

## *Original Paper*

# Research on Comprehensive Development Strategy of Railway Station Space under the Background of Urbanization

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### ***Abstract***

*With the development of urbanization and the arrival of the high-speed rail era in China, railway stations as urban transportation centers, the spatial structure and functional organization of stations have also undergone major changes, and their spatial integration trends and complex forms are becoming increasingly prominent. On this basis, promote the comprehensive development of the station space and the rational construction of its functional system, and conduct research on relevant strategies to rationally utilize the station resources to meet the various needs of urban development, traffic construction and public activities, and help guide stations. The city integrates and contributes to the sustainable development of the city.*

### ***Keywords***

*urbanization, station space, comprehensive development, functional layout, strategy research*

## **1. Introduction**

With the advent of the high-speed rail era, railway transportation has become increasingly prominent in the national economy and transportation. It has the advantages of high speed, large volume, comfortable and safe, energy saving and environmental protection, which is in line with China's future development needs. The high-speed rail take "bus operation mode" provides passengers with convenient travel, shortens travel time, strengthens exchanges and integration between cities, promotes the innovation and development of urban industries, and plays an important role in the comprehensive transportation system.

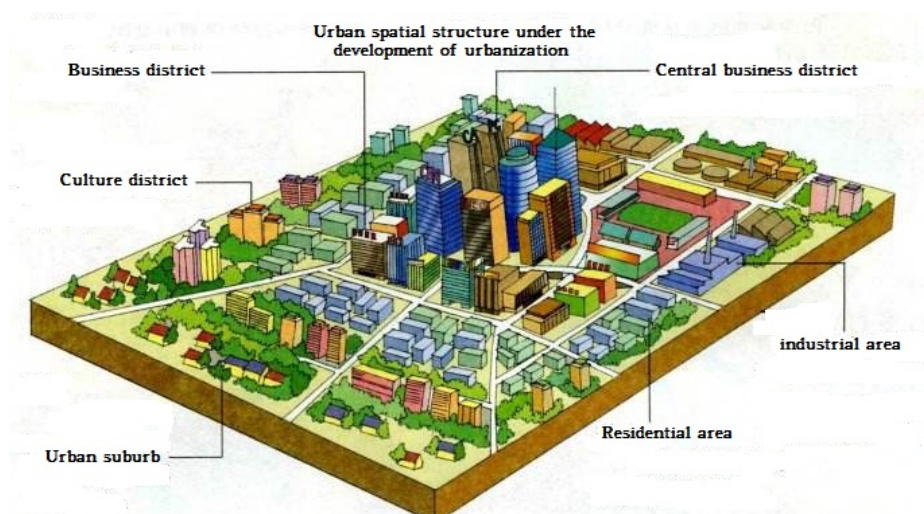
At the same time, with the rapid development of high-speed rail transportation, it also drives

passengers' choice and demand for efficient and high-quality services. The comprehensive development and layout of station space based on urban railway stations has become an important way to meet passengers' travel choices and consumer demand. It is also an effective way to promote regional economic integration, industrial synergy in the metropolitan area, and enhance the overall competitiveness of the city. On the one hand, the comprehensive development of station space will help improve the service level of the railway industry, extend the industrial chain, and achieve its sustainable development; on the other hand, the comprehensive development of station space effectively combines the advantages of railways with local resources, on the ground of the site area. Unified planning, integrated development, and comprehensive utilization of underground space; to maximize the social and economic benefits and contribute to sustainable urban development.

## 2. Research Background

### 2.1 Urbanization Development and Urban Space Transformation

With the growth of social economy, urban space has also undergone a series of changes, and its urbanization has been increasingly enhanced and developed into a sustainable, integrated and diversified form. The urban functional division is further blurred, land use is mixed and integrated, and people's lifestyles, consumption patterns, behavioral habits, etc., are also changing, which promotes the transformation of urban environment, industrial layout and transportation system, and modernized comprehensive transportation system. Urban service systems, resource development and operation modes have become important factors in promoting urban transformation and development. Building complexes and public spaces have become the key nodes of modern urban structure (Figure 1).



