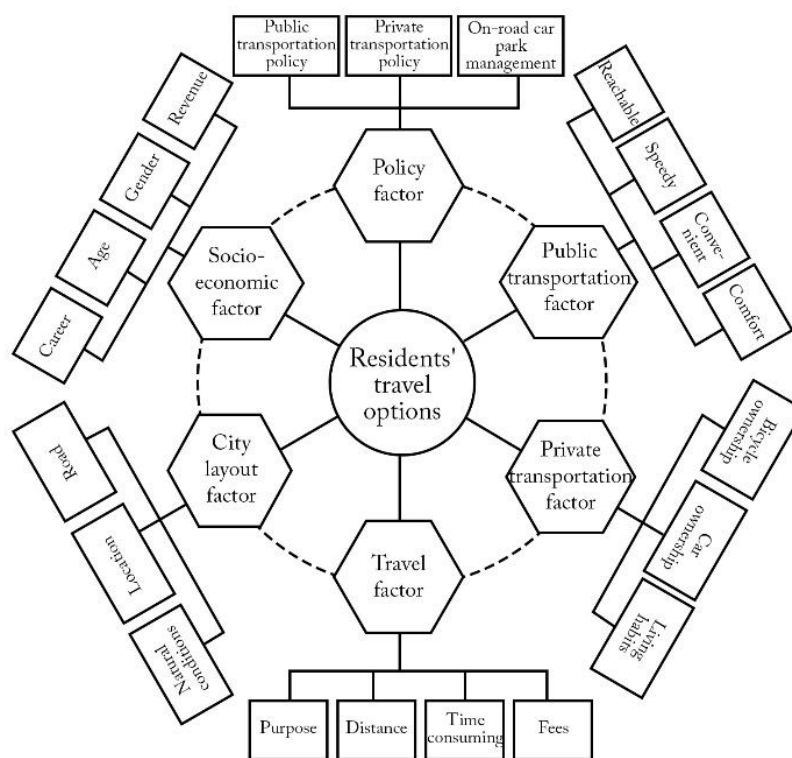


Fig. 4-2 Correlative factors affecting the choices of trip modes
(Source: Hu Huaying, 1990)

Therefore, to encourage walking, it is crucial to consider the starting point and destination of most walking trips when developing land uses, which is what our country means when promoting 15-minute living circles in communities. Within a 15-minute walking distance, we focus on the daily "food, clothing, housing, and transportation" of residents and consider the differentiated needs of different types of residents. Under the unified planning objectives, concepts, and principles of action, formulating different policies for the three types of communities: newly built, built-up, and stocked, according to the location and development

situation. That includes schools, local stores, restaurants, markets, and parks within this circle of life.

By encouraging and creating these key destinations and the ideal routes, urban planners and designers can create appropriate networks and hierarchies considering the type of city and the local development conditions. Mapping connections to destinations within a 15-minute living circle helps designers to keep track of the more extensive pedestrian network, improve the condition of the existing physical environment, and decide which sidewalks need to be prioritized for investment in construction.

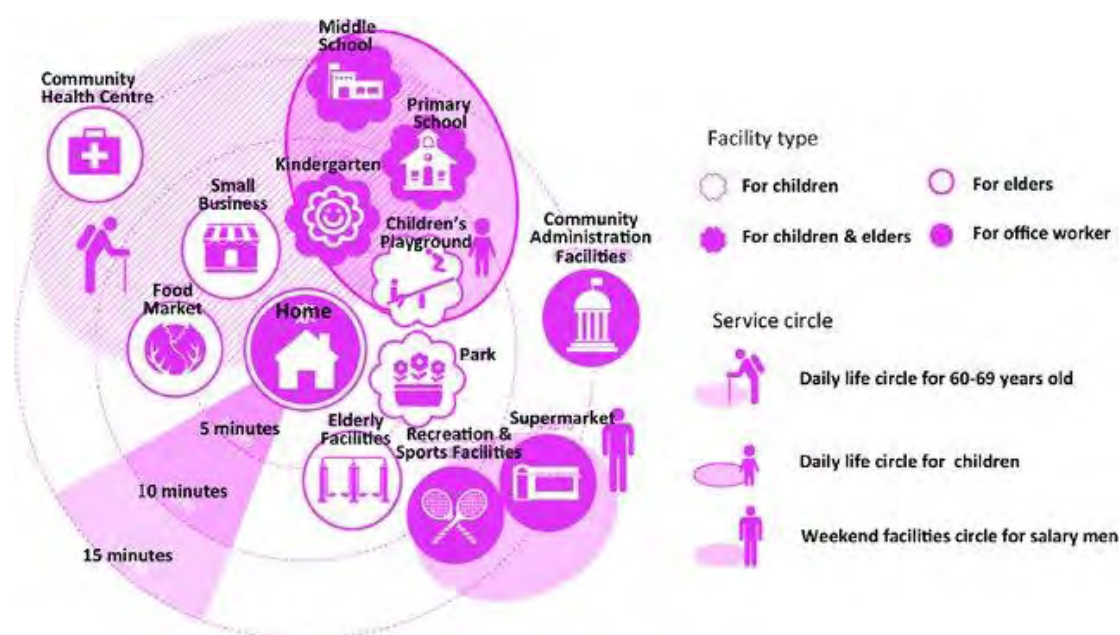


Fig. 4-3 Facilities' distribution of 15-minute community life circle
(Source: Shanghai Urban Planning and Land Resources Administration Bureau, 2016)

It provides residents with walkable destinations and safe, continuous, and fun trails that can considerably impact individuals incorporating physical activity into their lives. Encourage walking and a healthy lifestyle.

Step 1: Identify key destinations within a 15-minute living area

The draft Guangzhou Territorial Spatial Master Plan (2018-2035) proposes that by 2035, the main urban area, Nansha sub-center, and peripheral urban areas should achieve 90% coverage of community public service facilities such as health, education, culture, sports, and elderly care within 15 minutes walking distance. Accordingly, the above-mentioned public service facilities are regarded as critical destinations. Careful consideration is given to the existing functions within the coverage of the design site, and appropriate functional land is added or

reduced to ensure the diversity of functions within the living circle and the balanced distribution of each function.

1. Determine the scope

The '15-minute community living circle' service distance is the full path that residents can take within a 15-minute walk from the starting point of the residential building. Generally, the walking speed of adult males, adult females, the elderly, and children are 4.5km/h, 4.0km/h, 3.5km/h, and 4.0km/h, respectively. After considering the walking speed of various groups of people, the coverage area of the '15-minute community living circle' is determined as 1000m in this paper.

2. Classification of public service facilities

In this paper, the public service facilities in the '15-minute community living circle' are divided into nine categories, namely culture, education, fitness, medical care, transportation, shopping, dining, leisure, and elderly care, with the starting point of meeting residents' demand for urban public service facilities and providing them with more quality public services.

3. Coverage criteria

The 15-minute community living circle 'coverage standard refers to whether various public service facilities meet the standard requirements of the 15-minute community living circle', that is, whether such facilities can be reached by walking 1000m along the pedestrian network from the residential buildings. In determining whether the 15-minute community living circle covers these facilities, we consider the following points: first, whether there is the possibility of substitution between various public service facilities; second, whether the public service facilities are necessary to meet daily life; third, for cultural, fitness, transportation, leisure, and elderly facilities, as long as there is one of the facilities in the secondary classification, they can meet the needs of residents' life, that is, they are considered covered. '

Considering the above, the criteria for coverage of various facilities are as follows: for cultural facilities, one of the science and technology museums, libraries, cultural palaces, exhibition halls, art galleries, and museums can be 'covered'; kindergartens and elementary school can only be recorded as 'covered' for educational facilities if they exist at the same time.

In fitness facilities, the presence of one of the gymnasiums, stadiums, and fitness venues can

be 'covered. ' In medical facilities, the presence of one of the general hospitals, disease control centers, specialized hospitals, community health service centers, and clinics and the presence of pharmacies can be 'covered. '

For transportation facilities, the presence of one bus station and one subway station is 'covered. ' Only one must be present in shopping centers, supermarkets, and convenience stores, and a food market must be present for the shopping facilities to be 'covered. ' For dining facilities, the presence of one Chinese or foreign restaurant and the presence of a fast food restaurant is 'covered. ' In the case of leisure facilities, the existence of one of the park, square or scenic spot can be 'covered. ' In the case of institutional and community elderly care facilities, the existence of one can be recorded as elderly care facilities 'covered.'^[28]

4. Complement the missing functions

After analyzing the site regarding the coverage criteria mentioned in the third point, the missing functions in the site are identified. The approximate functional distribution of the land is based on the site's conditions, the existing functional distribution, and the functional distribution around the design scope. In addition, it is also necessary to consider the site's positioning in the city, whether it needs to provide the corresponding lack of functions for urban development combined with the overall development positioning of the city. The future development of the site is to make a specific positioning of the function to determine the dominant function of the site.

The following two points can be considered in the preliminary analysis: First, the development orientation of the site. Suppose it is positioned as a CBD of the city. In that case, business functions should inevitably be the primary function in the site, leaving enough space for business offices and taking into account the supporting functions of business functions. Suppose it is positioned as a residential community. In that case, the primary consideration is to provide supporting facilities for residential functions, increase living support functions and public space, support services for the elderly, and space for children's activities.

The following two points can be considered in the preliminary analysis: First, the development orientation of the site. Suppose it is positioned as a CBD of the city. In that case, business functions should inevitably be the primary function in the site, leaving enough space for business offices and taking into account the supporting functions of business functions. Suppose it is positioned as a residential community. In that case, the primary consideration is to provide supporting facilities for residential functions, increase living support functions and public space, support services for the elderly, and space for children's activities.

Step 2: Mapping the pedestrian network

Walking is good for physical and mental health, but admittedly it is tiring, leading pedestrians to choose the more convenient path. We must admit that people always tend to site a direct route and path. Only the presence of tremendous obstacles, such as expressways that cross the road, massive structures that block the way to the road, etc., will interrupt the direct path selection.

Some surveys also show that people take the initiative to create a straight and easy path. This has occurred on many campuses where people have intentionally created the shortest path. As shown in the figure below, the shortest distance route between two points is blocked by the green area due to the road design, and the pedestrian path is planned along with the vehicle path outside the green area at the four corners.

Since the two corners of this four-cornered green connect the school gate to the student street and the student dormitory, while the paved sidewalk runs along the outer side of the green, causing great inconvenience to students and faculty. As a result, many people chose to ignore the paved sidewalk and instead trod a path along the straight line between the two points. As the number of people taking the shortcut grew, the grass at that location became a visible path. Eventually, the university paved a new sidewalk on that path.

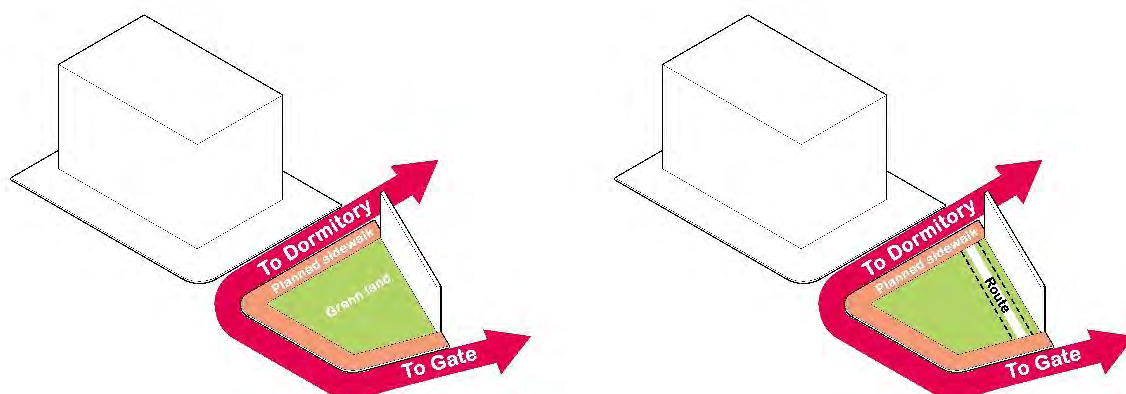


Fig. 4-4 Designed paths vs. paths chosen by pedestrians

A similar model for Campo in Siena is mentioned in Jan Gehl's *Life Between Buildings*, even though this means that for 135 meters, the pedestrians must first walk 3 meters down the sloping pavement and then 3 meters up. Jan Gehl also mentioned that in trafficked streets, the tendency is to follow the shortest route instead of the safest one. Only where automobile

traffic is hefty, where the streets are very wide, or where pedestrian crosswalks are very well placed is there effective use of cross- walks. ^[1]

Taking into account this characteristic of human walking, when mapping walking paths, we try to open up the paths between destinations that are frequently reached in daily life as much as possible.

1. Key destinations

Destinations are ranked according to the results of resident travel surveys, prioritizing routes between destinations frequently reached in daily life. A questionnaire can be used to rank these locations by asking residents to choose the number of times they patronize leisure, recreation, fitness, and other weekly services in their daily lives. Destinations frequently reached have a higher degree of importance, and connecting communities to these destinations with straight lines creates the ideal linear path. When conducting the survey, it is necessary to consider the age of the community enough to become. If the elderly population is large, it is necessary to focus on the daily travel destinations of the elderly, reflecting the aging-friendly design of the site.

Schools, transportation stations, shopping malls, and recreational facilities are a few destinations to focus on. In people's daily life, commuting on weekdays, children going to and from school, grocery shopping, and recreation are a few essential activities. The destinations associated with these activities form the key destinations. According to Guangdong Life Data Research, residents' daily activities in first-tier cities are mainly for work life. The survey divided the purpose of travel into four categories, work morning, leisure and recreation, daily life, and travel and tourism. The results show that work business accounted for the highest percentage of 39.31%, leisure and entertainment accounted for the second highest percentage of 31.34%, daily life accounted for only 15.7%, and travel and tourism accounted for 13.65%. Based on these four categories and then divided into 15 sub-categories, the results of the analysis show that work business under 15.75% for companies and enterprises, leisure and entertainment under the significant category of shopping amounted to 18.51%, daily life under education and training accounted for 6.14%, travel out of the transportation hub accounted for 9.01%. The specific data is shown in the chart below.

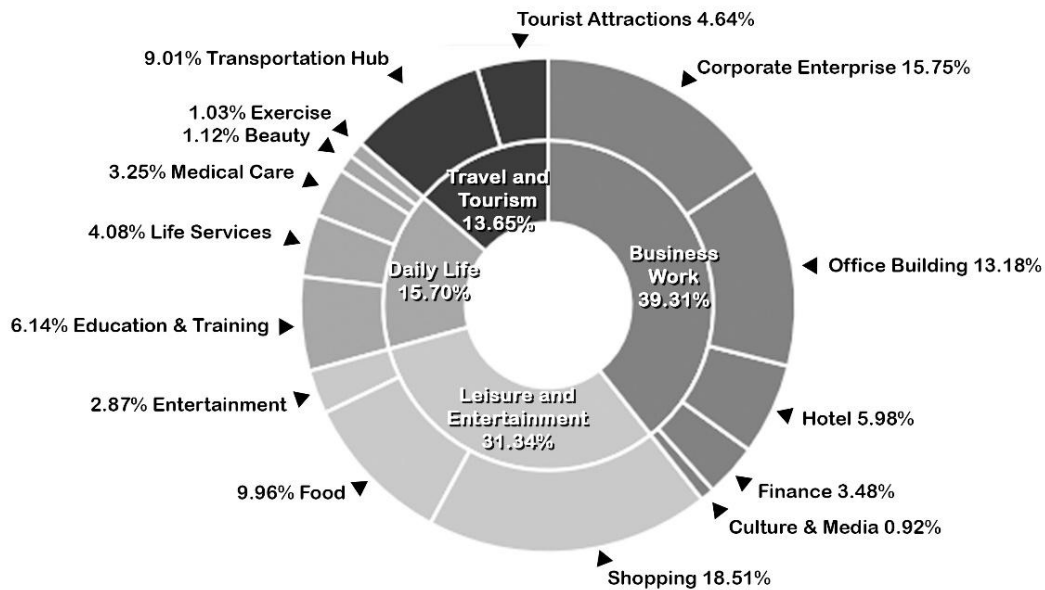


Fig. 4-5 Daily travel purpose of Guangzhou residents

It can be seen that the residents' daily life is dominated by work and leisure. When identifying key destinations, specific travel destinations can be understood through travel surveys of residents near the site. In the subsequent design study of this paper, the key destinations were identified as subway stations, schools (including elementary schools and kindergartens), parks, shopping malls, and dining areas by combining the residents' travel questionnaire results.

2. Draw the path

The first is mapping the paths that already exist on the site, where the walking paths to reach the critical destinations of daily life are mapped out on a site plan.

The first thing that analyzes the road conditions of these paths is the continuity of walking paths, the continuity of bicycle paths, and other slow traffic flow. The second is the convenience of identifying the paths. After the paths are mapped out, the walking distance and convenience of the paths can be identified. Whether there is a more convenient path or what obstacles exist on the better path causes the path to change. Identify barriers that exist in the path. The third is to analyze the road conditions on the path, including the green cover, pavement condition, sidewalk width, and other physical conditions related to walking comfort. The fourth is to identify the paths that need improvement.

In this regard, on the one hand, it is necessary to pay attention to whether some paths are

missing due to the lack of critical destinations on the site, in which case it is necessary to consider whether there is a need to supplement this function when the site is functionally laid out. On the other hand, paths with poor walking conditions or severe detours will need to be redesigned in the next step of the road design.



Fig. 4-6 Key destinations and desirable routes
(Source: City of New York, 2013)

4.1.2 Vehicle Network

Dividing roads into primary, secondary, and branch roads made using cars easier and difficult for other modes of transportation. Although the car-oriented street design is gradually shifting to human-centered design, the automobile is still the primary mode of transportation, and the use of motor vehicles cannot be neglected when designing streets. What is to be done here is how to make motor vehicles give up more space to other modes of transportation while ensuring the conditions for motor vehicles to pass.

Encourage transit vehicles to divert from receiving at successive nodes to create a suitable environment for motor vehicles and not allow higher traffic volumes in sensitive street areas, structuring some transit vehicles using street turns and diversions, and encouraging them to create shared street networks and slow zones with community scale through wayfinding and insensitive routes. A well-constructed vehicular network enables connectivity between different communities and avoids vehicles entering high-density areas. The availability of large public spaces in city centers and other destinations and the reduced reliance on small cars can help boost public transportation capacity and ensure more efficient trips.

Step 1: Mapping motor vehicle travel network

The existing vehicular system network of the site is sorted out, the roads are classified

according to different road classes, speed limits, etc., and the connectivity of the existing vehicular network is analyzed. Special attention must be paid to roads in low-speed and restricted traffic zones. Observe and record each road's traffic volume and congestion at each time of the day, and mark the time of day and the corresponding road that will generate congestion.

Analyze the causes of congestion in the surrounding traffic conditions of these congested roads. Enumerate the problems in the site's current vehicular network. Taking into account the paths of the pedestrian walk network, a new travel network is drawn to connect the site's carriageway with the site's peripheral urban roads, forming a more extensive urban traffic network that facilitates the timely traffic transition from the site to the urban traffic network. Designing car-free zones, low-speed zones, and restricted traffic zones in the new vehicular network, with strategies to allow individual motor vehicles to enter the site without impeding the safety and mobility of other traffic patterns.

Step 2: Determine the lane

After the formation of the motor vehicle network, it is necessary to take into account the width of the street, the road grade of the connected city road, the road type, the reserved width of the sidewalk, and other factors, and by considering the limitations of these factors, the width of the lane and the number of lanes are determined.

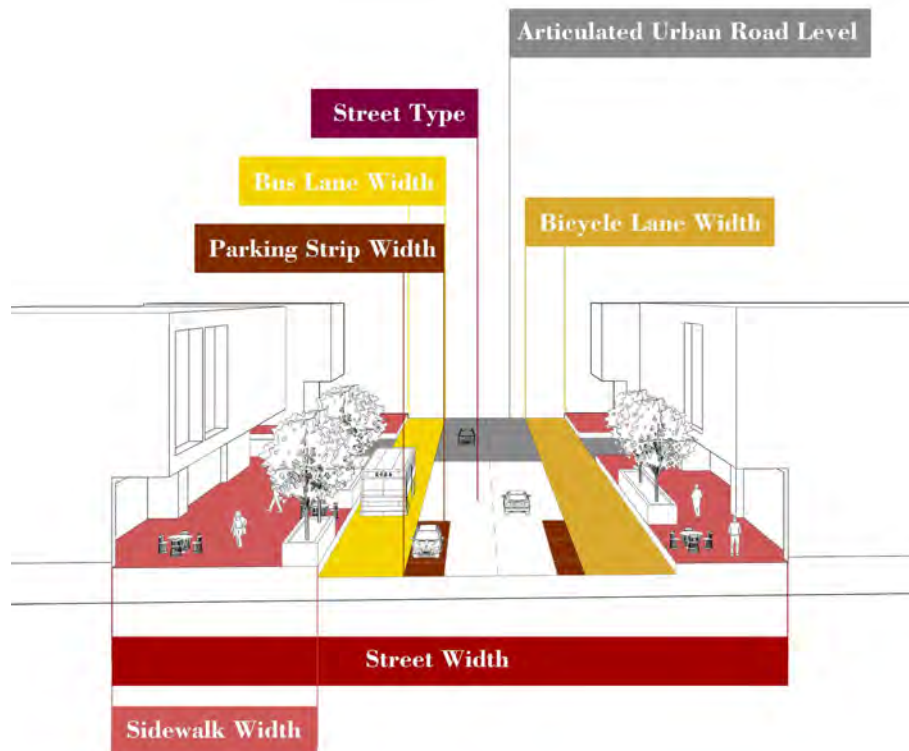


Fig. 4-7 Elements affecting the width of the street

Determine the number of lanes on each roadway after considering all things. The width of each lane that is too wide for the standard highway lane width can result in traffic violations for most of the day if speeding during off-peak hours or vehicle congestion during peak hours. Reducing the lane width to 3m or less ensures safe driving in an urban street environment. In cities, a 3m wide roadway is more appropriate, positively impacts street safety, and does not interfere with traffic operations.

For designated truck or public transportation routes, a 3.3m wide travel lane can be provided in each direction. In exceptional cases, narrower travel lanes of 2.7m-3m can be used as straight lanes in combination with turn lanes. Lanes wider than 3m are not recommended, leading to mindless speeding, double parking, and valuable space in other lanes. Wide travel lane restrictive strategies have no place in an urban space where space is at a premium. Studies show that narrower lanes can effectively manage speed without reducing safety and that there is no correlation between wider lanes and safer streets. In addition, wide travel lanes increase the probability of contact between pedestrians and traffic vehicles and pedestrian crossing distances, and lane widths should be set based on the overall street configuration.

Step 3: Determine vehicle speed

Speed management reduces the likelihood of severe or fatal traffic crashes. Speed

management creates a safe environment for pedestrians to cross the roadway, walk along a corridor, or share space with bicycles and motor vehicles. For bicyclists, lower speeds reduce the incidence of overtaking incidents, improve visibility, extend response times, and significantly reduce the severity of crashes. Lower and consistent traffic speeds reduce noise and air pollution caused by acceleration and deceleration. Collisions under 30km/h are not fatal to pedestrians.

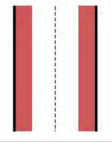

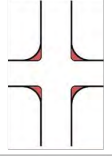

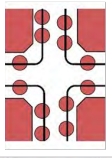

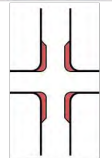

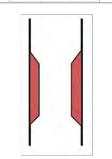

Younger or older users should travel at lower speeds in collisions with larger vehicles. For vulnerable groups and heavy vehicles, there are no non-fatal collision speeds. Reduce turning speeds at crosswalks to 10km/h, and if bicycles share lanes with motor vehicles, reduce the maximum speed to 30km/h. Streets may allow speeds of 40km/h if human-motor vehicle interaction is limited to controlled intersections. The target speed should be set low enough to ensure that even unqualified drivers do not cause injury to pedestrians.



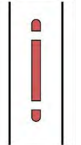

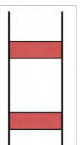

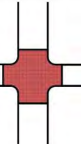

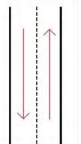



Fig. 4-8 Target speeds and context
(Source: Global Street Design Guide, 2016)

On roads in living areas, active commercial areas, near schools, and shared streets, vehicle speeds should be reduced appropriately to ensure the comfort and safety of pedestrians on the street. Several strategies can be used to reduce vehicle speeds.

Table 4-1 Traffic Calming Strategies

Strategy	Layout	Examples	Detail
Road diet		<p>The road next to Unhyeon Palace</p>  <p>Before After</p>	Narrow lanes reduce speeds and minimize crashes on city streets by way of reducing the right-of-way and making drivers wary of traffic and adjacent users. Use the additional space for pedestrian space, cycle facilities, or green infrastructure.
Reduced corner radius		<p>New Westminster, British Columbia, Canada</p>  <p>Before After</p>	Narrowing corner radii reduce vehicle turning speeds as well as pedestrian crossing distances. Minimizing the size of a corner radius is critical to creating safe and compact intersections.
Consecutive buildings and trees		<p>Main Street, Greenville, South Carolina</p> 	Buildings at the right-of-way with articulated facades and windows indicate that a street is in an urban environment, not a highway.
Gateway treatments		<p>Bulb outs at a midblock crosswalk in Canada</p> 	Gateway treatments alert drivers that they are entering a slower area. This treatment may include signage, entry portals, speed tables, raised crossings, and curb extensions.
Pinchpoints		<p>Stackpool Road, Bristol</p>  <p>Before After</p>	Pinchpoints narrow the roadway at a mid-block point. They can be combined with speed tables to create high-quality pedestrian crossings. They can also be used on low-volume, two-way streets to require facing motorists to yield to one another.

Chicanes and lane shifts		NW 55th Street and 3rd Avenue NW in Seattle, Washington 	Chicanes and lane shifts use alternating parking, curb extensions, or edge islands to form an S-shaped path of travel which lowers vehicle speeds.
Medians and refuge islands		Port Townsend, WA 	Raised center medians and pedestrian refuge islands can be used to reduce lane width for vehicles, even on relatively narrow streets. They can also be used to organize traffic at intersections or to block access at strategic points.
Speed humps, speed cushions, speed tables			Speed humps are formed by raising sections of the road in a sinusoidal shape, typically 10–15 cm high and 4–6 m long. Speed cushions are similar to speed humps, but have wheel cut-out openings to allow large vehicles like buses to pass unaffected while reducing car speeds. Speed tables are similar to speed humps, but have a flat top, typically 6–9 m long.
Pave materials and appearance		Beaufort Street 	Pavement appearance can be altered through unique treatments that add visual interest, such as colored or pattern-stamped asphalt, concrete, or concrete pavers, which can be used to make other traffic calming techniques more noticeable to drivers. Pedestrian crossings and intersections can be painted to highlight crossing areas.
Two-way streets		Astoria 	Two-way streets, especially those with narrower profiles, encourage motorists to be more cautious and wary of oncoming traffic.

(Source: Global Street Design Guide, 2016)

4.1.3 Public Transportation Network

From small public vehicles to fixed-route bus and rail services, public transportation provides a sustainable and efficient way for urban residents to get around. Public transit complements walking and bicycling, enabling longer trips to be completed without a large number of private vehicles. Public transit services increase reliability and ridership, attract more activity, and enhance street vibrancy. Therefore, careful design and operational decisions are needed to keep public transportation operating in a safe and reliable pedestrian-friendly environment that serves all users.

Step 1: Add or remove stops

First, draw a map of the site's original bus routes and analyze these stations' radiation ranges. In the site of the new residential areas, office areas, commercial areas, and other places with a high concentration of people, the original station service area can not cover all the sites. There

is a need to add new stations and extend the route to increase the service radiation range. Because of the site function adjustment, part of the station service capacity is reduced. It is necessary to remove the station and re-adjust the bus route. Enable city residents to use public transportation more conveniently. Provide quality service around bus stops to increase public transportation ridership. Provide high-quality public spaces, pedestrian-friendly streets, comfortable station designs, and complimentary transfer modes to attract riders further and make public transportation more beneficial to citizens.

Step 2: Mapping the network

Public transportation network planning directly influences street design, and streets should prioritize space allocation for major routes with high service demand. Public transportation can provide convenient and reliable service based on the geography and priorities of the street. Prioritizing public transportation with dedicated street facilities contributes to a fast and efficient urban transportation mobility system. Additional street space can be available to its users, contributing to sustainable development goals. Multiple public transportation systems can operate simultaneously on city streets to create a comprehensive and reliable public transportation network.

Integrated public transportation services can extend the network's connectivity, increase the area covered by public transportation, and encourage a shift in transportation patterns. Designing quality interchange points promotes people to transfer between different types of public transportation, such as BRT and local public transportation.

Provide a certain amount of space for public transportation to provide safe, reliable, and centralized service. Bus-only lanes can reduce delays caused by mixed traffic operations and improve the system's overall efficiency and capacity. Dedicate lanes for public transportation on necessary roads to ensure the service level of public transportation.

4.1.4 Bicycle Network

As a green and environmentally friendly way to travel, bicycles can reduce the use of small cars and alleviate problems such as traffic congestion and air pollution. At the same time, cycling can exercise, catering to the residents' pursuit of a healthy lifestyle. However, the right-of-way for bicycles on the road is squeezed by motor vehicles, resulting in a lack of safety and comfort for bicycle travel. In order to promote bicycling, streets should be designed with a comprehensive bicycle network for cyclists. Bike lanes should meet cyclists'

social and daily needs and accommodate long-distance commuting. Bike lanes should accommodate all cyclists, ensure comfort, and serve bicyclists from 5 to 95 years of age. ^[29]

Step 1: Bicycle docking stations

The arrangement of bicycle docking stations should consider the destination of the active population on the site using bicycles, residential areas, the location of living services, and other locations. Set up reasonable stopping points to make it easy for bicyclists to reach their destinations. Furthermore, ensure that all residential areas are covered, allowing cyclists equitable access to bicycle facilities and other infrastructure. When planning the bicycle network, set up bus stops, schools, parks, markets, community centers, and office areas as destinations, and install docking points at these locations. Interviews and research can also be conducted with residents within the service radius of the site to understand the actual needs of residents and where docking stations are needed to facilitate their bicycle travel.

Step 2: Mapping the network

After setting up the docking stations, the bicycle travel network will be mapped. The bicycle network should be integrated with the site's transit and pedestrian networks. In the bicycle network, the needs of all cyclists are fully considered, and the needs of safety, comfort, and accessibility are fully guaranteed. Also, future capacity and modes are to be considered as part of the consideration to meet future usage needs.

4.2 A Shared Street

After completing the functional configuration of the site and the design of the network of various transportation modes, it is time to think carefully about the street design. In this research, instead of establishing new classification criteria, the street classification is based directly on Guangzhou city's criteria for street classification. The reasons for this are, on the one hand, to classify the streets according to the existing classification standards and to generate the corresponding street elements. That can directly guide the transformation and construction of other streets in Guangzhou; on the other hand, this research focuses on shared streets, and more attention will be paid to the research and elaboration of the street-sharing model.

Each street has the main types of users and the flow of vehicles. These indicators will

determine the scale of the street; the needs and purposes of different types of road users determine the function of the street. Different needs and purposes, in turn, affect the type of space; the type of space further determines the spatial form of the street's function determines the street's type, and the type of street also affects the spatial form of the street. The spatial form of the street is divided into four components according to the New York Vibrant Street Design Guide, according to which the four components are specifically explained and illustrated. These elements are interlocked and step-by-step to form the specific design of the street.

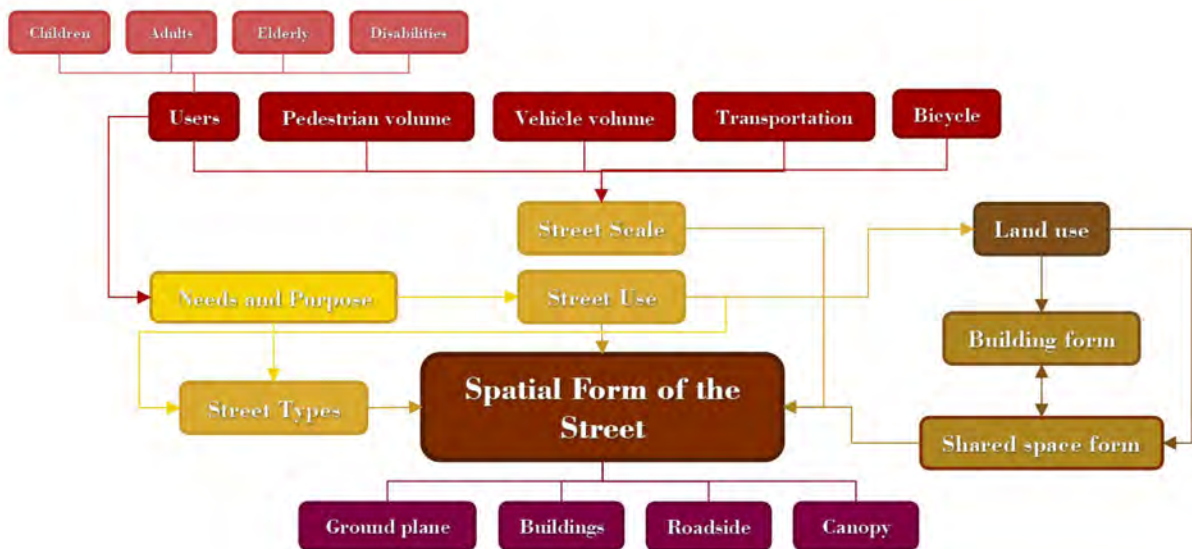


Fig. 4-9 Factors influencing the design of street spatial form

Physical elements

According to the understanding of street in New York Active Design, the street is divided into four parts, each of which has physical elements. Each component of the street will have a different specific design. These elements may overlap in the four component classifications of the street. For example, the street tree is an element that exists under the ground plane and canopy classification. Because the street tree's location and the pit's size affect the design of the ground plane, the tree forms a natural canopy on the street that affects the design of the canopy.



Fig. 4-10 Physical elements of street
(Source: City of New York, 2013)

Users on the streets

The design of the street is based on the activity characteristics of the prominent participants in the lifestyle street. The street participants are pedestrians, vendors, non-motorized vehicles, and public transportation. Among the pedestrians, different types of pedestrians must be considered, including the elderly, disabled, and children. These individuals have different speeds on the street.



Fig. 4-11 Speed of different people on the street
(Source: Global Street Design Guide, 2016)

The design of the street is considered according to the characteristics of the activities of the prominent participants in the living street. The street participants are pedestrians, vendors, non-motorized vehicles, motorized vehicles, and public transportation. Among the pedestrians, different types of pedestrians must be considered, including the elderly, disabled, and children.

These individuals have different speeds on the street.

The following section discusses the street design elements of shared street space for each of the five categories: living street, commercial street, landscape street, integrated street, and traffic-oriented street, according to the Guangzhou city street classification standards.

At the same time, for the disabled and elderly using wheelchairs or crutches, it is necessary to ensure that the sidewalk must be broad enough so that two people using wheelchairs can pass each other. The width of the passing area on low-capacity streets should be greater than 2m and not less than 1.8m. The passing area should be unobstructed, flat, and smooth. Provide a slight slope at all crosswalks, preferably an 8% slope, and a pedestrian is crossing through the path without height difference in the central separation zone, pedestrian safety island. For children, their shorter height and slower speed require consideration of these factors in crosswalks' design, signal timing, etc. Therefore, crosswalks that consider children should have the following characteristics: slow traffic speeds, long walking signal times, low turning speeds, and high visibility. Drivers are also alerted to children walking in the street nearby, limiting vehicle speeds and introducing efficient pedestrian infrastructure to serve this group of children.

Activities on the streets

Based on the behaviors that occur on the street by street participants, a table of street participant activities, with the characteristics of each activity, corresponds to the space on the street. That can be developed to guide the design of the street. In addition to the activities listed in the table, it is necessary to develop a site-specific activity table based on field research at the site. It is to clarify whether some types of activities on the site require special attention and what requirements exist for the space for these types of activities.

Table 4-2 Activities on the street

Basic Activities					
General					
	Walking	Seating and resting	Seating and waiting	Chatting	Jogging
Disabled person					
	Wheelchair	Visual impairment			
Elderly					
	Wheelchair	Slowly walking			
Children					
	Slowly walking	Stroller	Running		
Additional Activity					
General					
	Seating and watching around	Shopping	Coffee	Eating	Roadside stall
					
	Meeting and chatting	Performance	Fitness	Walking dog	Seating on the grass
Elderly					
	Square dance	Morning exercise	Playing chess		
Children					
	Scooter	Playing games	Play ground	Sports	Flying kite

(Source: Photo from the Internet; collated by the author)

4.2.1 Shared Space on Living Street

The street space is first divided into the sidewalk part and the carriageway part. The sidewalk portion is divided into the ground, building interface, frontage road interface, and top surface. The design elements of ground design include street width, green location, street furniture,

various paving, road facilities, and retail placement; the architectural interface involves the design of the following aspects: interface setback, building height, building length, entrance design, and greening; the frontage road interface includes greening, site function, and multiple traffic modes; and the top surface: the roof.

The functions of the land along the route are life service type commercial, small and medium scale retail, restaurant, and other commercials, as well as public service facilities serving residents. Living streets, such streets are dominated by small- to medium-scale retail, restaurant, and lifestyle-serving commercial (e.g., barber stores, dry cleaners, etc.) facilities and public service facilities (community clinics, community activity centers, etc.) Along the streets that serve residents, businesses, and workers.

1. Spatial form

This plane is the most considered aspect of the sidewalk. Without it, the sidewalk would not exist. An adequate clear path and slope should make the sidewalk accessible for multiple users. The materials used and their ease of maintenance drastically impact the sidewalk's aesthetic while affecting its safety and navigability. The nature of the area closest to the building wall or private property line depends on the presence of entryways, sidewalk cafes, signage, and overflows from stores. When trees are placed in planting strips on this side of the sidewalk, they should ideally be wide to ensure the plants' survival. The overall volume and speed of traffic also significantly impact how this plane is experienced. From the observation of the living street, the design of the living street ground level contains the following broad categories: street width, green area, adjacent building area, street furniture, and paving.

