

# Design of underground space around metro stations based on TOD theory

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## Abstract

The development of large cities in China is currently facing many serious problems. At present, many first-tier cities in China have more than 20 million permanent residents, and the population of small cities is continuously gathering in large cities. The concentration of population has brought many serious problems, such as traffic congestion, disorderly expansion of urban land, chaotic land use functions, serious air pollution, and high difficulty in urban governance.

I selected a megacity in central and western China--Chengdu, the Tianfu New District of Chengdu, to do theoretical analysis and spatial design. Starting from the actual situation, I find the core problems which the region's development is facing, namely, traffic congestion, lack of functions, lack of public services, and population violence. Further, I learn from TOD theory and find solutions to these problems, they are, strengthen public transportation-oriented development, strengthen the design of pedestrian space, integrate the urban land functions, and strengthen the space design around subway stations.

Taking this as a guide, the space design of Tianfu New District in Chengdu, including Transportation system design, Function distribution design, Vertical design, Underground space design, What's more , I appropriate land development policies and management policies to ensure the long-term healthy development of the region.

Key words: underground space, metro station, Land development

## 1. Project background

### 1.1 In China, cities are facing many serious problems

The development of large cities in China is currently facing many serious problems. At present, many first-tier cities in China have more than 20 million permanent residents, and the population of small cities is continuously gathering in large cities. The concentration of population has brought many serious problems, such as traffic congestion, disorderly expansion of urban land, chaotic land use functions, serious air pollution, and high difficulty in urban governance.

### 1.2 Metro brings important opportunities to cities

As a modern urban public transportation, the metro has many advantages such as large capacity, fast speed, green and energy saving, etc.

Nowadays, the metro is increasingly becoming an important part of urban life and an important factor affecting the development of urban spatial pattern. It can be said that, on the one hand, metro construction has changed the allocation and layout of urban resources, changed the nature of urban land use near metro stations, promoted population and industry agglomeration, and further promoted the optimization of urban spatial pattern, bringing important opportunities for urban development; The metro stations are connected in a network layout to form an effective urban catalyst, which is conducive to promoting the overall economy and urban vitality of the city.

### 1.3 Metro stations are an important link connecting urban spaces

As the only link between the metro and the urban space, the station is self-evident of its importance to the development of the urban spatial pattern. In the metro system, the station plays the function of attracting and evacuating the flow of people, and plays the role of communication and connection with the urban space; in the urban space, it can attract a large number of people around, thereby forming a cluster of industries and functions, and forming a vitality in the city. The growth pole drives the planning and construction of surrounding areas and land development, has a strong radiating effect on the surrounding urban areas, and helps to drive the formation of a virtuous circle of regional economy.

#### 1.3.1 The development around the metro stations is an important part of the redevelopment of the city center

The metro stations will help realize the integration of urban functions. Since traffic transformation is often the main motivation for the utilization and development of underground space, combined with the development of metro stations, the underground space expanded from metro stations will pass through the metro, underground walkways and the ground. Important high-rise buildings are connected to each other to form an underground public space network, which will help promote the development of urban underground space and the improvement, transformation, and supplementation of the functions of the central city. In fact, in many countries, metro space have promoted the intensive use of urban land and significantly improved the environmental quality of the city. Its development activities have become an important part of the redevelopment of urban central areas.

### 1.3.2 Development around metro stations will increase the overall value of the area

The construction of metro stations will surely bring a large amount of passenger flow, the change of travel mode and the mode of comprehensive development of stations will change and guide people's lifestyles. The construction of the site space can change and complement the functional structure of the ground block to varying degrees, enrich the level and interest of the commercial space, and further enhance the convenience and comfort of users. The potential economic and social benefits are very significant.

### 1.3.3 Development around metro stations is conducive to promoting the improvement of the urban environment

The comprehensive development around metro stations revolves around the traffic stations, and further combines and organizes the traffic of people and vehicles in the area to make the traffic in the area more orderly. At the same time, some urban functions, especially the traffic functions, are transferred to the underground or the ground, reducing road traffic. The fragmentation of the city and the flow of motor vehicles on the ground reduces traffic pollution while reducing congestion, helping to create a comfortable and peaceful urban environment. In addition, some of the underground and semi-underground commercial spaces create possibilities for the building's covering form, extending the urban green skin to the building roof, enriching the traditional urban space and improving the urban environment.

## 2.TOD theory

### 2.1 Theory development

#### 2.1.1 TOD theory (basic implication):

TOD mode, that is, transit-oriented development (TOD) is a non-automotive planning and design method that maximizes the use of public transportation when planning a residential or commercial area. Among them, public transportation mainly refers to subway and bus routes such as railway stations, airports, subways, light rails, and then a central square or city center is established with a bus station as the center and a radius of 400 to 800 meters (5 to 10 minutes walk).

#### 2.1.2 TOD theory (research development):

In 1993 , Peter Calthorpe proposed the TOD model to replace the development model of suburban sprawl in "The Next Generation of American Metropolis-Ecology, Community and American Dream"

In 1997 , Robert Cervero and Kockelman proposed the "3D" principle in TOD theory: "density", "diversity", and "reasonable design"

In 2000 , Maryland Department Of Transportation proposed that the TOD model is a relatively high development density and emphasizes the design principles of pedestrians and bicycles.

In 2002 , California Department Of Transportation proposed the TOD model to develop high-density land around public transportation stations, emphasizing coordination with public transportation

The development of TOD theory in China is relatively late, and only scholars have begun to study since 2010

In 2011 , Southeast University Cao Jieyong proposed the combination of TOD mode and new urbanism to guide my country's urban planning and urban development

In 2014, Some scholars proposed a smart growth theory based on the TOD model, advocating the use of sufficient urban stock space and avoiding waste.

In 2015, Tian Wenhao proposed the evaluation of urban land use based on the TOD theory

Through the research on the status and development of TOD theory, it is found that the current TOD theory can solve the outstanding problems of land shortage, population density concentration, and traffic congestion brought about by urban spatial growth. At the same time, it can be used for urban spatial planning, urban land use, and urban land development. Such macroscopic fields play a very important role.

## 2.2 TOD Famous cases

### 2.2.1 Japan model

The general idea of the Japanese model is the "market-oriented integrated model of station and city", with public transportation stations as the core, and the deep integration of surrounding land development and bus stations to achieve integrated station-city development, advocating mixed spaces and mixed behaviors.

#### ■ Shibuya Subway Station, Tokyo, Japan:

Shibuya is located in Tokyo, Japan. There are 9 subway lines that intersect here. They are: JR Yamanote Line, JR Kaikyo Line, JR Shonan Line, Tokyu Denen Metropolitan Line, Tokyu Toyoko Line, Keio Itou Line Subway Ginza Line, Subway Hanzomon Line, Subway Fukutoshin Line; more than 3 million people transfer every day, Shibuya Station is the second largest transportation hub in the Tokyo area after Shinjuku Station.