**Figure 1. Urbanization Promotes the Transformation and Development of Urban Space and Components**

*Resource:* Authors organize and draw according to Internet data.

## 2.2 Development and Construction of Urban Underground Space

With the continuous development of urban above-ground space, land resources are increasingly scarce, and urban space can only grow in three dimensions in a high-density environment. Underground space has also become an important way of urban expansion. The development and utilization of underground space is the result of urban redevelopment and in-depth development. The purpose is to improve the intensification and comprehensive utilization of urban land, and to meet the building functions, transportation systems, and municipal facilities. And other underground development needs, which are particularly prominent in alleviating a series of problems caused by urbanization expansion. At the same time, as an irreversible resource, underground space guides the development of green development concepts and ecological buildings, which is a great potential power to stimulate the sustainable development of underground space. Therefore, the diversification and green development of urban underground space, while giving it more value connotation, also pointed out the direction for the comprehensive development, functional layout of the railway station space and its coordinated development with urban space. The development and utilization of space creates certain social and economic benefits (Figure 2).



**Figure 2. Underground Space Is an Important Direction for Comprehensive Development of Station**

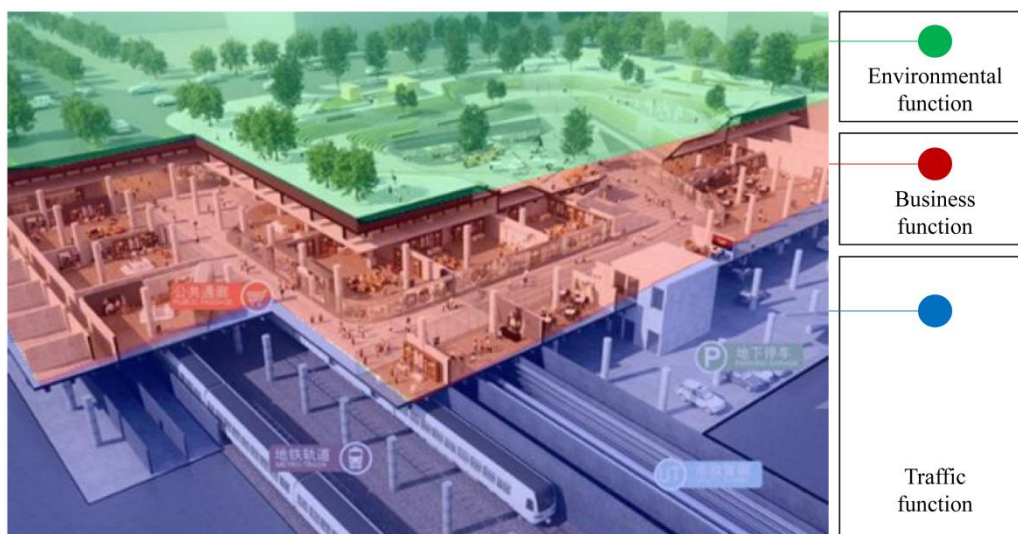
Authors organize and draw according to Internet data.

## 2.3 Innovation of the Station City Integration Model

As the core node of railway network and urban traffic, railway station is not only the connecting link and resource operation center of internal and external traffic, but also an important engine for activating and driving urban renewal and development. With the development of social economy and the advancement of urbanization, the decentralized construction of the railway station and the waste of land caused by the flat layout, the closed management of the station is isolated from the urban space,

and the single functional positioning of the station is difficult to integrate various types of transportation resources. As a result, the planning and design of traditional stations have been unable to meet the requirements of sustainable urban development, and cannot meet the comprehensive needs of traffic passengers and urban residents.