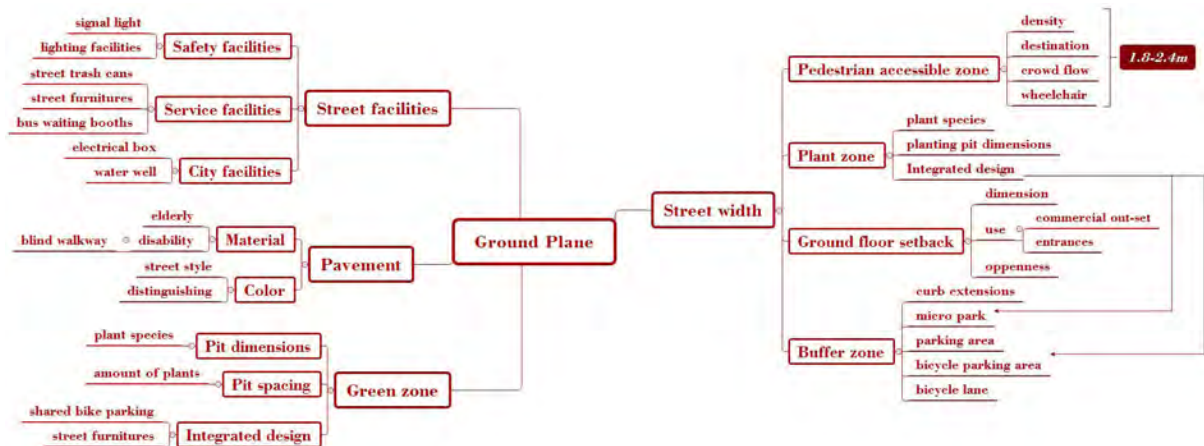


Fig. 4-12 Physical elements of ground plane in the living streets

The building wall plane is where the sidewalk meets the private property line. Zoning

regulations typically have the most significant impact on this plane. The position of the building wall plane—whether a building is set back or sits directly on the property line—can significantly affect the sidewalk experience. For buildings that sit on the property line, forming a street wall, the vertical rhythm, depth, and textures of the façades help create interest and break down the building mass to the pedestrian scale.

The primary consideration of the building interface is more than the ground level. The design of the building interface directly affects the appearance of the street and the feeling of walking. Just like the walls of a room, so the building interface is also called the building wall. The factors that affect the building wall are land use, ground floor setback, façade, length of lots/frontages, overall building height, the entrance of the building, and outdoor use.

Some of these factors overlap with ground level design considerations, such as ground floor setbacks, precisely because this part of the space is a transitional space between the building and the street. Therefore, when discussing street design, we cannot simply strip a space independently. In order to avoid confusion, these factors are also mentioned twice when key influences are collated, if necessary.

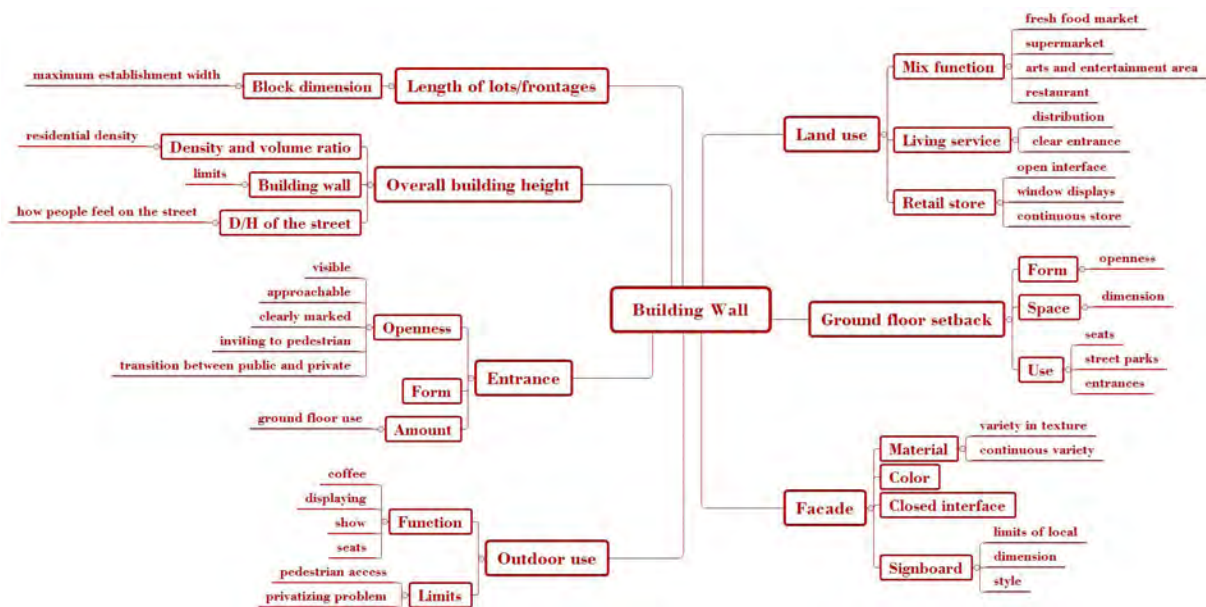


Fig. 4-13 Physical elements of building wall in the living streets

The roadside vertical plane can have great depth, adding several layers to the pedestrian experience. This plane is defined primarily by the rhythm of vertical physical elements like tree trunks and light poles that line the immediate edge of the sidewalk. The more closely these are spaced, the more prominent and denser the first layer becomes. The second layer in this plane is shaped by the immediate roadside adjacency and varies greatly depending on

whether it is a bike lane, a parking lane, or a moving travel lane.

Parked cars and other static objects can act as buffering elements to moving vehicles and can, in some cases, help increase the intimacy of the sidewalk experience. Finally, in the distance, the street wall, buildings, and trees across the road add a third layer of depth. While this layer often serves as the background of the sidewalk experience, the absence of vertical elements in the foreground can significantly amplify the effect of what is happening on the other side of the street. The overall volume and speed of traffic also significantly impact how this plane is experienced.



Fig. 4-14 Physical elements of roadside in the living streets

The canopy or sky plane is the area pedestrians perceive as overhead. Zoning regulations play a significant role in the composition of the canopy. In most cases, the canopy plane is defined by the amount of sky apparent to pedestrians. In higher-density areas, however, building walls and cornice lines from both sides of the street cut into it, along with awnings, canopies, balconies, signage, fire escapes, and other projecting elements. Sidewalks with trees provide a strong and diverse canopy filled with tree branches or heavy foliage and change seasonally. The number of elements that project into this plane affects the sidewalk's overall sense of enclosure and the amount of shade and shelter it provides for pedestrians in extreme weather conditions. Distant landmarks are often apparent in this plane.

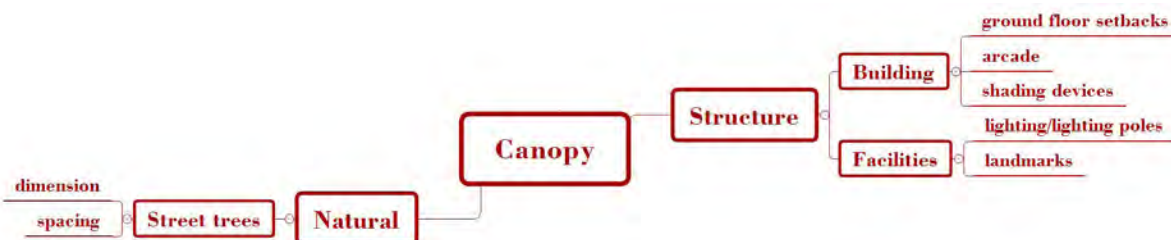


Fig. 4-15 Physical elements of canopy in the living streets

Ground plane

Pedestrian access areas are dedicated and usable paths parallel to the street and access areas

ensure that pedestrians have safe and ample walking space. In residential streets, the width should be 1.8m-2.4m and not less than 2m, considering wheelchairs. The integrated design of planting areas on amenity streets can be considered to expand street tree planting areas into small street parks for the community by combining the design with shared bike parking areas or with resident fitness facilities.

Especially in locations close to residential areas, the installation of street parks can provide residents with a place for daily recreation, create some social space, and provide a place for residents to stay and talk. For shared bicycle parking areas, consideration should be given to setting them at the entrances and exits of residential areas, retail food markets, bus stops, and other places for the convenience of residents.

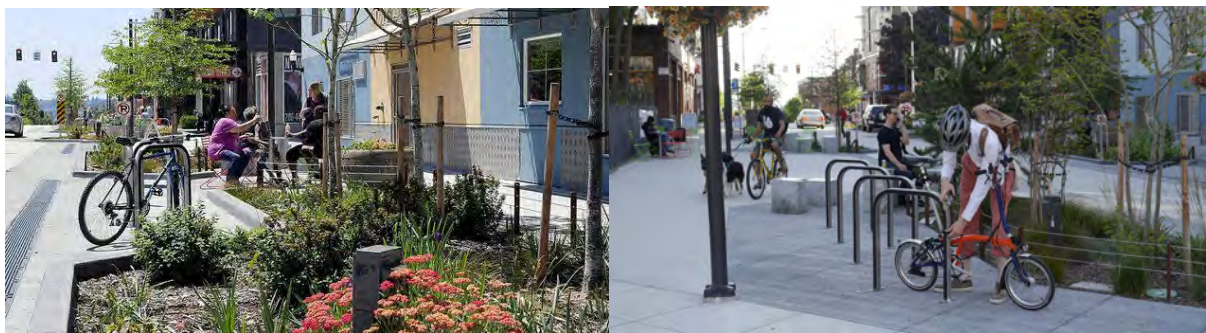


Fig. 4-16 Bell Street Park Shared Street, Seattle
(Source: Google)

Building setbacks can bring more space to the sidewalk. The setback space's deep integration and character development is the primary trend of future development, based on the complete neighborhood theory, from two-dimensional road to three-dimensional space, from road specialty to multi-professional synergy. There is an urgent need for more in-depth coordination and integration under the current situation of many elements. The neighborhood has its soil for growth, so integrating the unique cultural elements in the receding space will significantly enhance the environmental atmosphere and temperament of the neighborhood.

Retail businesses are arranged along the street on a lifestyle street, with the first floor of the building set back from the boundary. It can form an entrance space to guide pedestrians on the sidewalk into the store, form a gray space for the building, and provide a street space for pedestrians on the street to get shelter from the sun and rain. There also exists a receding boundary space that acts directly as a passing area on the street, increasing the width of the street and generous street space that can stimulate autonomous use and allow for behaviors

such as vendors and children playing. Restaurants on lifestyle streets can also use the receding boundary space as a commercial out-setting and merchandise display area, using the street as part of a business to attract pedestrians and enliven the commercial atmosphere of the street.

A wider setback boundary can then be created as a recreational area of the street, combined with planting areas to form a street park, providing a place for people on lifestyle streets to relax on a daily basis.

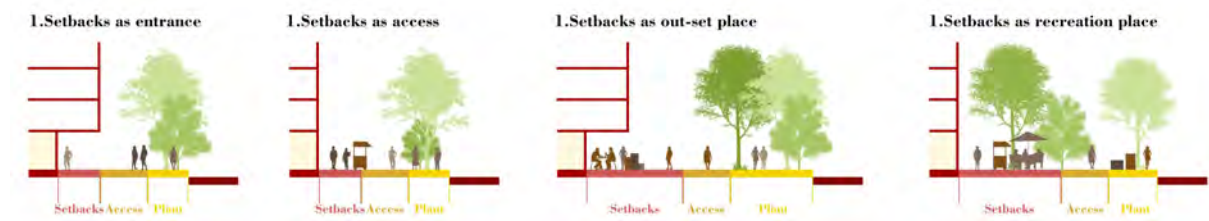


Fig. 4-17 The function integration in the living streets

2. Activities

Living service streets should become an important place in the community's daily life, providing a space for residents of different ages and backgrounds to meet and interact. People's behavior is closely related to their daily lives on lifestyle streets. By observing the behaviors of residents on the streets in their daily lives, especially near residential areas and in spaces such as lifestyle streets, we organize and record these behaviors. In addition, the behaviors that occur in them are also organized by referring to excellent examples of lifestyle streets.

Here, I compiled some behaviors based on the Shanghai Street Design Guidelines and observations made in our daily lives. Classify pedestrians as general, elderly, and children, respectively, to organize some of the activities that may be present on living streets. Divide these activities into basic and additional activities. First is the general basic activities. The regular or basic activities on the living streets are: walking (from residence to local stores, to school, to bus stops, to work), resting on the street seats, sitting and waiting for people (or waiting for the bus), occasional gossip between neighbors, jogging in the street, etc. These are typical behaviors on a living street. It can be said that this is the most basic function of a living street.

For people with disabilities, their basic activities on the street differ from those of the general

population. Wheelchair users need spacious streets to accommodate two wheelchairs simultaneously, which requires a good street width of more than 2m and at least 1.8m. Visually impaired people need to be accommodated on the street pavement, and blind alleys guarantee direct and unobstructed routes. The basic needs of the elderly are reflected in need for wheelchair travel, a slower walking speed, and non-slip material in the floor covering. Street seats also need to take into account the use of the elderly. The arrangement of the distance should not be too far.

Children are also an active subject on lifestyle streets, and all streets, except lifestyle streets, should provide safe spaces for children with or without adult accompaniment. Children are not as quick to judge as adults, and designers should provide safe transportation options for children when designing streets for safety. In addition, children are shorter and walk more slowly, and crosswalks and signal timing need to be considered. Strollers are also a common subject on lifestyle streets.

We often see families going out near residential areas, pushing strollers together. Streets should also consider the needs of stroller travel by paving roads to facilitate the advancement of strollers, providing spacious enough recreational areas to place strollers, and not causing traffic problems for other pedestrians.

Pedestrian

Basic Activity



Additional Activity

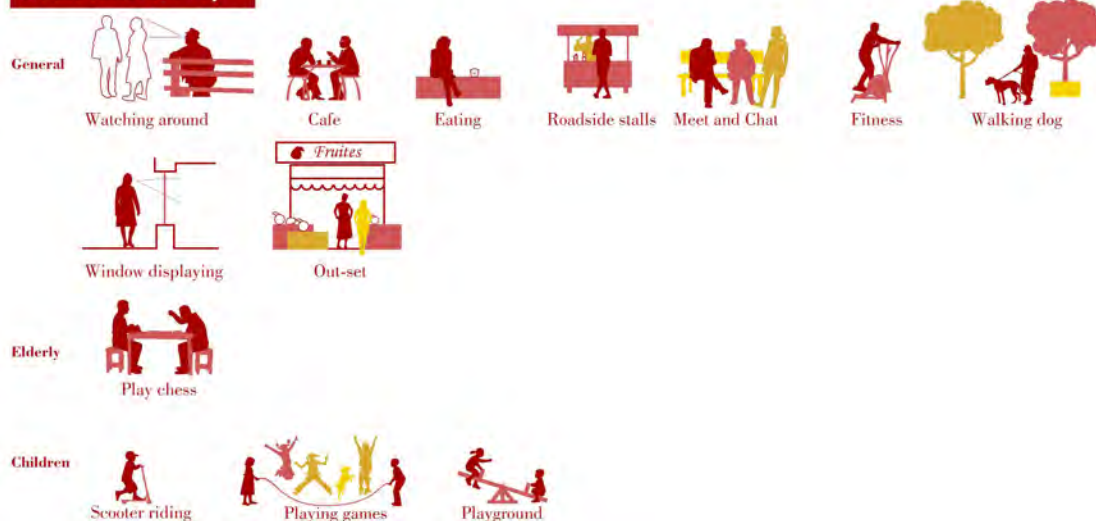


Fig. 4-18 Pedestrian activities on the living streets

In order to make streets work better for people, streets should provide more humane services.

3. Shared space

Community shared space

With the development of the sharing economy in various industries, sharing is gradually becoming known and applied in urban construction and settlement renewal. Some cities in China, such as Beijing and Shanghai, have tried to incorporate the sharing concept into the renewal of community public spaces. Furthermore, it has resulted in many buildings that embody various connotations of sharing, have various functional types, and use the concept as

a tool for urban development. They have various functional types and use rich design techniques.

Sharing has been incorporated into the renewal of community public spaces in some cities, such as Beijing and Shanghai. It has resulted in many buildings embodying various connotations of sharing, having various functional types, and using great design techniques. These practices provide a great deal of experience for the concept of sharing in the renewal of communities.

To summarize the renewal cases of these communities, they can be divided into different categories according to the connotation of sharing concept. The first category focuses on the exchange and mutual integration of community residents, such as creating a shared living room with multiple functions and opening the boundary wall of the neighborhood to the city. The second category focuses on the community's public interest and the equal inclusion of individuals, such as the arrangement of time-share parking spaces to meet the needs of more residents. For example, the arrangement of time-sharing parking spaces to meet the needs of more residents and the sharing of open space between the old and the young shows more care for environmentally sensitive groups. The third category focuses on the efficient use of idle resources in the community, such as a shared space where second-hand goods can be rented and bought and sold, and community donations can be made.

Table. 4-3 Types of Renewal Spaces in Older Communities with Different Connotations of Sharing

Sharing Connotation	Space Types
Interaction and Integration	Shared living rooms, open community walls
Equality and Inclusion	Shared parking, Open space for young and old
Utilization of idle resources	Resource sharing space, Shared storage
Shared Construction and Governance	Shared green space, Shared facilities

(Source: Liu Huijun, 2022)

Residential areas on living streets can open up the ground floor as a shared space. According to the residents' demand for shared space, the openable space is designed as a shared space, and this part is directly connected to the street while expanding the street space. A master plan

can be placed at the entrance of the community to identify all shared points. In Guangzhou's Triumph Xintiandi community, the ground floor is used for commercial, and the entire interior of the community is open for retail stores. Retail stores bring a lively atmosphere to this community.



Fig. 4-19 Kaixuanxintiandi Community, Guangzhou

I am dividing the shared space of the community into several levels, community level and neighborhood level.

Table. 4-4 Sharing level and activities

Level	Shared Space	Activity
Society	Street	Jogging, Rest, Sailing, Outdoor Exhibition
	Green land	Walking, Flower Exhibition
	Service facilities	Public Toilet, Shared Parking
Community	Open place	Sports games, Performance, Outdoor Movie
	Green land	Planting, Exhibition, Community Bazaars

When designing a community shared space, research can be conducted on residents' openness. When the residents are willing to share community space, the community can be opened to society at the highest level of unrestricted use. Such as the practice of the Guangzhou Kaixuan Xintiandi community, where the public land of the community residents is opened for the use of the public social land. Suppose the willingness of community residents is low. In that case, we can consider sharing the community public land for community residents' use only and design it to open the use of some service facilities for social residents. Furthermore, providing a smooth passage for the street pedestrian system avoids the large scale of the neighborhood due to the large area occupied by the community.

Also, the issue of privacy in residential areas should be considered. After opening up the internal space of the community, the part located above the ground floor commercial remains for residential use, and the separate entrance of the residents should be protected. The daily life of the community residents is guaranteed. For communities with many older adults, the nature of commerce should be considered while opening up green space. Older adults prefer a quiet living environment and avoid introducing active commerce such as bars late at night, which affects the night rest of residents.

Referring to Auckland's approach to shared street design in the CBD, gaining the support of property owners is key to building shared streets. Furthermore, getting business permits and other documents for the stores in open spaces while building shared streets so that the stores can be put into use immediately after the streets are built. Use the rental income from the stores to bring returns to the owners who share the space, balancing their efforts to share the property rights.

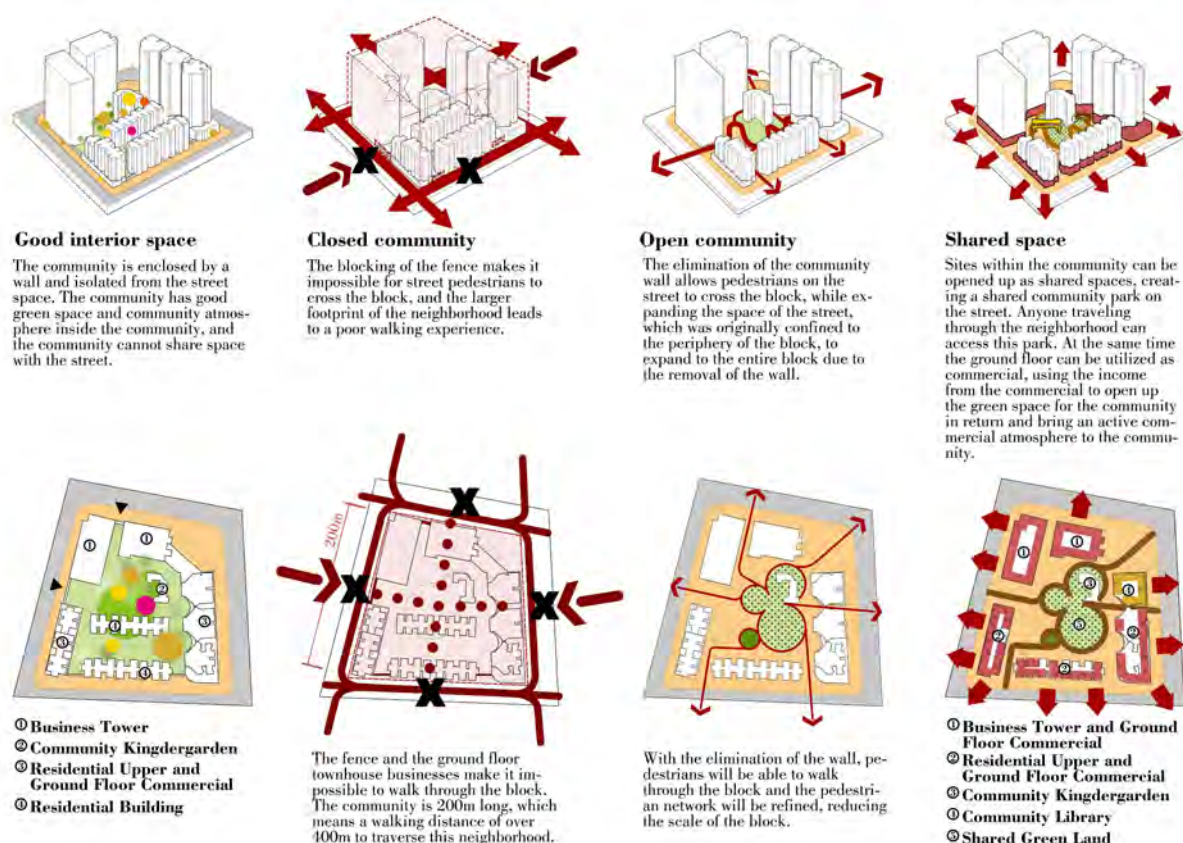


Fig. 4-20 Transforming closed community spaces into shared spaces

4. Street elements

The design elements of living street can be summarized as follows. Special attention is paid to the daily needs of the residents in the living street and the activities of various people.

Create a playground for children in the living street, using building setbacks or community land sharing. Children's playgrounds need spacious and open enough land to set up some rest seats, convenient for parents to watch over the side. The street can be divided into several zones: adjacent building zone, safe passage zone, activity zone, and pedestrian-vehicle separation transition zone. Each area can be designed differently according to the daily activity needs of the living street.

The adjacent building area is designed with more of a receding space. The first floor of the building is set back to create some receding space, which can be used in different ways in conjunction with the needs of the street-level stores. The stores along the living streets are mainly retail businesses, with the first-floor building set back so that it can be used as a commercial out-setting area for the stores. Building setback space to increase the use of the street ensures that all types of activities can occur.

The safe passage area is connected to this part of the space, in which a flat floor and a blind walkway are provided. The shared street design elements, also designed to the comfort zone requirements, set up a safe passage area to ensure the safe passage of all kinds of people on the street. The safe zone needs to guarantee the smooth flow of the road and reduce twists and turns. This zone is located near the building area, away from the driveway, and can meet the needs of pedestrians, older adults, and wheelchair users who need to pass quickly.

The activity area is designed to meet the needs of various activities. A vendor area can be set up in this area to provide street vendors or stores with outside stalls, outside catering, etc. The vendor area is opposite the stores, with pedestrians in the middle, creating a relatively rich commercial interface. In addition, some leisure seats are designed in combination with green areas to provide a public rest area for residents. These seats can also be used as support areas for vendors, and customers who have purchased a meal can eat on the lounge seats. The space between the seats can be used as a performance venue for street performances.

The transition area, separating the walking area from the carriageway, further ensures walking safety and comfort. Bike lanes and parking facilities can be located here. On the other hand, bicycle lanes can be protected by separating the roadside motor vehicle parking zone from the motor vehicle lane. Some street parks can also be designed on the living streets where the street width is sufficient.

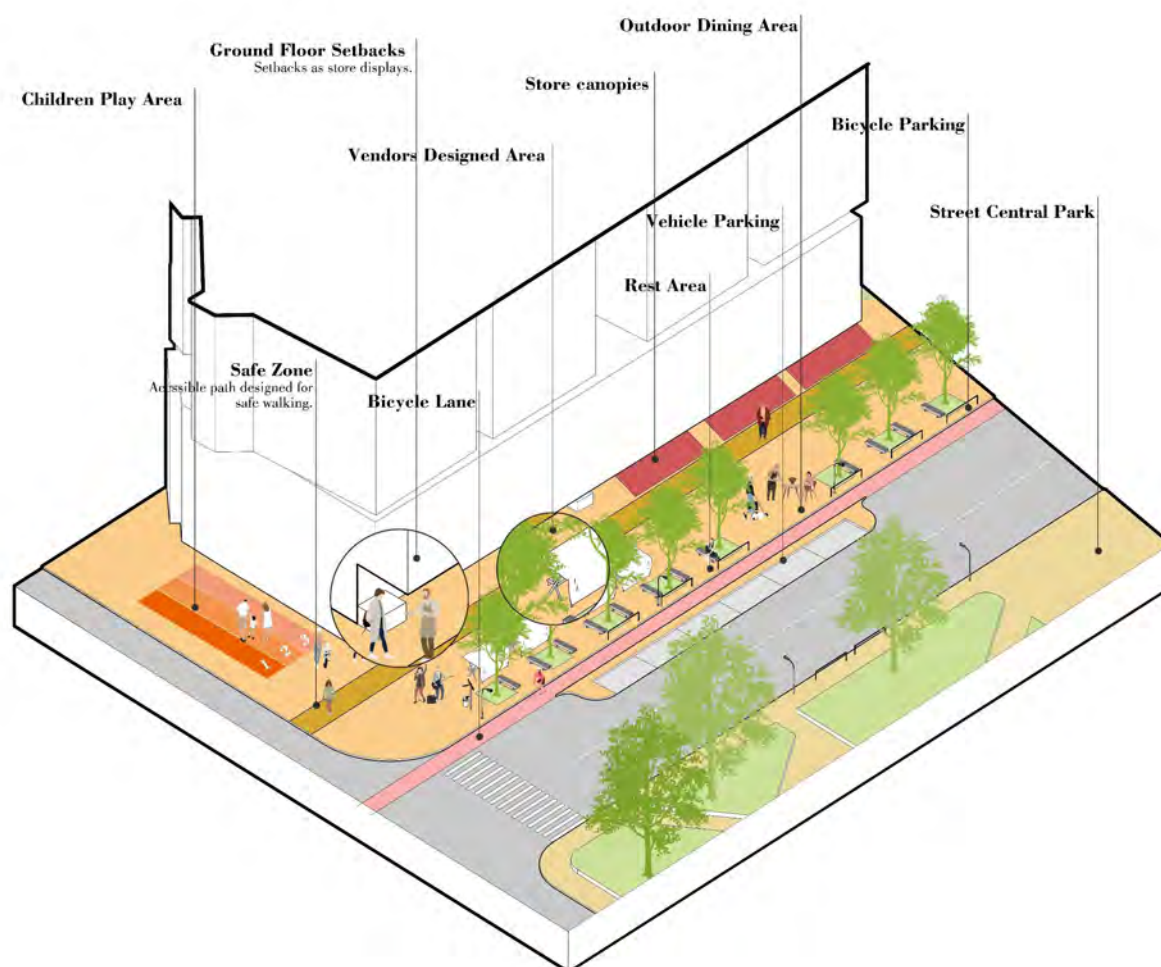


Fig. 4-21 Design elements of living streets

4.2.2 Shared Space on Commercial Street

The difference between commercial and living streets is that commercial streets have a more intense commercial atmosphere. Commercial streets are also quite common in cities, whether in central CBDs, lively shopping districts, or scattered store streets surrounded by commercial streets. Commercial streets in cities often have a large amount of foot traffic and can be an essential component of our urban public space.

As the city's most dynamic commercial open space, these roads occupy a vital position in the urban space and are an essential part of the urban landscape. Most commercial-type streets in Guangzhou consist of numerous stores, restaurants, and service stores, both in the form of cavalry buildings and sizeable modern malls with an organic combination of retail stores. Based on the business characteristics of commercial streets, the core of this type of road

design is to make the space functional and comfortable and to promote the development of the business and service industry.

1. Spatial form

The ground plan of a commercial street includes the following four main points, street width, street facilities, paving, and green area design.

The width of a commercial street differs from that of a residential street, with a recommended street width of 5 to 8 meters. The street width is influenced by four factors: the width of the pedestrian zone, the width of the green zone, the increased width of the first-floor setback, and the width of the buffer zone. The good pedestrian area of the commercial street should be not less than 2.5 meters. The first-floor receding boundary can be used as a commercial out-swing, building entrance, the plaza of a commercial plaza, a commercial display area, an outdoor dining area, etc. The curb extension of the buffer zone can be set up as a mini park, the parking area can also be used as a transition area between people and vehicles, the bicycle path can also be set up in this area, and there are also bus stops.

Street facilities are needed to meet the daily needs of residents, including security facilities, service facilities, and municipal facilities. The green area must be designed with street trees, not blocking the store signs.

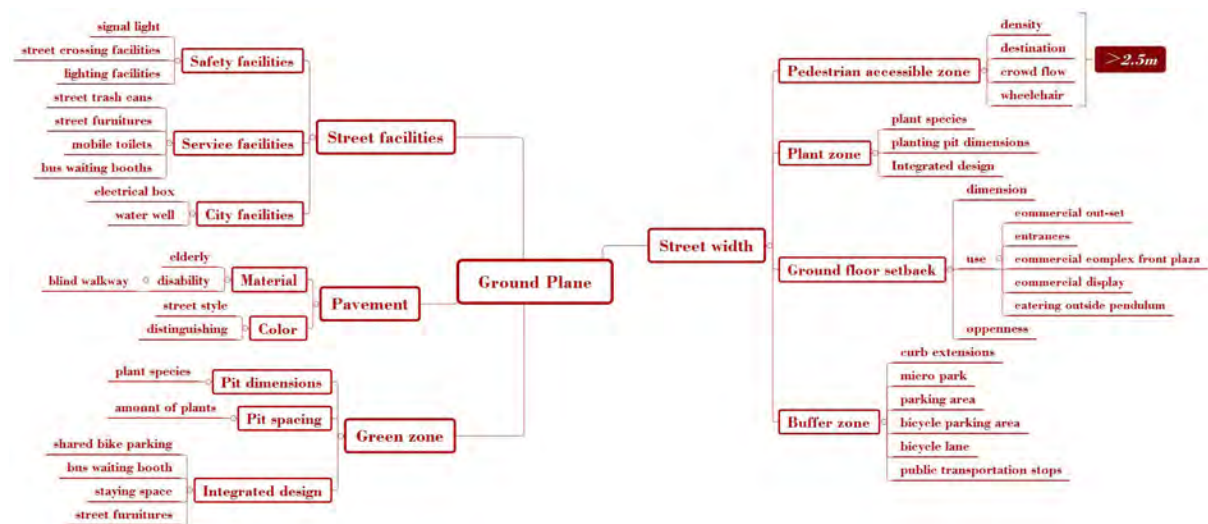


Fig. 4-22 Physical elements of ground plane in the commercial streets

The architectural interface considerations for commercial streets include six significant points: land use, ground floor setbacks, façade, length of lots/frontages, overall building height, entrance, and outdoor use.

The building function of commercial streets is mainly commercial, service, and retail. Commerce, in turn, includes restaurants, commercial complexes, and specialty businesses. The first-floor setback of a building on a commercial street contains three elements, the type of formal space and the function of use. Space size proximity to the display window requires a distance of no more than 2 meters, which is convenient for merchandise display, and pedestrians can see the goods in the window more clearly at this distance, bringing a good shopping experience. Furthermore, when the space is used for dining, the size should not be too small. Setting aside a width of 3-5 meters is recommended to protect the placement and use of the dining table.

Despite the predominantly commercial function in commercial streets, different functions are encouraged, with entrances for non-commercial functions along the street. Provide more functions for the street during non-commercial business hours. Outdoor use needs to consider specific functions. Commercial streets can be used as coffee, display, performance, seating, etc. The building façade needs to ensure the continuity of the stores. Continuous stores can create a better business atmosphere and guarantee commercial vitality.

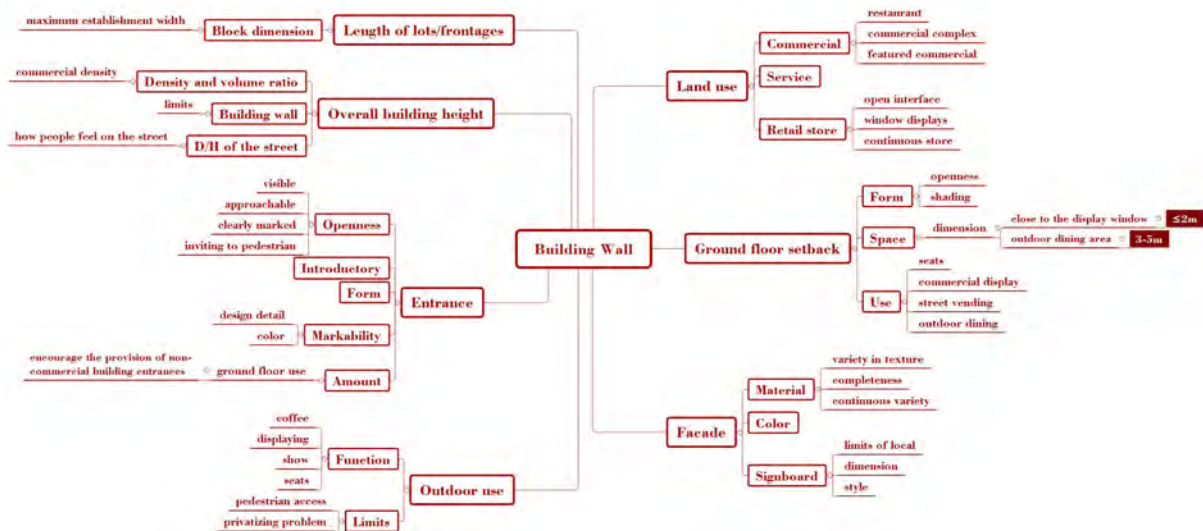


Fig. 4-23 Physical elements of building wall in the commercial streets

There are two main elements involved in roadside, traffic transition and greening. Traffic transitions serve to transition pedestrians from vehicular traffic, a form of protection for pedestrians on the street. Nevertheless, a complete separation limits the range of pedestrian movement while increasing the rights of motor vehicles. Therefore, this part of the transition zone does not exist on streets shared by pedestrians and vehicles because there is no clear and exclusive activity zone for pedestrians and vehicles. If a traffic transition zone is set up, this

part of the area can be equipped with slow traffic, public transportation, and parking. Public transportation stops are required on commercial streets, and stop design needs to be sensitive to the need to direct pedestrian flow to commercial areas.



Fig. 4-24 Physical elements of roadside in the commercial streets

Canopy of commercial street is divided into two categories: structures and natural objects. The canopy of the street is provided through building design to provide a comfortable environment for pedestrians on the street. The tree canopy can also be used to provide shade for pedestrians.

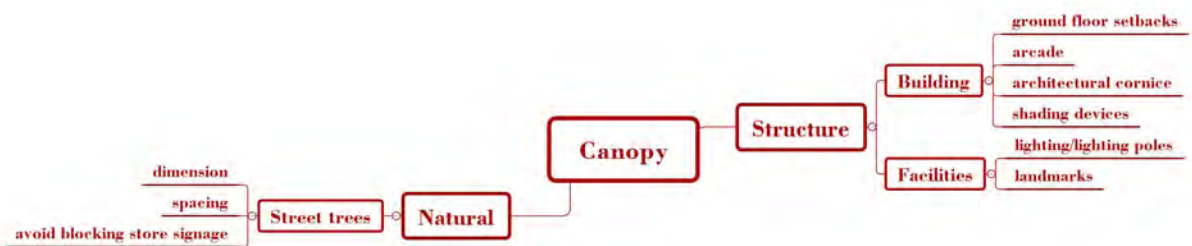


Fig. 4-25 Physical elements of canopy in the commercial streets

2. Activity

Pedestrian activities on commercial streets are mainly related to commercial activities, and the primary activities include walking, resting, shopping, and waiting. To enrich the commercial street activities, additional activities can be considered.

Additional activities on commercial streets related to business activities can enrich the business atmosphere and drive business development—outdoor dining, street vendors, window shopping, etc. Businesses set up continuous windows to provide a good shopping experience. In addition, non-commercial activities can enrich the public life of people on commercial streets and enhance the vitality of commercial streets. The installation of a street park can provide a recreational area, ground lighting can enliven the street space, performances can enrich street life, and a children's play area can provide a playground for children on commercial streets.