Figure 1 Plan view of Shibuya Station

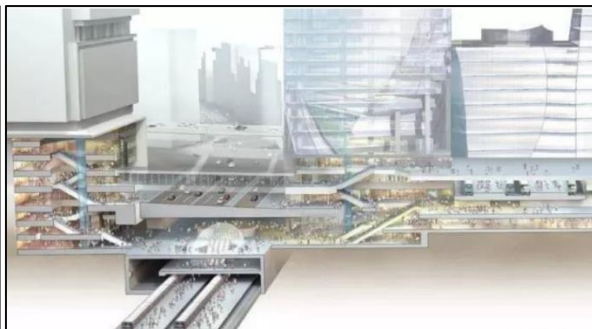


Figure 2 Sectional view of Shibuya Station

Shibuya Subway Station not only contains 9 main subway lines, but also 7 super high-rise commercial Buildings on the ground, which are:

1. Shibuya Hikari; 2 Shibuya Station Building; 3. Shibuya South Street Building STREAM ;4. Shibuya Station Sakuraigaoka ;5. Tokyu Blue Tower Building; 6. Dogenzaka Street Building ;7. Shibuya Mark (Mark City)

The block with over 1 million square meters centered on Shibuya Station is an outstanding work of TOD development model. The underground spaces of the 7 super high-rise buildings are intertwined to form a huge commercial comprehensive space. In the east side plaza, multiple vertical lines of elevators and escalators are set up to connect the three-dimensional traffic, which improves the mobility of the station and the surrounding area and the underground space. Safe evacuation capability. Taking Shibuya Hikari as an example, Shibuya

Hikari integrates various functions such as Tokyu subway station, commercial facilities, restaurants, theaters, and offices to form a "three-dimensional city". The underground space and the ground are vertically connected by the "urban core" that integrates underground and above-ground space. Floors B5-B3 are subway stations, floors B3-7 are commercial facilities that seamlessly connect with subway stations, floors 11-16 are large theaters that can accommodate about 2,000 people, and floors 17-34 are office buildings. Before the development of the site, the Tokyu Cultural Hall had an annual loss of 300 million yen. After the completion of the complex, the turnover exceeded 19 billion yen in the first year and the number of visitors was 22 million.

The future Shibuya Station will not only meet the daily operation of 9 lines, but also realize the three-dimensional development of the city and the highly intensive use of resources and space, and gradually transfer the transportation function on the ground to the underground, build super high-rise buildings on the ground, and build commercial complexes underground. With parking and transfer spaces, it realizes multi-level integrated development of above and below ground and seamless transfers between various lines, between various lines and bus lines, between various lines and airport buses, greatly improving the quality and value of urban space.

### 2.2.2 Hong Kong model

The general idea of the Hong Kong model is a "government subsidized, policy-oriented subway + property" model. The main travel mode of the subway, high-intensity mixed use of land and land development complement each other to achieve land appreciation and subway profitability.

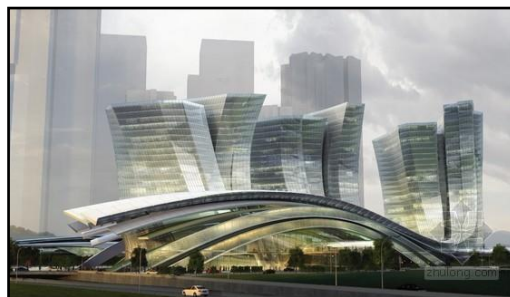


Figure 3 Hong Kong Kowloon West Station

Metro hub stations that place equal emphasis on urban transportation and commercial functions are largely due to the original commercial areas being re-given the functions of transportation hubs after the construction of the subway. For example, Hong Kong Kowloon West Station is the southern terminus of the Guangzhou-Shenzhen-Hong Kong high-speed railway under planning. It is located in West Kowloon, Yau Tsim Mong District, Hong Kong, adjacent to the West Kowloon Cultural District. The Hong Kong section of the railway is expected to open in 2014. The surrounding commercial and entertainment functions are maturely developed, and the superimposition of the traffic function enables the vitality of the surrounding area of the site to be better reflected. Most areas around subway stations that are developed with equal emphasis on urban transportation and commercial functions are gradually formed due to changes in external traffic conditions on a certain commercial basis. Business itself constitutes an attraction to the flow of people, and convenient transportation provides good external conditions for the further development of commercial areas. When developing land around such sites, you can consider setting up purpose-built buildings, such as shopping centers, hotels, office buildings, etc., to build rail passenger flow, reduce passing people, and inject vitality into regional development. The development map of Kowloon West Station in Hong Kong is shown in the figure.

## 2.3 TOD Guiding Principles

### 2.3.1 Focus on public transportation

From the perspective of urban spatial macro planning, the TOD model advocates taking public transportation stations as the center and expanding the pedestrian area with an appropriate radius as the center of the circle. At the same time, the corresponding transportation stations and arterial lines must be connected to form a compact Layout of urban space; from the perspective of urban space micro-planning, the TOD model advocates taking public transportation stations as core points, and extending and expanding the urban space around these core points, thereby realizing the entire urban space functionality And the unity of layout.

### 2.3.2 High-density land development

Advocating the development of high-density urban transportation space means to increase the carrying capacity of urban transportation arterial lines through the intensive use of land resources; relevant data shows that high-density land development is conducive to promoting the rate of public transportation.

### 2.3.3 Space and function mix

As far as the components of the TOD model are concerned, it is recommended to establish a standard TOD station area and a standard sub-area surrounding the station area in each unit. The so-called TOD station area specifically refers to a high-density area composed of functional core traffic arteries, residential areas, commercial service areas, and employment areas. The so-called standard secondary areas refer to schools and factories. , Community services, square parks and other low-density areas.

### 2.3.4 Suitable walking environment

The TOD model advocates the establishment of a comfortable and pleasant walking environment. On the one hand, a comfortable walking environment helps to enhance the residents' walking experience, thereby attracting more residents to choose public transportation and give up the use of private transportation; on the other hand, it can also improve the walking among residents by creating comfortable pedestrian streets. of interaction.

## 3. Analysis of the research project

### 3.1 District/Population/Industry/Transportation

The project is located in the Tianfu New District of Chengdu, a city in central and western China.

#### ■ Population:

Chengdu is the capital of Sichuan Province, a sub-provincial city, a megacities, and the core city of the Chengdu-Chongqing dual-city economic circle. It is an important central city in western China approved by the State Council, an important national high-tech industrial base, a commercial logistics center, and a comprehensive transportation hub. As of 2019, the city has 12 municipal districts, 3 counties, and 5 county-level cities under its jurisdiction, with a total area of 14,335 square kilometers. As of 0:00 on November 1, 2020, Chengdu has a permanent population of 20.93 million.

Chengdu will focus on the development of five strategic industrial functions, including international regional hubs, international regional finance and headquarters, high-tech and advanced manufacturing, tourism, and cultural creativity, and use industrial functional zones as the space carrier to promote the realization of strategic industrial functions.

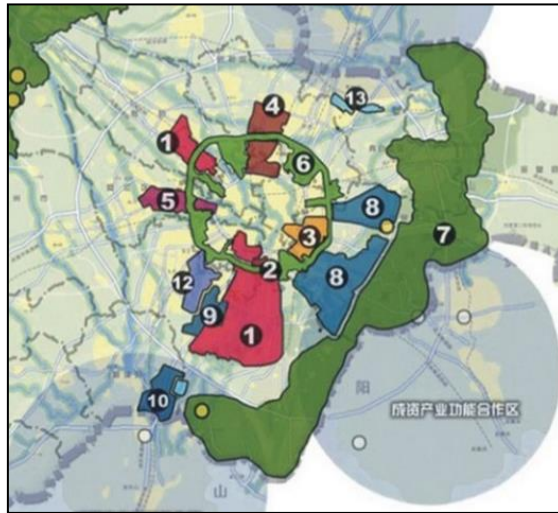


Figure 4 Picture of 13 functional areas in Chengdu

■ Tianfu New District of Chengdu:

The industrial function zone is positioned to focus on the development of high-tech industries based on electronic information (including software) and biomedicine, and cultural and creative industries based on animation, games, and cultural tourism. It is the central business district (CBD) of the city.