Therefore, some developed countries have proposed sustainable development concepts and construction methods. By guiding the development of railway stations and urban spaces, they will coordinate from the three aspects of urban space, urban functions and urban transportation, and realize the station by developing station complexes. A win-win strategy with the city. Around the model of integration of station and city, it is necessary to establish a sustainable design concept and intensive land use strategy, and integrate the ground space, underground space and the upper space of the high-rise building to form a three-dimensional station space to efficiently utilize limited urban resources. Coordinate the development of the station and the surrounding area, which will help to improve the overall efficiency of the station hub, enhance the comprehensive service capacity, improve the urban space environment, promote urban renewal and development, and realize the integration and coordinated operation of the station and urban system (Figure 3).



**Figure 3. Implementing the Strategy of Integration of Station and City Is a Positive Response to the City's Sustainable Development Needs**

Authors organize and draw according to Internet data.



### 3. Research Status and Existing Problems

#### 3.1 Status of Foreign Research

In the comprehensive development of site space in foreign countries, it focuses on the relationship between its business distribution pattern and urban development and residents' travel, including the people's choice of rail transit, the scope of attraction distribution, the probability of selecting business facilities, and the rail transit site. The mutual feeding mechanism of surrounding land development and its relationship with the city's symbiotic development. At present, most of the station hubs in foreign countries use a variety of transportation modes to integrate a variety of urban functions and service systems, and systematically and diversified comprehensive development of the main space of the station and surrounding areas.

For example, the Lille high-speed railway station in France closely links the bus station, subway station, underground parking lot and urban road system through the three-dimensional traffic and urban public space system. The station has concentrated many urban functions and coordinated development with surrounding commercial buildings. The area of various business service functions accounts for 54% of the total construction area, which promotes the development of surrounding commercial shopping, leisure and entertainment, hotel accommodation and other industries. Residential properties, while increasing the non-transport revenue of the site and surrounding areas, enhance the satisfaction of travellers and urban residents, making the station a new urban center to promote the coordinated development of the region and the increase in economic benefits (Figure 4).