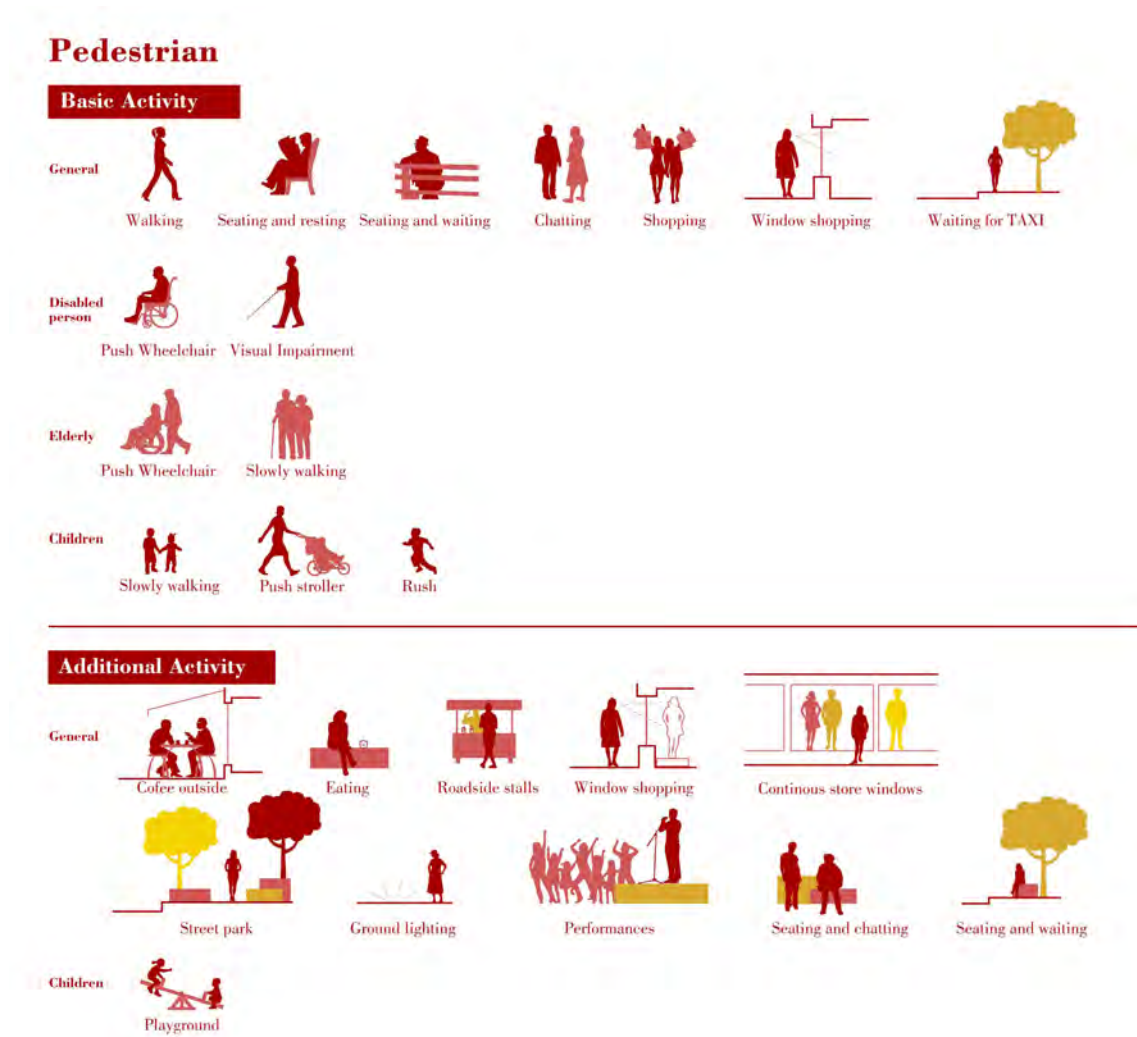


Fig. 4-26 Pedestrian activities on the commercial streets

3. Shared space

Commercial complex

The commercial complex itself has a better environment and abundant public space. Although these spaces are also open for public use, they exist inside the commercial complex, and pedestrians on the street must first enter the commercial complex to reach these spaces. The commercial body occupies a large area of the site, and pedestrians need to bypass the commercial body when they want to cross the plot. Although there are more entrances to the commercial blocks, pedestrians can cross them, but it is still more troublesome. For commercial complexes, street space can be increased through building setbacks, in this space as a street park to add some dwelling space for the commercial body.

At the same time, the street park can also be used as a park for the city. When designing sky gardens for commercial bodies, the entrance to the gardens can be set at street level, where

pedestrians can visibly see these spaces and reach them directly from the street without entering the complex.

The land titles of these street parks and rooftop gardens are owned by the commercial complexes, except that these spaces are used by the public and are directly accessible from the street, thus increasing the street space.

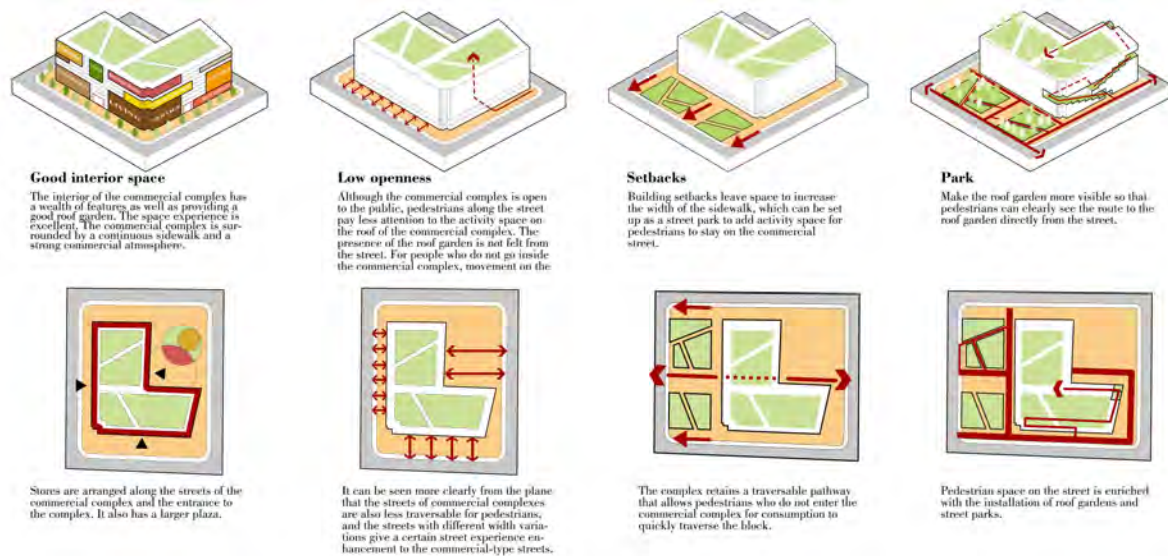


Fig. 4-27 Transforming commercial complex spaces into shared spaces

4. Elements

The design elements of commercial streets can be classified by street zoning as well and are designed according to the needs of the commercial street.

Close to the building area, continuous stores, and diverse building façade. Outdoor tables are set up for outdoor dining in the beverage store. The building interface is open and convenient for people on the street to enter the retail stores. A good pedestrian area is set close to the building to ensure the safe passage of pedestrians. The activity area of the commercial street can be equipped with street parks and recreational facilities to provide a recreational venue for people who visit the commercial street for activities. Providing a place to stay can also bring popularity to the commercial street.

A mix of commercial, office and residential functions is set up to create a 24/7 vibrant area that is not only active during the day. Different functions can form different interfaces, and diverse architectural and building interfaces along the street interact to enrich the pedestrian experience. The activity area of the commercial street can also be set up with some entertainment and game elements to enrich the function of the street and provide a social opportunity for all kinds of people who arrive at the activity of the commercial street. In

particular, these play areas can be considered for children's use, and street paving needs to consider using children's scooters and baby strollers.

Public seating along the street can be set up with some enclosed seats to provide a suitable space for communication. The traffic transition area of the frontage road is equipped with bicycle lanes and bicycle parking facilities. Bicycle parking on commercial streets needs adequate space to facilitate the bicycle travel needs of the public. Public transportation stations on commercial streets can be combined with motor vehicle parking zones together to form a separation zone between bike lanes and motor vehicle lanes.

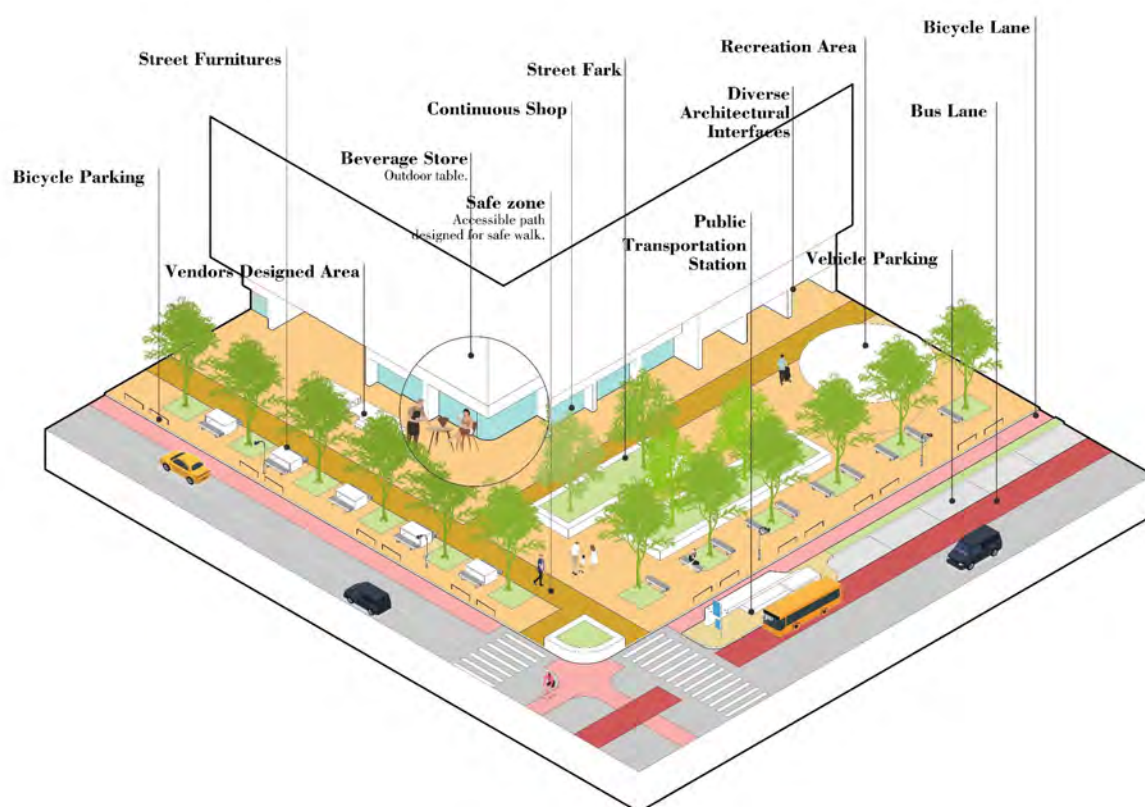


Fig. 4-28 Design elements of commercial streets

4.2.3 Shared Space on Landscape Street

Landscape leisure features outstanding, set along the leisure activities facilities. In the city landscape, recreational streets mainly include boulevards, landscaped, waterfront, and historical-style streets. In the vicinity of Guangzhou Happy Valley, Jinsui Road on the north side of Zhujiang Park and Linjiang Avenue are both landscape streets. On such streets, the most striking thing along the way is the stunning scenery. These are streets that provide a recreational landscape for city residents.

1. Spatial form

The difference between landscape streets and commercial and living streets is that landscape streets are more recreational, existing like urban parks, except that their landscape is linearly arranged along the street.

Width considerations for landscaped streets differ from the other two types of streets. Among the considerations for street width, if the landscaped street is to have a central activity area in the middle of the road, the recommended width of this activity area is not less than 14 meters. This is to leave enough width for the landscaping and event space design in the activity zone. In addition, the number of motorways on one side of the central activity zone should not exceed two and one-way traffic, providing space for public rest and activities. To further enhance the level of service and enable more people to enjoy the landscape, temporary drop-off points along the road on the landscaped streets can facilitate the arrival of sightseers and recreationists who travel via small cars. Temporary drop-off points can be integrated into the parking strip. This part also belongs to the width of the street consideration factors, which must be considered in advance.

The green areas are also more delicately designed than the other two categories. Plant greening should use different morphological characteristics to contrast and set off, choose flowering and foliage plants to match, pay attention to seasonal changes, increase the landscape hierarchy and color diversity, and enhance the identifiability of the road.

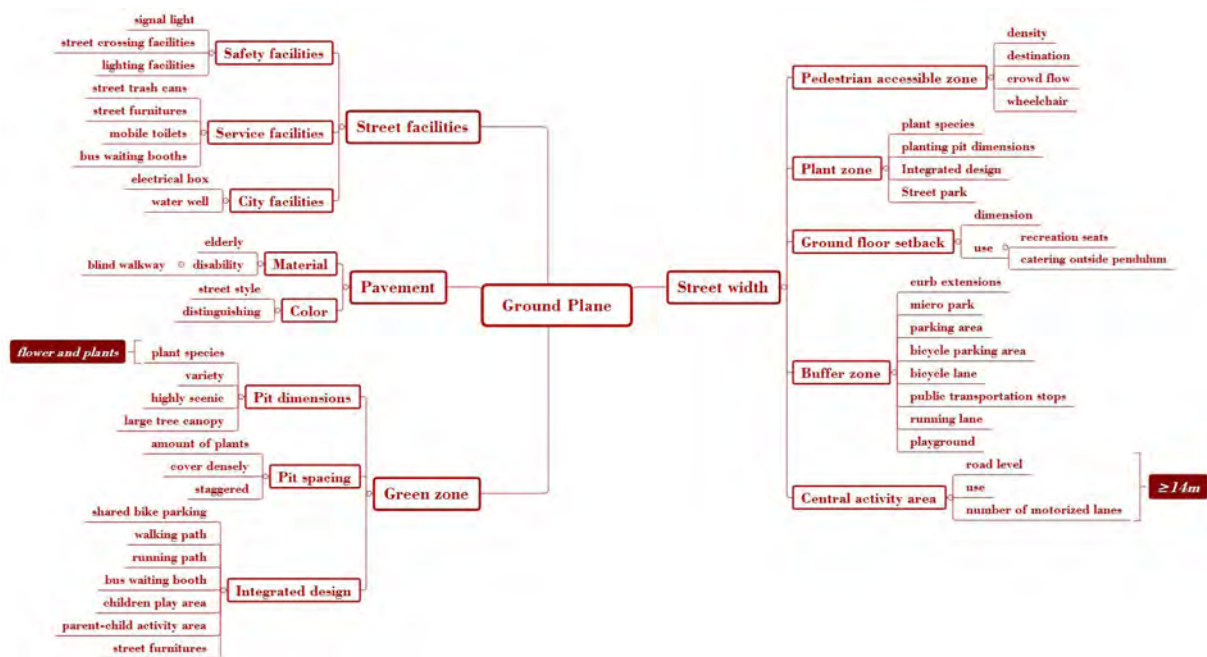


Fig. 4-29 Physical elements of ground plane in the landscape streets

The building wall of the landscape street considers six main elements, as shown in the figure below.

The land use is mainly commercial and service-oriented. The commercial restaurants and retail stores serve the people on the landscaped streets. Restaurants can set up outdoor dining areas, using building setbacks or combining them with street squares to set up tables on the street so that diners can enjoy the street view while eating. The outdoor dining area needs to take into account the issue of shade. Without an excellent outdoor environment in the Guangzhou area, the practicality of the outdoor dining area will be significantly reduced.

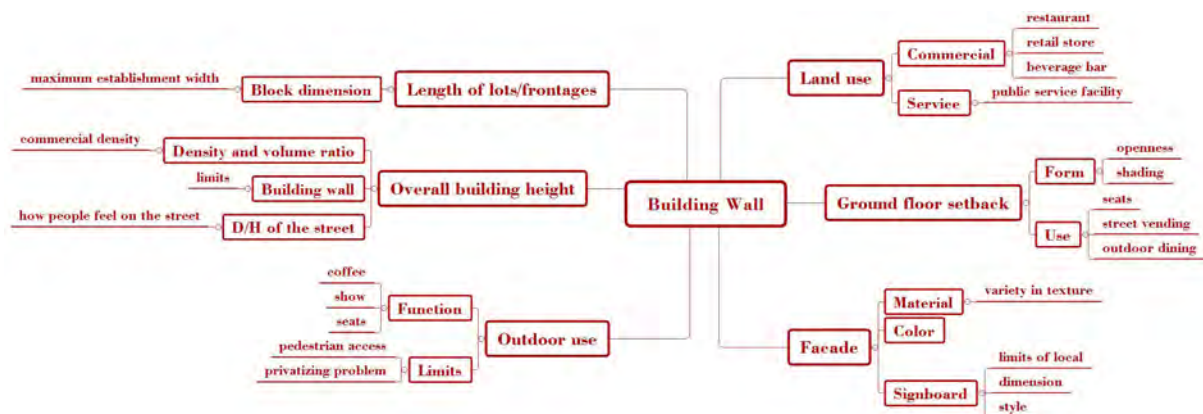


Fig. 4-30 Physical elements of building wall in the landscape streets

In addition to transitional traffic and greenery, the roadside of the landscape street considers the design of an additional facility belt compared to the two types of streets mentioned earlier, as shown in Figure 4-31.

In transitional transportation, continuous bicycle lanes, fitness running paths, and other slow-moving facilities are encouraged in landscaped streets, and distance tips can be set on paths, etc. For bus access areas and related facilities, emphasis should be placed on connecting paths to other slow-moving transportation. Commercial and service facilities can be provided in conjunction with bus stops, focusing on increasing seating and other rest facilities.

The public facility strip along the road is for people who come to the landscaped street for recreation. In addition to providing seating, greenery, and necessary public welfare facilities, this facility zone should also provide convenient and humane urban furniture and set-up facilities such as hand-washing stations (providing direct drinking water), bicycle parking racks, public toilets, etc.

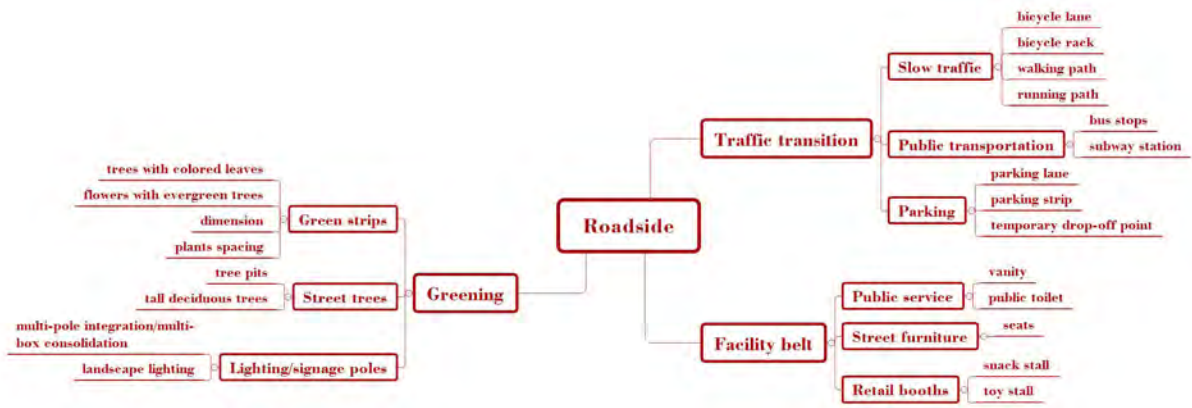


Fig. 4-31 Physical elements of roadside in the landscape streets

The canopy of landscaped streets is similar to the other two types of streets and aims to create a good pedestrian environment. The specific considerations are shown in Figure 4-32.

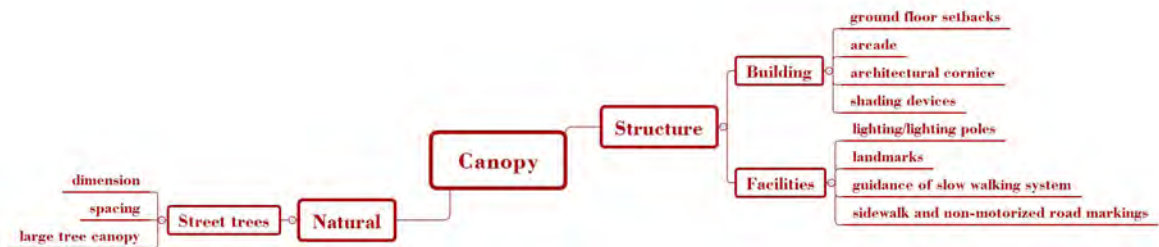


Fig. 4-32 Physical elements of canopy in the landscape streets

2. Activity

Slower-speed leisure activities dominate the activities of the landscaped streets.

The activities along the street of the landscape leisure street are mainly leisure activities such as strolling, running, cycling, etc., and combined with the space nodes, can be fitness and leisure activities. Creating unique landscape features is not the goal for landscape leisure streets, but the fundamental purpose is stimulating street activities through the beautiful landscape.

Small-scale landscaped recreational streets can be formed in residential and office communities to enhance landscape design and promote recreation, interaction, and community communication. Among the spontaneous basic activities, unlike other streets, landscape streets will also have activities such as resting, sightseeing, and photo-taking, which means that landscape streets need to provide some spatial landscape nodes with street furniture and characteristic iconic landscapes to form hit points. Among the additional

activities, it can provide residents with sports and fitness, square dance, small group leisure activities, vending along the street, and other activities, as well as the necessity of daily travel activities for residents.

Encourage displaying urban landscapes and accommodating public leisure activities with equal importance, considering the landscape and practicality. In addition, the use needs of different people of all ages should be considered to enhance the experience of activities.

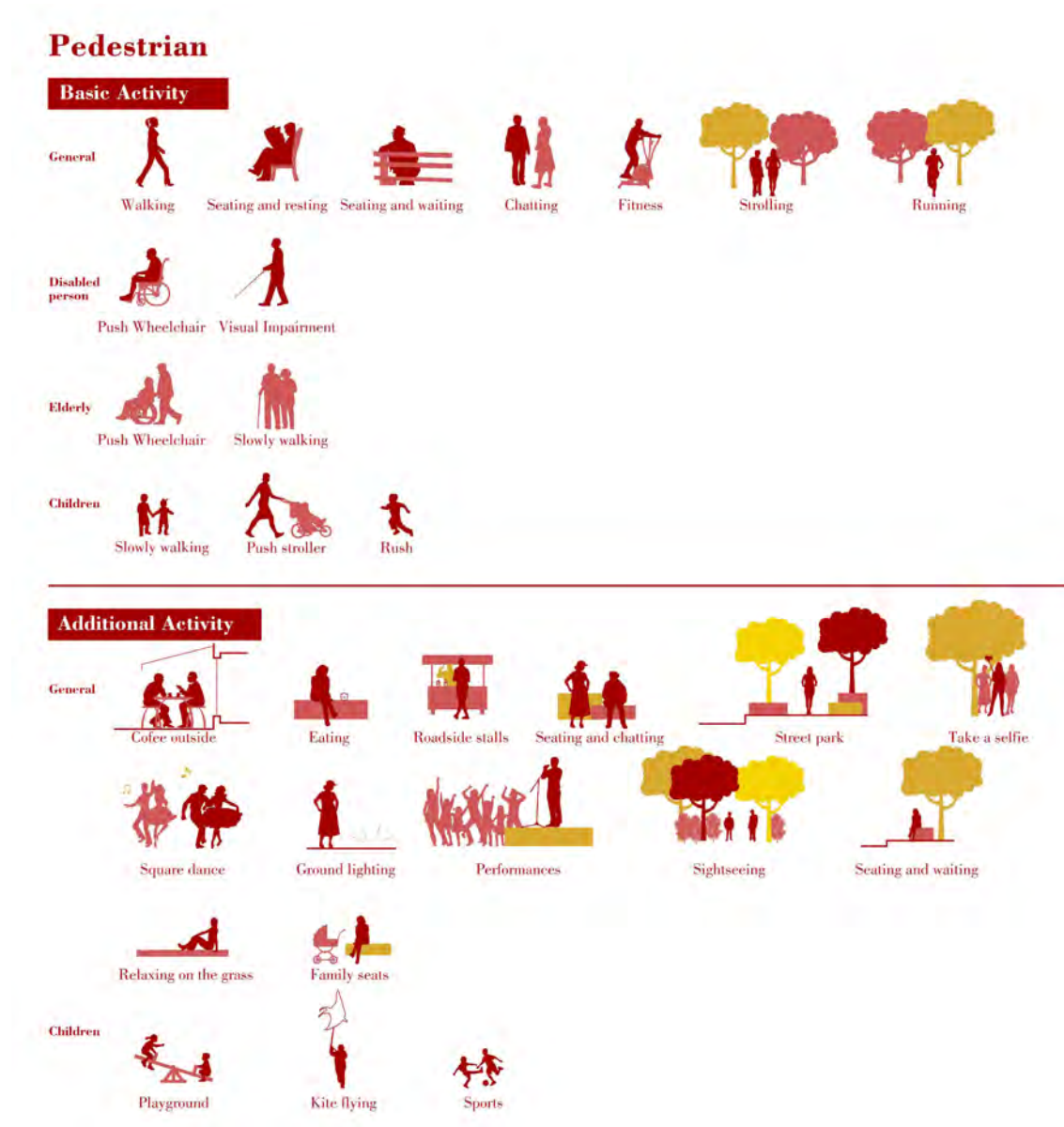


Fig. 4-33 Pedestrian activities on the landscape streets

3. Shared space

Street park

A street park is a virtual node on a landscaped street. How to design a street park as a shared

space focuses on the accessibility and inclusiveness of the street park.

A street park differs from a city park because it is smaller and more connected to the street. However, many street parks suffer from being separate from other blocks and less connected. This has led to a reduction in the advantages that the street park itself should have. Street parks should be more accessible. There is also a need to increase the accessibility of green spaces along the route to avoid planting greenery, etc., becoming a barrier to activity. In addition to addressing accessibility issues, there is a need to consider the inclusiveness of the street park, taking into account the needs of all people. Different groups of people have different needs for open space. The design of street parks should take into account not only the needs of ordinary people but also the unique needs of disadvantaged groups, such as the disabled, the elderly, and children, so that street parks have qualities that can induce social activities among the general public.

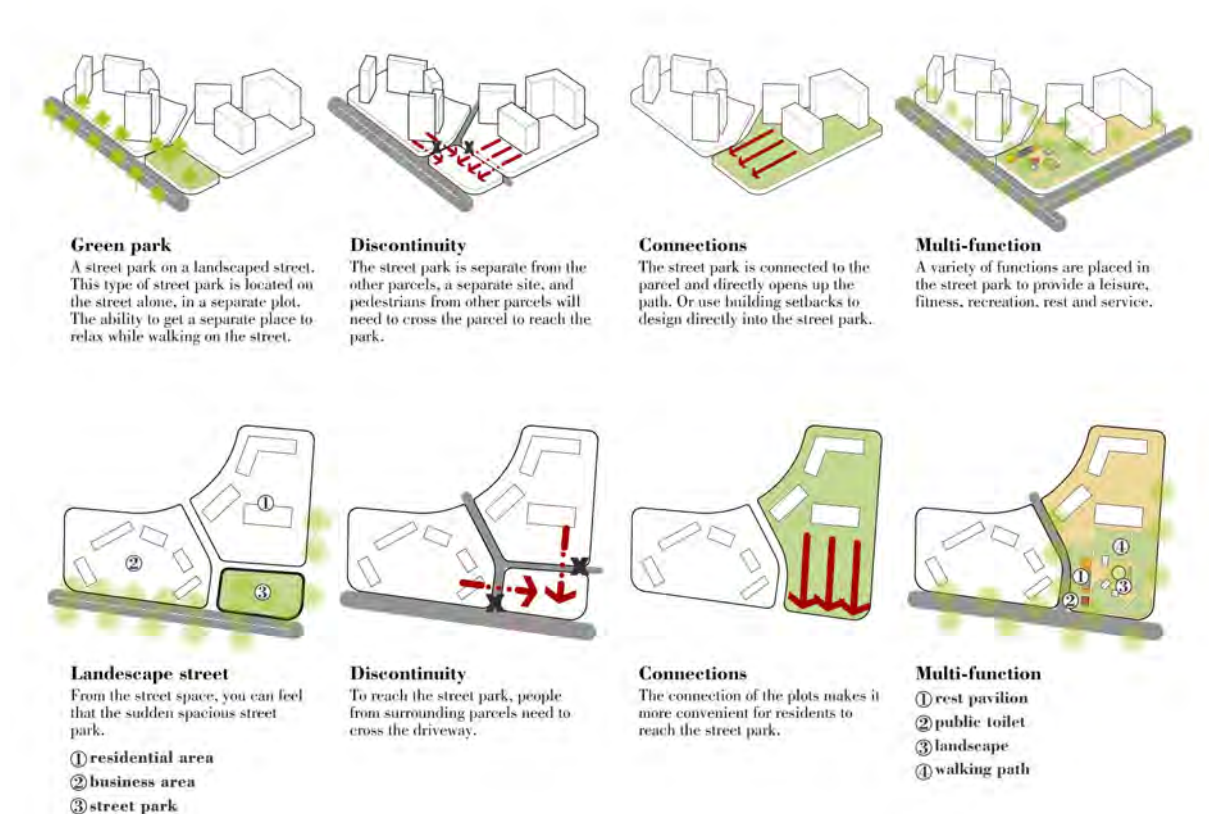


Fig. 4-34 Street park as a shared space

4. Elements

Landscape roads are different from the previous two types of roads. These roads can be a

moderately simple red line along the green space, waterfront space for integrated design, tandem green space, and building setbacks to form a street square to form a rich spatial experience.

The adjacent building zone encourages the first-floor building setback to form various outdoor use spaces. Store-out displays, merchandise displays, and dining can use the setback space. The blind corridor in the pedestrian safe passage area can guide the visually impaired to the landscape nodes in addition to passage guidance.

The activity area considers setting up children's play areas and placing children's play facilities; some small street squares can also be set up to enrich the activity experience; the vendor area can also be set up in this area. The bicycle path in the traffic transition area can be protected by greenery on both sides and create a good riding experience.

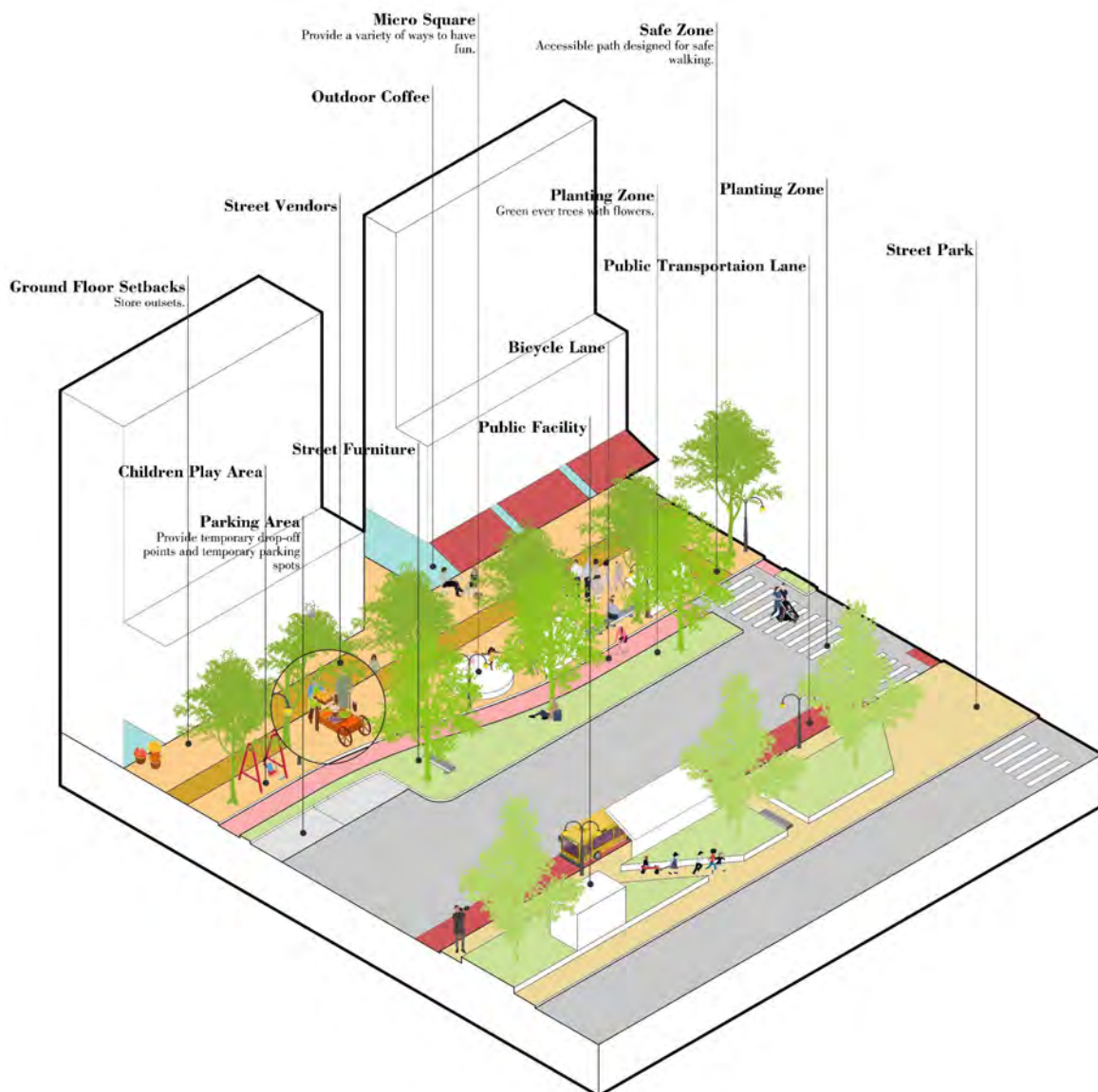


Fig. 4-35 Design elements of landscape streets

4.3 A People-oriented Street

Health impairments due to inactivity are related to the car-oriented urban development of recent decades, along with sedentary lifestyles. A health-maintaining environment must therefore not only reduce direct health risk factors, but also contribute to health chances that may indirectly support health. Walking has been identified as the most influenceable behavior; it is also the most environmental-friendly mode of transport, social and health. From the planning view, the concept of walkability therefore aims at a built environment facilitating physical activity. It is increasingly recognized that walkability has become an important topic in the field of planning, urban design and health, since the built environment affects certain behaviors. From practice, concrete guidance is demanded as to the type of urban design features to be captured or applied to evaluate the walkability or to create active cities.^[30]



Fig. 4-36 Health map
(Source: Minh-Chau Tran, 2016)

Walkability as a field of study first began in the field of public health. Research in the field of public health stemmed from concerns about the rising rates of obesity worldwide. It was first initiated in the field of public health due to concerns about obesity rates. Since the 1990s, multidisciplinary walkability research has accumulated. Multidisciplinary walkability research has accumulated. These studies have included health sciences and transportation planning and,

later, urban planning in particular. The idea of walkability is not new in many countries, and the idea of promoting walkability through good planning and urban design is not new. This is despite the fact that in the last few years there has been a comprehensive understanding of the importance of health. However, walking as a way of life largely seems to play only a minor role. This is because today's developing countries should have no acute health hazards directly from the built environment compared to the industrial era. Urban planning can clearly only address health as a design issue, where health is objective, measurable and is objective, measurable, and generalizable.

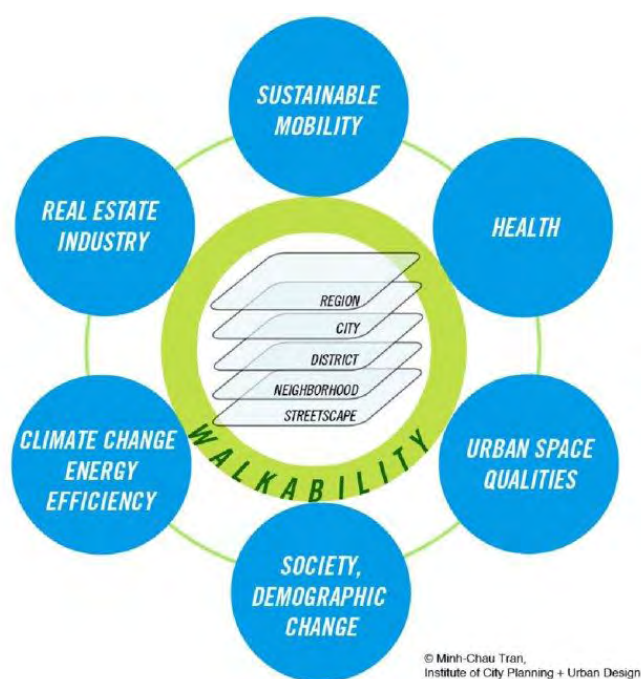


Fig. 4-37 The dimensions of walkability
(Source: Minh-Chau Tran, 2016)

Streets designed for high volume, fast moving traffic operate differently than streets designed for low volume, slow moving traffic. When embarking on designing a street, consider the following five guiding principles and the design principles that follow. Design for people; appropriate size; and provide multiple benefits. Street benches do not need to be hard, flat plastic. Wood, art, trees, lighting and details can draw the eye and humanize the environment. Streets are part of a larger puzzle; what happens on one street affects the other streets around it. Some streets clearly need to function as arterials to keep cars moving; others can focus more on shared spaces for pedestrians and bicyclists. A street should be physically designed to be safe enough, for example, that parents do not feel they have to hold their children's hands tightly at all times. The design of a street should connect the two sides of the street so that

people walking on one side can connect to the street.^[31]

4.3.1 Inclusive Design

This is despite the fact that academics and the broadsheet press still tend to refer to the "elderly" and "disabled" as if they form separate groups. There is a growing trend to acknowledge that age and disability are something we all experience and are therefore part of society. People with disabilities have become more confident, and for older people, the focus is now on independence. Both groups are eager to participate actively in the mainstream of society, rejecting the dependency and institutionalization of much of the last century, and beginning to assert themselves as consumers. Consumers who control a significant amount of disposable income. This new expectation provides a rationale for design that is "inclusive" rather than exclusive, and more closely aligned with contemporary social expectations.^[32]

All people move within a certain range of abilities and are able to do different things at different ages. Thus, ability is a relative concept, that is, relative to those abilities that are considered to be within the range of normal behavior at a given age. In this context, disability becomes synonymous with deviation from normal. According to the World Health Organization (WHO, 1980), 'impairment' is defined as a loss or abnormality in both mental and physical terms. A 'disability' then is any limitation or lack of ability to perform an activity as a result of an impairment. A 'disability' is a disadvantage experienced by a person as a result of an impairment or disability that limits or prevents the fulfillment of a role that is considered normal. These definitions imply a chain of cause and effect. Impairment can lead to disability, which in turn can lead to impairment.^[33]

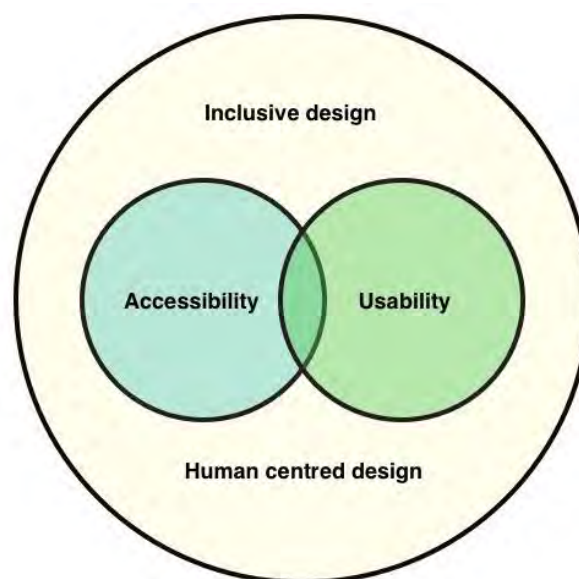


Fig. 4-38 Accessibility is part of an Inclusive design methodology
(Source: Josephine Miller, 2018)

The reality of the built environment is a social, physical, and attitudinal barrier for people with disabilities. It impedes their mobility, movement and accessibility. In the UK, most homes are inaccessible by wheelchair and accessible transport is the exception rather than the rule. And accessible transportation is the exception, not the rule. And most public and commercial buildings have few design features that provide accommodations for people with disabilities.