The planned area extends to the First Ring Road in the north, Chengdu-Kunming Railway in the west, the outer winding of the freight railway in the south, and the Chengzi-Lu Expressway in the east, covering an area of approximately 237 square kilometers. Among them, the short-term development zone (until 2015) has an area of about 50 square kilometers, the medium-term development zone (until 2020) has an area of about 60 square kilometers, and the long-term development zone (after 2020) has an area of about 38 square kilometers.

Tianfu New District is generally positioned as an international modern new city with modern manufacturing as its mainstay, high-end service industry clusters, and business, business, and living conditions. The core function is summarized as "one portal, two bases and two centers". As an inland opening gateway, Tianfu New Area is an important part of the inland opening to Europe and Asia. It will become a channel and platform for the western region and the global economy, technology, information, and cultural flow and cooperation. The "two centers" are specifically the western high-end service industry center and the national independent innovation center.

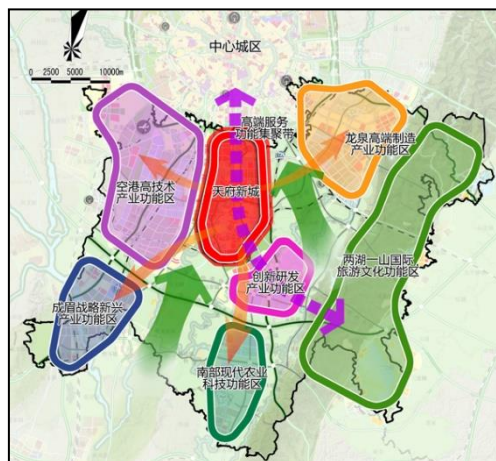


Figure 5 Layout of Tianfu New District

■ Industry&Function:

The planning structure of Tianfu New District can be referred to as eight characters—one belt, two wings, one city and six districts.

"One Belt" is a high-end service function gathering belt, from Renmin South Road to Tianfu Avenue, extending south along the Tianfu Central Axis, and gradually turning towards Longquan Mountain and Sancha Lake.

"Two Wings" are industrial functional belts of east and west wings, including Chengmei high-tech and strategic emerging industry clusters and the high-end manufacturing industrial functional belts of Longquan Economic Development Zone.

"One City" is Tianfu New City. "This is one of the 13 strategic functional areas proposed by the Chengdu Municipal Committee last year. It also carries the main high-end functions of the city in the Tianfu New Area. It will gather and develop central business, headquarters office, cultural administration, etc. High-end service functions to build the main center of regional production organization and life services". The "six districts" are based on leading industries and ecological isolation to delineate six industrial and urban comprehensive functional areas, to give play to the effect of industrial agglomeration and complete supporting functions of production and life services. They are the Airport High-tech Industrial Function Zone, Chengmei Strategic Emerging Industry Function Zone, Southern Modern Agricultural Technology Function Zone, Innovation R&D Industry Function Zone, "Two Lakes and One Mountain" International Tourism Cultural Function Zone, and Longquan High-end Manufacturing Industry Function Zone.

■ Transportation:

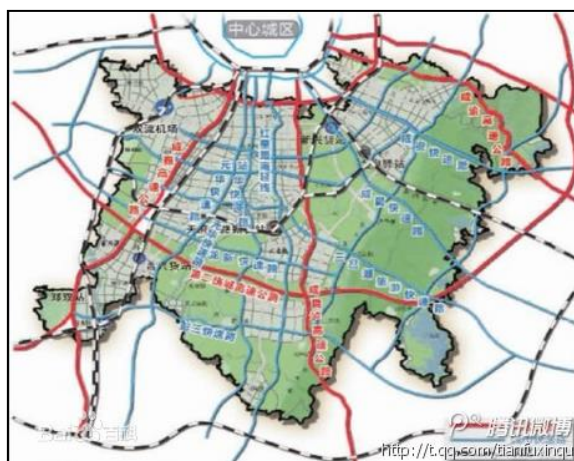


Figure 6 Traffic road network map of Tianfu New District

Traffic status: Due to the sparse road network in the central urban area and the design of some road widths is not sufficient, the road is relatively congested; the lack of parking spaces in the area leads to common parking and occupation of sidewalks along the road on both sides of the road, and the phenomenon of mixed traffic between people and vehicles is more prominent .

Highway traffic: The city's external roads-Chengya Expressway and Chengzihu Expressway pass through the west and east of the section respectively. Tianfu Avenue, the center of the area, connects to the downtown area. The distribution of main and secondary roads within the city is reasonable, and the distribution of branch roads is slightly sparse. The traffic conditions along the line section are generally good and the traffic is convenient.

Static traffic: The development on both sides of Tianfu Avenue is relatively rapid and the traffic is convenient. Most of them adopt underground parking methods. The parking problem is not prominent at present.

Transportation hub: The current status of traffic flow and human flow around the hub is not reasonable



enough, and the phenomenon of mixed traffic between people and vehicles is serious. There are several small passenger stations in the area, and the problem of random parking of vehicles often occurs around the hub.

## 3.2 Data and forecast

### 3.2.1 Total number of trip population

Table 1-Total number of passengers in the planning area of Chengdu

Data	Year	2021	2028	2043
Total number of resident population				
Resident population (10,000 people)		1140	1391.2	1750
Employment positions (ten thousand)		651.5	794.0	972.7
Trip intensity (person/time/ day)		2.56	2.62	2.65
Total number (ten thousand passengers)		2918	3645	4638
Total number of floating population				
Floating population (10,000 people)		125.4	159	255
Travel intensity (person/time/ day)		3	3	3
Total number (ten thousand passengers)		376	476	765
Total number of passengers				
Total number (ten thousand passengers)		3294	4121	5403
Total number of public traffic (ten thousand passengers)		1021	1442	2134

### 3.2.2 Travel model

Table 2-Chengdu travel method composition (%)

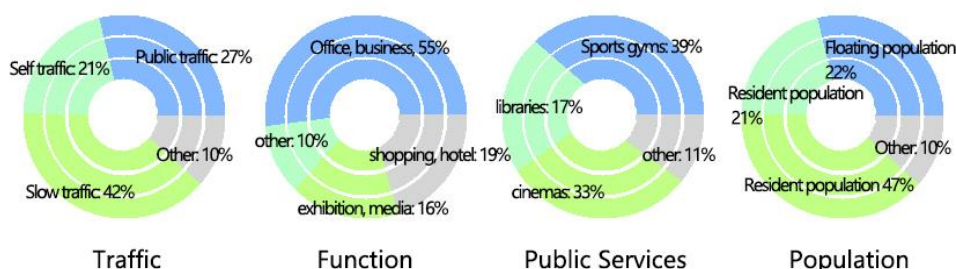
Year	Slow traffic (walk)	Public traffic (metro/bus)	Self traffic (car/taxi)	other
2021 年	42.0	31.0	26.0	1.0
2028 年	38.2	35.0	25.8	1.0
2043 年	33.9	39.5	24.1	1.0

### 3.2.3 Metro network passenger flow datas

Table 3-Full-day passenger flow forecast for the entire metro network

Year Data	2021 年	2028 年	2043 年
Wire net length (km)	365	585.1	904.8
Metro passenger traffic (10,000 passengers/day)	442.3	1003.4	1691.2
Metro transfer coefficient	1.38	1.61	1.70
Metro trip volume	320.2	623.2	997.3
Percentage of rail in public transportation (%)	31.36%	43.2%	46.73%
Average distance of single line (km)	8.83	8.40	8.62
Average distance	12.20	13.41	14.63
Load intensity (10,000 person-times/km·day)	1.21	1.71	1.87

### 3.3 Summary



Transportation : More attention should be paid to slow traffic and public transportation, to reduce private car travel, and to slove traffic congestion;

The current road network in the central urban area is relatively sparse and some road widths are not designed for use, which leads to road congestion; the lack of parking spaces in the area leads to common parking and occupation of sidewalks on both sides of the road, and the phenomenon of mixed traffic between people and vehicles is more prominent.