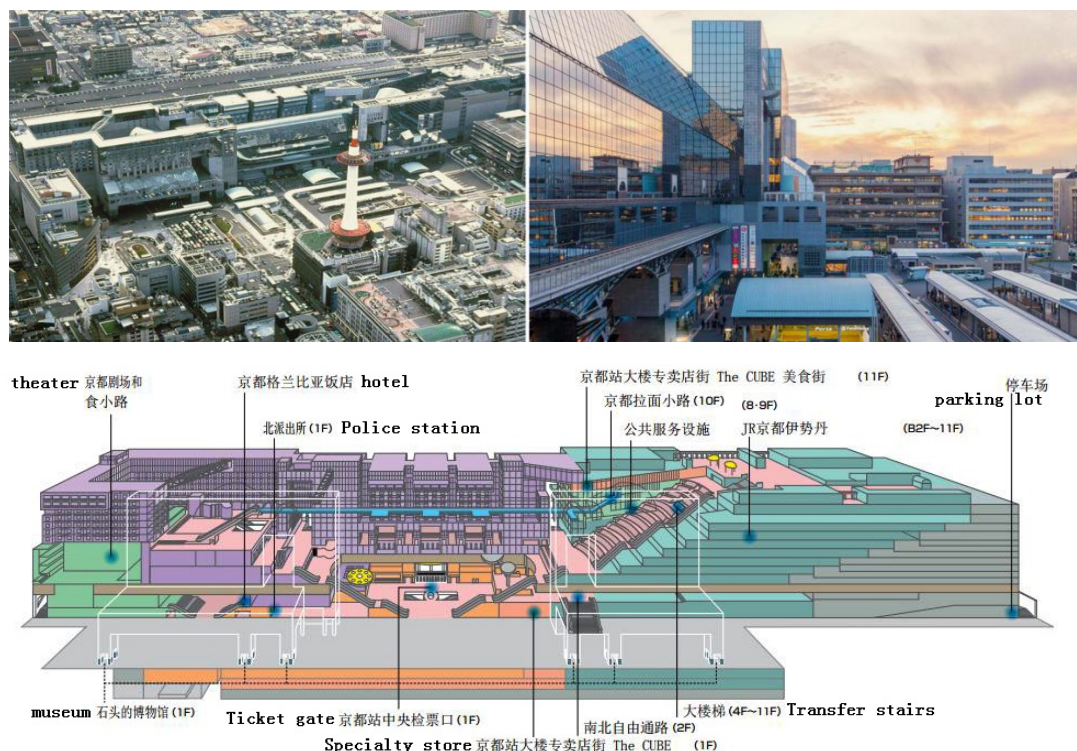


**Figure 4. Lille Station Planning**

Form: Authors organize and draw according to Internet data.

Relying on the perfect development of the railway network, the Japanese city has made the station become the transportation hub and activity center of the city. Its comprehensive development and utilization of the station space has reached a high level, which has reference significance for the comprehensive development of the station in China.

For example, the Kyoto Station in Japan is a centralized station complex. The central hall on the ground floor is the core space of the station. It is the hub connecting the surrounding businesses, culture, residence, parking and other functions. At the same time, the city squares, transitional spaces and underground walks outside the site are also an important part of gathering and guiding the surrounding population and resources. The station will bring vitality to itself and its surroundings in a three-dimensional and integrated development mode, and promote the cities in the region. The three-dimensional development and coordinated operation of space (Figure 5).



**Figure 5. Kyoto Station Planning**

Form: <http://www.kyoto-station-building.co.jp/floorguide/>

### 3.2 Status of Domestic Research

At present, the research on the comprehensive development of station space in domestic academic circles mostly focuses on the business development mode and industrial management. There are relatively few studies on its planning and design strategies and application measures. At the same time, the early railway stations in China are limited by historical and technical reasons. There are large constraints and limitations on the comprehensive development and utilization of the station space. Therefore, the space utilization rate of most railway stations in China is relatively low, mostly consisting of single-station building, closed square, and single station. Although the relevant exploration and practice research on station complexes in China has continued in recent years, it has made slow progress in its comprehensive development and utilization.

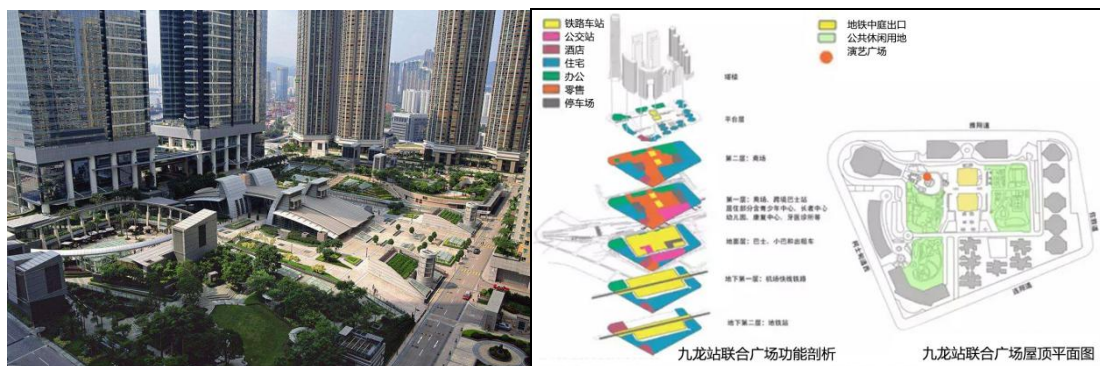
For example, The Shanghai Hongqiao Hub conducts functional design positioning from the perspective of the city. While integrating urban transportation resources, it rationally determines various business layouts and functional ratios, and builds a perfect station functional system, fully taking into account passenger travel characteristics and behavioral needs. Because the hub planning emphasizes its traffic function, it is slightly insufficient in the function connection and coordination development with the surrounding urban areas, and becomes an individual group independent of the city, but its overall business distribution and operation mode are better, which is in line with Collaborative needs of urban environment, transportation, and functions (Figure 6).