Inclusive Design is a document about the attitudes, values and practices of real estate professionals, including developers, surveyors and architects, in meeting the architectural needs of people with disabilities.^[34]

Inclusive design presents unique challenges because it is designed to improve usability for a wide range of users. This typically includes people with lower levels of ability as well as mainstream users. In inclusive design, a combination of approaches should be used rather than relying on a single approach.^[35]

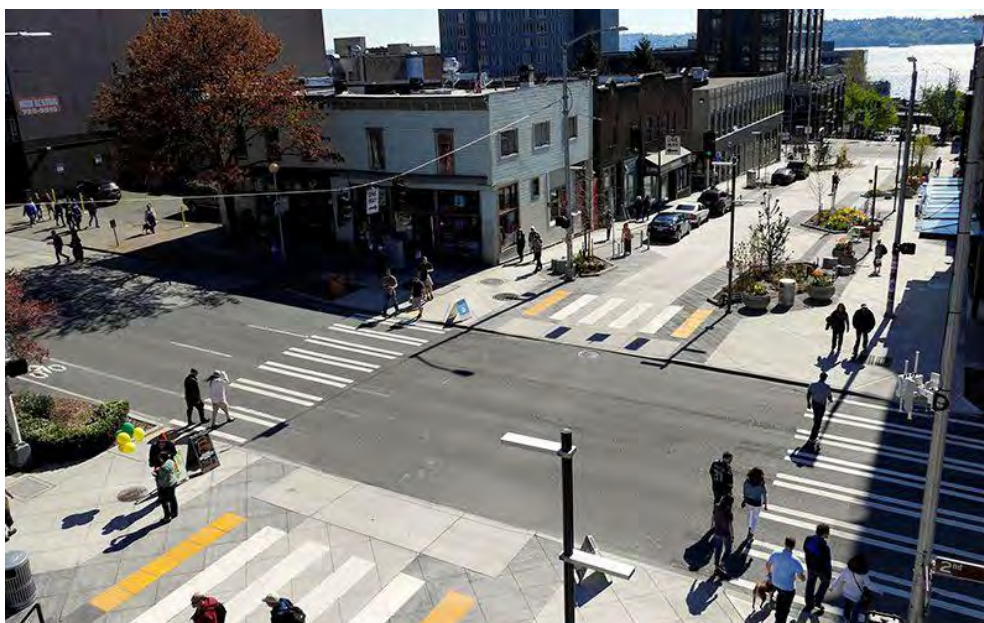


Fig. 4-39 Bell Street Park, in Seattle, is a shared street that incorporates universal design principles
(Source: SvR Design + Hewitt, 2010)

Therefore, it is important to consider the usage needs of all people when designing streets. "If we want everyone to participate in public life, we must design and build a public sphere that is inclusive." Public life cannot be available only to people with disabilities, young people or or healthy people."^[36] ASLA's universal design guidelines consider physical disabilities such

as mobility, blindness and low vision, and deafness; people with neurocognitive disabilities such as cognitive impairments like Alzheimer's; people with neurodevelopmental disorders such as autism; and people who are aging. ASLA defines the universal landscape as accessible, participatory, comfortable, ecological, predictable, multisensory, walkable and predictable. "Access to public spaces is indeed - and should always be - a civil right," said Alexa Vaughn, a deaf landscape architect who consulted with ASLA on the guidelines." If we continue to If we continue to design and plan cities that are inaccessible to certain people, we are committing a grave injustice to those people. This is about guaranteeing the rights of all people to public space regardless of disability." Accessible streets are especially important because they are the foundation for how people get around. "They are the arteries of our cities," says Vaughan." Increasingly, designers are moving toward greater accessibility and sustainability by considering pedestrians and bicyclists over cars. Designers can take this a step further by considering the bodies of people with disabilities in the streetscape."

Discussions about the equity and accessibility of streetscapes often focus on multi-modal transportation, such as reallocating space on car-dominated streets to accommodate pedestrians, public transit, and protected bike lanes. What comes after "complete streets"? -- streets designed to provide safe access for all users, including pedestrians.

"Complete Streets" are streets designed to provide safe access for all users, including pedestrians, bicyclists, motorists, and transportation participants of all ages and abilities. Transportation and safety advocates are calling for the creation of Dutch-style "woonerfs," or shared streets. On these streets, pedestrians, bicycles, scooters and cars share the same space, with no separate sidewalks or lanes. Prioritizing the free movement of people can lead to safer, more accessible streets for everyone.

The Americans with Disabilities Act (ADA) guidelines for streets are minimal and focus primarily on technical elements. Such as clear travel routes and curb ramps for people with physical disabilities. Other interventions, such as tactile pavement - bumps on curb ramps and accessible pedestrian signals - auditory cues that tell blind and low-vision pedestrians when they can cross the street. The ADA guidelines do not take into account the quality of the experience, or how pleasant and informative a place is to use. This has implications for people with sensory or mental impairments. Noisy, cluttered streets may just be annoying to some people, but for some people with disabilities, these qualities can make it serious.

In advance of consulting on ASLA's guidelines, Vaughn developed her own accessible street concept called "Deafscape". It applies the concept of Deaf Space. Deaf Space is a 10-year-old architectural approach rooted in the deaf experience of space that is applicable to the urban landscape. She proposes a minimum width of 10 feet for the streetscape and a buffer zone between the sidewalk and the multimodal transportation, consisting of landscaping, seating and bike racks. Her designs have a rhythm to them, help with spatial understanding, and look beautiful.



Fig. 4-40 Alexa Vaughn's DeafScape concept calls for streets with public seating, vegetation, bright lighting at night, tactile cues, and wide sidewalks
(Source: Alexa Vaughn and Courtney Ferris, 2018)

4.3.2 Connectivity

Connectivity refers to the directness of links and the density of connections in a street network. A highly connected network has many short links, many intersections, and minimal dead ends.

As connectivity increases, travel distances decrease and route options increase, making travel between destinations more direct and creating more accessibility. More direct travel between destinations creates more accessibility. It affects the demand for travel and the attractiveness of walking and cycling.



Fig. 4-41 Comparison in 800-meter radius walking catchment in different street connectivity scenarios (compact grid vs. sprawling suburb)
(Source: World Resources Institution, 2015)

An interconnected street pattern with short block lengths provides multiple routes, diffuses automobile traffic and shortens walking distances.

Neighborhood design, particularly street connectivity, has been understood to be an important component of urban sustainability. An important component of urban sustainability. Scholars have proposed a range of measures to assess connectivity A range of measures to assess connectivity, some of which have been adopted by North American governments in the development review process.^[37]

Regular walking, both recreational and transportation walking, has a significant preventive effect on health. However, population estimates show that the prevalence of participation in recreational or transportation walking sufficient to achieve health benefits is low. To achieve sustainable growth, environmental and policy measures at the community level are needed. Research identifying environmental correlates has highlighted aspects of the neighborhood-built environment. One particular built environment attribute that is particularly relevant to walkable transit (WFT) is street connectivity. While some studies have found no relationship or a negative relationship between street connectivity and total or recreational walking, a recent review reported that street connectivity was not associated with overall walking or

recreational walking, and a recent review reported that street connectivity was positively associated with WFT in the studies identified.^[38]

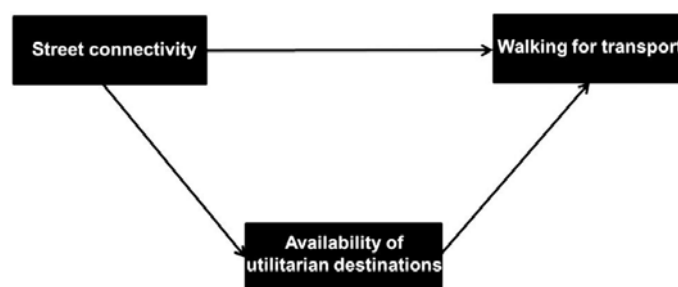


Fig. 4-42 Conceptual diagram to examine if availability of utilitarian destinations is a mediator in the association between street connectivity and walking for transport
(Source: Mohammad Javad Koohsari, et al. 2014)

Create multiple links for pedestrians and cyclists through an interconnected street network. Plan new subdivisions based on pedestrian and cyclist movement before the road network is fixed. Ensure pathway networks connect with arterial networks to travel longer distance (particularly relevant for cycle use) and that non-arterial streets connect. Balance with distinct design by function, associated speed classification and reduced accessibility, especially in residential areas. A dense network of streets can disperse traffic rather than concentrate it on arterials, so that traffic is more spread out and can be scaled accordingly. Excellent connectivity actively seeks to discourage car use by making local trips easier and more pleasant by foot. A connected network has more intersections making it easy to reach a destination in a reasonably direct route.

4.3.3 Safety

Street safety includes many aspects. Appropriate street lighting is the primary factor in increasing the perception of safety on the street, followed by the complexity of street form created by various business types, outdoor dining, street performers, and other pedestrian activities. In addition to the physical environment, age and gender influenced the level of pedestrian anxiety.

Street network layout characteristics are an important factor in traffic accidents.^[39] The design characteristics of street planes, cross-sections and interfaces also have a significant impact on traffic accidents. Different classes of streets have variability in traffic flow and differences in the impact on traffic accidents.^[40] Street density can influence the generation and distribution of traffic flows and significantly affect the occurrence of traffic accidents.^[41] The number of lanes, sidewalks, parking lot density, number of entrances and exits, arterial length,

streetscape width, connectivity (chain link ratio), and intersection density are also significantly associated with traffic accidents.^[42]

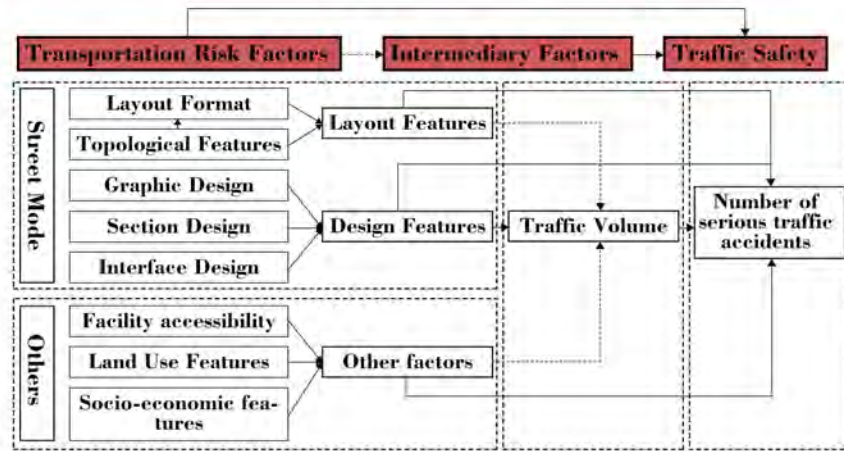


Fig. 4-43 Theoretical framework for the impact of street patterns on traffic accidents
(Source: Xie bo, Ling Changlong, Wang Lan, 2022; remade by the author)

Sidewalk safety design

The width of the sidewalk is matched to the usage requirements. The ideal width of the sidewalk is recommended to be approximately 12 people per yard (approximately 0.9 m) per minute. In addition, pedestrian crossing paths should be optimized. Additional diagonal and pedestrian priority crossing facilities should be installed at intersections to protect pedestrian passage and reduce crossing distances. Intersection and roadway conflicts should also be reduced. For streets with high pedestrian traffic, add as few motor vehicle entrances and exits to the roadway as possible. Narrow or reduce the number of motor vehicle lanes at larger intersections to achieve civil and quiet traffic. Improve traffic safety management facilities. Set up central dividers, safety islands, intersection edge slopes, and set up eye-catching crosswalk markings in wider roads to improve visibility. Optimize pedestrian signal timing, giving priority to pedestrians in the same phase to ensure that pedestrians cross the street safely.

The London Street Design Guidelines for sidewalk safety design state that sidewalk safety can be ensured in the following ways. First, implement sidewalk segmentation control. The sidewalk is divided into curb zone (0.45m), street facilities and green belt (0.5-2m), walking section (>1m) and building along the street section four space, the specific width needs to be adjusted according to different street environment. When the speed of the road exceeds 50km/h, the street facilities and green zone will be widened to separate people and vehicles. Second, the physical design to improve the warning. In the premise of ensuring the smooth

connection of two different levels of roads, at the intersection of the branch road, raise the height of the road surface to 7.5cm and set the width of the pedestrian crossing facilities at 2.4m or more, prompting motor vehicles into the new environment, should promptly adjust driving behavior, slow down the speed of turning vehicles to ensure the safety of pedestrians crossing the street. Third, to prevent the impact of on-street parking on walking. The design of the parking harbor should ensure that it does not affect the normal activities of pedestrians, while regulating the size of the parking harbor, which should not be less than 1.8m wide for cars, rental cars and motorcycles, and not less than 2.4m wide for parking spaces loaded with goods.

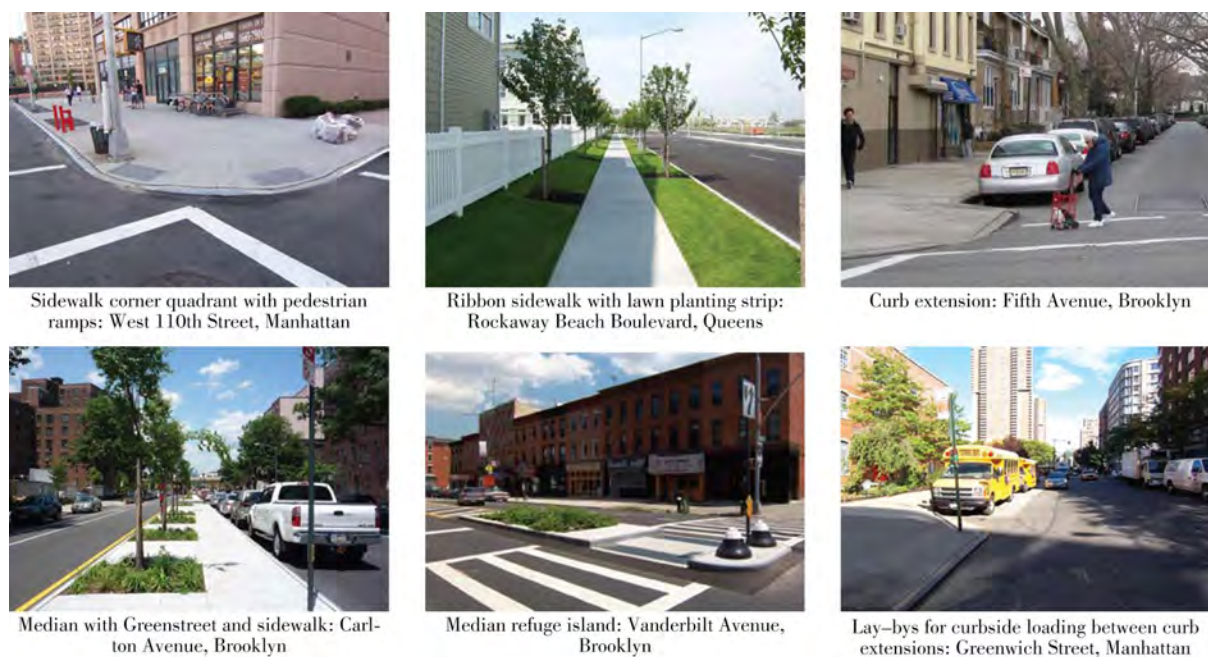


Fig. 4-44 Strategies to make a safe sidewalk
(Source: City of New York, 2009)

Bicycle lane safety design

As part of slow-moving transportation, urban street design should ensure the safety of bicycle travel, thus prompting residents to choose bicycle travel as a mode of transportation.

On the one hand, there is a need to enhance bike lane visibility. A wider buffer separation zone between the bike lane and the motor vehicle lane with white solid lines is needed to clearly distinguish the bicycle riding area from the motor vehicle driving area visually and to prevent bicycles from mixing with motor vehicles. On the other hand, reduce conflicts with on-street parking. When the parking lane is adjacent to the bicycle lane, or there is no physical separation facility between the bicycle lane and the parking lane, widen the parking lane design, generally not less than 3m, and the measure is also commonly applied in the area with

high parking turnover. Also, set up special signals for bicycles. Coordinated signal control for pedestrian, bicycle and motor vehicle traffic at busy intersections. Also, ensure safe sight distance. When setting up bicycle lanes, consider possible sight line obstruction to prevent traffic conflicts.

The City of London for bicycle lane safety design requirements, cycling facilities in line with the "London Cycling Traffic Design Code" standards, and according to whether the road has loading and unloading goods and parking needs, the bicycle lane is divided into mandatory bicycle lanes (bicycle traffic only) and proposed bicycle lanes (allocated by time, location, etc.). In addition, to optimize bicycle access at roadway intersections, the use of bicycle priority waiting areas is encouraged.



Fig. 4-45 Strategies to make bicycle lanes safer
(Source: City of New York, 2009)

4.4 Summary

This chapter proposes three thematic design strategies for street design, aiming to put street design at the forefront when carrying out urban design solutions, and to focus on people-oriented street design, while incorporating the concept of sharing in street design.

So, the first design strategy was about how to increase the importance of street design in urban design. So, I proposed the first strategy from street design to urban design. The transportation system of the city is used as the starting point for the design. The first step is to meet the daily travel destinations of residents to be reached within 15 minutes on foot, and to map these destinations to form an easily accessible walking network. The paths will be enriched to form continuous, safe and interesting streets, thus encouraging people to choose to travel on foot. Next is the need for bicycle trips to be met as much as possible, as well as public transportation trips. Lastly, motorized trips will be met. With the four transportation networks in place, the basic framework of urban design - the road network - can be formed.

This leads to the second design strategy, about how to form a shared street space. Starting from the spatial form of streets, different types of street space forms, corresponding activities of pedestrians and design strategies for shared spaces on that type of streets are explored. The

result is a design strategy for different types of streets.

The third strategy is a further refinement of the human-centered street design. Inclusive design, connectivity, and safety are taken into account in the design of the street, so that the street design meets all three of these requirements, resulting in a people-centered street.

The design strategies developed in this chapter are then applied to the design in Chapter five to test the strategies.

Chapter5 Urban Design of the Racecourse

5.1 Analysis of Guangzhou Racecourse

5.1.1 General Introduction

The object of the design study was briefly introduced in Chapter 1, and this chapter will mainly focus on the current situation.

Location

The area of the racecourse site is from Huangpu Avenue in the north to West Road, from West Road to Racecourse, from East to Tancun Road, and from South to North Road to Racecourse, with a total area of about 38 hectares. From the planning of this area in the development plan of Tianhe District of Guangzhou, the racecourse is located in the planning area of Zhujiang New City, adjacent to the Guangzhou International Financial City area in the east. It is a part of the economic development belt of Guangzhou City along the river. The bustling Tianhe Road shopping circle and the high education zone are to the north, and across the river to the south is the Pazhou CBD. On a planning level, the area where the racecourse is located is of highly high land value. It is worth considering how the racecourse can bring its land value into play as a site linking left and right Zhujiang New Town and Financial City.

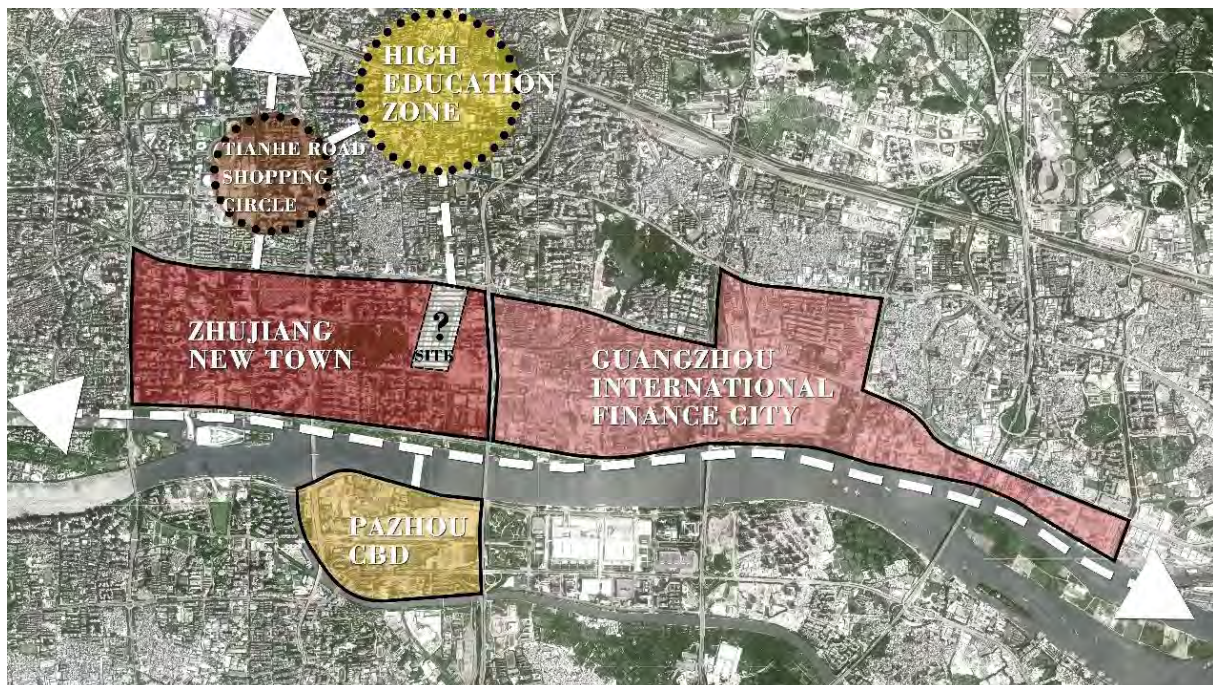


Fig. 5-1 Location of racecourse in a planning level of Tianhe District

Focusing on the Zhujiang New Town area to look at the racecourse site, we can see the

positioning of the racecourse under the Zhujiang New Town planning. Pearl River New City is divided into 14 plots in planning. A, B, F, and J are core plots located on the planned city axis; I plots are edge plots of core plots located on the west side of the axis, adjacent to core J plots; the rest of C, D, E, G, H, K, L, M, N belong to the city core plots. The plot where the racecourse is located belongs to plot M. In the plan of Zhujiang New Town. This site is listed as the city's central area.

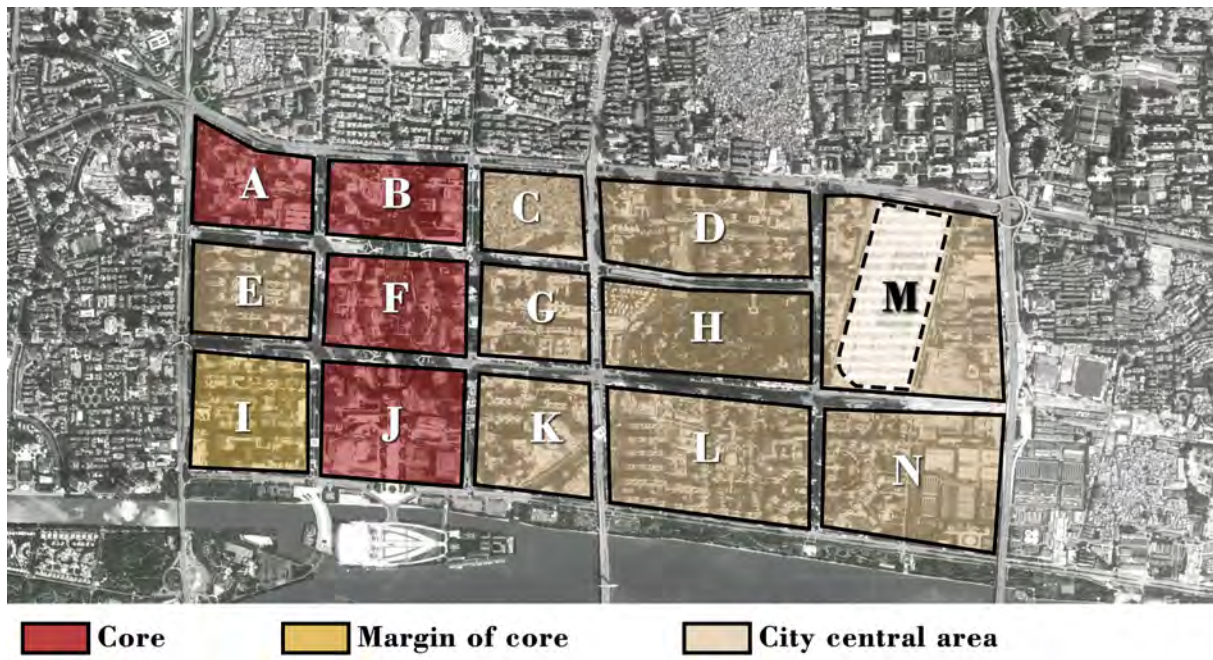


Fig. 5-2 The blocks A-N of Zhujiang New Town

Development

In the late 1980s, the Chinese government began to think about reviving horse racing. At that time, except for table tennis and basketball, some sports that required equipment with substantial financial support and were also criticized as bourgeois sports during the Cultural Revolution were not popular and widespread. The head of the Guangzhou Jockey Club said, "At that time, someone suggested whether Guangzhou could try to start horse racing to raise welfare funds." Considered to be ahead of history, horse racing was held in Guangzhou for the first time, and Guangzhou was allowed to try out the "horse lottery" on the Hong Kong model.

In 1992, Guangzhou City implemented the city's "Eastward" development plan, and the city's Standing Committee decided to develop the Pearl River New City. As part of this new city, the racecourse was also on the agenda for preparation. On August 10th of that year, the then mayor of Guangzhou, Li Ziliu, presided over an executive meeting of the municipal

government and agreed to establish the Guangzhou Racing Club and the Guangzhou Racing Entertainment Corporation.

In 1992, the Guangzhou Municipal Government formally proposed to hold horse racing activities, and four shareholders, including Guangzhou Sports Development Company Limited, formed the "Guangzhou Jockey Club" with a registered capital of RMB 66 million. The Club then invested more than 80 million RMB in constructing the racecourse, which was completed in January 1993.



Fig. 5-3 Photos of racecourse in 90s
(Source: Baidu)

Since 1996, the CPC Central Committee, the province, and the city have repeatedly stressed the need to stop betting on horse racing in Guangzhou. However, Huang Qihuan, the chairman of the General Company in charge of horse racing and entertainment, has tried every means to insist on betting on horse racing. The company first changed the format of "betting on betting" to "quiz" and later to "tickets to prizes in kind" and continued betting on horse racing until November 1999. The Guangzhou Municipal Party Committee and Guangzhou Municipal Government ordered the cessation of horse racing.

On December 12, 1999, the racecourse ran its last race, and on December 14, horse racing was banned in Guangzhou. In the seven years since then, 757 races have been run at the Guangzhou Racecourse.

On August 6, 2003, the Guangzhou Municipal Government announced that it had officially approved Guangzhou Racing Entertainment Corporation to lease out 210,000 square meters of the Guangzhou Racecourse and convert it into an auto trading market, Guangzhou Sanying Industrial Co. On December 13 of the same year, the Three Eagles Auto City started its trial operation. The planning required that the two scoreboards in the racecourse would not be removed and were to be used as permanent monuments.



Fig. 5-4 Photos of racecourse in 2000s
(Source: Baidu)

In 2013, Guangzhou Racing Entertainment Corporation issued a "Notice of Non-renewal of Lease Contract on the Expiration of Auto City," stating that the company would not renew the contract with each operator after the expiration of December 31, 2013. From April 1, 2014, Auto City would be completely closed, and the water and electricity supply would be stopped. The outer part of the racecourse has been transformed into restaurants and furniture stores, as well as a golf driving range, badminton court, KTV, and many other service projects.



Fig. 5-5 Photos of racecourse in 2022
(Source: Photos by the author)

In 2021, with the Notice of Competitive Consultation for the Tianhe District Machang Land Function Enhancement Development Planning Project, the long-silent Machang Land returned to public view.

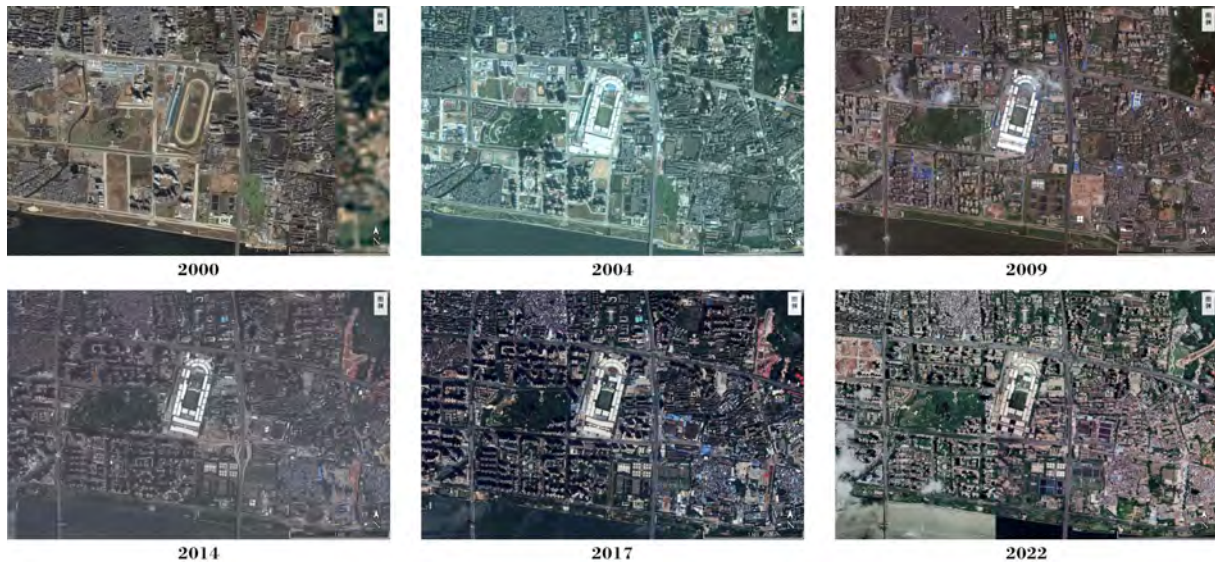


Fig. 5-6 Racecourse from 2000 to 2022
(Source: Google Earth)

Land use

The site's function shows the current functional positioning of the racecourse. Under the development requirements of high-quality development and "new vitality of the old city," Guangzhou put forward the action of "four new and colorful" in order to "integrate and revitalize the operational resources in infrastructure and public services, and launch more government-social capital cooperation projects." It is necessary to upgrade the functions of the low-end and inefficient racecourse site.

A large number of residential sites are located around the racecourse. The type and year of construction of the residences also vary, from a dense urban village like Shipai Village in the north to an open community like Kaixuan Xintiandi in the south. There are fewer commercial sites. A Taiyang Xintiandi shopping center is on the west side, immediately adjacent to the race track. The leading commercial is mainly tiny retail, and the first-floor retail stores in the residential area meet the daily needs of the residents. According to street research, nearby residents choose to arrive at shopping centers other than the racecourse for their shopping.

There are more business sites than commercial sites, mainly concentrated at the southern end of the racecourse. Several high-rise office buildings are distributed, including Guangfa Securities Building, Fuli Ying Sheng Building, and Guandong Technology Building. Educational land is more distributed. Jinan University is located north of the racecourse

across Whampoa Avenue, and there are also compulsory school sites such as primary and secondary schools.

Educational resources are sufficient. Educational land is more distributed. Jinan University is located north of the racecourse across Whampoa Avenue, and there are also compulsory school sites such as primary and secondary schools. Educational resources are sufficient. There are fewer cultural sites, with the Guangzhou Library and Museum in Zhujiang New Town, and a lack of cultural facilities within 1 km of the racecourse. However, there are many sports sites inside the racecourse, golf courses, badminton courts, and other sports sites. Pearl River Park, located west of the racecourse, is an excellent green space near the grounds. In addition, is the riverfront park to the south.

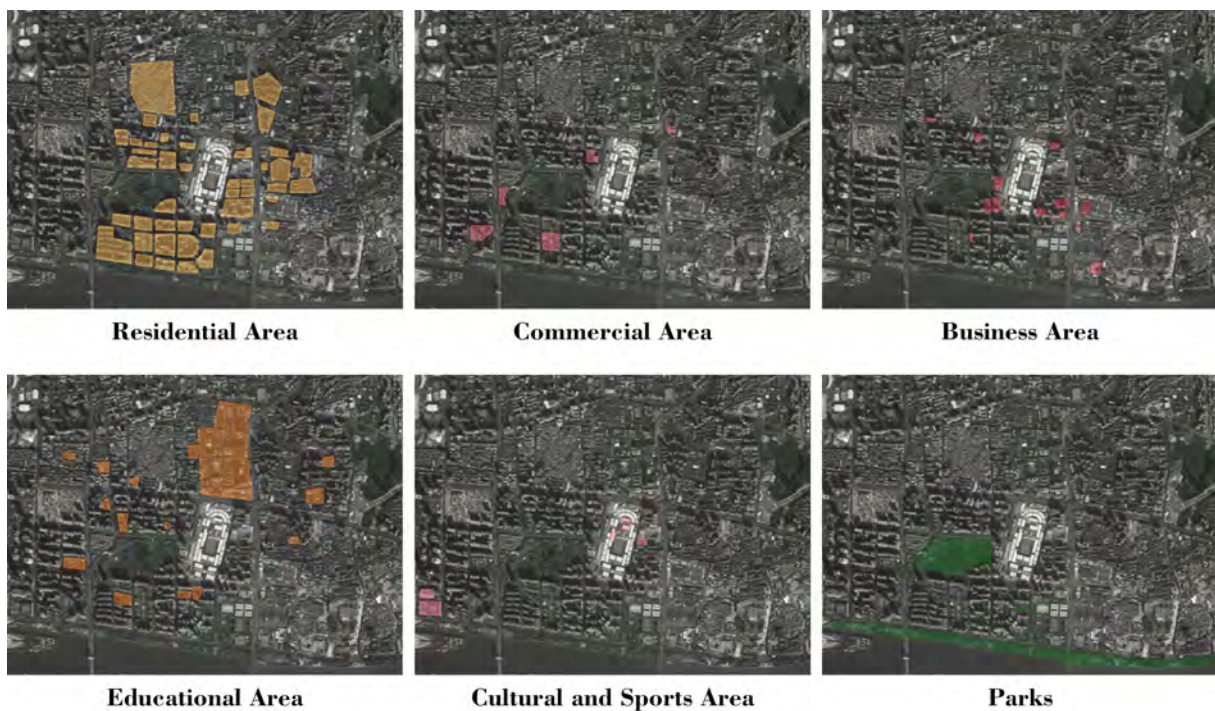


Fig. 5-7 Land use situation around the racecourse

Community

It is taking the community's 15-minute living circle as the scope. The distribution of living services and other facilities can be seen in whether the daily needs of residents are met. Streets grade the construction of a 15-minute living circle, so it is necessary to know the distribution of streets around the racecourse site. The construction of the community under the street belongs to it will be further analyzed.

There are five subdistricts around the racecourse. The racecourse site belongs to Xiancun

Subdistrict, and several communities are distributed around it. To the north is Shipai Subdistrict and to the south is Liede Subdistrict. To the east is the Yuancun Subdistrict, and the northeast corner is the Tianyuan Subdistrict.

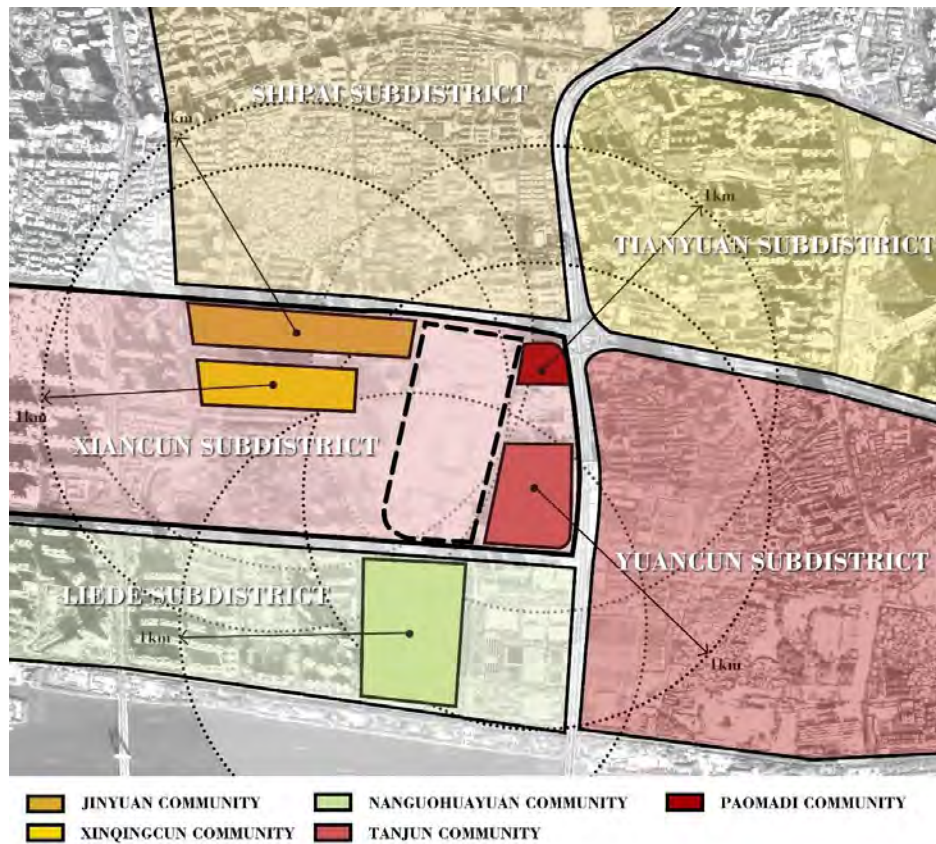


Fig. 5-8 Subdistricts and community distribution around the racecourse.

The residential areas in China are mainly closed communities, and the construction environment and facilities inside the community meet the daily activity needs of the residents. The analysis of the construction of facilities in the community near the site can help to understand what other public service facilities the site needs to provide to the residents. The construction of the community's interior mainly looks at four indicators: greening rate, public green space, sports fields, and public recreational space.

With the racecourse as the center, the 1 km range is the research area (1 km means 15 minutes are living circle range). The residential area to the north is mainly Shibai Village (urban village), which is not a gated community; therefore, no analysis of its internal community facilities is conducted.

The specific results are shown in the figure below. The greening rate of all the neighborhoods is above 10%. Only Paomadi Garden in the southeast has a greening rate of about 10%, while

the rest of the neighborhoods have a greening rate of 20% or more. Each neighborhood is equipped with green space in terms of public green space. Sports facilities are limited, and some communities are equipped with swimming pools, badminton courts, tennis courts, and other sports venues. Public recreation land is only partially configured in the south and the west in the Yufeng neighborhood.