Function : The commercial and service functions of the area should be increased, and the comprehensive use of the commercial office area should be improved to repower the area. In this area, there is the world's largest single building-New Century Global Center, which is a multi-functional building integrating entertainment, exhibition, business, media, shopping, and hotel, composed of amusement areas, hotels, commerce, and offices. It is the commercial center of Tianfu New District.

Public services : sports gyms and cultural supporting facilities should be increased. Due to rapid urban development, high population density and relatively insufficient public supporting facilities, the environmental quality of some places is poor. The public cultural and sports facilities are inadequate, and sports gyms, cinemas, theaters, and libraries are relatively low and unevenly distributed.

## 4. Land development policy

### 4.1. Development Goal

With an open mind and a multi-faceted perspective, looking at modern products and services, looking at the future, we will comprehensively innovate the resource development, operation and management system, mechanism, model and concept of Chengdu Metro, so that Chengdu Metro has strong professional capabilities and market integration capabilities. To become a cultural subway with good social influence and important economic contribution; to become a brand subway virtual telecom operator; to become Chengdu's largest and most influential retail brand and service integrator, realizing subway resources Maximize development and utilization.

### 4.2. Development Model

The development of stations is mainly divided into the forms of internal space development, underground space development and development on top space of the station. This development model enables the comprehensive development of the station area into a concentrated area of "clothing, food, housing, transportation, work and entertainment", thereby increasing the demand for subway passenger transportation.

#### ■ Internal space development of the station

The internal space develop of the station mainly includes the development of shop resources and the development of advertising resources.

#### ■ Development of store resources

The development of store resources is mainly to set up small restaurants, convenience stores and other convenient facilities in the non-paying area of the station hall level to facilitate the travel of passengers and meet the basic living needs of surrounding residents. The diagram of store resource development is shown in the figure.

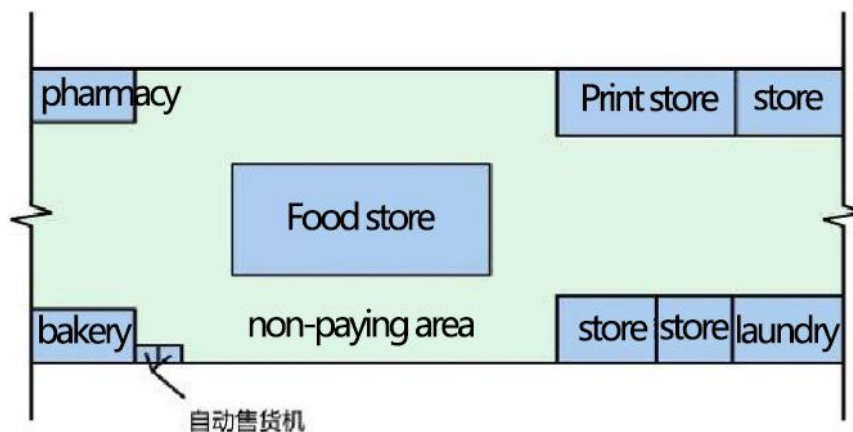


Figure7: the development of shop resources

In the design, through the reasonable layout of these spaces and good connection with the public areas of the station, the value of these affluent spaces can be effectively enhanced and the waste of resources can be avoided. The World Window Station of Shenzhen Metro Line 1 makes full use of the upper (underground level) space formed by the open excavation of the station's turn-back line (underground level) to set up underground bus connection stations and commercial passages. At present, the passenger flow of subway stations and bus stations is very large, bringing a lot of passenger flow to the commerce in the station. A diagram of the underground space naturally formed during the construction of the subway is shown in the figure.

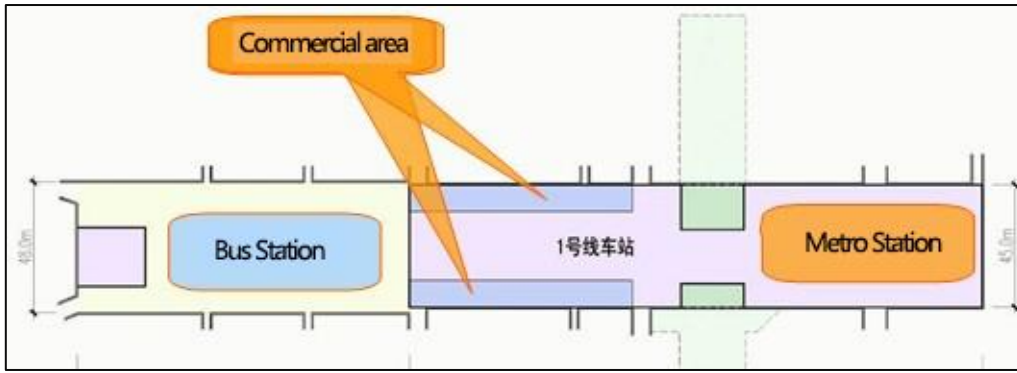


Figure8:the underground space naturally formed during the construction of the subway

Combining the moderate extension of subway construction to form an underground development space means that in order to make full use of the passenger flow business opportunities brought by the subway, the channel or the adjacent space of the station hall should be appropriately expanded through a moderate increase in investment without affecting the function of the station. Form a certain development space. This kind of development model is small in scale, flexible and diverse, and can adapt to the construction conditions of various rail stations. The business model can also be well adjusted according to market demand. After the formation of networked operation, the benefits it produces cannot be underestimated. The underground development space formed by the moderate extension of subway construction is shown in the figure.

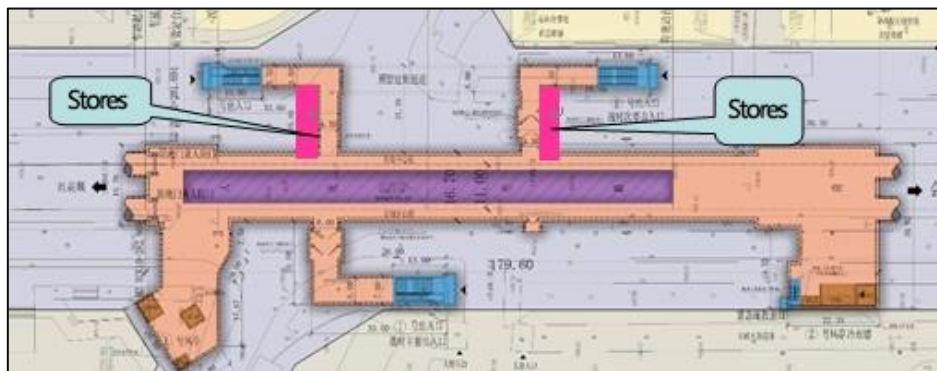


Figure9: The underground space formed by the moderate extension of subway construction

■ Development of advertising resources

The development of advertising resources can make full use of the conventional advertising, commerce, and commercial communication services in the space development station of the auto show, and strive to create benefits to make up for the operating losses.

Advertising business can use advertising light boxes, automatic inquiry machines, guidance systems, electronic media, glass stickers, wall paintings, staircase billboards, outdoor advertising and other forms. The above advertising space can be reserved during the construction and decoration of the station, and a certain amount of capacity should be reserved when designing the power supply.