**Figure 6. Hongqiao Station Planning**

Form: <https://itbbs.pconline.com.cn>

As an international city with a high-density population, Hong Kong has a high level of comprehensive development of its transportation stations. Through the unified planning and collaborative development of the transportation stations and the surrounding areas of the trunk lines, it has created a functional mixed and smooth operation environment, which has improved the site properties and the attraction of the surrounding area meets the needs of the urban population and strengthens the transportation links between the stations (Figure 7).



**Figure 7. Kowloon Metro Station Square Comprehensive Planning**

Form: <http://www.quanjing.com>



### 3.3 Problems

In addition to the current research and practice on the comprehensive utilization and layout of railway station space, there are still some limitations.

(1) At present, the mode discussion and strategy research around the comprehensive development of railway stations only involves the scope of above-ground space. Regarding the relevant layout and comprehensive development of the station and surrounding station areas, both theoretical research and practical cases are not enough, and a systematic and comprehensive research system has not yet been formed.

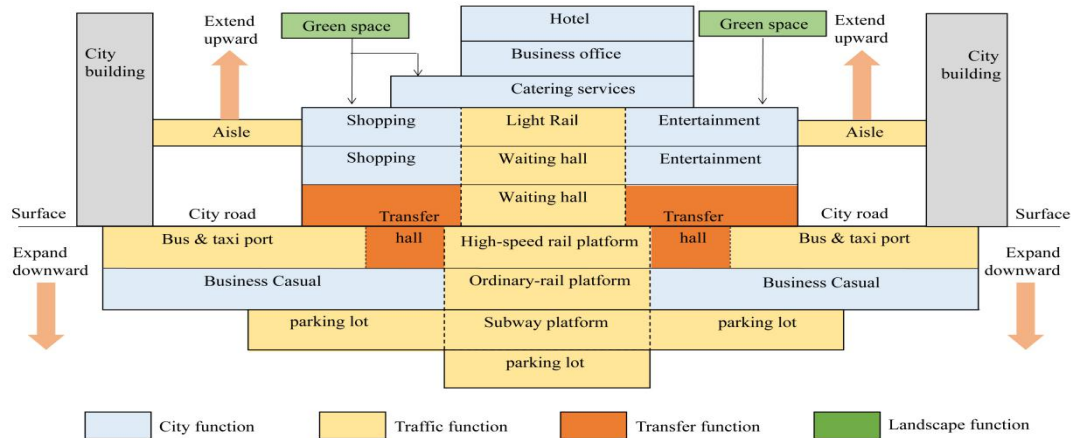
(2) In the related practice of underground space in the site, the traditional development and construction are mostly concentrated on the functional development of underground transportation integrated transfer space, underground parking lots, underground pedestrian passages and underground commercial blocks. From the perspectives of sustainable development, green transportation, and low-carbon hubs, the research on the development of underground green space, underground green landscape and related ecological and energy-saving technologies is still insufficient.

(3) Regarding the development practice of the railway station in the integration of above-ground and underground space, the space form design of the station, the visual perception of the internal and external space, the site combination and comprehensive development, the site traffic flow line, and the site public transportation transfer system are unified. There are few related cases of organization and collaborative development. Based on the multi-dimensional perspective, the case of station space integration development needs to be increased. From the perspective of long-term development needs, the lack of relevant research theories and practical experience is not conducive to China's railway transportation construction and urban sustainable development.

### 4. Station Space Comprehensive Utilization and Planning Strategy

The research on the comprehensive development and planning layout of the station space needs to be based on urban development, focusing on urban environment, transportation construction, industrial development, and public activities (Figure 8).





**Figure 8. Comprehensive Development of Station Space for Collaborative Urban Sustainable Development Needs**

Form: Author drawing.