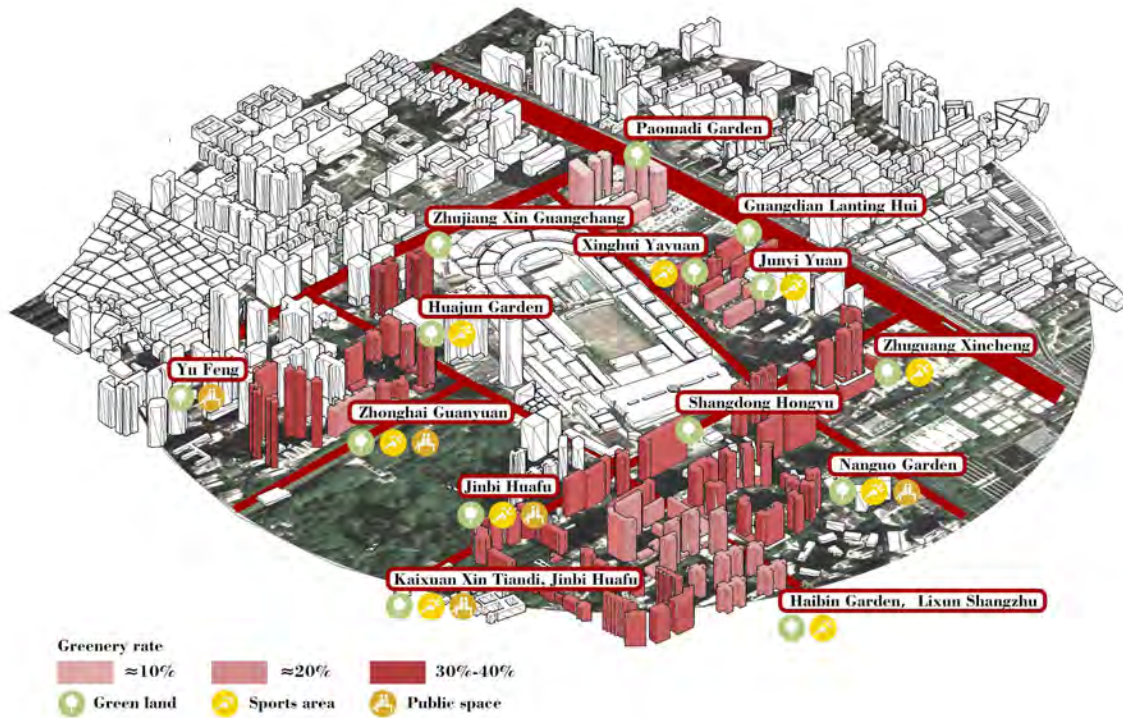


Fig. 5-9 Facilities in the communities around the racecourse

In general, the neighborhood around the racecourse is well equipped with greenery, and Pearl River Park also meets the residents' needs for park greenery. However, sports facilities and public recreational land are lacking. In the subsequent design, it is necessary to add some plaza land with hard pavement for residents to create public space and meet their daily leisure needs.

POI

According to the design strategy mentioned in Chapter 4, the functional distribution within the 15-minute living circle needs to be analyzed. By analyzing the distribution of functions within a 15-minute walking distance, it is possible to know whether the essential functions that residents need in their daily lives are being met. A 1 km area centered on the racecourse and a 1 km area centered on the four surrounding communities were used as the survey area.

Calculate the distribution of various types of points of interest. Figures 5-9 and 5-10 below show the specific functions and distribution.

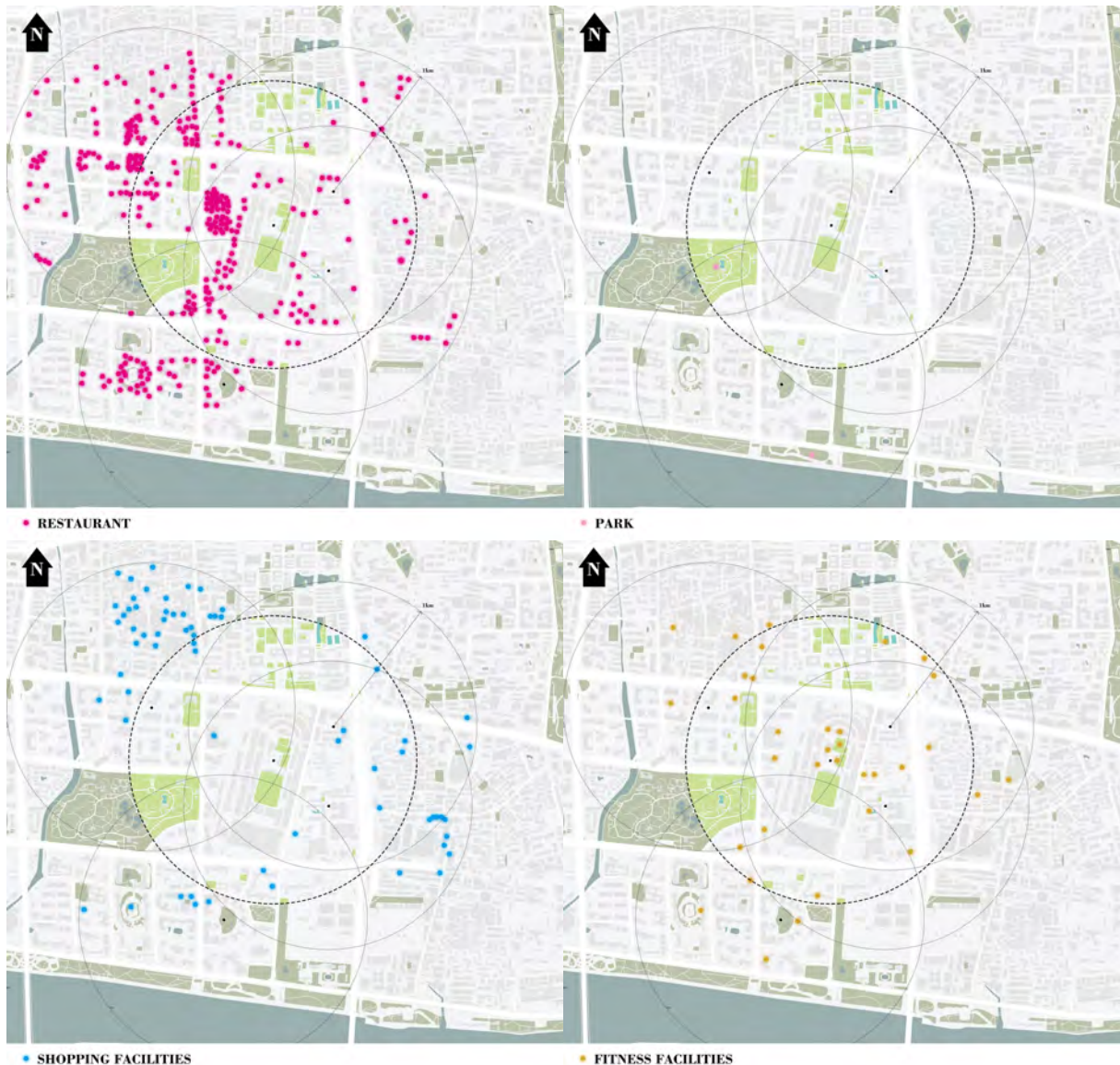


Fig. 5-10 POI distribution 1(restaurant, park, shopping facilities, and fitness facilities)
(Source: Draw by the author; data from Baidu map)

Restaurants are more densely distributed, as can be seen in the first small map in Figure 5-9. There are various kinds of restaurants around the racecourse. As mentioned in the introduction to the basic situation of the racecourse, the main business inside the racecourse is now the restaurant industry. The racecourse food circle is the leading business circle of the racecourse today. This is what needs to be considered in the subsequent design. The function of the racecourse food town needs to be retained, which belongs to the memory of a generation of people for the racecourse.

The second is the distribution of park scenes. Only one park, Pearl River Park, exists within the study area. Pearl River Park is a green and ecological park that provides residents with a place to go for leisure. According to the street research, the residents demand hard-paved parks and consider designing a parking space different from Pearl River Park's subsequent site design.

The distribution of shopping facilities and the racecourse area business needs some supplements. The direct commercial support is the Taiyang Xintiandi Shopping Center, which can be considered for additional commercial functions.

The fourth is the distribution of sports and fitness facilities, with more sports fields distributed inside and to the east of the racecourse. These sports fields are also the more characteristic business of the racecourse today. The redesign of the racecourse needs to consider the retention and redesign of sports facilities.

The distribution of transportation facilities shows that the number meets the criteria. Transportation stations are distributed near the main streets and residential areas, and there are no public transportation facilities inside the racecourse. Therefore, when redesigning the racecourse, it is necessary to consider adding transportation stations inside to meet the needs.

In terms of educational facilities, the indicators are met. However, suppose residential land is added to the site, and residential housing is added. In that case, additional elementary school and kindergarten configurations need to be considered to meet the educational needs of the newly moved-in residents.

As the map of cultural facilities shows, there is a slight lack of cultural facilities. However, the number of cultural facilities within a 15-minute walking distance is still in line with the requirements. Consideration can be given to increasing the number of complex cultural facilities, such as community cultural centers, to provide a public cultural center for the surrounding residents.

The distribution of medical facilities can be seen as more abundant medical resources. General hospitals, pharmacies, disease control centers, etc., meet the daily needs of residents.

More noteworthy is that cosmetic medicine accounts for many of these dense medical facilities. It can be seen that the residents in the vicinity of the site have special needs in terms of body maintenance and a particular pursuit of quality of life.



Fig. 5-11 POI distribution 2(transportation facilities, educational facilities, cultural facilities, and medical facilities)

(Source: Draw by the author; data from Baidu map)

The specific number of statistics for each type of facility is shown in the table below. The primary classification divides essential amenities into nine categories: culture, education, fitness, medical care, transportation, shopping, food & beverage, recreation, and senior care. Each category is subdivided into secondary categories.

Table. 5-1 Specific number of each type of facility

First level classification	Second level classification	Amount
Culture	Large-scale cultural facilities / Community cultural facilities (science & technology museums, libraries, cultural palaces, exhibition halls, art galleries, museums)	5
Education	Kindergarten	13
	Primary school	3
	Secondary school	2
	Total	18
Fitness	Gymnasiums / Sports areas / Fitness areas	24
Medical care	Hospital (general hospitals, CDCs, special hospitals, community health centers, clinics)	13
	Pharmacy	6
	Total	19
Transportation	Bus Station / Subway Station	19
Shopping	Commercial (shopping centers, supermarkets, convenience stores)	12
	Food Market	0
	Total	12
Food & Beverage	Chinese and foreign restaurants	180
	Fast food restaurant	50
	Total	230
Recreation	Park/Scenic Spot	1
Senior Care	Institutionalized / Community Care	0

From the table, it is clear that the more tightly packed functions of the racecourse site are the fresh food market and elderly service facilities. The facilities that can be supplemented are shopping, cultural, and educational facilities (elementary schools). The functions that need to be retained in a targeted manner are food & beverage and fitness.

5.1.2 Current Situation

5.1.2.1 Street

The road framework around the site is prominent but poorly connected. The east-west direction is connected to the west via two arteries. They are Huangpu Avenue to the north and

Huacheng Avenue to the south. The roads on the east and west sides are secondary roads, which link the north and south. The secondary roads on the east and west sides are Tam Village Road on the east and Racecourse Road on the west. Feeder roads then connect each main road and the secondary road.

Regarding street types, the roads around the site are mainly lifestyle roads, with various road types. Huangpu Avenue on the north side is a traffic-oriented street, Machang Road is a wide street, and the streets around Tai Yang Xintiandi are commercial.



Fig. 5-12 Street levels (left) and street types (right) around the racecourse

The streets around the racecourse are classified according to a matrix of street levels and street types. Classification is shown in Figure 5-14. The vertical axis is the street level, and from top to bottom are an expressway, main road, secondary road, and branch road; the horizontal axis is the street type, and from left to right are traffic-oriented streets, commercial street, comprehensive street, living street, and landscape street.

The Huanan Expressway on the east side of the racecourse is an expressway in terms of street level and a traffic-oriented street type. This roadway creates a degree of division between the parcels to the east and west. Pedestrians on the east and west sides of the expressway can only travel from the crossing and the space under the viaduct. Also belonging to the traffic-oriented street is Huangpu Avenue on the north side of the site, but it is below the Huanan Expressway in terms of street level and is an artery. Huangpu Avenue also creates a cut in the parcels to the north and south, with pedestrians completing the north-south crossing from the underpass.

The main road around the racecourse is also Huacheng Avenue, which is located on the south

side of the venue. Huacheng Avenue differs from Huangpu Avenue in that it is a comprehensive street in terms of street type. There are more street functions because residential and commercial functions are distributed on both sides of Huacheng Avenue.



Fig. 5-13 Huacheng Avenue facade

The majority of the other few streets are mainly sub-arterial streets, while they vary in street type. There are both Pingchuan Road, a commercial street, and Machang Road, a comprehensive street. Tancun Road, a living street, and Jinsui Road, a landscaped street located on the north side of Zhujiang Park.



Fig. 5-14 Tancun Road facade

The remaining feeder roads, represented by the roads between residential areas, are amenity roads, meeting the daily travel needs of residents.

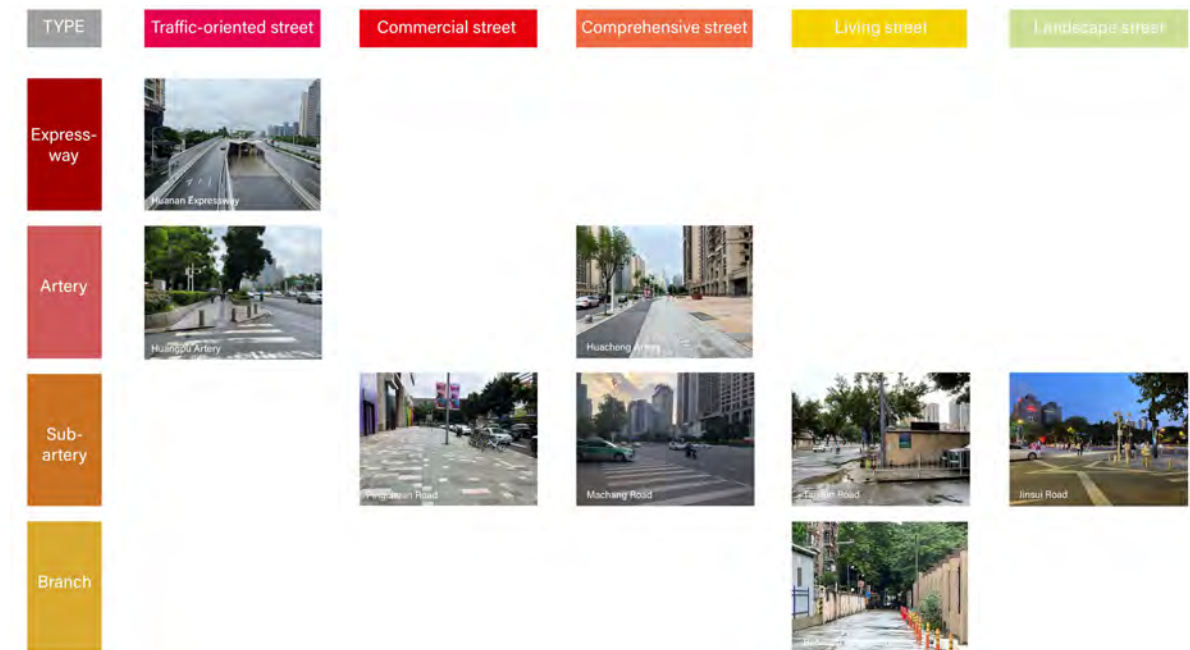


Fig. 5-15 Street matrix

5.1.2.2 Public space

Some public spaces are distributed within a 1 km radius of the racecourse. One of the highest quality is Pearl River Park, a green park that can provide residents with a place to relax. The sports field is next, distributed inside and to the east of the racecourse. The central green space inside the track, which initially belonged to the race track period, is now utilized as a golf course site. The rest of the public space is utilized for parking space use. A large number of motor vehicles and kindergarten school buses are parked.

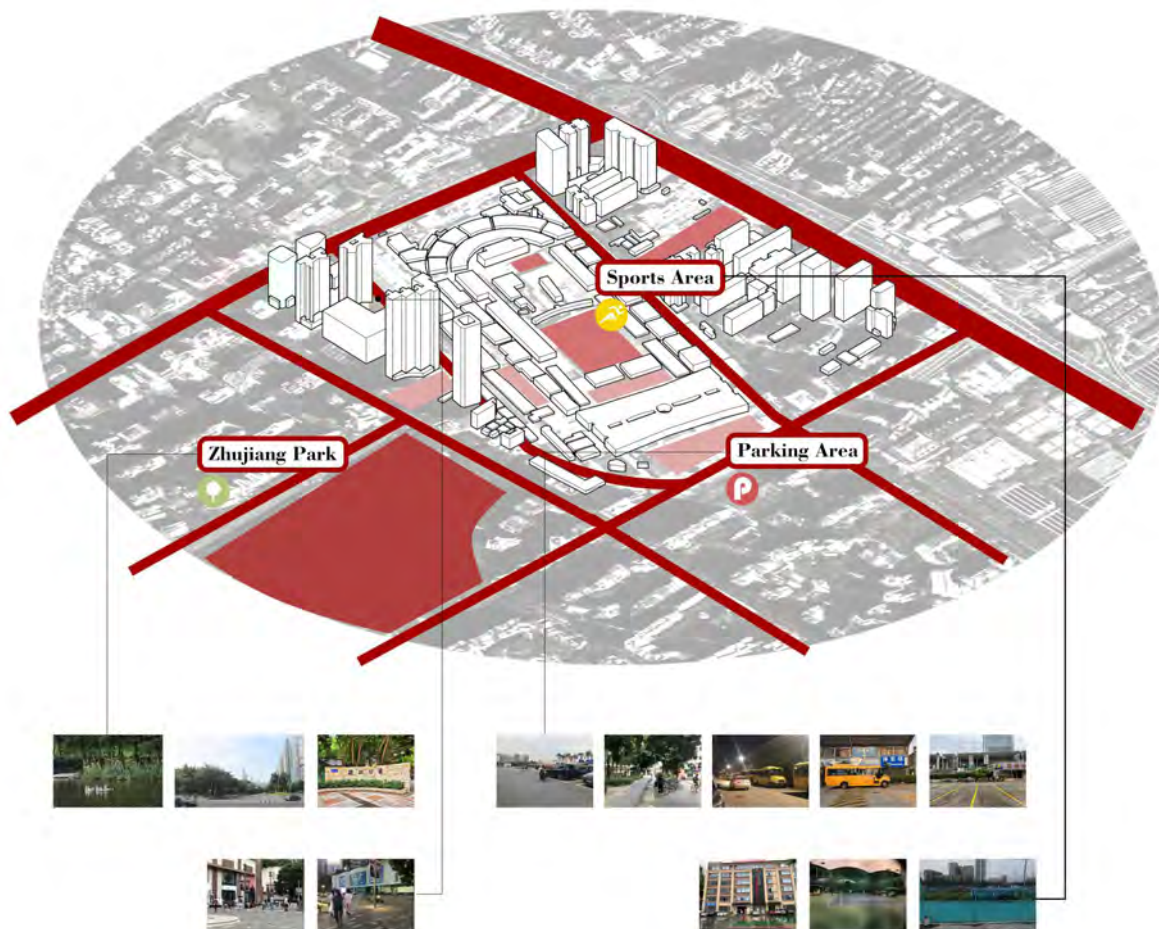


Fig. 5-16 Distribution of public space within 1 km of the racecourse

In terms of public space, the vicinity of the racecourse lacks spaces that can provide daily interaction and activities for residents. Based on street interviews, it is clear that there is a demand for square dancing among older groups, and the lack of such hard-paved public space near the racecourse has led them to choose to go to the riverfront park, 1 km away, for their

activities. There is a need to provide public space within site to meet the needs of the residents.

5.1.2.3 Traffic system

The transportation system is divided into four themes, the pedestrian network, the bicycle network, the public transportation network, and the motor vehicle network. From these four transportation systems, the traffic of the site is analyzed.



Fig. 5-17 Pedestrian network

First is the walking network. The sidewalks outside the racecourse are complete, with some residential areas having cutoffs. The residential parcels on the east side have a low density of the pedestrian network, and there is a lack of pedestrian paths inside the parcels, with only two alleyways. The lack of a pedestrian network inside the racecourse creates a significant gap in the pedestrian network of the entire site. A square exists on the north side of Taiyang Xintiandi.

Lack of connection between Pearl River Park and the central green space of the racecourse. The pedestrian system does not link several spatial nodes; the pedestrian system amounts to just providing walking and does not take into account the priority of walking.

The second is the bicycle network. Only Jinsui Road and Huacheng Avenue on the north and south sides of Zhujiang Park have bicycle lanes. Machang Road, Pingchuan Road, and Tancun Road are all mixed with bicycles and motor vehicles, and bicycles cannot be protected, causing some trouble to bicycle users. The streets between residential areas are mixed with bicycles and pedestrians, and bicycles cause problems for pedestrians.

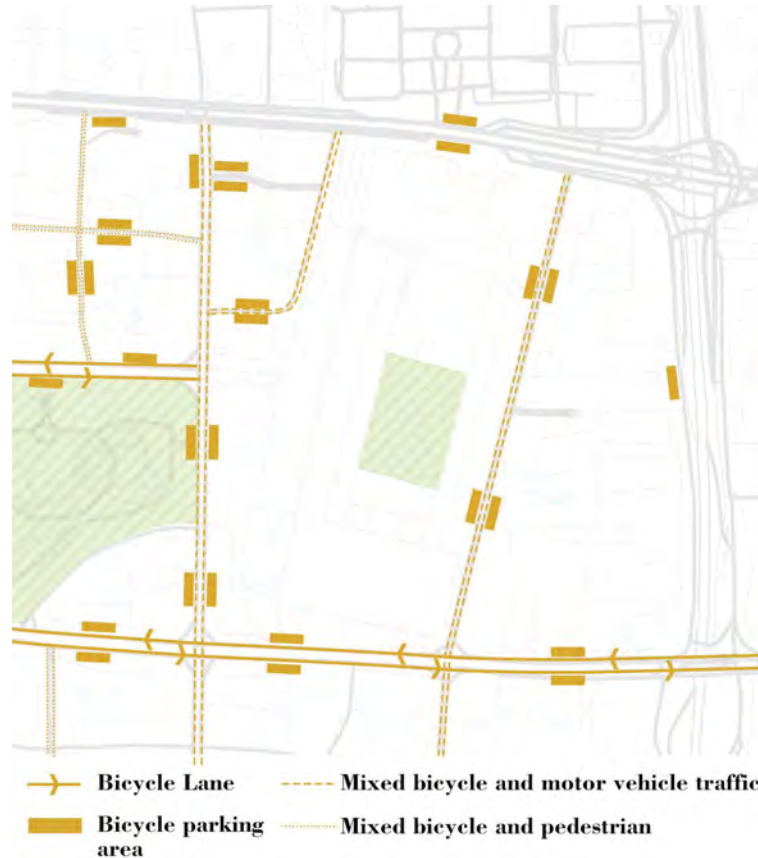


Fig. 5-18 Bicycle network

Bicycle parking spaces are provided on every street to meet the needs of residents for bicycle parking. Nevertheless, research at the actual sites revealed that many street bike parking strips were vacant. On the other hand, on Machang Road, near Taiyang Xintiandi, and near the Tancun Subway Station on Huacheng Avenue, bicycle parking far exceeds the designed parking space capacity.

The public transportation system in the site includes subway lines and stations distribution of bus lines and stations. The radiation range of the bus stops is 500 meters in radius. The construction of bus routes and bus lanes was analyzed. The more coordinated and convenient the public transportation network is, the better it will be able to meet the public transportation

needs of the residents and thus reduce the number of private car trips. The location of bus stops mainly considers the starting points of daily trips in residential, commercial, and business areas. The ease of public transportation interchange also increases the willingness of residents to choose public transportation for their trips. The public transportation network of the Racecourse area is shown in Figure 5-16.

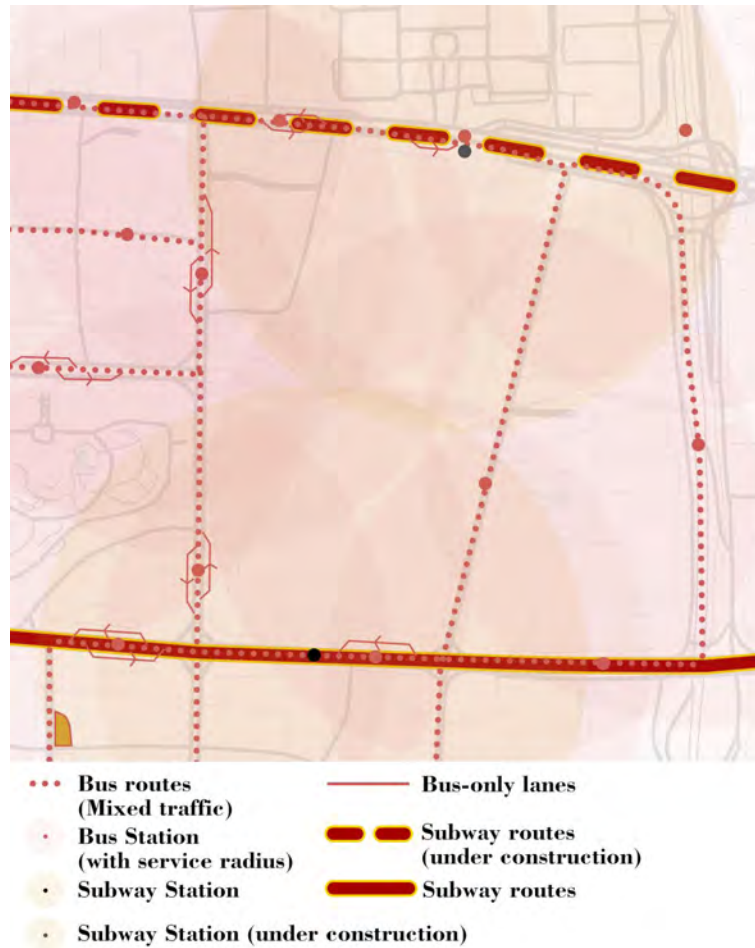


Fig. 5-19 Public transportation network

Huangpu Avenue and Huacheng Avenue are each served by two subway lines, Line 13 (north), which is under construction, and Line 5 (south). Both lines have stations stopping at the north and south ends of the racecourse. The bus lines cover the roads around the racecourse. Regarding bus stop service, the current stops radiate the entire area and meet the residents' demand for bus travel. Bus stopping lanes will be available near most bus stops to ensure bus stops.

For public transportation, bus lanes can enhance the priority of public transportation on the

road. Bus lanes can be considered on streets where there is a need to improve public transportation. Also, with the site's redesign, new bus stops will need to be built within the racetrack to accommodate the residents of the new functional site.

The motor vehicle network was analyzed mainly, such as motor vehicle lanes, speed changes, and road construction. From the perspective of motor vehicles, the situation of motor vehicle traffic in the racecourse area.

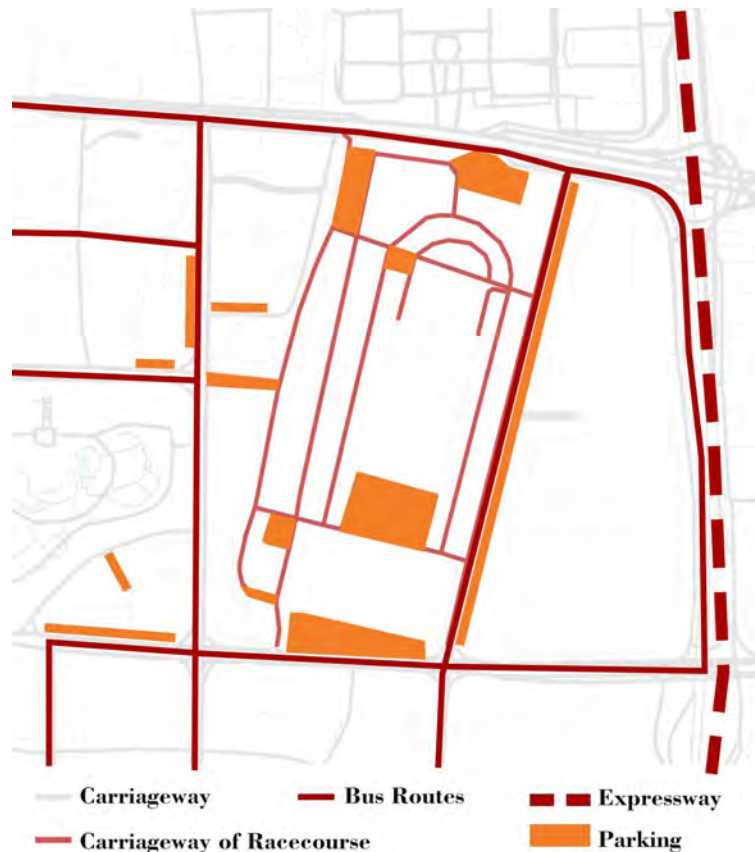


Fig. 5-20 Vehicle network

In the racecourse area, Huangpu Avenue, Huacheng Avenue, Machang Road, and Tancun Road, the four streets surrounding the racecourse are all familiar roads for public transport and motor vehicles. East of the dashed line indicated by the expressway, this expressway brings a particular impact on the traffic crossing, namely, from south to north. Only Huangpu Avenue and Huacheng Avenue can be crossed. The central carriageway can not be crossed due to the presence of elevated.

The internal carriageway of the racecourse is disconnected from the city road. The internal roads are connected to the city through four entrances and exits and are self-contained. At the

same time, the interior of the racecourse is filled with a large amount of parking space, both centralized parking and linear parking strips, which can be found everywhere inside the racecourse.

For the motorized traffic network, the main issue is to bridge the internal space of the site with the city streets to avoid traffic congestion. In addition, there is a need to address the issue of parking.

5.1.2.4 Group Portrait

An analysis of the people who are active at the site can help identify the activities and spaces the site needs to provide. The people are divided into three main categories: people who come to the site for consumption, people who come to work at the site, and people who live there. Then expand on what types of people are there, what activities they are doing at the site, and what these activities require.

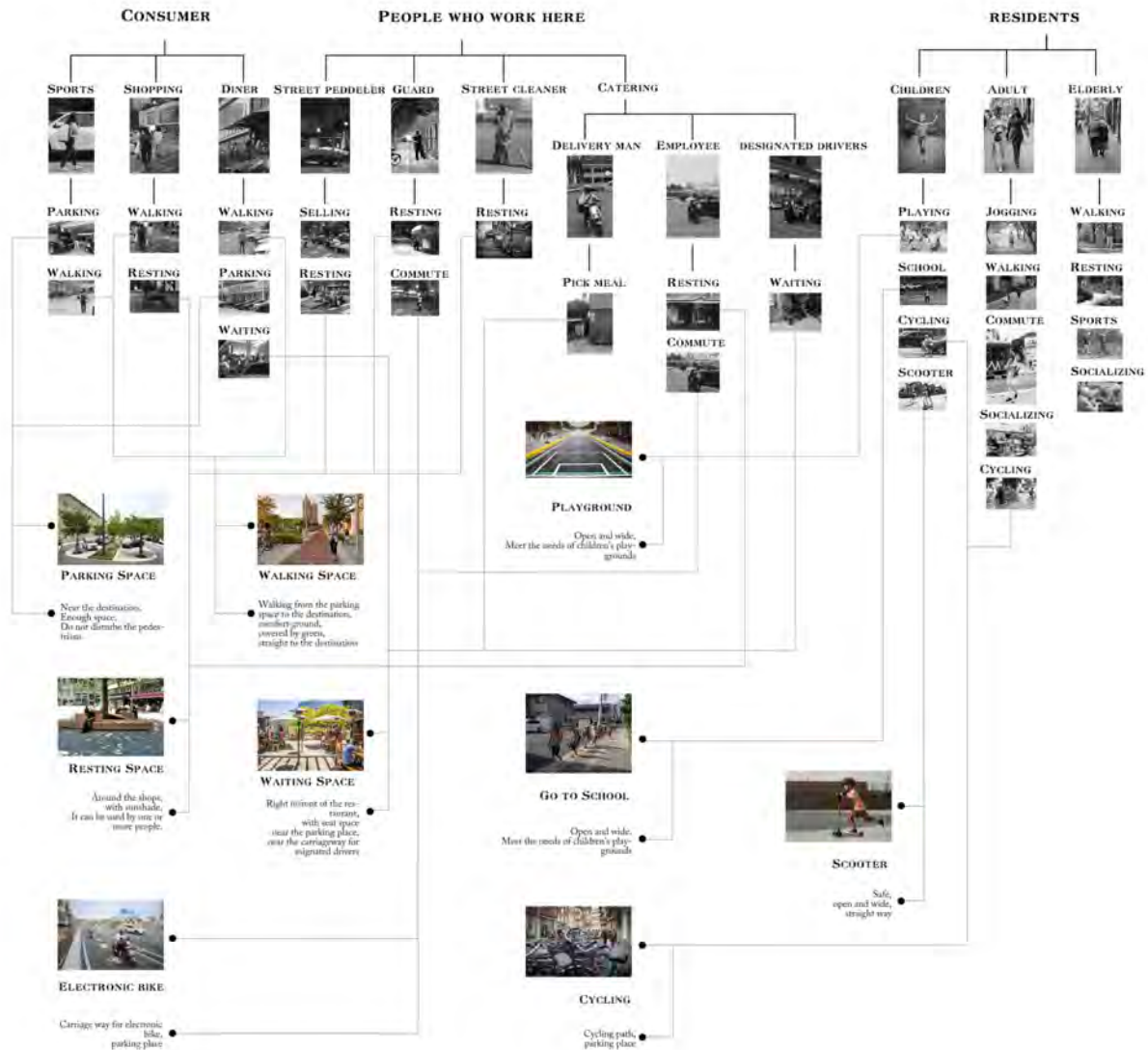


Fig. 5-211 Group portrait

Consumers cover three main categories, those who come to the racecourse for sports, those who shop, and those who dine. Based on the observation of these people at the site, it was found that their specific behaviors at the site were: stopping, walking, resting, and waiting. The specific spaces are parking space, walking space, waiting for space, and resting space. The following requirements need to be met for the parking space: the parking location is close to the sports field, and the walking space between the parking area and the sports field is a good experience. The requirements for walking space are safety, short walking distance, and good walking experience. Specific requirements for rest space are resting seats, space to meet communication, shade facilities, and close to the sports field.

The people who come to work at the venue are street vendors, security guards, street cleaners,

and workers related to the catering industry. The catering industry is a significant business of the racecourse. The staff variety is more abundant. These workers can also be divided into delivery workers, servers, and chauffeurs.

The main activities carried out by these workers at the racecourse are vendor selling, resting, commuting, a delivery man picking up food, and a chauffeur waiting for customers. Vending behavior in the racecourse is mainly concentrated in the section near the commercial area and the subway station entrances and exits, two sections of high traffic flow. The street space in these places is not more spacious, in addition to the sidewalk space occupied by vendors selling bicycle parking and occupying an ample space, coupled with the high volume of passing people, resulting in a relatively narrow and congested street space in these two lots.

There is a need to design a dedicated space for vendors on the street to ensure that the selling behavior does not interfere with the activities of other street users. Rest and wait for this type of space, similar to the previous consumer needs rest space, the requirements are the same, these spaces need to be provided on all types of streets. More remarkable is the pick-up space for take-out drivers and the waiting space for chauffeurs. The pick-up space can be combined with a back kitchen or storefront. It also provides a space for easy temporary parking of electric bicycles so that the takeaway driver can ride away directly after picking up the food.

The people living in the racecourse are mainly classified according to their age, divided into children, adults, and older adults.

Children's behaviors include: playing, going to and from school, riding, riding scooters, etc. For children, streets need to provide a safe and playful space for them to play. Certain play areas need to be created for children in living, commercial, and landscaped streets.

Adult behaviors on the site include: jogging, walking, commuting, socializing, and cycling. These can be designed to correspond to the type of street. For example, street furniture can be provided in living streets to create enclosed spaces for daily interaction; in landscape streets, jogging and cycling paths can be created to provide daily fitness and leisure places for residents.

The elderly have exercise in addition to walking and resting, and socializing. According to street interviews, many seniors reported a lack of hard-paved areas for their use in square dancing. In addition to safety and comfort, do not forget that seniors have particular needs for quality of life on the streets.

Questionnaires were distributed to further understand the needs and evaluation of the street by the residents and various activity groups in the vicinity of the racecourse. The questionnaire

includes background information about the respondent. Background information in turn covers the respondent's home address, the number of household members, and the age composition of household members. The background information of individuals includes personal age, gender, education, and occupation.

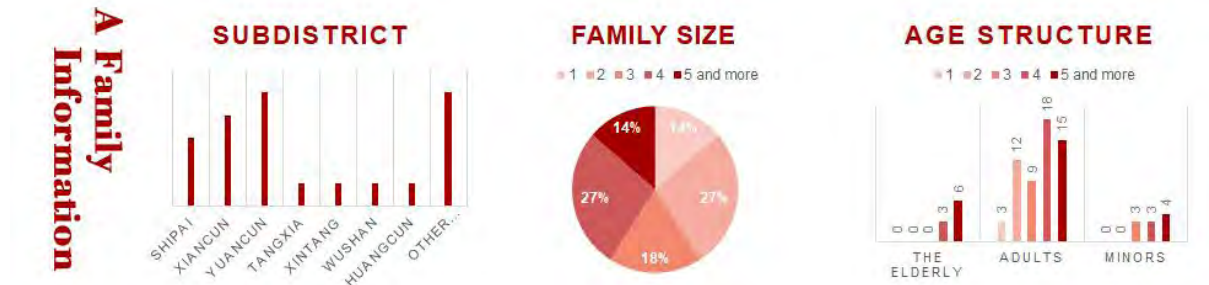


Fig. 5-22 Family information (address, family size, age structure)

The people who move around the racecourse mainly live in the Tianhe District, a few subdistricts near the racecourse. The subdistrict where the racecourse is located is Xiancun Subdistrict, so the people who are active near the racecourse mainly live in Xiancun Subdistrict, and a large part of them come from the subdistrict of Yuancun and Shipai near the venue. Family size is mainly four-person and three-person families. Others are two people living together, five or more, and living alone.