■ Double development of underground stations and underground commerce

Combined with subway construction, an underground comprehensive space integrating commerce, entertainment, and subway transfers will be built, and it will be organically combined with ground plazas, bus stations, and street crossings to form a multi-functional and comprehensive site development space. The schematic diagram of the joint development of underground stations and underground commerce is shown in the figure.

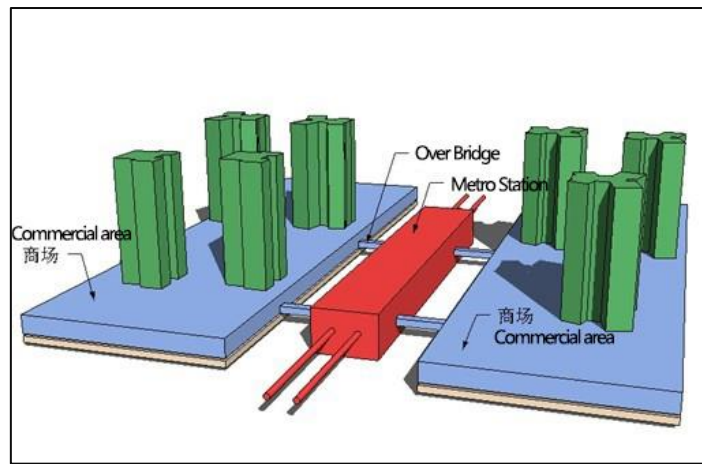


Figure10: Double development of underground stations and underground commerce

■ Combination of entrances and exits with underground commerce

It can provide convenient subway entrances and exits for the underground commerce, facilitate the flow of passengers in the direction of the underground commerce, and enhance the market value of the commerce. The diagram of the combination of the entrance and the underground commerce is shown in the figure.

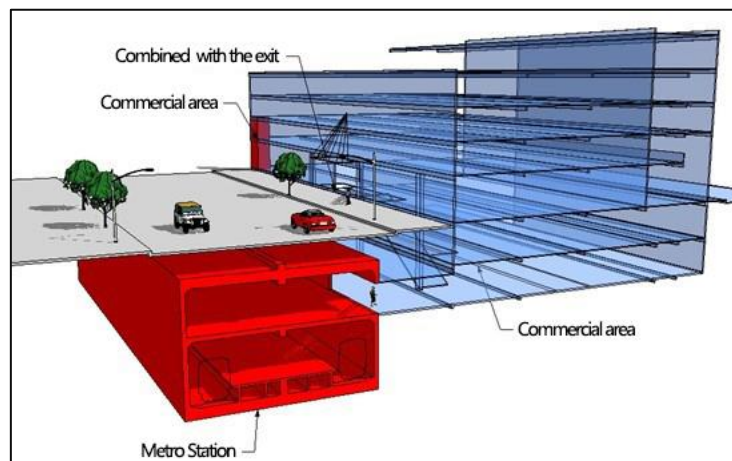


Figure11: Combination of entrances and exits with underground commerce

4.3. Business strategy

According to the status and development prospects of subway resources, and under the guidance of the principle of accelerating construction and striving for early realization of operating profitability, the comprehensive development and diversified operation of subway resources should be based on expanding the scope of business, with two focus on incremental investment and resource integration. In order to make a breakthrough, establish the strategy of diversified operation of auxiliary industry resources in subway.

4.3.1 Real estate management

As a compensation measure, the government often grants the subway company the right to manage and develop lands along the subway. How to develop these lands to maximize the benefits of the subway company is a topic that the subway company needs to focus on. In recent years, subways in various cities have begun to vigorously build subway real estate. Due to their good transportation convenience, they have quickly been favored by the majority of owners. You can consider learning from the successful practices of the Hong Kong Metro, and obtaining a share of the development revenue.

### 4.3.2 Metro Underground Commercial Resources management

The underground space provides a good environment for the development of subway commerce. The subway company may consider renting the rich area of subway stations for regular retail, fast food, banks, dry cleaners, etc. However, it is necessary to pay attention to the problem of "degree" in the development of subway commerce, that is, the overall coordination of subway commerce should be paid attention to. In general, subway shops are reasonably arranged and have clear customer passages to avoid excessive concentration of shops and avoid emergency accidents. Passengers evacuated. With regard to the development of underground communication resources, the subway company can negotiate with communication operators to finally determine the methods and methods for resource development.

### 4.3.3 Metro advertising resources management

As a means of transportation to realize the displacement of people, the subway station has a large area that can be used for advertising. It mainly includes platform advertisements (specifically refers to the advertisements on both sides of the tunnel at the platform layer), station hall advertisements, and entrance and exit channel advertisement lights. The subway company can attract investment on the area used for advertising, and rent out the advertising area of Fu Yu in the form of bidding. However, the overall planning of advertisements should be regarded as a unified regulation. In principle, advertisements are required to reflect the atmosphere of the times and help beautify the underground space.

### 4.3.4 Other resource management

Subway parking services, greening and nursery, building materials, equipment leasing, tourism and other businesses can be operated by the relevant business part of the establishment of the subway company or in the form of a subsidiary.

## 5. Space design

### 5.1 Design generation

### 5.2 Transportation system

### 5.3 Function distribution

### 5.4 Vertical design

### 5.5 Underground space design

### 5.6 Overview picture

## 6. Research summary

I selected a megacity in central and western China--Chengdu, the Tianfu New District of Chengdu, to do theoretical analysis and spatial design. Starting from the actual situation, I find the core problems which the region's development is facing, namely, traffic congestion, lack of functions, lack of public services, and population violence. Further, I learn from TOD theory and find solutions to these problems, they are, strengthen public transportation-oriented development, strengthen the design of pedestrian space, integrate the urban land functions, and strengthen the space design around subway stations.

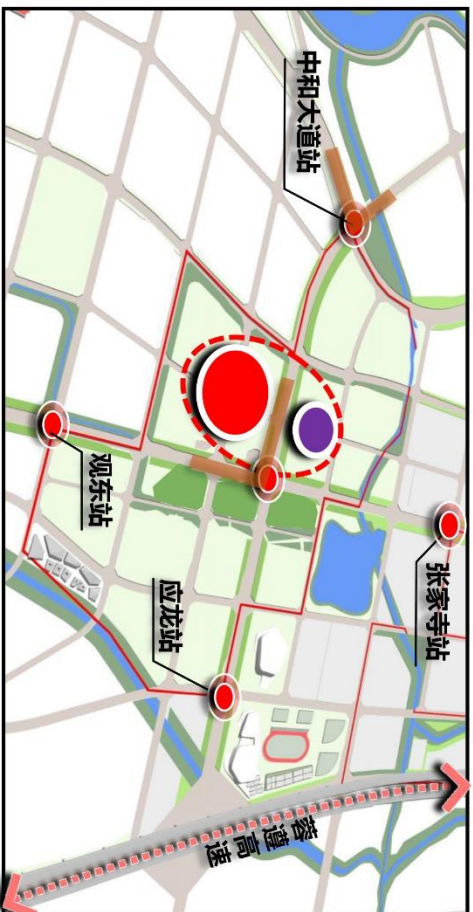
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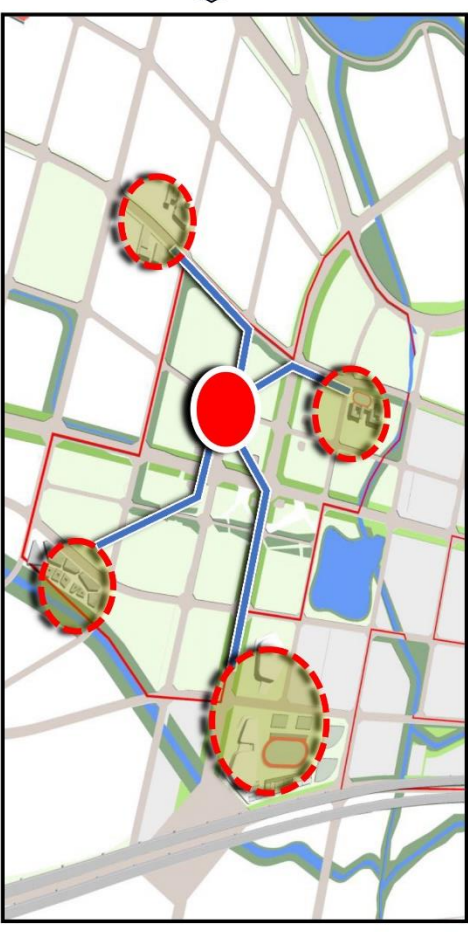
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## 5.1 Design generation