The development strategy involves the following aspects:

#### *4.1 Scientific Location of Station Function System and Development Model According to Different Grades and Categories*

In the comprehensive development of railway stations of different levels and types, we must pay attention to the formation of a systematic and hierarchical site development level. First, we must scientifically locate the station function system, comprehensively consider the size of the station, the number of passengers, the location of the area, etc., and divide the core. Development level of hub stations (such as Shanghai Hongqiao Station, Beijing South Railway Station, etc.), general hub stations (such as Suzhou Station, Xuzhou Station, etc.), passenger stations (sub-station passenger stations), and site design and planning according to the order level. At the same time, we must adhere to the concept of “system integration, overall optimization”, and pay attention to the organic combination of passenger service and business services, environmental form and commercial layout, hardware facilities and software management. In addition, we should pay attention to the innovative development model of the station format, and draw on different business forms, such as airport terminal buildings, city department stores, large shopping centers and other experiences, to meet the market demand in the development model, and to improve the flexibility of the site format function. In order to form a strong market competitiveness, it is in line with the development needs of the commodity economy in the new era.

#### *4.2 Mixed Development and Intensive Use of Land Resources*

China’s traditional railway stations adopt an extensional and extensive development model, which has a low level of integration and intensive use of station land, causing problems such as space congestion, traffic congestion, inefficient functions, and environmental degradation, which seriously restricts the health development of the station. Through the three-dimensional development and composite layout of the station space, the existing station resources can be integrated to reduce the resource consumption

and environmental damage caused by construction and development, so as to save urban land resources and improve the environment of the station area.

#### *4.3 Realizing Efficient Transfer of Urban Comprehensive Transportation*

By developing the underground space of the station and surrounding urban areas, the underground space is fully utilized, the interference is small, and the hidden features are used to plan and construct the comprehensive transportation system of the station, and the perfect traffic transfer system is used to strengthen the passenger diversion and distribution capacity. It is convenient for passengers of rail transit and other rail transit to transfer to other modes of transportation to strengthen the interconnection between the station and the urban underground space, which plays an important role in improving traffic diversion and personnel diversion in the station area.

#### *4.4 Rational Use of Underground Space to Expand the Public Space of the City*

The development of the underground space of the station can effectively transfer the ground building space, transfer all kinds of transportation facilities and functional formats to the underground of the station, coordinate development with the surrounding cities, and introduce green energy-saving technologies in the development process to improve the environmental protection of the underground space of the station. Ecological characteristics to reduce energy consumption and environmental pollution. It can also attract a large number of populations and resources through the development of underground commercial space, forming a comprehensive development model combining the underground space of the station city.

#### *4.5 Realize the Integrated Development and Construction of Above-Ground and Underground Space*

The three-dimensional space of the station building and the underground space of the surrounding city are organically combined, and the functional areas are uniformly planned and coordinated to form a variety of functional zonings such as transportation, commerce, finance, education, medical care and municipal services. The functions of the underground space on the ground complement each other and rely on each other to meet the needs of the station passengers and urban residents to form a comprehensive development mode of the station space with complex functions, to improve the station service system, ensure the needs of people's activities, reduce the interference and impact on the urban environment, and promote the spatial integration and coordinated development of the station city.

#### *4.6 Improving the Urban Environment and Promoting Sustainable Development*

By developing the three-dimensional space of the station, the station building and the railway line will be introduced into the underground, and combined with the existing comprehensive transportation system of the city, a comprehensive station integrated hub will be built to form a convenient underground transportation network to provide more land resources for the urban ground and improve. The coverage of urban vegetation and green space landscapes will improve urban environmental space and promote sustainable urban development.

## 5. Conclusion

Through the research on the spatial development and functional layout of urban railway stations, combined with the comprehensive needs of urban environment, traffic construction and public activities, in order to explore the characteristics and laws of comprehensive development of station space, form scientific design ideas and perfect development strategies, and provide guidance for the planning, design and renewal of urban railway stations in the future, and promote sustainable urban development.

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