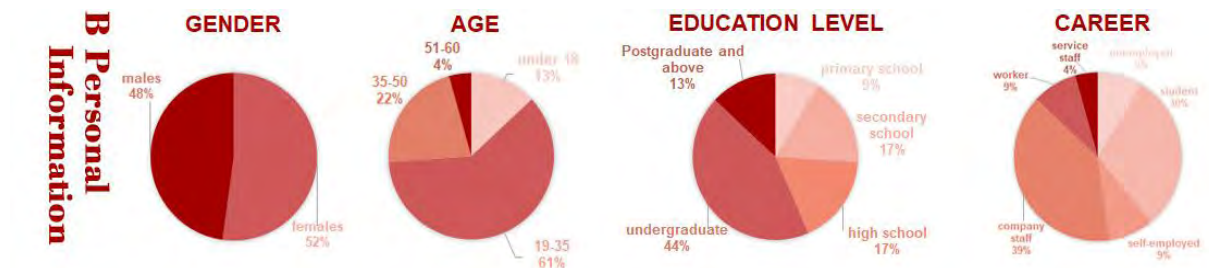


Fig. 5-23 Personal information (gender, age, education level, and career)

The questionnaires distributed were as balanced as possible in terms of gender and age to facilitate the examination of street usage by population. The final results in terms of gender were 48% and 52% for each gender, nearly one to one. Age was mainly focused on adults aged 19-35. In terms of education, the research subjects mainly have a bachelor's degree, accounting for 44% of the total research population, and nearly half of the people have a bachelor's degree. In terms of occupational distribution, they are mainly company employees and students.

From the above two background information of the research situation can help the follow-up to make some reference to the function provided by the venue street. First, the people who

move around the racecourse mainly come from the surrounding areas, so the streets need to provide functions that meet the needs of daily life firstly; secondly, they need to provide some places that attract more people from the area to come here for activities, so as to improve the vitality of the racecourse. Secondly, the population in the vicinity of the racecourse is mainly young people. Therefore, the street needs to provide activity space for young people. And from the age structure of households, it can be found that the elderly are more distributed, so the age-appropriate design of the street is also very important.



Fig. 5-24 Travel information (travel purpose, transportation, travel time, activity on the racecourse)

For travel information, the first is information about the surveyed person's current trip. This includes the purpose of the trip, the mode of transportation used for the trip, the time spent on the road and the activities carried out when arriving at the racecourse. This content provides information on the current traffic of active people at the racecourse.

The purpose of travel for people appearing on the streets of the racetrack at the time of the interview was mainly shopping and work, with some people returning home. This is consistent with the Guangzhou travel data, which shows that people travel for several purposes. The mode of transportation used for that trip gives an indication of people's transportation preferences for their daily travel choices. From the survey results, it can be seen that the majority of people choose subway and bus trips, followed by private car trips. The number of people who chose to walk was lower. The travel time reflects the acceptable travel time. More than half of the people traveled for 15-30 minutes, which is an acceptable length of time. Activities to the racecourse show the main features of the racecourse that currently attract foot traffic. A large percentage of these are work and entertainment experiences. From this set of findings, it can be seen that the activities of the racecourse are mainly office and living.

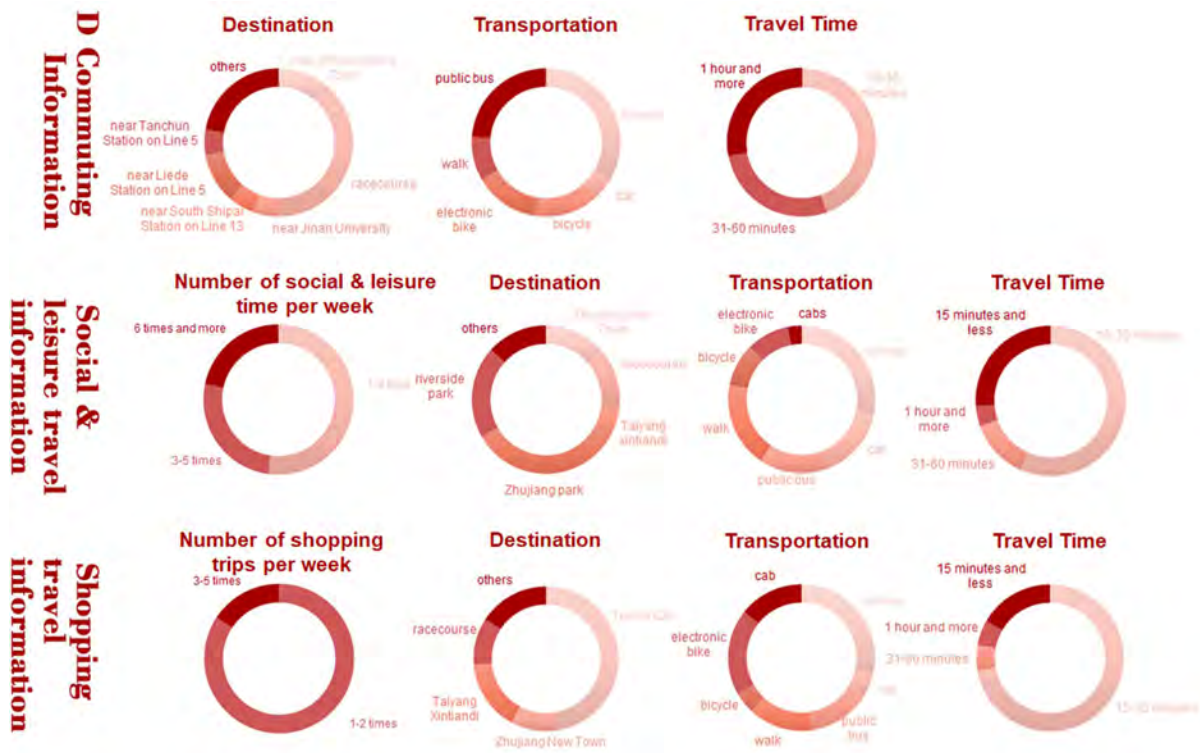


Fig. 5-25 Other travel information (commuting, social & leisure, shopping)

Other travel information focuses on commuting, socializing and leisure, and shopping, the three daily travel purposes of residents. All three types of trips were investigated for their respective travel destinations, transportation modes, and road time spent. Except for commuting trips where the number of trips was not investigated, the other two categories set questions on the number of activities in a week in the questionnaire.

The final results are shown in Figures 5-24.

In addition to travel information, another part of the questionnaire is about street evaluation. From the street evaluation, we can understand people's activities on the street and the factors that concern them about the street.

E Street Evaluation

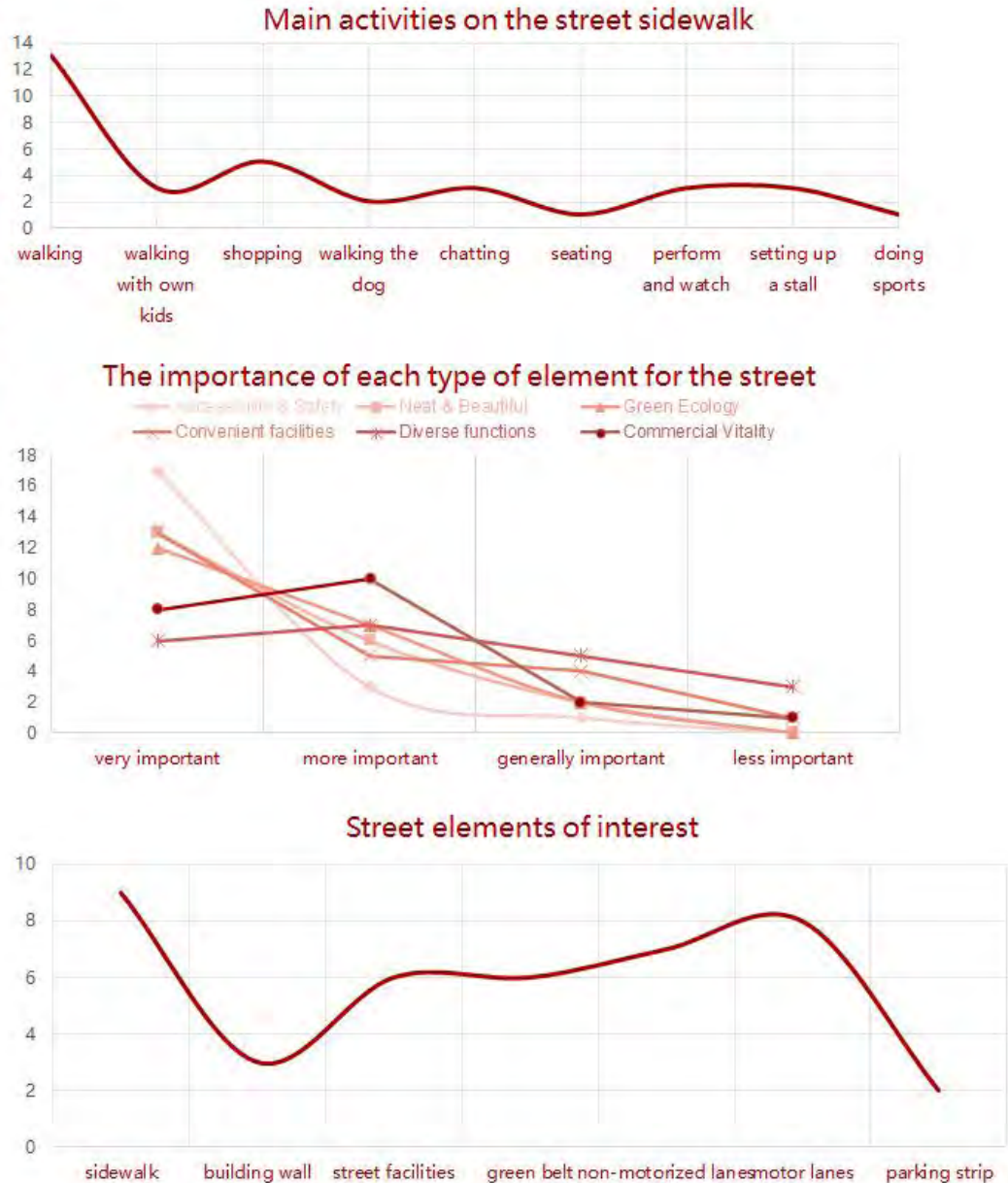


Fig. 5-26 Street evaluation-1 (main activities on the street sidewalk, the importance of each type of element for the street, street elements of interest)

The main activity on the street shows that walking makes up a large part of the activity. People are mainly interested in the activities on the street including basic activities, walking, shopping, and chatting. In fact, much more than these activities are observed on the street, which shows from the side that the street needs to provide more functions to meet people's needs. The importance of street elements is evaluated in six areas: accessibility & safety, neatness & beauty, green & ecological, convenient facilities, functional diversity, and commercial vitality. The survey results show that people are most concerned about the accessibility and safety of streets. The majority of people believe that the most important

thing about streets is that they are passable and safe. Street elements of concern, people are more concerned about the construction of sidewalks, followed by the construction of non-motorized lanes.

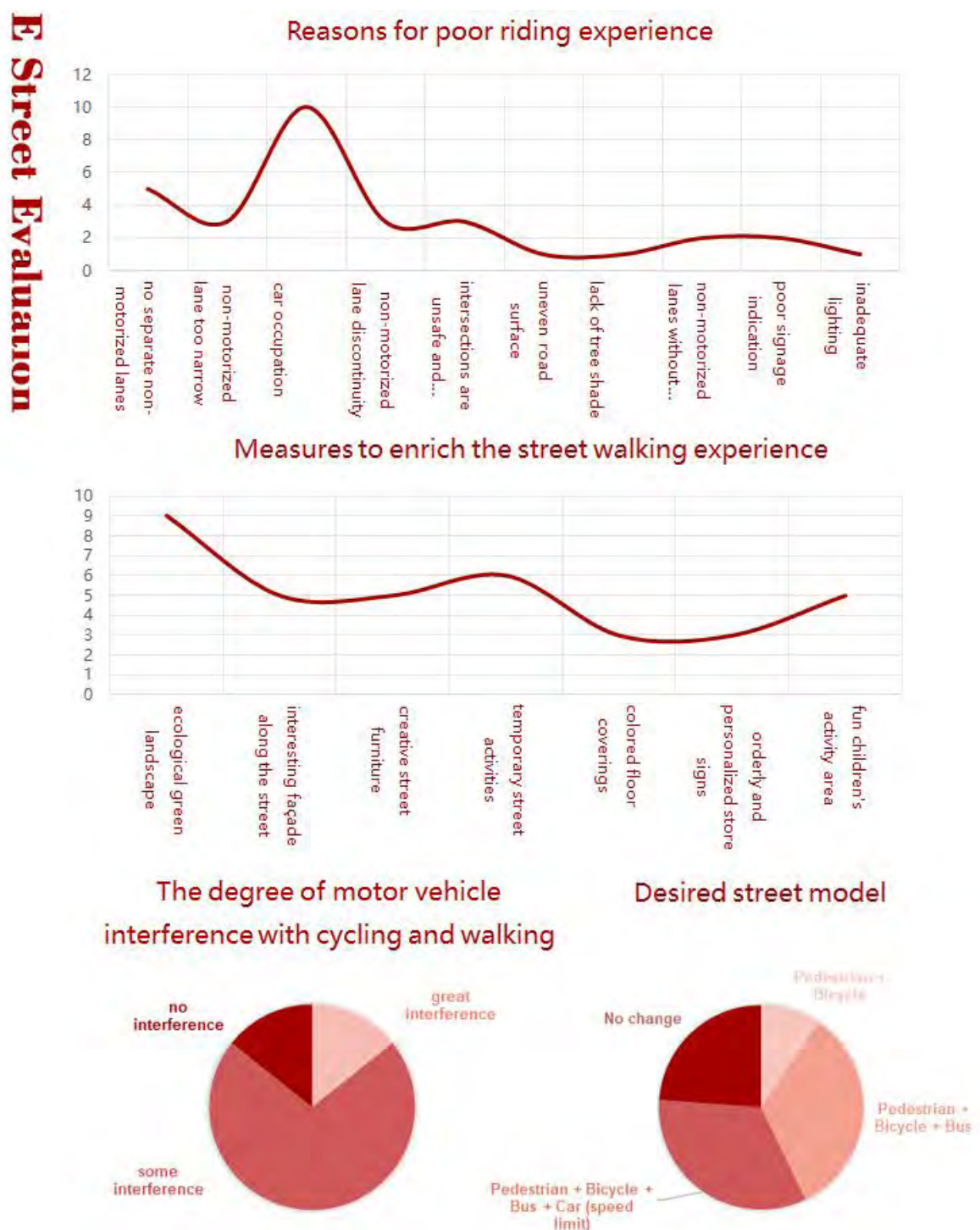


Fig. 5-27 Street evaluation-2 (reasons for poor riding experience, measures to enrich the street walking experience, the degree of motor vehicle interference with cycling and walking, desired street model)

5.1.2.5 Building analysis

The construction quality of the buildings around the racecourse is good, while the quality of the buildings inside the site is poor. The Mahui Home building in the south of the site is of medium-quality construction, as well as the building was designed in conjunction with the grandstand steps (currently used as a restaurant). The rest of the buildings are of poor quality.

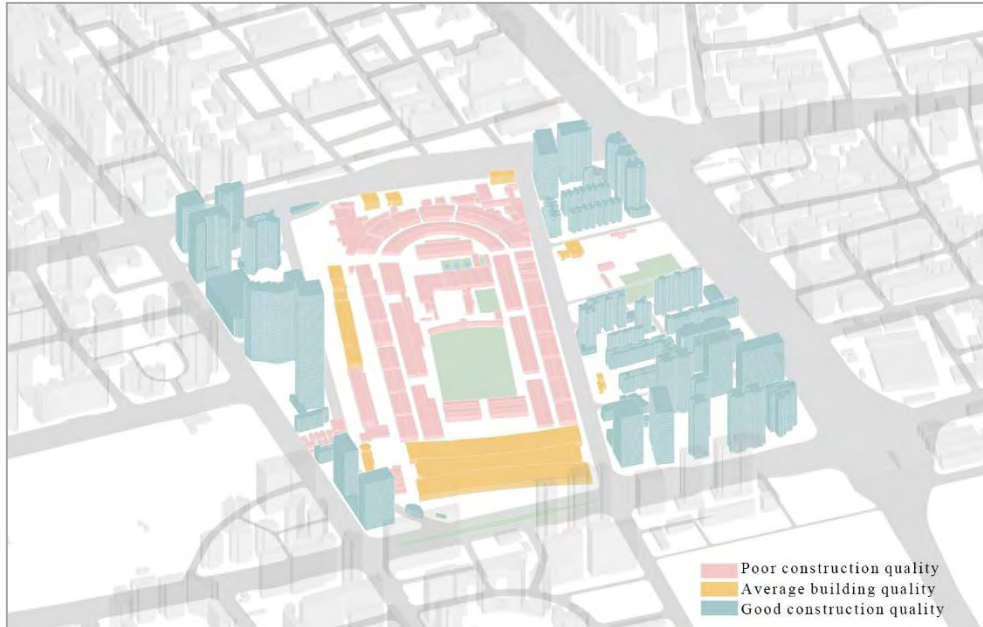


Fig.5-28 Building Quality Analysis

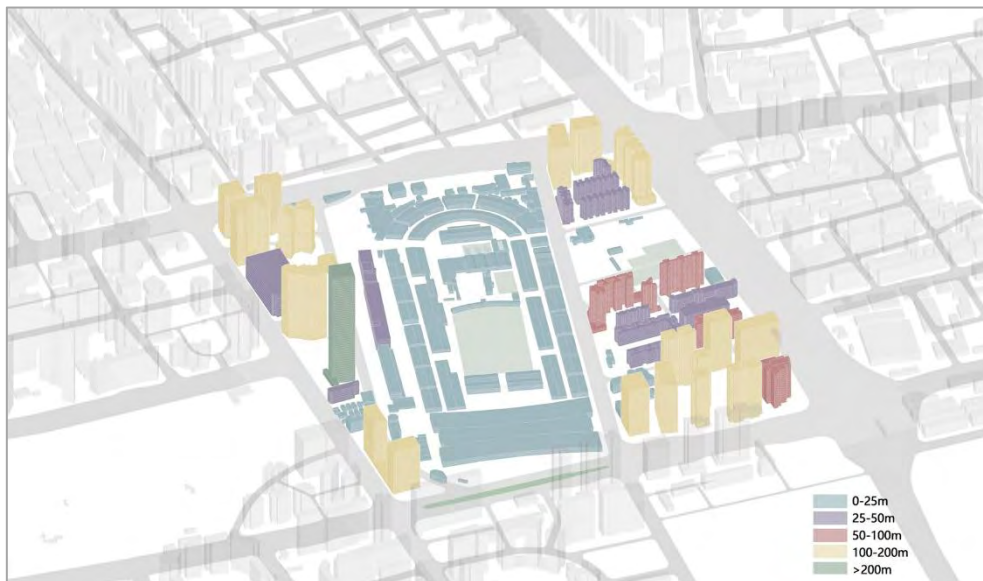


Fig.5-29 Building height analysis

In terms of building height, the surrounding area is dotted with mid- to high-rise buildings, with most buildings between 100 meters and 200 meters. The building heights inside the site are all low, with most of them being steel-frame factory buildings of less than 25 meters.

5.2 Problem and Goals

5.2.1 Problem

According to the on-site research, the final summary of the street problems of the site is the following four significant points: poor street connectivity, poor street quality, single street function, and poor slow walking system. Within each point, there are many specific questions. These issues will be addressed in the following section.

The study area was delineated with a radius of 1 km from the center of the racecourse. Specific problems were mapped out as shown in Figures 5-30, 5-31, 5-32, and 5-33 and illustrated with pictures taken on the site.

1. Poor Connectivity

The wide Huangpu Avenue and Huacheng Avenue on the north and south sides affect the connection between the north and south sides. The east side of the Hua Nan Expressway separates the plots on both sides, so pedestrians have only two choices - to cross the road from the significant flyover or the road from the bottom of the elevated southern bridge. From the junction of Huacheng Avenue and the expressway, ground crosswalks through the two sides of the plot are more convenient than the central expressway overpass; the east side of the residential area road closure can not pass through.

The internal roads of the racecourse are disconnected from the city roads, resulting in no direct connection between Jinsui Road and the residential roads on the east side of the racecourse. The whole racecourse blocks the connection between the parcels on the east and west sides.

In response to these problems, in the racecourse site's urban design, the design's scope focused on the racecourse. However, the problems of several parcels immediately adjacent to the racecourse also needed to provide countermeasures to address them.

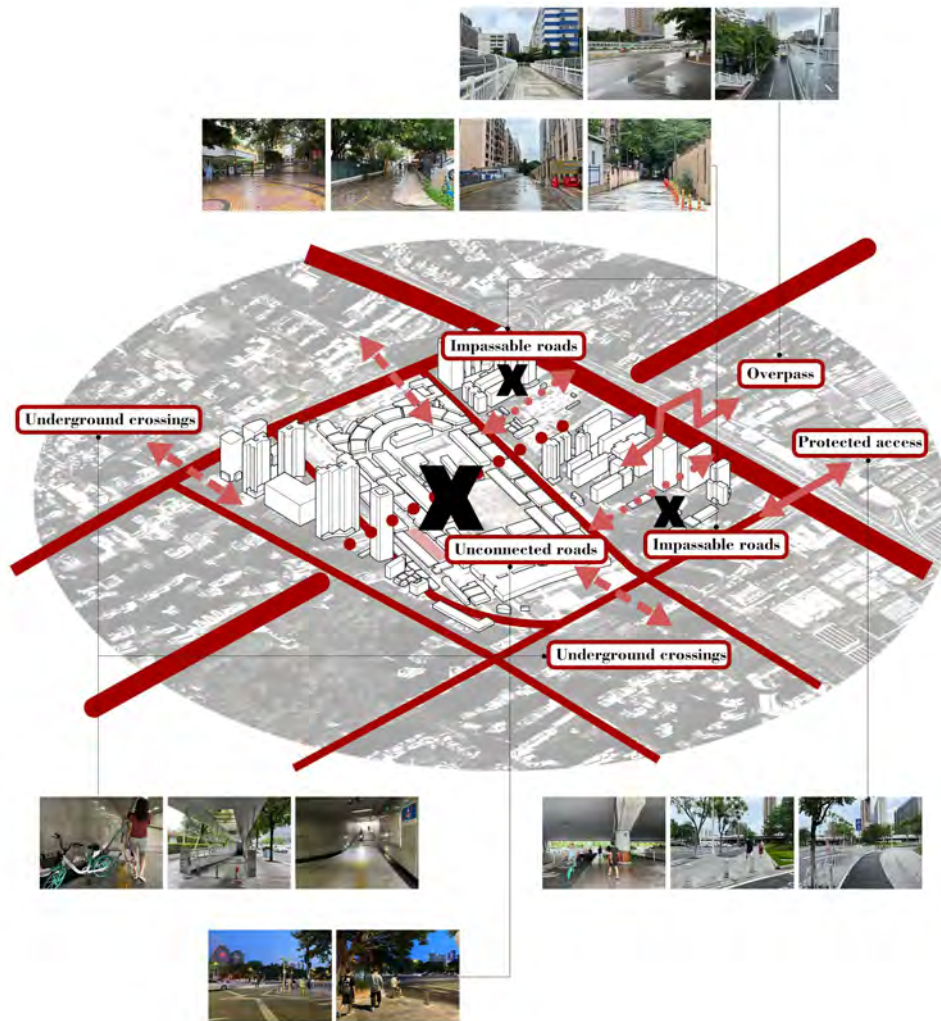


Fig. 5-30 Poor connectivity

2. Poor street quality

The low quality of street space is mainly reflected in these six problems: closed building interface, monotonous street space, unshaded overpasses, depressed under-bridge space, parking crowding the sidewalk, and lack of greening and shading facilities.

The first is Huangpu Avenue and Tam Tsuen Road, which have closed building interfaces along the sidewalks, resulting in a reduced walking experience. Whampoa Avenue has an imbalance in sidewalk scale due to the excessive width of the road, and the street is flanked by Jinan University and the racecourse, without stores along the street. Tancun Road, on the other hand, has a reduced sidewalk walking experience due to the closure of stores.

The east side of the racecourse was initially converted into stores along the street, mainly for the automotive industry, but closed as the industry dived and the lease contracts ended. The

streets between the residential areas on the east side are similar, with residential fences and simple landscaping on both sides of the street, parked motor vehicles, and even more random paving, resulting in fewer pedestrians crossing from these streets.

Racecourse Road and Huacheng Avenue are streets with relatively good sidewalk construction conditions. However, the poor walking experience is that the sidewalks are not wide enough, and the walking space is crowded by bicycle parking. The problem with the internal roads of the racecourse is that there is no planning and design of pedestrian space, mixed pedestrian and vehicle traffic, and a lack of greenery.

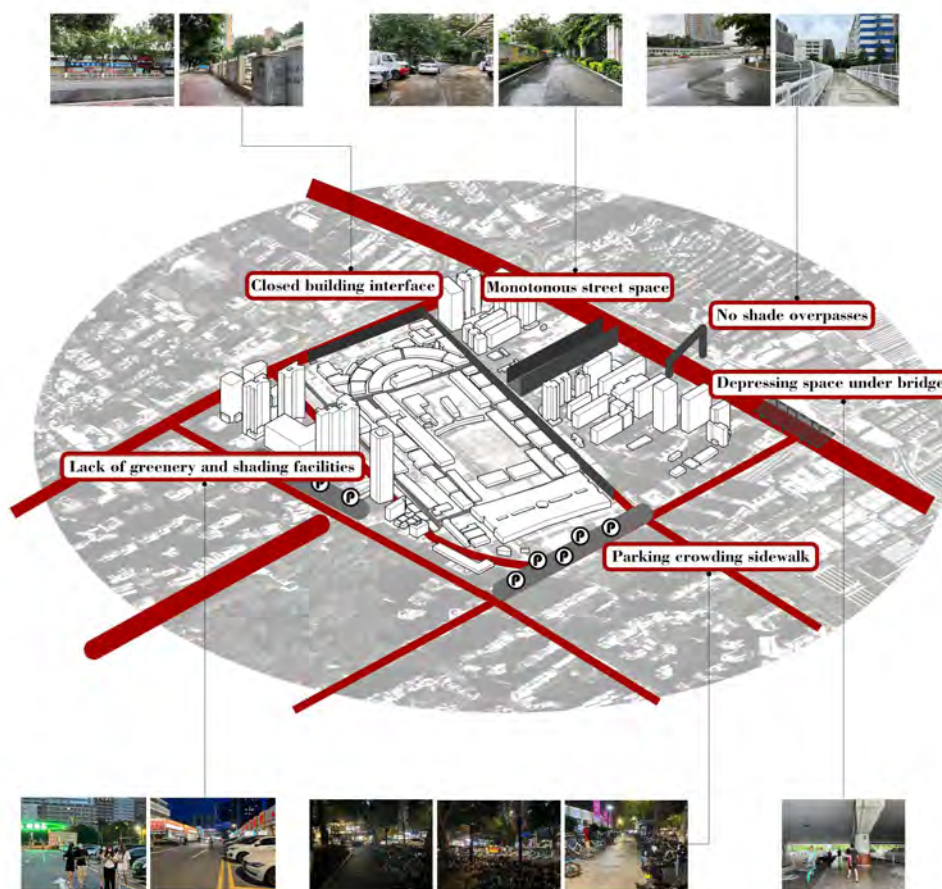


Fig. 5-31 Poor street quality

3. Single street function

The questionnaire results show that the activities performed on the street are more walking behaviors. In comparison, the observed behaviors are more decadent, except that the streets do not provide places to satisfy these behaviors, such as sitting, gossiping, playing, etc.

There is an intense commercial atmosphere in the Taiyang Xintiandi neighborhood on

Machang Road. The street provides features that do not meet the needs of the people on the commercial street. Retail stores need to display their goods outwardly, and the street space only meets the needs of pedestrian traffic, resulting in the stores' outward display crowding the sidewalk. Many pedestrians were also observed squatting on the curb or curbs on Racecourse Road, which shows the demand for street seating. At the same time, many children's scooter skating, children roller skating, and other scenes were observed. Near the food and beverage outlets inside the Racecourse, valet drivers wait for customers, and diners lack a space to wait.

The streets in residential areas also fail to provide daily public living spaces for residents. Residents place their own chairs at intersections on these streets to facilitate socializing.

Commercial streets and subway station entrances and exits have vendors selling on the street, but they do not have a well-designed area for them to use, resulting in the stalls crowding the sidewalks.



Fig. 5-32 Single street function

4. Poor slow traffic system

Both the pedestrian and bicycle paths are discontinuous, affecting slow travel's viability.

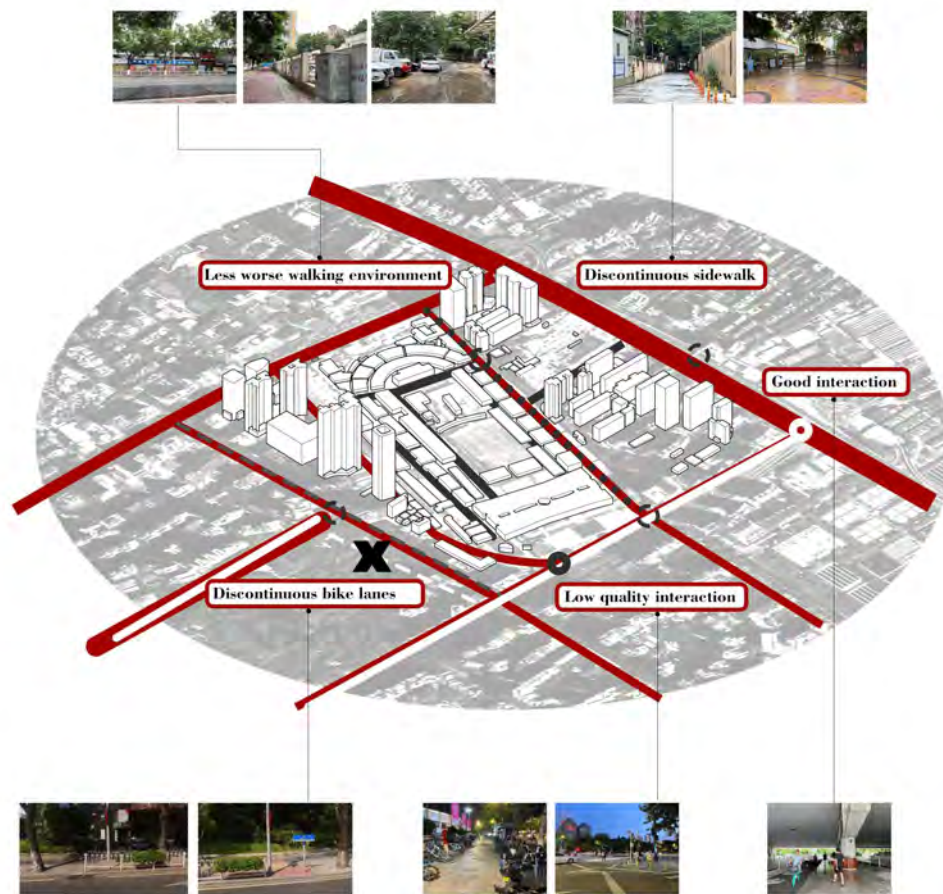


Fig. 5-33 Poor slow traffic system

The western parcel of the racecourse has a better pedestrian environment, while the eastern parcel has a poorer pedestrian environment and the interior of the racecourse. The quality of several street intersections is also poor, and pedestrians have difficulty crossing the street.

The bike lanes are also discontinuous and do not allow free cycling through the site to complete the ride.

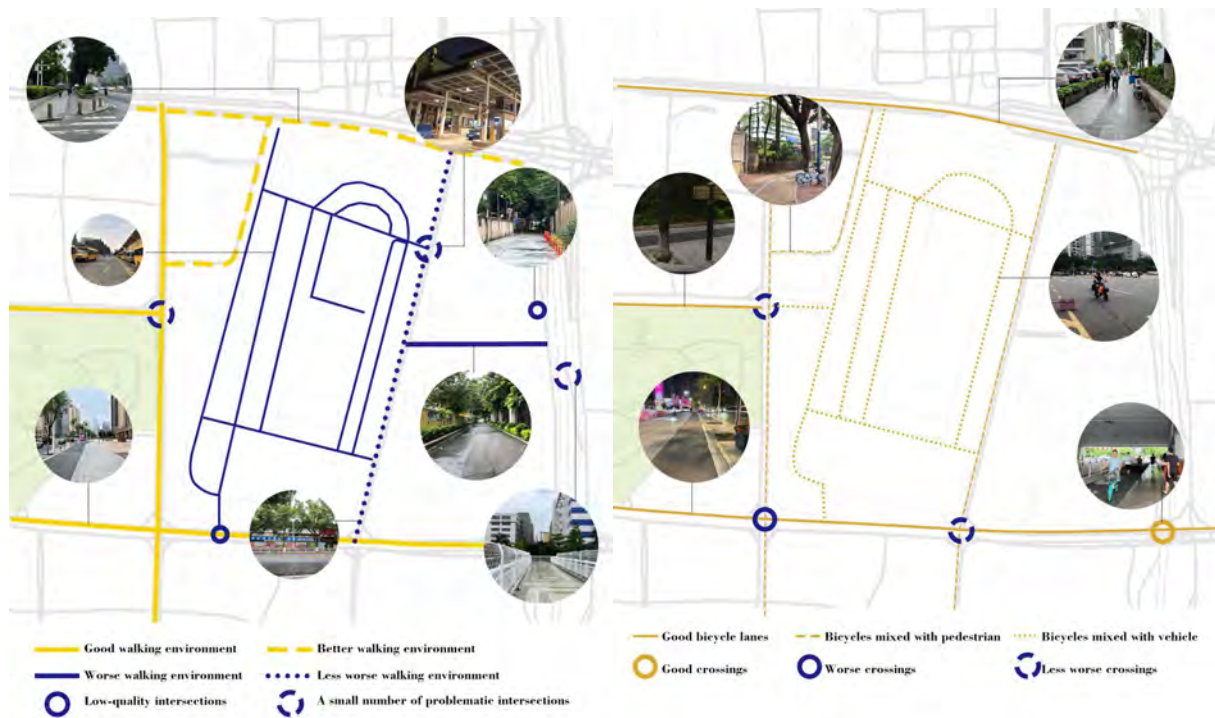


Fig. 5-34 Walking environment (left) and bicycle environment (right)

5.2.2 Goals

In response to the past and current situation of the racecourse area, the future racecourse should be able to provide for the needs of the present residents while preserving the memory of the place and catering to the needs of future development. Specifically, the vision for the future development of the racecourse includes the following goals.

First, to preserve the memory of the racetrack. Extracting the site's musculature can help preserve the site's memory. The identification of the site's retainable components and the site's retainable components can be modified or retained in situ. For example, the site has retained the grandstand components for nearly 20 years. Over time, while this component of the grandstand has been preserved, the residents have also modified this component, and further research is needed to preserve and design this component.

Second, to meet the needs of street life in the racecourse. The street life of the racecourse should be colorful, and how to revive the vibrant street life of the racecourse is one of the main points of the design. The activities on the street need to be explicitly discussed.

Third, future-oriented social development. Keeping appropriate site space can be accessible for residents to play and use.

5.3 Solution



Fig. 5-35 Master plan

After redefining and redesigning the racecourse, the final design plan is shown in Figure 5-35. The racecourse was demolished for the existing buildings, except for some facility components with preservation value. The site is divided into two functional landscape axes, horizontal and vertical, and connected to the city road. The horizontal and vertical axes

intersect at the center of the site and expand into a plaza space. The plaza's paving continues to the building frontage on the west side. The site is divided into 12 large plots, then linked by a slow walking path that serves as a space for the race track's original runway to preserve the site's memory.

The two parcels to the north serve as a business center, bridging Jinan University north of Huangpu Avenue and supporting science and innovation industries. The parcels further south serve as a commercial center, connecting the Sun Xintiandi shopping center to the west and forming a more substantial commercial center. A commercial walkway will be formed in the center of the site to continue to the eastern part. The plaza on the north side of the horizontal axis is used as a civic activity plaza with hard pavement and greenery to meet the needs of various activities. The plots east and west of the plaza are arranged with hotels, offices, and other high-rise buildings.

The plaza on the south side of the horizontal axis is designed as a prominent civic market in combination with a fresh food market. To the west is the reserved grandstand component of the original running track, combined with the site to form a small children's sports park, retaining the grandstand as a continuation of the memory of the place. The eastern parcel is designed as a shared community. Opening up the ground floor and part of the roof space of the community allows pedestrians on the street to share community resources. Further south is the elementary school site and community cultural center. The two southernmost sites are used as sports complexes. The ground floor of the sports complex is used for commercial, with small volumes forming a traversable space on the ground floor.

A landscape-oriented street park is designed in the middle of the road in the two horizontal axes. However, the function of the central landscape activity area changes with the function of the plots on both sides. The horizontal axis, as a continuation of the landscaped road of Jinsui Road, is mainly landscape-oriented, and public service facilities and children's play areas are placed in the street park when passing through residential areas. The vertical axis is mainly for comprehensive services, and when passing the stadium site, the park is designed as a sports park for residents' sports and fitness use. When passing through residential areas, it is designed as a temporary marketplace that can be used as an activity site for residents.

Bicycle lanes are designed on both sides of the horizontal and vertical axes to follow the landscape and create a good cycling experience. At the same time, the horizontal axis is designed with a bus-only lane to ensure the priority of public transportation.



Fig. 5-36 Axonometric view

The relationship between the building masses of the entire plot gradually decreases from the periphery to the interior. The open spatial feeling of the core area is guaranteed. The volume of the buildings around the central square is also tiny to ensure that the people moving around the square will not feel the oppression of the surrounding buildings.