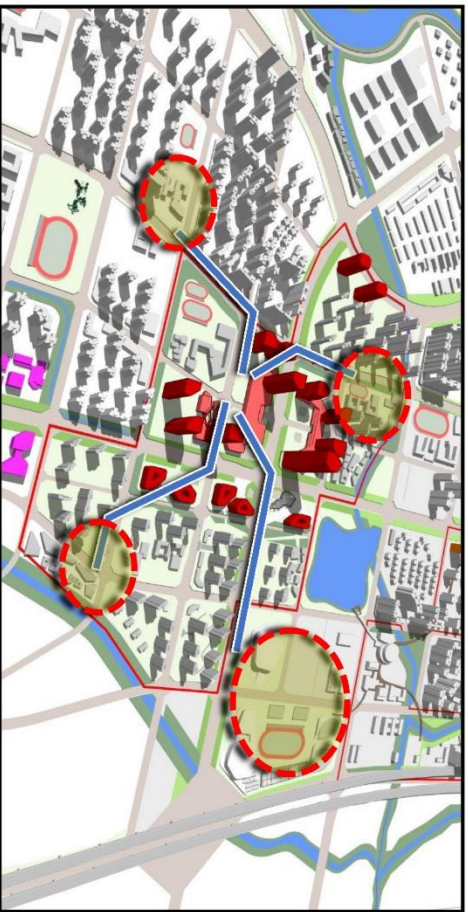
Determine the center



Gather people flow



Integrate into the city



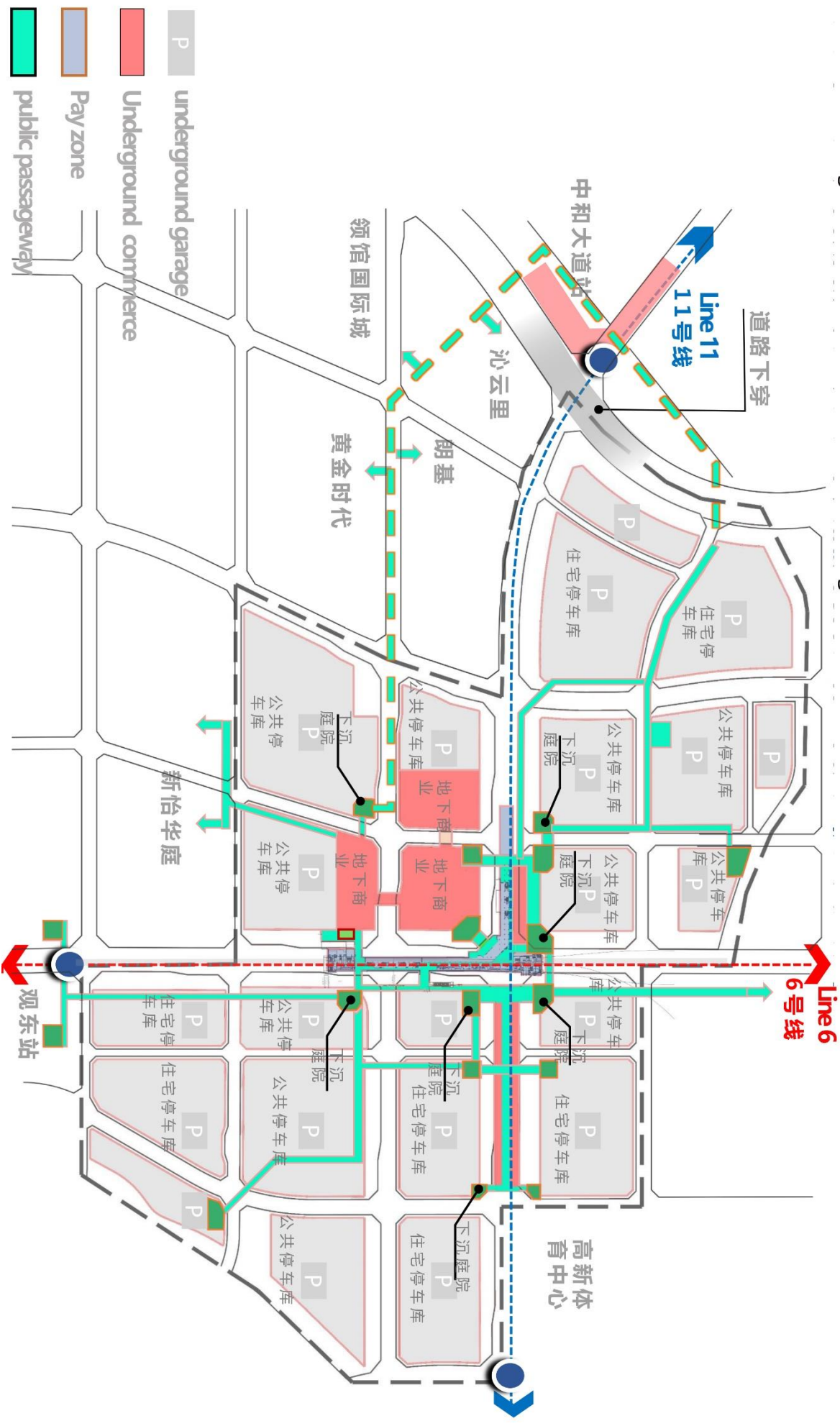
Core area layout





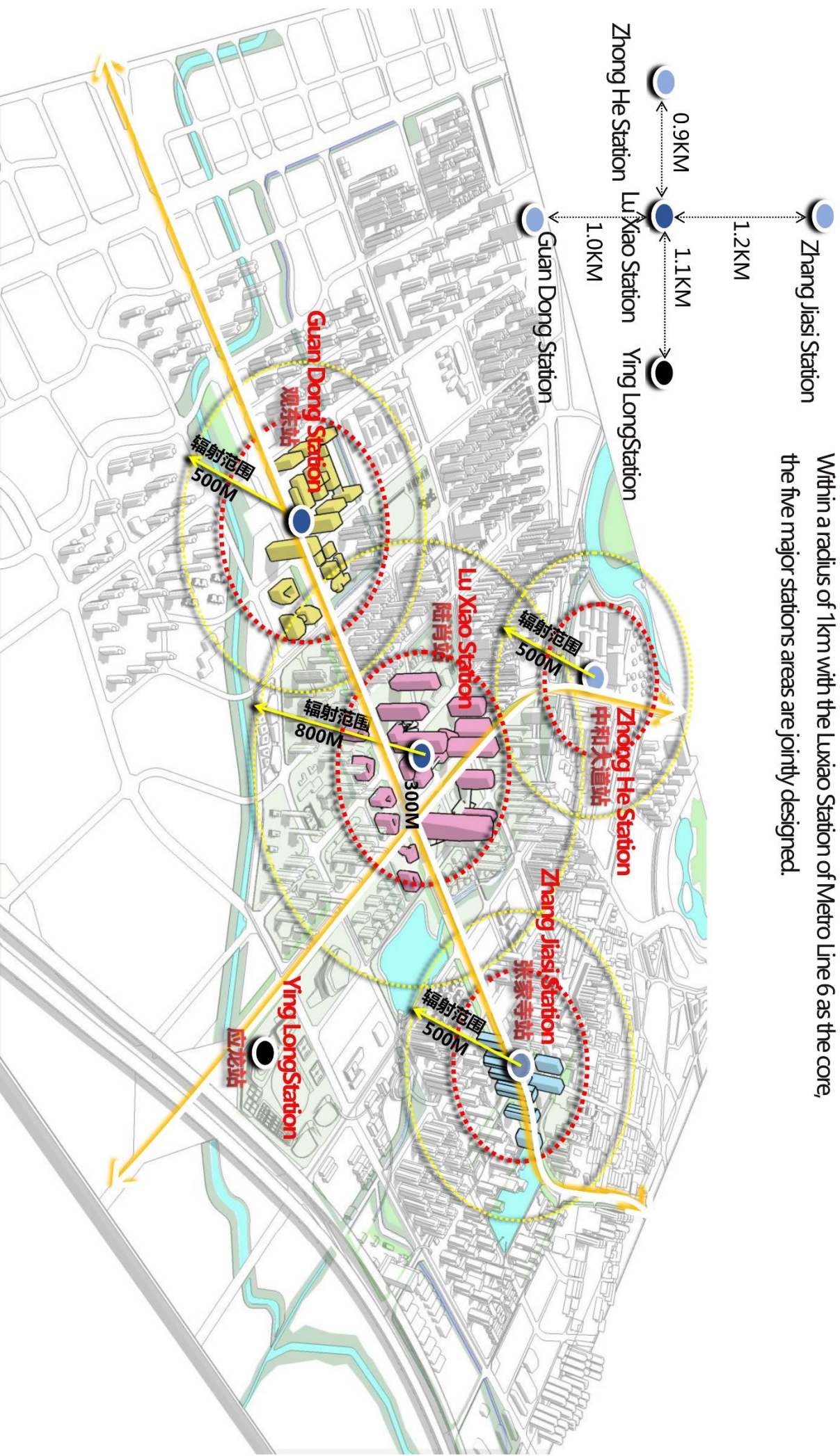
## 5.2 Underground transportation system

1. Establish an interconnected underground pedestrian space system
2. Reserve underground entrances and exits for future buildings



## 5.3 Design region

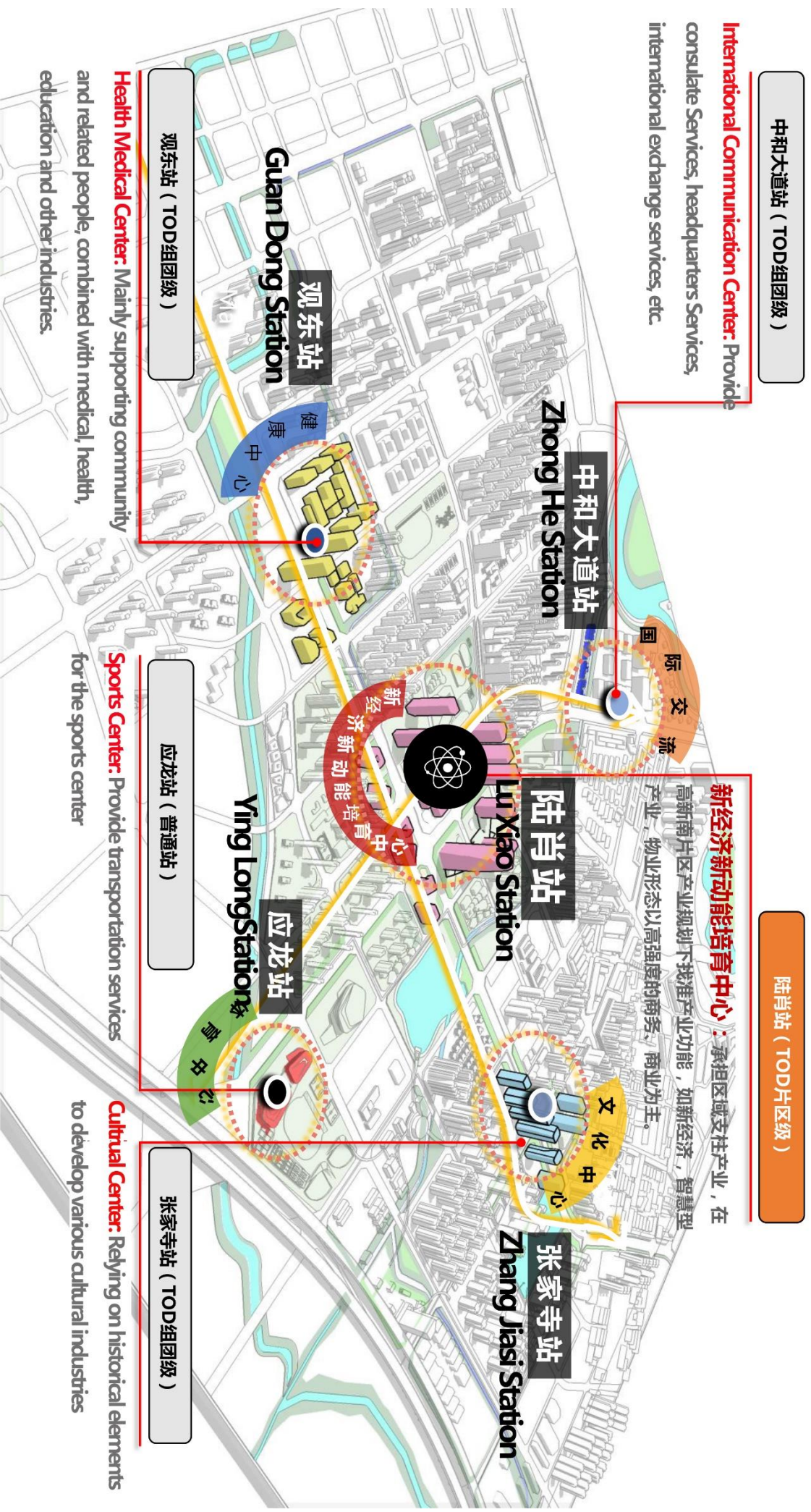
Within a radius of 1km with the Luxiao Station of Metro Line 6 as the core, the five major stations areas are jointly designed.