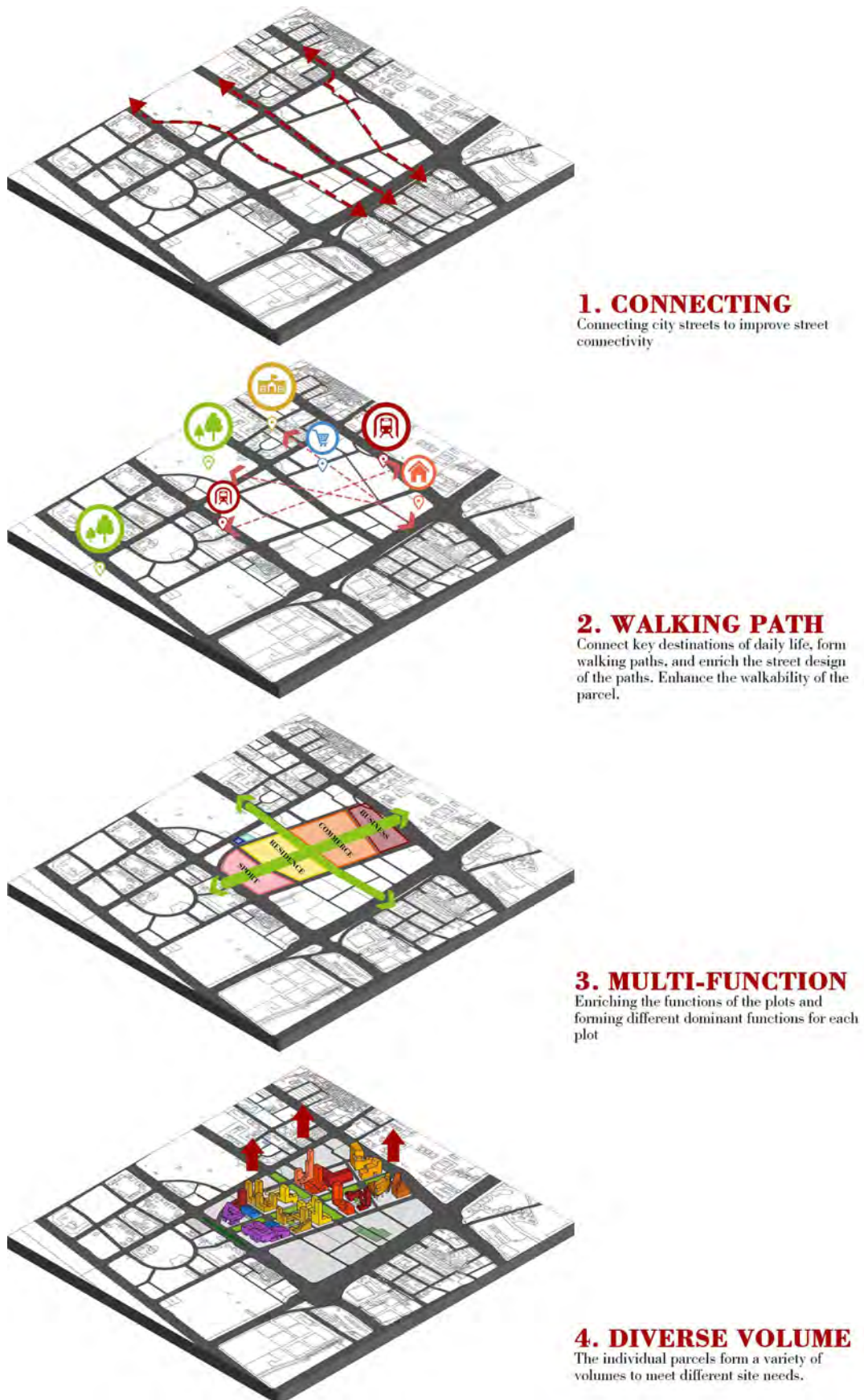


Fig. 5-37 Solution generation steps

5.3.1 Traffic System

Form a design plan for the transportation system. Against the four transportation networks of the design strategy in Chapter 4, based on the pedestrian priority principle, the demand for walking is met first, followed by the demand for bicycles and public transportation, and finally, the demand for motorized transportation. According to the site division, four traffic networks are designed, as shown in Figures 5-38, 5-39, 5-40, and 5-41, respectively.

1. Pedestrian network

The pedestrian walking network needs to be a dense network of pedestrian spaces that meet essential travel. A dense pedestrian network means a high degree of ease of walking, shorter distances from one location to another, and a higher willingness of people to travel on foot. Good walking paths are reserved at the periphery of the parcel, and adequate alley space is reserved inside the parcel when the parcel is larger. Expand the pedestrian paths to form plazas and green spaces in appropriate lots. Furthermore, form public nodes in the center of openable plots. Install crossing facilities where it is necessary to cross the carriageway to ensure pedestrian walking safety.

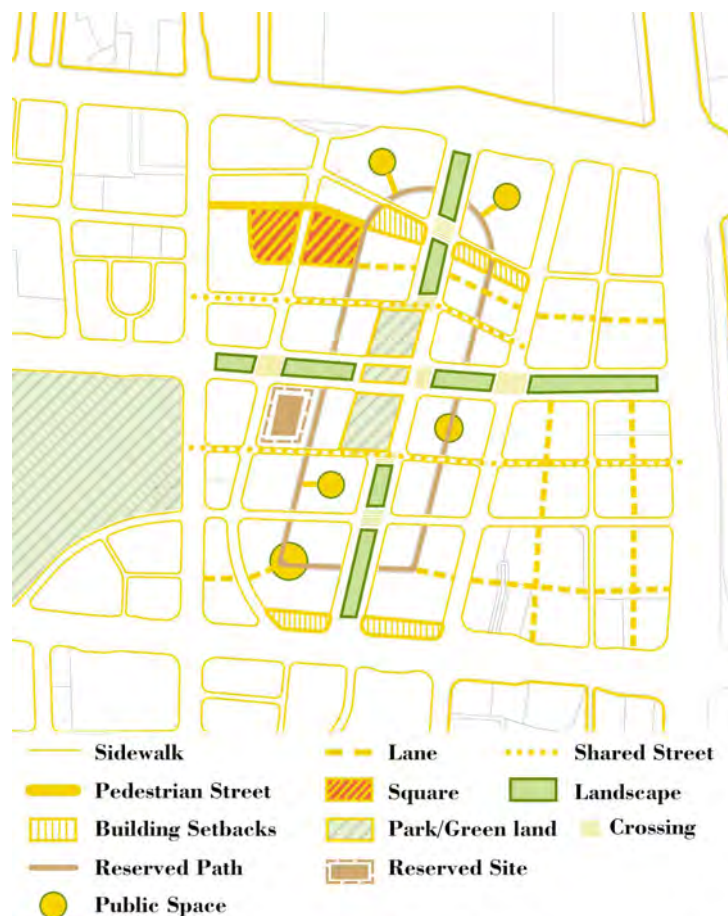


Fig. 5-38 Pedestrian network

The pedestrian network not only involves the racecourse parcel but also continues to the peripheral parcels of the site to address pedestrian issues. Two shared streets, north and south, continue from the site to the periphery. The resulting pedestrian network is shown in Figure 5-38. The pedestrian walking experience is enhanced.

2. Bicycle network

The bicycle network first needs to ensure accessibility. The original bicycle lanes around the site will be continued and integrated, with the bicycle lane on Jin Sui Road continuing to the central landscaped street on both sides of the site before reaching the easternmost end via a two-way bicycle lane. The bicycle lane of Huacheng Avenue is retained and combined with the southernmost parcel of the site. Bicycle lanes are provided in the north-south direction along the longitudinal axis, linking north and south. A single two-way bicycle lane is provided on Huangpu Avenue and Huanan Expressway. These two lanes are too broad, and bicycles traveling bilaterally in one direction would cause difficulty in route switching. That creates the bicycle lanes network, as Figure 5-39 shown.

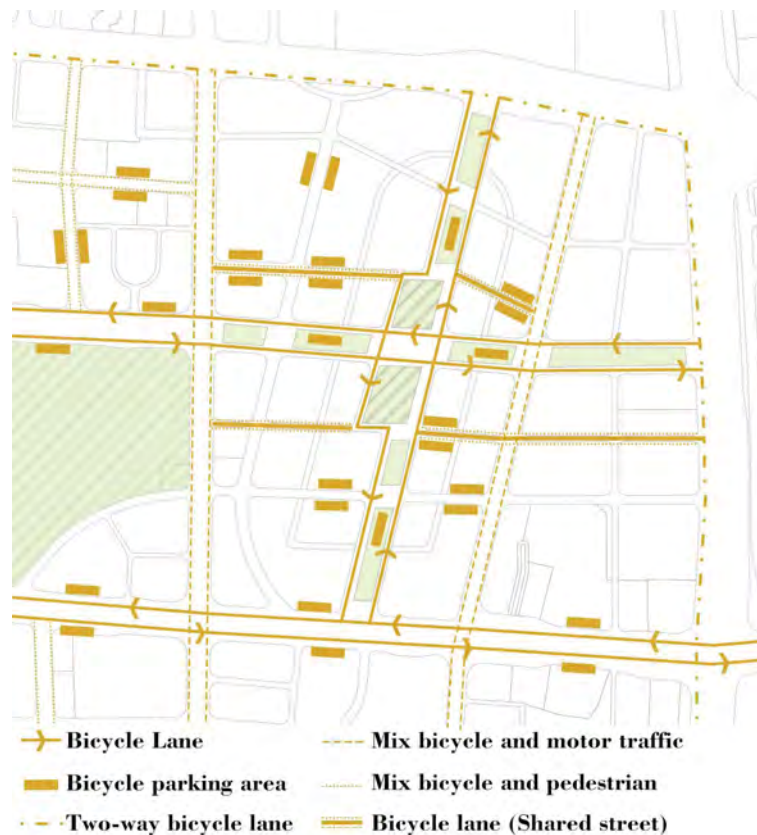


Fig. 5-39 Bicycle network

Bicycle parking facilities are set up along the streets and at essential nodes in the central landscape area of the road to facilitate bicycle riders to reach the landscape area. Larger parking areas are also reserved near transportation stations and commercial centers to avoid street congestion caused by excessive bicycle parking.

3. Public transportation network

The public transportation network has been altered to a lesser extent, and the original station coverage has met the demand for use. A station was added inside the site, located in the eastern section of the landscape transect, placed close to the residential area. At the same time, bilateral one-way bus lanes are planned on both sides of the landscaped cross-axis to ensure the movement of buses on the landscaped streets and to bring a comfortable experience to bus users passing through this location.



Fig. 5-40 Public transportation network

4. Vehicle network

The motor vehicle network mainly lies in the security of accessibility and the streets with speed limits. Motor vehicles on the horizontal axis travel along both sides of the central landscape strip. The motor vehicle lanes of the vertical axis converge to one side to drive when passing the plaza, guaranteeing the integration of the plaza and the site.

On the eastern parcel of the site, alley spaces are reserved, which are closed to vehicular traffic and safeguard pedestrians on foot. Likewise, the horizontal pedestrian paths and plaza areas are closed to vehicular traffic in the commercial center parcel. On the two shared streets in the north and south, the speed of vehicles will be limited and controlled below 20km/h, bringing the speed down and making the car closer to a person's behavior so that people and cars can share the street space.

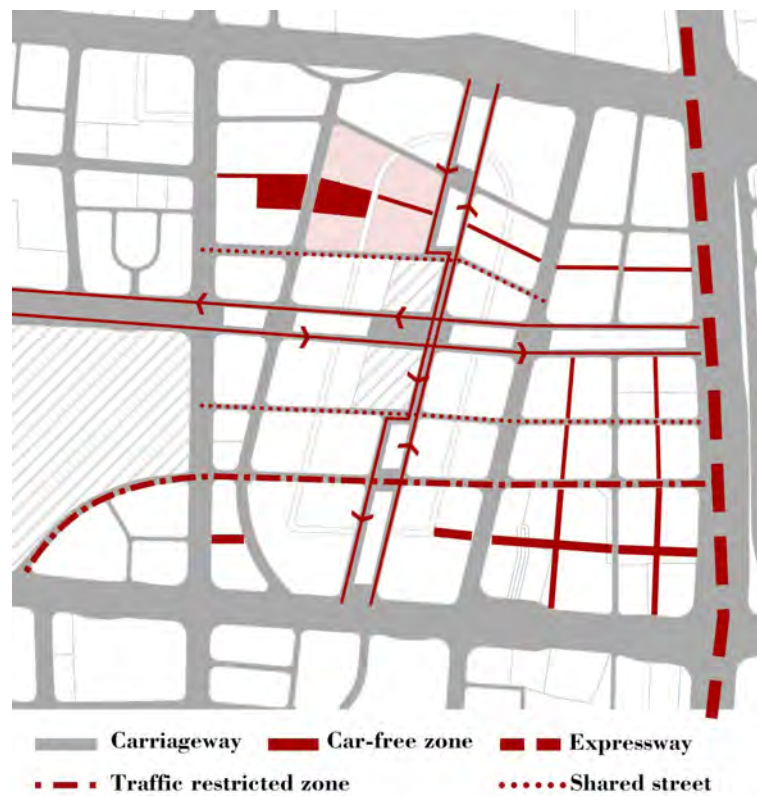


Fig. 5-41 Vehicle network

In the south of the site, a traffic restriction zone crosses three areas because it crosses the living area and the elementary school. Honking and speed are reduced to ensure the safety of residents and children going to and from school. Daily life and study are thus safeguarded.

5.3.2 Public space

The original public space of the site was mainly the central green area of Happy Valley, which is now divided into several sports fields. There is also a sports field in the middle of the residential area on the east side. The most significant green space in the center of the racecourse is the golf course, and the two smaller green spaces to the north are the tennis court and the miniature golf course.

The sports fields in the residential area center are a basketball court and a soccer field, respectively.



Fig. 5-42 Public space before



Fig. 5-43 Public space after

After placing the horizontal and vertical landscape axes, various types of public spaces are designed on these two axes. The main activity area of the road directly in front of the commercial site is a civic park. The plaza further south is a civic square designed with hard paving and greenery. The plaza on the other side is the new food market plaza. Further south is the living area, and the main activity area of the road in this location is used as a civic activity market site. The southernmost sports field has a civic sports park in the center of the road. The horizontal axis is a landscape park.

The preserved running path is redesigned as a walking path, linking the various public spaces of each plot. The spatial structure is shown in Figure 5-44.

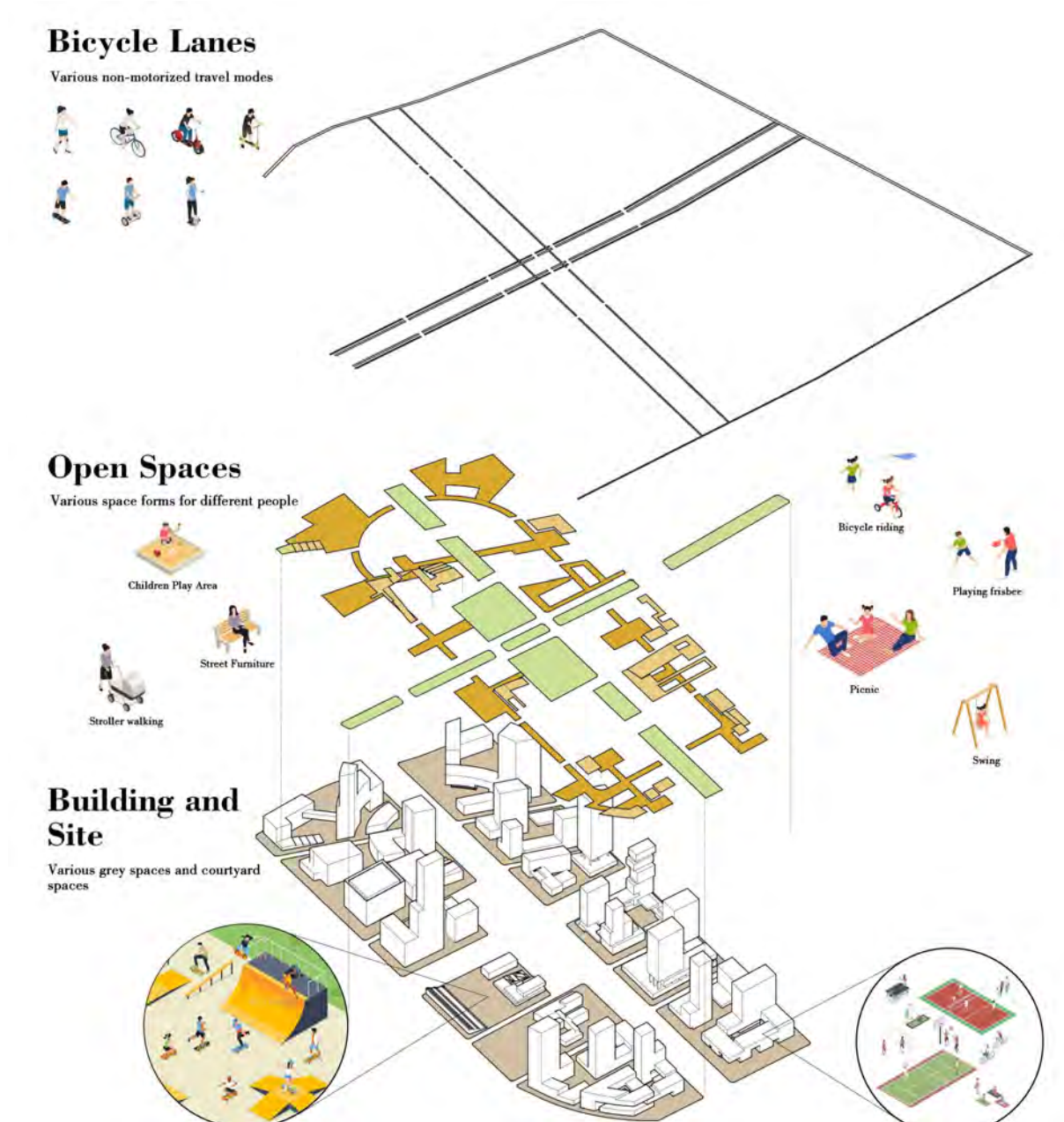


Fig. 5-44 Space structure

Separate spaces are represented. The building and the plot are on the first level of Figure 5-30, and the building block is in an enclosed shape on the ground floor, with superimposed upper floors and public spaces in the enclosed courtyard on the ground floor. A walking path then links these nodes together. At the same time, movable spaces are set up on the roofs of some podiums. Pedestrians on the street can go up to the roof directly from the ground level and enjoy the public space above the second floor. The specific spaces are shown on the second floor, "open spaces." Large or small spaces, high or low, add different interests to the walkway.

The two central horizontal and vertical landscaping zones and the walkway create a rich public space. At the top of the image is the bicycle path. The bike path surrounds the public space and the central landscape axis.

5.3.3 Street Space

The final spatial structure of the streets is five horizontal streets and one vertical street.

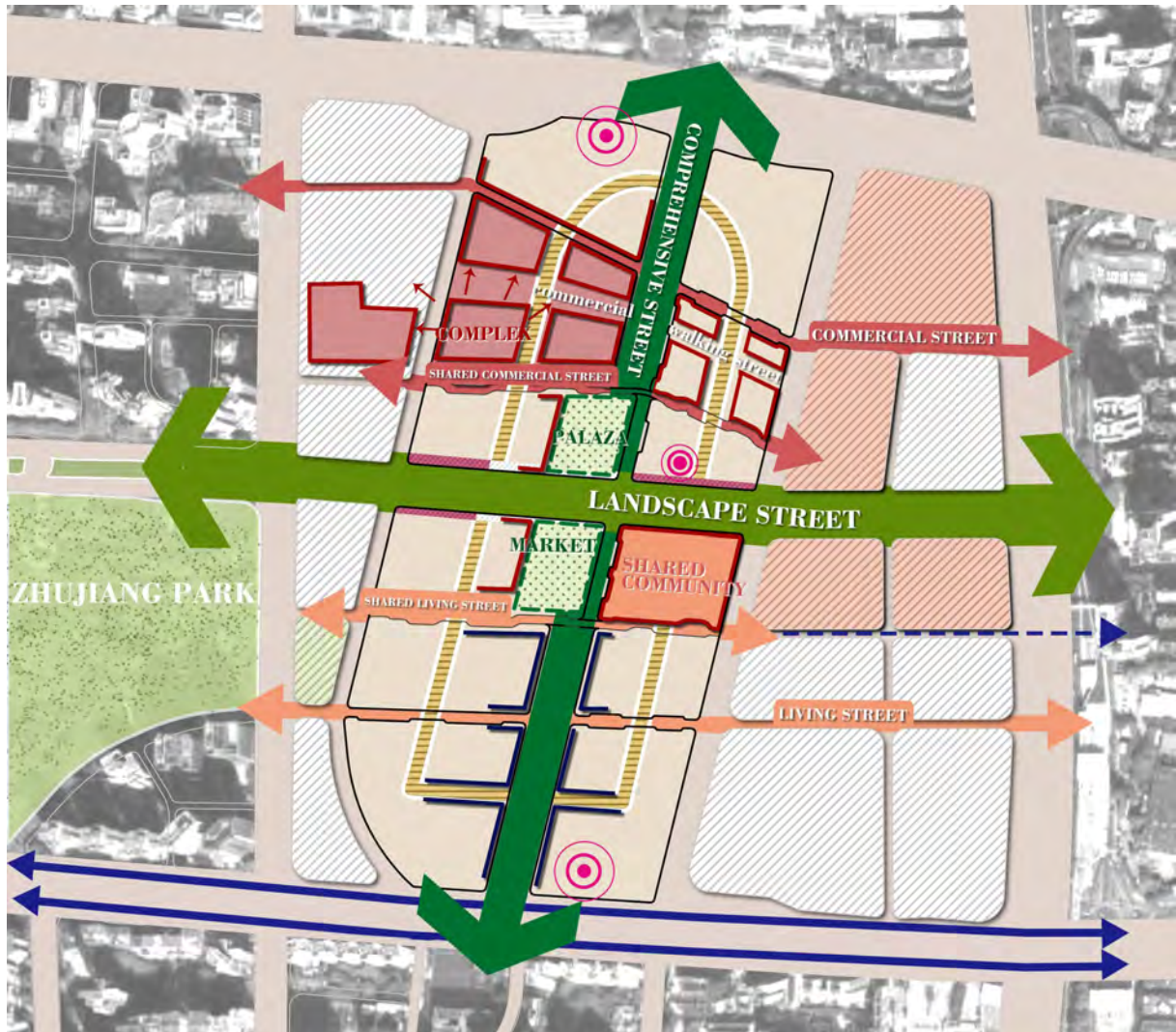


Fig. 5-45 Street space structure

Two horizontal commercial streets at the north end, one of which is a shared commercial street (20km/h traffic speed). The middle of the two commercial streets is a commercial pedestrian street. The middlemost lateral street is a landscaped street. The two transverse streets at the south end are living streets, one of which is a shared living street (20km/h

vehicle speed).

The longitudinal street connects each parcel and the five horizontal streets, and this longitudinal street is a comprehensive street. The intersection of the two horizontal and vertical streets is a plaza.

The two shared streets are a shared commercial complex and a shared community, respectively. The two ends of the integrated street are subway stations, and transfers between subway stations can be made through this integrated street. The 12 plots are linked by a circular walkway that forms different public space nodes through the center of each plot.

1. Living street

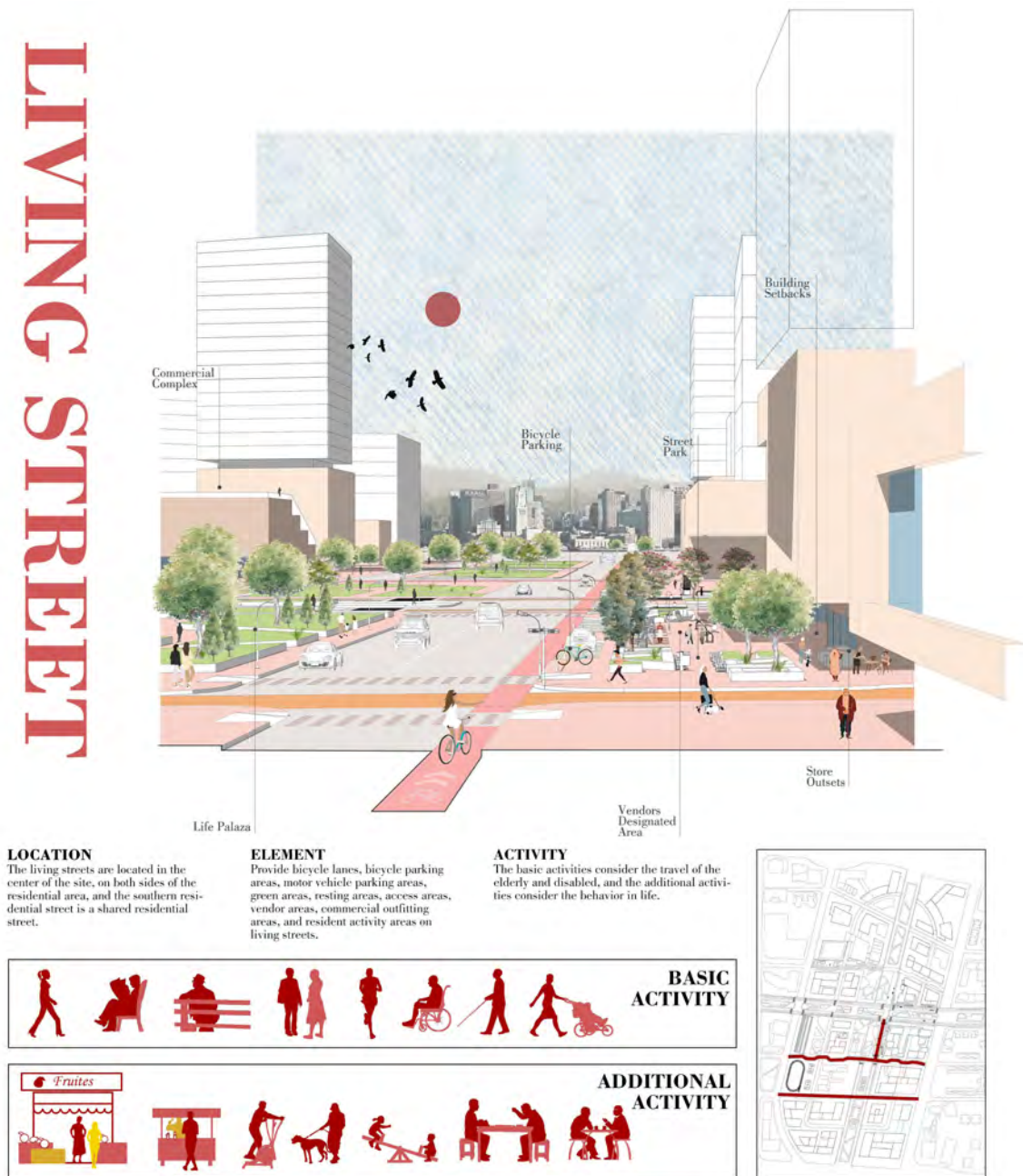


Fig. 5-46 Elements, activities and location of living streets

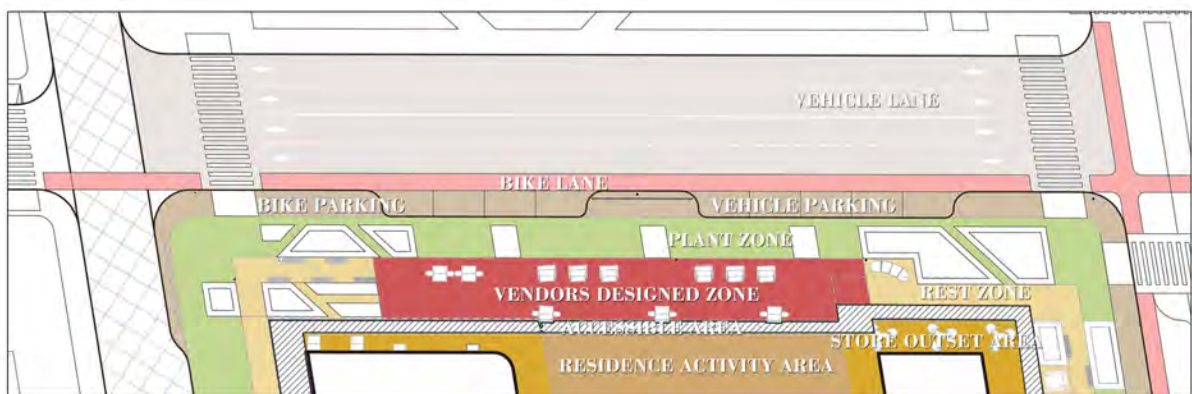


Fig. 5-47 Planar functional zoning of a living street

In addition to the two horizontal streets, the longitudinal street segments also belong to the living streets.

The upper floors on both sides of the living streets are mainly residential, with retail, commercial, and residential service-related businesses along the streets. The commercial center is located close to the living street to meet the residents' shopping needs. The fresh food market is located on the square next to the living street, not only for the residents of the racecourse but also radiates to several nearby communities for everyday use. Spacious sidewalk space is created at the street using building setbacks. Bicycle lanes and bicycle parking facilities are provided on the lifestyle streets. Install street resting facilities at street corners. The first-floor building setback space can be used for stores to display their goods and for restaurants to display their tables. Vending areas are also provided in the amenity streets.

Basic and additional activities are included in the proposed activity content of Living Streets. Basic activities meet the daily travel needs of all types of people: walking, resting, talking, jogging, etc. Safe access areas are provided to accommodate the elderly, blind, wheelchair users, and stroller users for travel on living streets. In terms of additional activities, the focus is on improving the public life of the residents. Meet the merchandising out of retail stores and the street vending behavior of vendors. Install daily fitness facilities, children's play facilities, and chess and card tables in street recreation areas and shared community atriums. Consider different types of tables and chairs in the design of rest seating, enclosed spaces for accessible communication, and independent rest spaces. Street trees and landscaping are planted on the streets to create a suitable environment for residents to walk their dogs, take a stroll, and dine outdoors.

The planar functional zoning of the living street is arranged according to the needs of the activity.

The motorway is with a bicycle lane on the periphery of the sidewalk. The bicycle parking zone and motor vehicle parking zone serve as a transition zone between the sidewalk and the motor vehicle lane. Pedestrians are separated from motor vehicles by parking facilities. The

inner side of the parking zone is the green area, designed with different forms of landscaping to avoid monotonous linear street trees. The street recreation area is arranged by the green area, and different types of street furniture are placed. A vendor zone is set up in the middle section of the street. Further in, a safe passage area is set up. A blind pavement is installed in this area, where all types of people can pass through the street in this passage.

The innermost building setback space is used as an outward display area for stores, which can be used as a free space for stores or can be freely chosen by store owners as a shared space. The atrium of the building is the activity area for residents, and various activities are set up in this area.

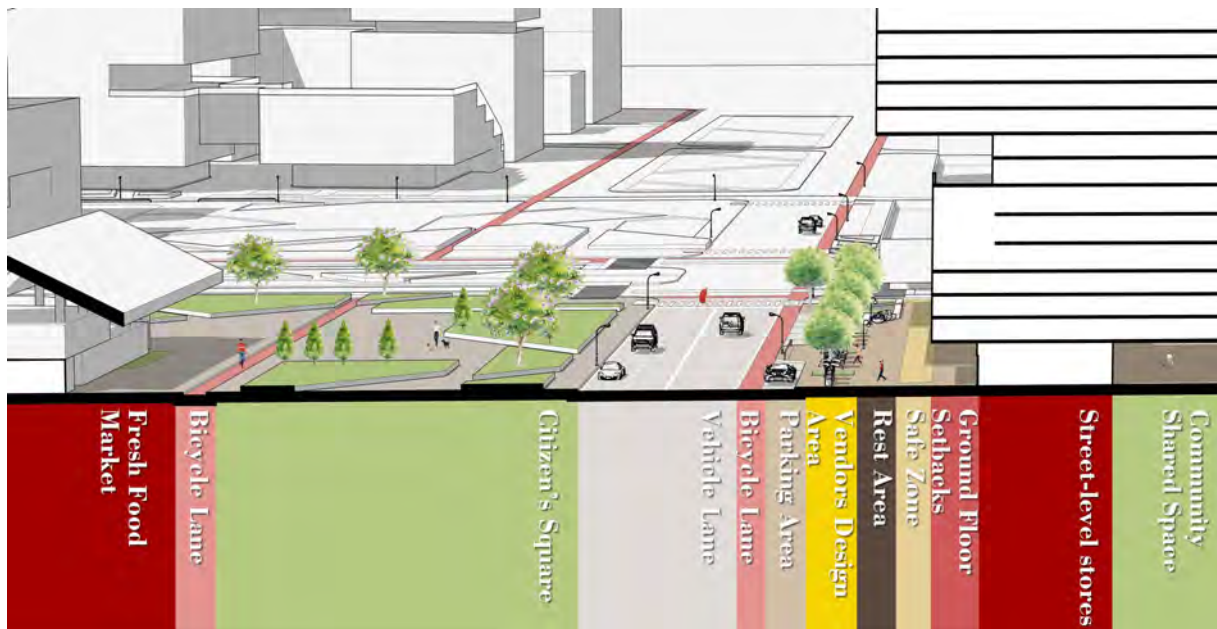


Fig. 5-48 Street profile of living streets

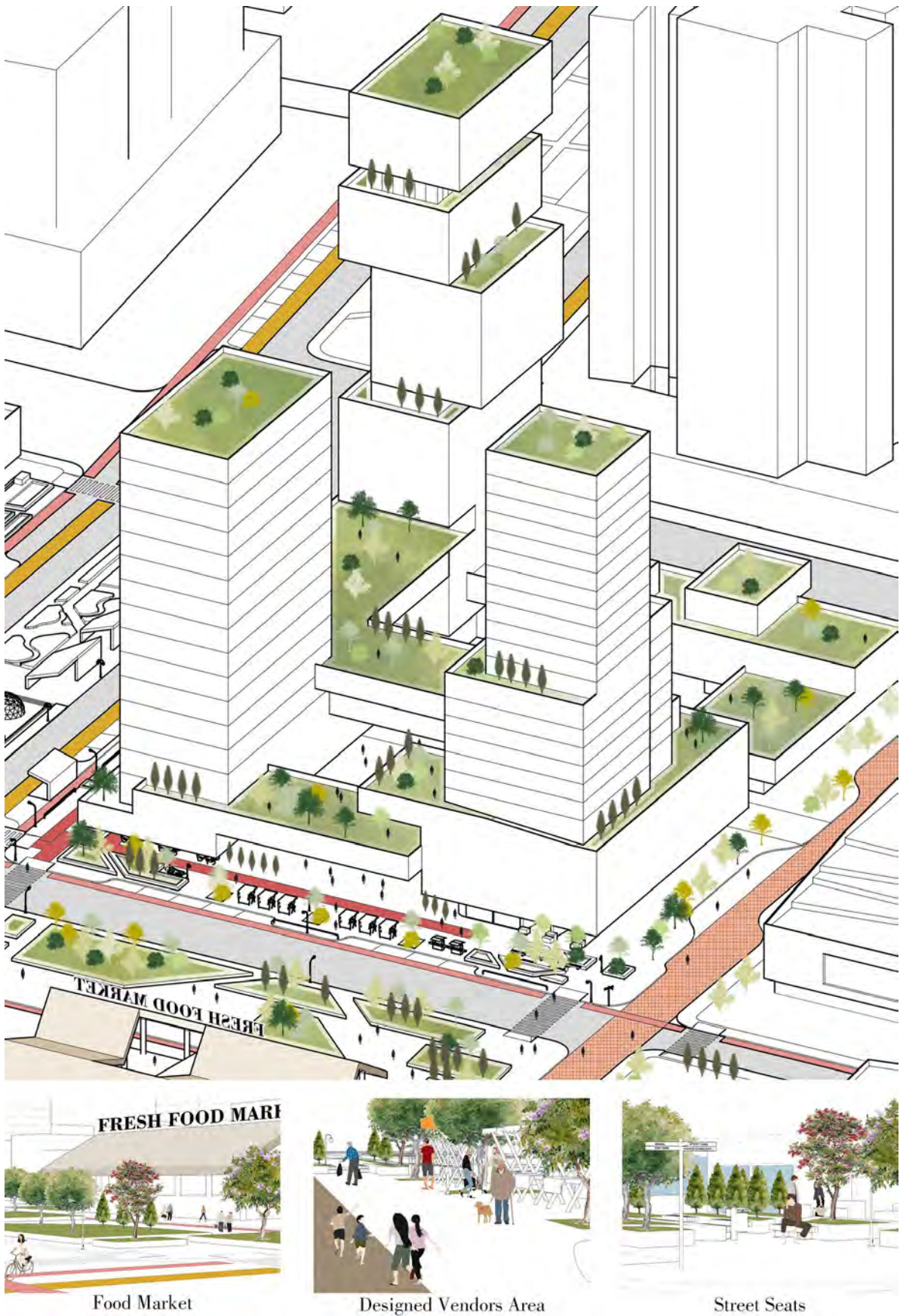


Fig. 5-49 Axonometric view of shared community and scenes of living street

The ground floor of the shared community is open, enclosed to form an inner courtyard, and the podium forms a staggered terrace. The three residential towers are located at three corners. Street parks of different sizes are set up around the streets.

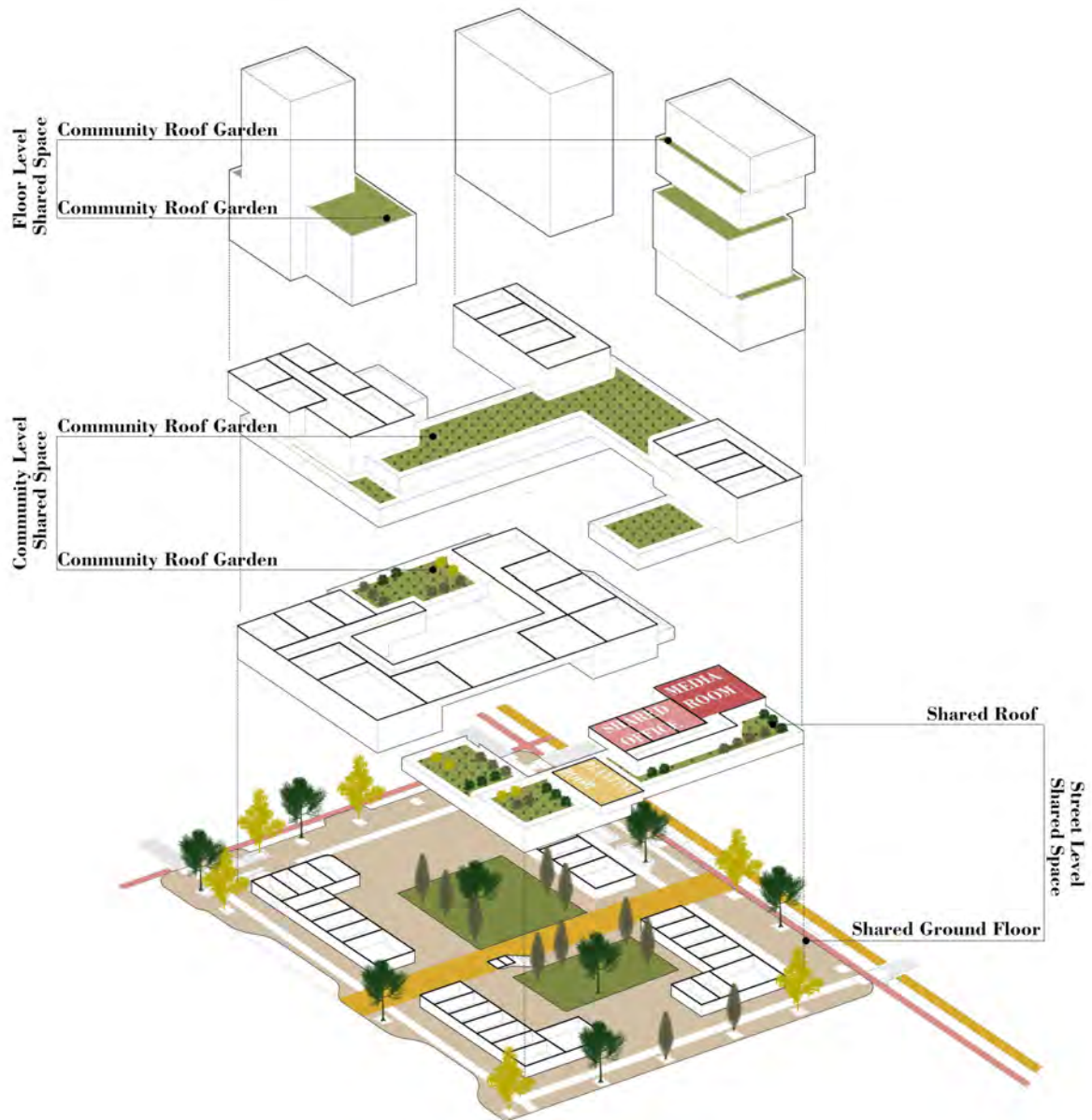


Fig. 5-50 Different shared level in shared community

2. Commercial street

COMMERCIAL STREET



LOCATION

The commercial streets are located in the northern part of the site, on both sides of the commercial complex. The southern side is a shared commercial street.