## 5.3 Function distribution

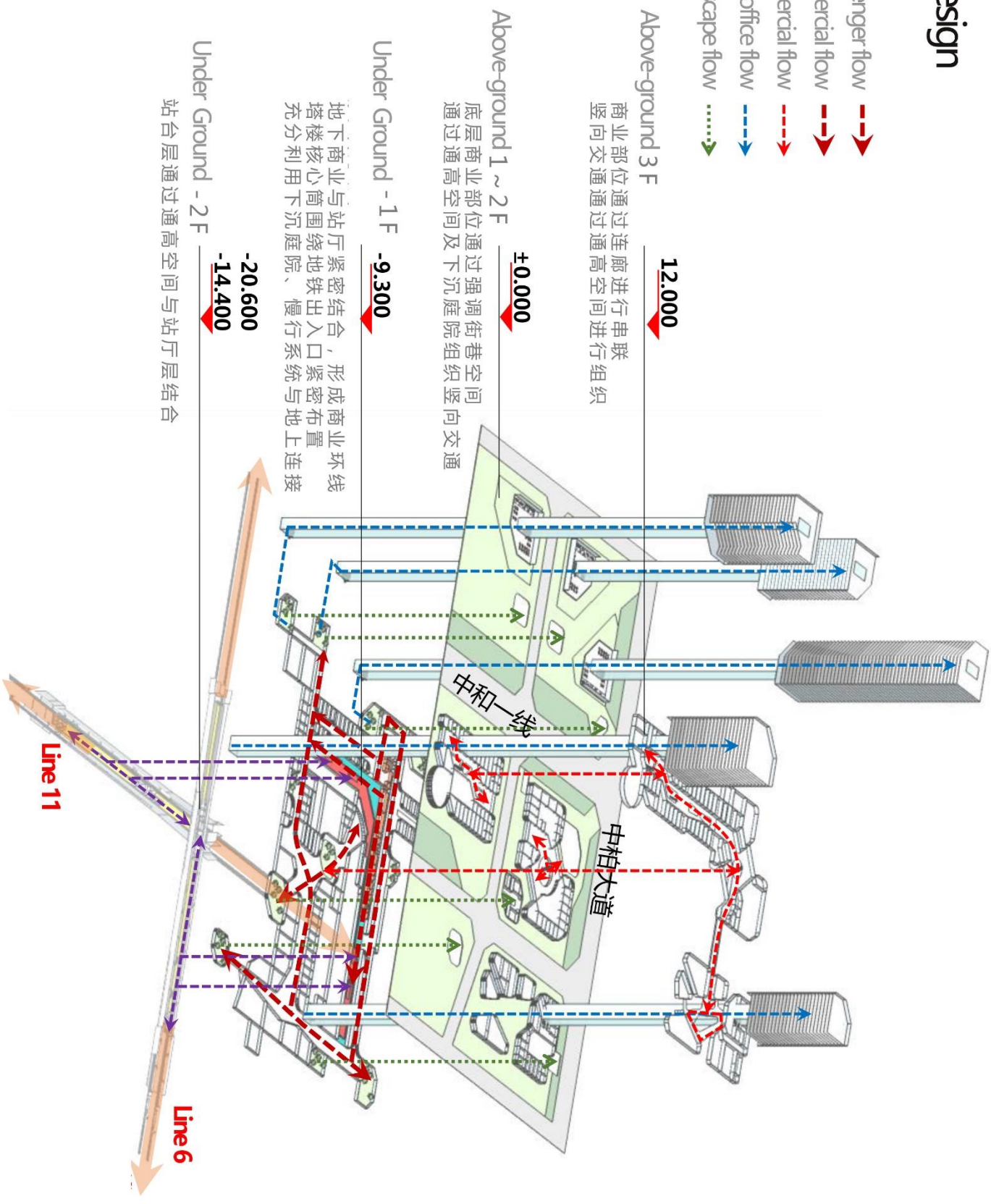
**New Economy Cultivation Center:** Including regional pillar industries, such as new economy, smart economy high-intensity business and commerce.

**International Communication Center:** Provide consulate Services, headquarters Services, international exchange services, etc



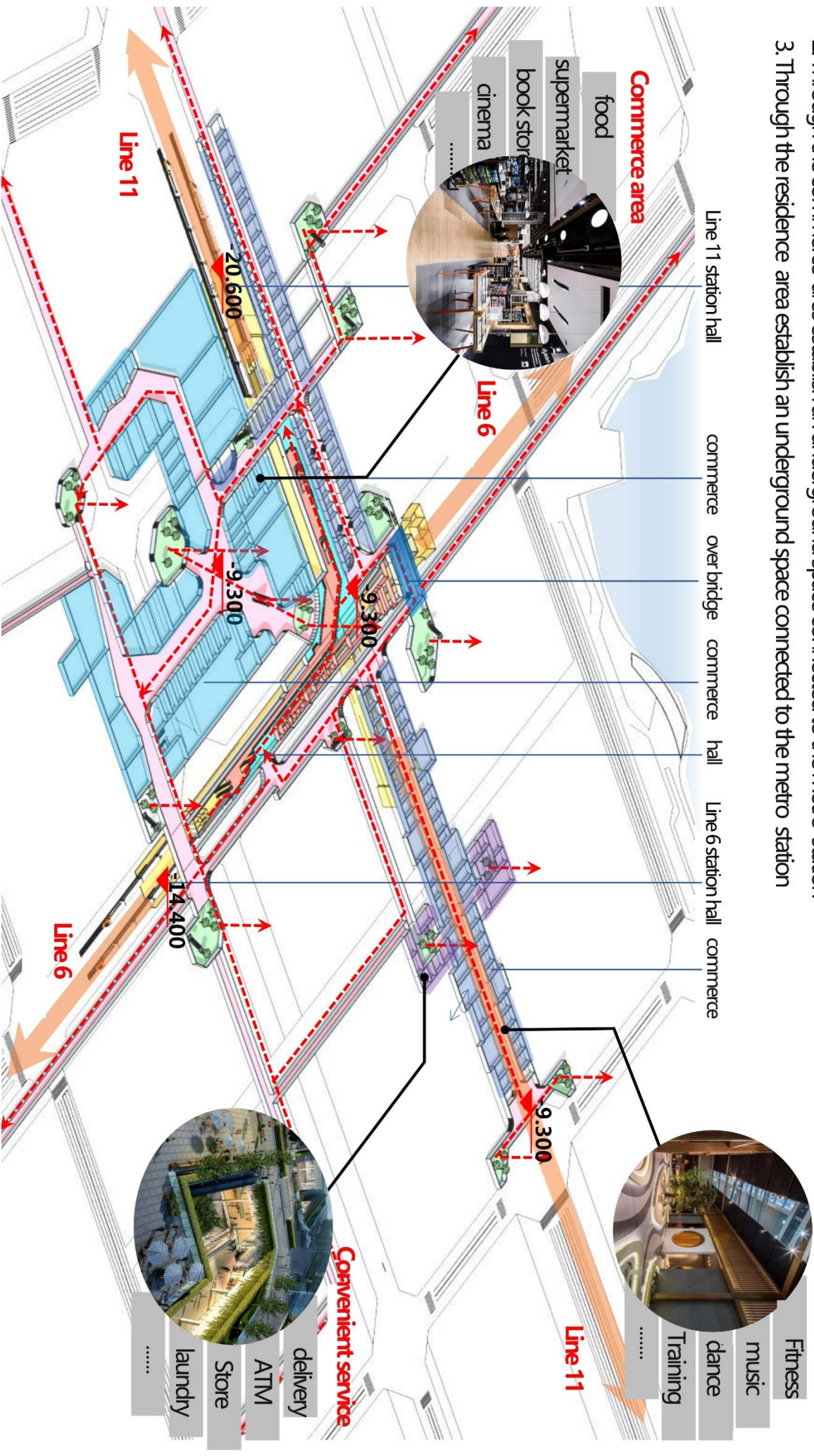
# 5.4 Vertical design

- Underground passenger flow -->
- Underground commercial flow - ->
- Above-ground commercial flow - - ->
- Business office flow - - ->
- Sinking landscape flow - - - ->



# 5.5 Underground space design-01

1. Through the sinking park establish an underground space connected to the metro station
2. Through the commerce areas establish an underground space connected to the metro station
3. Through the residence area establish an underground space connected to the metro station



# 5.5 Underground space design-02



# 5.6 Overview