ELEMENT

Provide shared streets, resting places, service facilities, parking areas, green areas, street parks, stall areas, commercial out-setting areas, and passable areas.

ACTIVITY

The basic activities take into account the behaviors on the shopping street, and the additional activities mainly consider the behaviors that enrich the business atmosphere and provide places to stay and rest.



BASIC ACTIVITY



ADDITIONAL ACTIVITY



Fig. 5-51 Location, activities, and planar zoning of living streets

The two horizontal streets at the north end are commercial, and the shared commercial street to the south of the two was selected for display and illustration.

he shared commercial street is lined with retail stores and a commercial complex. Pedestrians and automobiles share the street, and the road is stabilized by traffic calming measures to reduce the speed to 20km/h. Street parks, vendor areas, and stores are set up on the street to create a commercial atmosphere.

Both basic and additional activities are included in the commercial street activity proposal. Basic activities include shopping, window displays, talking, waiting, and wheelchair and stroller travel. On the other hand, additional activities are observed on commercial streets that are spontaneously generated by pedestrians and contribute to the quality of the commercial street. Examples include outdoor coffee, transparent displays, continuous store displays, and casual seating.

The planned zoning of the commercial street allows for clear visibility of the travel and pedestrian activity areas. However, the pedestrian activity area is not limited to the pedestrian activity area indicated by the picture, so the travel area is labeled as a shared street, not a travel lane. That is because pedestrians can also move to this area. The travel zone reduces vehicle speed through the meandering of the street. The pedestrian-friendly paving and consistent grade level with the sidewalk can also visually cue drivers to reduce speed. The entrance to the street indicates to drivers through the narrowed street entrance that they are about to enter a shared street and need to reduce their speed.

Partial parking spaces are provided by the side of the travel area to meet the demand for temporary parking. Green areas, activity areas, facility areas, and vendor areas are set up on both sides of the travel lane. The area closest to the building is used as a safe passage area to guarantee the need for fast and safe passage. At the same time, the facility zone is arranged in commercial streets and set close to the building fronts.

As a public space, the roof garden of a commercial complex is an essential public space node in the commercial street. Creating an entrance from the street directly accessible enhances its accessibility. Similarly, the roofs of other podiums serve as spaces open to public use and are directly accessible from the street. The public spaces on the second floor are continuous

together to create a more extensive and varied public space.



Fig. 5-52 Axonometric view of commercial complex and scenes of commercial street

Commercial street-side park space enriches street activity. The continuous public space on the second floor is directly accessible from the street, forming a second-floor street space. By expanding the street space, the street public life is enriched.

The street profile shows the distribution of commercial streets, with various activity spaces from the building frontage to the building frontage on the other side, where all street users can move around.

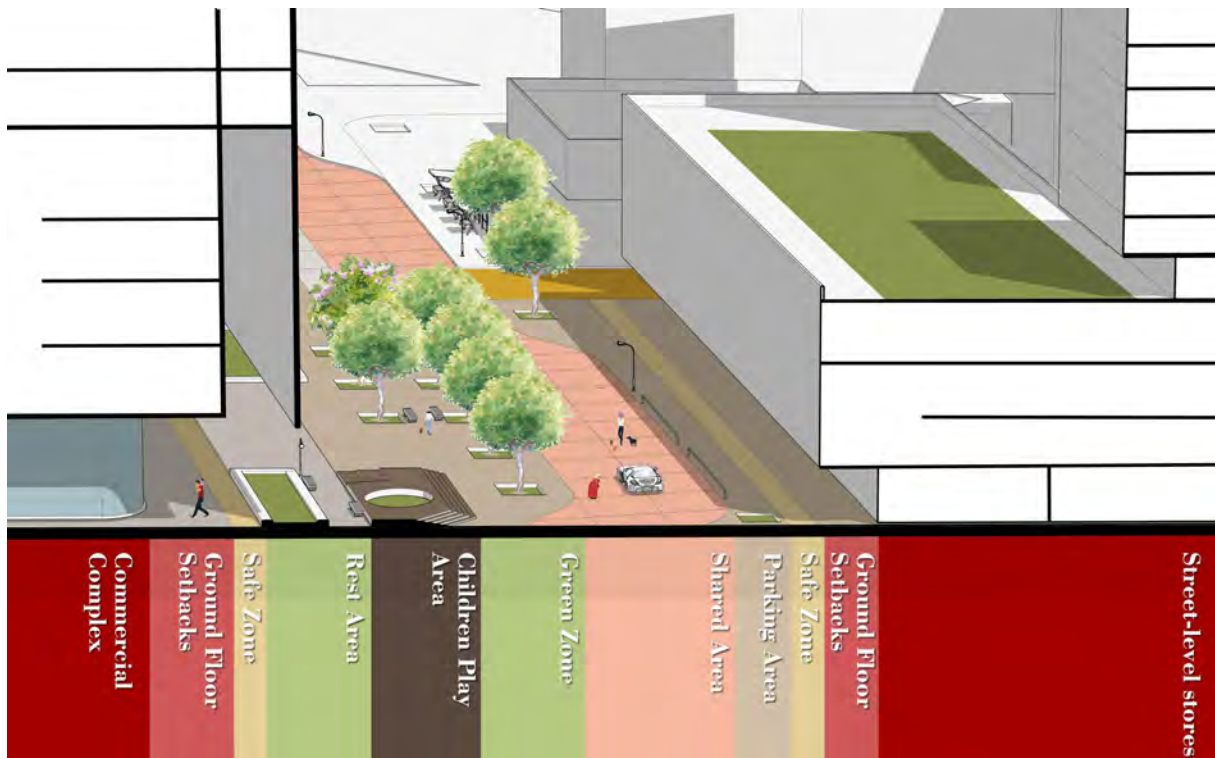


Fig. 5-53 Street profile of commercial streets

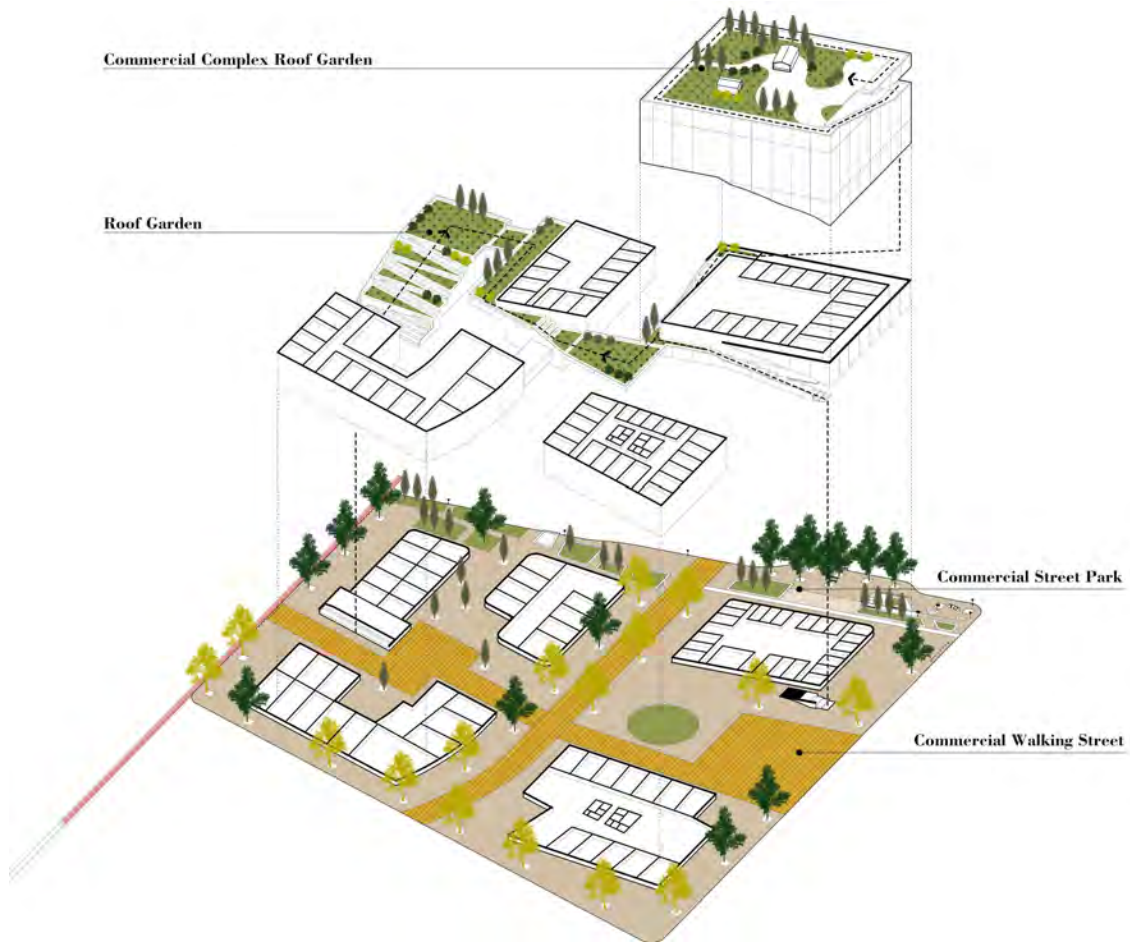


Fig. 5-54 POPS in commercial street

3. Landscape street

LANDSCAPE STREET



Fig. 5-55 Elements of living streets

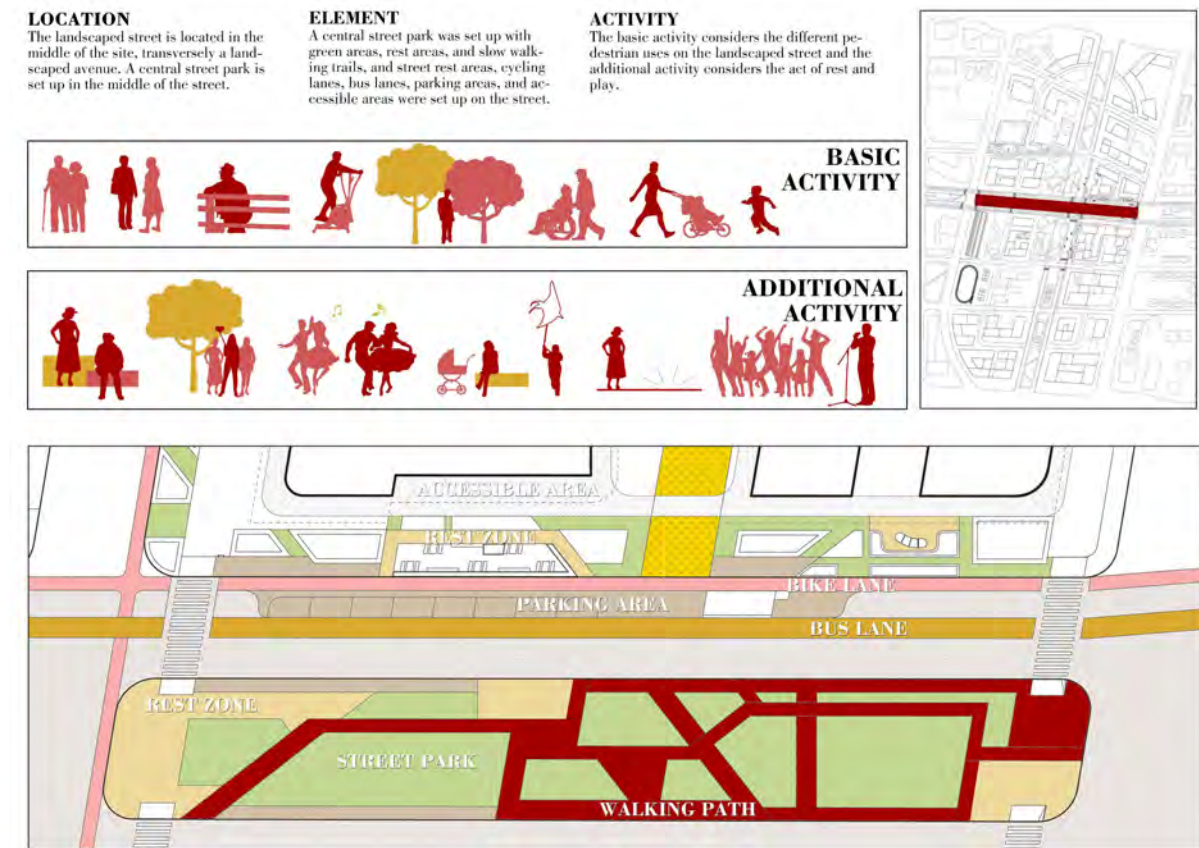


Fig. 5-56 Location, activities, and functional zoning of landscape streets

Landscaped streets are characterized by the landscape design of the streets. Street trees are selected to match evergreen green foliage trees with colored foliage trees. A landscape activity zone is designed in the center of the street to arrange landscaping, service facilities, and rest facilities. There are also lanes and stops for public transportation. Bicycle lanes are separated from motor vehicle lanes by parking strips and docking stations to ensure the safety of bicycle movement. Street furniture is installed on the streets to provide viewpoints.

There is only one landscape street in the center of the site laterally, which continues the landscape street of Jinsui Road.

The activities in the landscaped streets are recommended to be mainly leisurely. All kinds of people are catered for walking on the streets, and the elderly, blind, wheelchair users, and baby carriages can move smoothly on the streets. The basic activities of the landscaped streets also include children playing on the streets. For additional activities, resting seats, parent-child spaces, landscaped punching points, square dance sites, landscaped lighting design, and

event performance venues are recommended.

In the planned zoning of the landscaped street, it can be seen from Figure 5-40 that the area close to the building is designed as a safe passage area to ensure the safety of pedestrians. This part of the space is also the building setback space, where the second-floor building can provide roof shading for the street and smooth passage even on rainy days. Outside, the street furniture is placed in the street, designed together with the green area. Bicycle parking is also designed in this area. The bicycle lane is located close to the green activity area. Outside the bicycle lane are a parking area and a bus stop. The public transportation lane is on the outermost lane of the motorway. The center of the street is designed as a central landscaped activity zone. Paths and landscaping are designed in this activity zone.

The street furniture of the landscape street can be designed in different forms. The dining table style table and chairs allow people to enjoy the scenery while dining on the landscape street. The enclosed seats can create a good communication space, which is convenient for family and friends to communicate here. The independent resting seats meet the use of people who travel alone and can enjoy their own resting space alone.

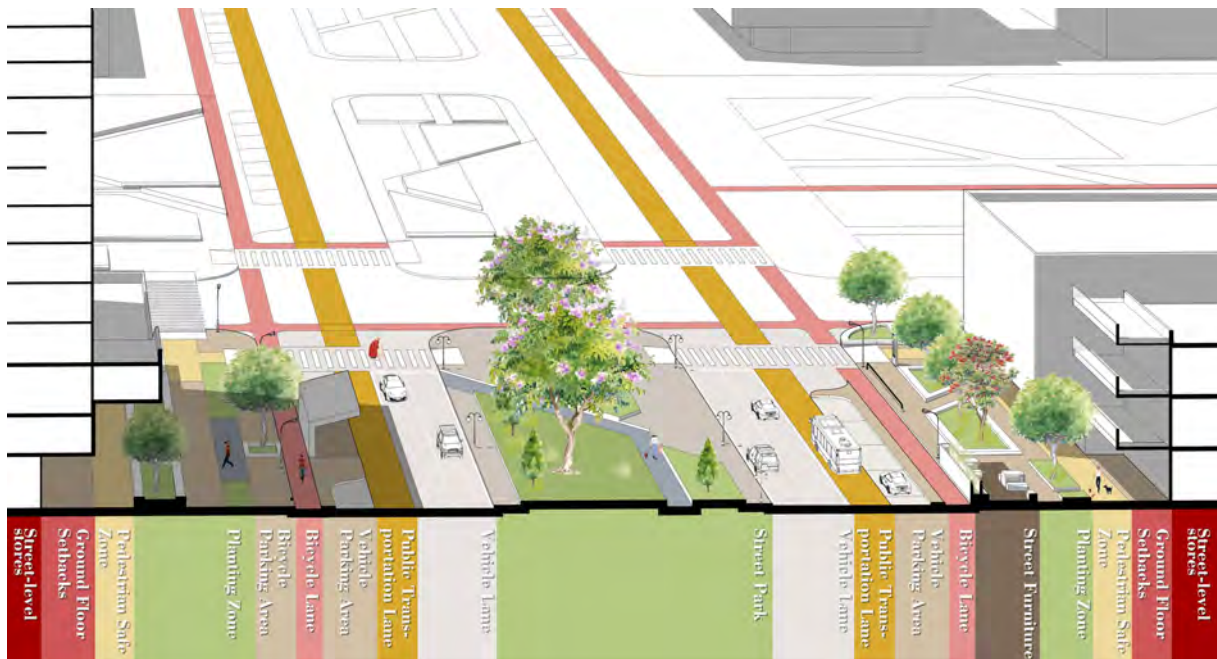


Fig. 5-57 Street profile of landscape streets

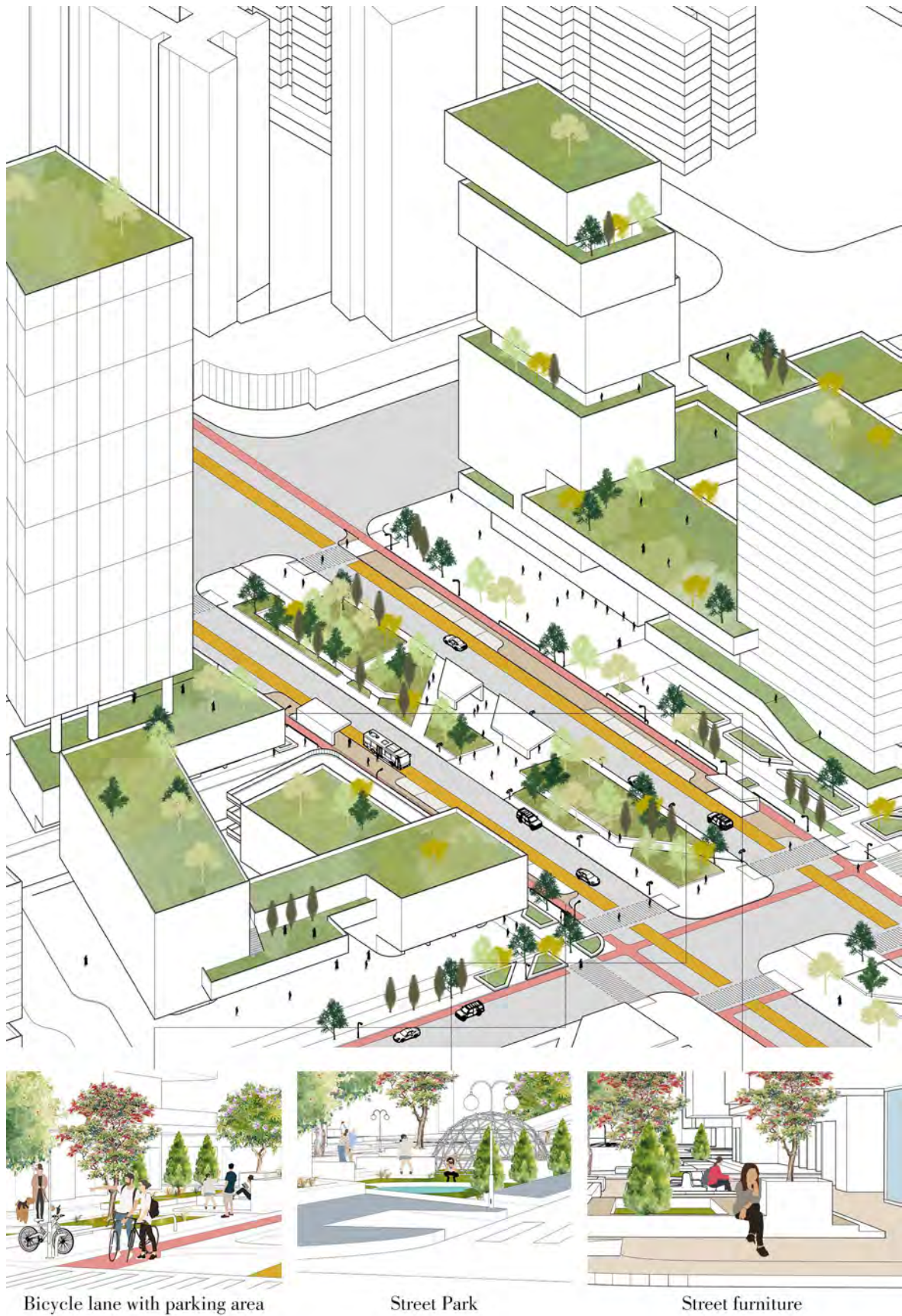


Fig. 5-58 Axonometric view of street park and scenes of landscape street

The landscape streets provide public spaces for different people, including playgrounds for children, cycling paths, walking paths, resting seats, etc. Temporary parking strips and drop-off points are also provided on the streets to facilitate access to the landscaped streets for people traveling by motor vehicle. Street furniture combines green design, using trees to create street shade.

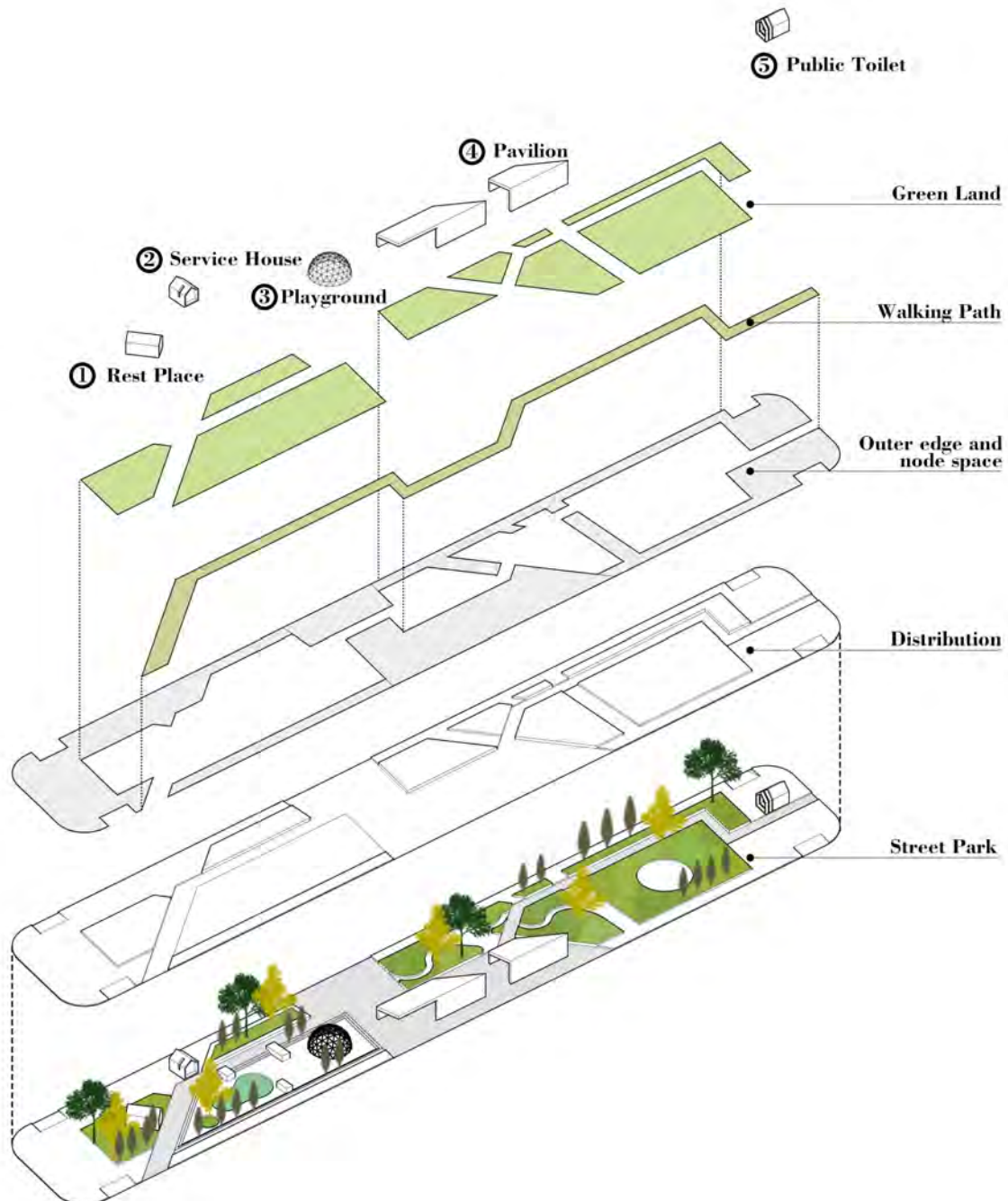


Fig. 5-59 What is in the street central park

Chapter6 Discussion and Conclusion

6.1 Conclusion

This thesis aims to explore how to design streets for people. Starting from theoretical research, learning from case studies, and finally, the generation of design strategies and applying the strategies to urban design solutions. That is the logic of this thesis. The reason for choosing street design as the theme of this paper is that streets belong to an essential part of the city and many activities of people happen on them. At the same time, as a critical link between public and private spaces in the city, how to design the street space better and return the street space to the people is worth exploring.

A long history of car-based street design has created many problems. That has led to a vicious cycle of "congestion - road expansion - more cars - more congestion." To solve this problem, China has also launched many thoughts and practices. The concept of human-centered streets is gradually gaining attention. The introduction of shared streets has given us a new perspective on street space. A shared street encourages all users to share the use of the street and blurs the right of way. It enhances people's power in the street and improves the safety of the street.

However, in China's national context, shared streets cannot be directly applied to all streets. At this time, there is also a need to expand sharing, from the sharing of people and cars to the sharing of public and private, and to expand street space through the publicization of private space, thus improving the street environment and encouraging more activities to occur. Based on this, POPS research and exploration are of interest.

As for the street space, we usually define it on a plane level. In New York's functional design, they Judge from the pedestrian perspective that the sidewalk is conceptualized as a room with four planes. Inspired by this, I also consider the street space in these four aspects when I design the street.

To better understand shared space streets, I compiled the development of this concept. This concept developed from the concept of road user integration. For the case study, I chose two cases. One is a shared street program of Auckland city. Fort Street has been widely acknowledged as an international exemplar of 'shared space' and, since its completion, has delivered massive uplift in footfall and turnover for surrounding businesses in the

neighborhood. Moreover, another is the POPS program in New York City. The water street upgraded program.

After studying theories and cases, there are three main topics to design the street in the design strategies. The first is from street design to urban design. The first consideration is the traffic system in urban design. Start from the pedestrian network. Step 1: Identify a key destination within a 15-minute living area. The scope of this living circle is determined as 1000meter, which considers the speed of different people in a 15-minute walk.

Furthermore, there are nine crucial public service facilities in this living circle. The pedestrian network should ensure residents can arrive at these facilities in 15min walks. They are, moreover, defined as whether the facilities are covered or not by the criteria. Besides the basic facilities, the daily travel purposed destination was also considered. Step two is mapping the network. By understanding, encouraging, and creating such key destinations and desirable routes between them, we can build appropriate networks and hierarchies that consider the types and numbers of people using the sidewalks. Providing people with destinations to walk to and safe, continuous, and exciting pathways to travel can have an enormous impact on individuals' decisions to incorporate physical activity into their daily lives.

The other three networks are the bicycle, public, and motor vehicle networks. The vehicle network is the last consideration. In some certain roads, the vehicle speed should be reduced to ensure other road users' activities on the road. So, there are some strategies to reduce speed. This is a table of traffic calming strategies from the global street design guide. I rearranged and mapped specific design examples to these strategies to apply them in subsequent designs directly.

The four networks only form a frame of the site. There is a need for a detailed street design. The street design should consider all users on the street and their activities on the street. The different street offers different functions, which means different spatial forms in a different street. In Guangzhou, there are six types of streets: living streets, commercial streets, traffic-oriented streets, landscape streets, industrial streets, and comprehensive streets. In the further discussion, I mainly focused on the living street, commercial street, and landscape street.

What is a shared street like is the second topic of the design strategies. The first one living street. For the spatial form, from four planes level: ground plane, building wall, canopy, and

roadside. Furthermore, second is people's activities on a living street, including basic activities and additional activities. The third is shared space in the living street. Finally, there are several design elements of a living street. The same consideration takes into account in the commercial street. It also listed the factors that influenced the spatial form of the commercial street in four aspects. And the activities in the commercial street. As for the shared space design strategies, it is a POPS in a commercial complex. The last one is landscape street. All the considerations are the same as the previous two streets.

The third topic of design strategies is a people-oriented street. Mainly including three aspects: inclusive design, connectivity, and safety.

All these strategies were applied in the design solutions. Chapter five shows the solutions to racecourse urban design. Developing streets for people in Guangzhou.

6.2 Research gaps and suggestions for further research

This thesis is still lacking in theory and specific design.

In terms of theoretical research, time and energy constraints have led to a lack of research on the origin and development of the theory. There is no in-depth study and understanding of the origin of the shared street theory, but more reading and learning about the development of shared streets from secondary research materials. Unfortunately, there is not enough learning about the use of shared streets in China. Shared streets originated in Europe and had many discomforts when they were introduced to the Chinese environment. Therefore, not enough theoretical research has been studied in the Chinese context.

In the design part, there is a certain amount of fallout.

First of all, the research of the site is not deep enough. On the one hand, the assessment of the building quality of the current situation of the racecourse is rather superficial, and the identification of the quality assessment is only given based on the observation of the current situation. The current buildings of the racecourse are mainly steel-frame factory buildings, which are easy to demolish. There is little point in preserving them, so the final decision was made to demolish the current buildings. On the other hand, the design was not in place. For the retainable terrace structures on the site, it was proposed to retain them, but since the design focus was on the street design, no specific design was proposed for the retained grandstands.

Second, the specific embodiment of the street design is not in place. The four spatial dimensions proposed in the strategy section appear to be somewhat neglected in the specific design. For example, in the "canopy" of the street, the three types of streets uniformly adopt the first-floor setback of the building to create a corridor space to provide shade for the street. Third, the exploration of shared space is not deep enough. Three types of shared spaces on streets are proposed in combination with the street types, but the street types are not limited to these three, and at the same time, the spaces on each street are not limited to one. Due to the limited time and energy, only one design strategy of shared space is proposed for each street type.

Therefore, further research is expected to address these points of deficiency in the future. In terms of theoretical research, we will read more first-hand research materials, especially those on the origin of theories, and read and study the origin of theories as clearly as possible. When researching and studying theories that emerged overseas, I will focus on applying theories in the Chinese context. In terms of design, more time should be spent on researching the current situation in the preliminary research. Assessing the current situation of buildings that need to be demolished and renovated is vital. Finally, hoping to further study the shared street theory in the future and apply it to street construction.

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Appendix

Guangzhou Racecourse Street Design Survey Questionnaire

A Family Information

1. Address

Tianhe District ☐ Yuexiu District ☐ Liwan District ☐ Haizhu District ☐ Huangpu District ☐
Baiyun District ☐ Others ☐

Subdistrict:

Wushan ☐ Yuancun ☐ Chepi ☐ Shahe ☐ Shipai ☐ Xinghua ☐ Shadong ☐ Linhe ☐ Tangxia ☐
Liede ☐ Xiancun ☐ Tianyuan ☐ Tianhenan ☐ Yuangang ☐ Huangcun ☐ Longdong ☐
Changxing ☐ Fenghuang ☐ Qianjin ☐ Zhuji ☐ Xintang ☐ Non-Tianhe District Subdistrict ☐

2. Family size (Current Population)

2.1 Total: 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 and more ☐

2.2 Age structure:

Seniors: __ (persons), 61-74 years old ☐, 75-89 years old ☐, 90 years old and above ☐

Adults: __ (persons), 19-35 years old ☐, 35-50 years old ☐, 51-60 years old ☐

Minors: __ (persons), Under 6 years old ☐, 6-14 years old ☐, 14-18 years old ☐

B Personal Information

1. Gender: Male ☐, Female ☐

2. Age: Under 18 years old ☐, 19-35 years old ☐, 35-50 years old ☐, 51-60 years old ☐, 61 years old and above ☐

3. Education level:

Below Primary School ☐, Primary School ☐, Secondary School ☐, High School/Junior College/Technical School ☐, Undergraduate/Junior College ☐, Postgraduate and above ☐

4. Career:

Student ☐ Self-employed ☐ Unemployed ☐ Worker ☐ Retirees ☐ Civil Service ☐ Business Unit Staff ☐ Company Staff ☐ Service Staff ☐ Others: ☐

C Travel Information

1. Purpose of this trip:

Go to work ☐ Go to school ☐ Official Business ☐ Shopping ☐ Recreation & Sports ☐
Visiting friends & relatives ☐ Go home ☐ Return trip ☐ Others: ☐

2. Destination: _____ (Fill in the road name, door number or unit name or prominent building)

3. Star point: _____ (Fill in the road name, door number or unit name or prominent building)

4. Transportation:

Walk ☐ Bicycle ☐ Electronic bike ☐ Car ☐ Bus ☐ Subway ☐ Cab ☐ Others:

5. Travel time: Less than 15 minutes ☐, 15-30 minutes ☐, 31-60 minutes ☐, More than 1 hour ☐

D Other Travel Information

1. Commuting

1.1 Destination:

Near Zhujiang New Town ☐ Near Taiyang Xintiandi ☐ Near Liede Station of Line 5 ☐

Near Tancun Station of Line 5 ☐ Near Yuancun Station of Line 5 ☐ Near Jinan University ☐

Racecourse ☐ Others:

1.2 Transportation:

Walk ☐ Bicycle ☐ Electronic bike ☐ Car ☐ Bus ☐ Subway ☐ Cab ☐ Others:

1.3 Travel time: Less than 15 minutes ☐, 15-30 minutes ☐, 31-60 minutes ☐, More than 1 hour ☐

2. Social activity

2.1 Number of social activities per week: 1-2 times ☐ 3-5 times ☐ 6 times and more ☐

2.2 Destination:

Own or friend's home ☐ Downstairs in the neighborhood ☐ Zhujiang Park ☐ Zhujiang New Town ☐ Taiyang Xintiandi ☐ Others:

2.3 Transportation:

Walk ☐ Bicycle ☐ Electronic bike ☐ Car ☐ Bus ☐ Subway ☐ Cab ☐ Others:

2.4 Travel time: Less than 15 minutes ☐, 15-30 minutes ☐, 31-60 minutes ☐, More than 1 hour ☐

3. Shopping

3.1 Number of shopping trips per week: 1-2 times ☐ 3-5 times ☐ 6 times and more ☐

3.2 Destination:

Tianhe City Shopping Area (Zhengjia Square, One Link Walk, TaiKoo Hui, etc.) ☐

Buy Now Shopping Area (Tianyu Square, Mopark, etc.) ☐

Zhujiang New Town Shopping Area ☐ Taiyang Xintiandi ☐ Racecourse Food City ☐ Others:

4. Activity at the racecourse:

Go to work ☐ Go to school ☐ Official Business ☐ Shopping ☐ Recreation & Sports ☐
Visiting friends & relatives ☐ Go home ☐ Return trip ☐ Others:

E Street Evaluation

1. The main activities you do on the street sidewalk are:

Walking ☐ Walking with own kid ☐ Walking the dog ☐ Shopping ☐ Chatting ☐ Seating ☐
Sailing ☐ Performing and watching ☐ Playing cards and chess ☐ Doing sports ☐ Others:

2. How important do you think each of the following elements is to the street:

2.1 Accessibility & Safety: Very ☐ Comparative ☐ General ☐ Less ☐

2.2 Neat & Beautiful: Very ☐ Comparative ☐ General ☐ Less ☐

2.3 Green & Eco: Very ☐ Comparative ☐ General ☐ Less ☐

2.4 Convenient facilities: Very ☐ Comparative ☐ General ☐ Less ☐

2.5 Diverse functions: Very ☐ Comparative ☐ General ☐ Less ☐

2.6 Commercial Vitality: Very ☐ Comparative ☐ General ☐ Less ☐

3. Which of the following elements are you more concerned about in the street?

Sidewalk ☐ Building Interface ☐ Street facilities ☐ Green belt ☐ Non-motorized lanes ☐
Carriageway ☐ Parking zone ☐

4. In your opinion, the reasons for the poor street walking experience are:

No separate sidewalk ☐ Narrow sidewalk space ☐ Bicycles parked indiscriminately ☐
Occupied by motor vehicles ☐ Poor hygiene ☐ Lack of sitting and resting facilities ☐ Road
surface is uneven and non-slip ☐ Lack of flowers and trees ☐ Store outside the pendulum
occupy the road ☐ Lack of instructional facilities ☐ Lack of accessibility ☐ Others:

5. In your opinion, the reasons for the poor street riding experience are:

No separate non-motorized lanes ☐ Non-motorized lanes are too narrow ☐ Car occupancy ☐
Non-motorized lanes are not continuous ☐ Intersections are unsafe and inconvenient ☐
Uneven road surface ☐ Lack of shade from trees ☐ Non-motorized lanes without guardrails ☐
Poor signage instructions ☐ Inadequate lighting ☐ Others:

6. What other measures would you like to see to enrich the street walking experience?

Ecological green landscape ☐ Cultured façade along the street ☐ Creative street furniture ☐
Temporary street activities ☐ Colored floor coverings ☐ Orderly and personalized store signs
☐ Fun children's activity area ☐ Others:

7. Do you feel that motorized vehicles on the street interfere with your cycling and walking?

No ☐ Certain degree ☐ Very ☐

8. To reduce the disturbance of pedestrians by motor vehicles, which of the following models would you like to see the street become?

Pedestrian + Bicycle ☐ Pedestrian + Bicycle + Bus ☐ Pedestrian + Bicycle + Bus + Car (limit
speed) ☐ No change ☐ Others