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Research on Key Points of Planning and Design of Modern Integrated Transportation Hub – Taking Jinfeng Hub in Chongqing High-Tech Zone as an Example

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Abstract: The Chengdu-Chongqing twin city economic circle has become a national strategy. As the westwards gateway of Chongqing central city, the High-tech Zone should further strengthen its traffic integration and interconnectivity with the Chengdu-Chongqing main Corridor. Combining the design concept and functional positioning of Jinfeng Hub, the research should be carried out from the aspects of hub scale control, three-dimensional spatial layout, rail transit connection, road collection and distribution system construction, and integrated development with the city. It is expected to provide a good reference for the planning and design of modern integrated transportation hub.

Keywords: Modern comprehensive transportation hub; Transportation collection and distribution; Zero-distance transfer

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1. Introduction

As a major national strategic deployment, the construction of Shuangcheng Economic circle in Chengdu-Chongqing region is strategically positioned to build an important economic center with national influence, a scientific and technological innovation center, a new highland of reform and opening up, and a livable place for high-quality life. Chongqing has the geographical advantage of building an international comprehensive transportation hub cluster in the Chengdu-Chongqing Economic Circle and becoming an international comprehensive transportation hub city. It is planned that by 2035, Chongqing will basically build a modern and high-quality comprehensive three-dimensional transportation network that is convenient, smooth, economical and efficient, green intensive, intelligent and advanced, safe and reliable.

As the main railway hub in the Western (Chongqing) Science City, Jinfeng Junction is planned to introduce Chengdu-Chongqing high-speed railway, Chongqing-Kunming high-speed Railway, Chongdu-Zi intercity (connecting Sichuan-Tibet Railway), Chongdu-Bi intercity, covering Western Chongqing, Southern Sichuan, Northern Guizhou, and other regions, and has the inherent advantages of becoming a modern comprehensive

transportation hub for the integrated development of the Chengdu-Chongqing dual-city economic circle. Based on the science and technology research project of Chongqing Education Commission "Research on the Planning and Design of Modern Integrated Transportation Hub under the background of the construction of Shuangcheng Economic Circle in Chengdu-Chongqing Area - A case study of Jinfeng Hub in Chongqing High-tech Zone" (Project No. : KJQN202405604), this paper studies the key points of modern integrated transportation hub design.

2. The historical background of building Jinfeng modern comprehensive transportation hub

In 2020, the sixth meeting of the Central Financial and Economic Commission made it clear that promoting the construction of the Chengdu-Chongqing twin City economic circle was a major strategic decision at the national level, and the 20th Party Congress wrote the construction of the Chengdu-Chongqing Twin City economic circle as a major regional strategy into the work report. Chongqing regards the construction of the Twin Cities Economic Circle as the "No. 1 project" and the overall starting point of the city's work, proposes to optimize the traffic layout, grasp the location characteristics, establish a modern traffic concept, scientifically plan a multi-dimensional, three-dimensional, cross-over, and seamless modern comprehensive transportation hub, and build a fast, convenient and smooth transportation network. Therefore, creating Jinfeng modern comprehensive transportation hub is a specific measure to implement the national policy requirements, implement the work deployment of the municipal Party committee and the municipal government, and is the need for high-quality and high-level development of high-tech zones.

3. Overview of modern integrated transportation hubs

3.1. Definition of modern integrated transportation hub

Integrated transportation hub is composed of two or more modes of transportation, important lines, terminals, and other facilities, located at the main node of the integrated transportation network interchange, is the main carrier of efficient connection and integration of various modes of transportation. Passengers pass, arrive, and transfer from here, goods are transferred from here, transport vehicles carry out technical operations here, and it is the connection point between various modes of transport, urban and intercity traffic [1].

Modern integrated transportation hub is a comprehensive transportation hub built according to the main goal of achieving efficient internal and external connection and transportation collection and distribution, which integrates high-speed railway, rail transit, long-distance bus, taxi, online car, and other modes to provide a variety of transportation transfer services to meet the different travel needs of passengers [2]. Therefore, the modern integrated transportation hub is not only the external gateway hub for the transformation of railway and urban traffic, but also the internal hub for the transfer of various transportation modes within the city.

3.2. Functions of modern integrated transportation hubs

The comprehensive transportation hub is the intersection point of various transportation modes, which has multiple functions such as efficient connection, passenger flow distribution, and urban service.

3.2.1. Traffic connection and transfer function

The transportation hub integrates railway, rail, bus, taxi, long-distance passenger transport, and other modes of transportation to achieve seamless transfer and improve travel efficiency. At the same time, three-dimensional design and hierarchical layout (such as underground subway, ground bus, and elevated railway) can optimize

the utilization of hub space, reduce traffic congestion, and improve transfer efficiency (**Figure 1**) [3].

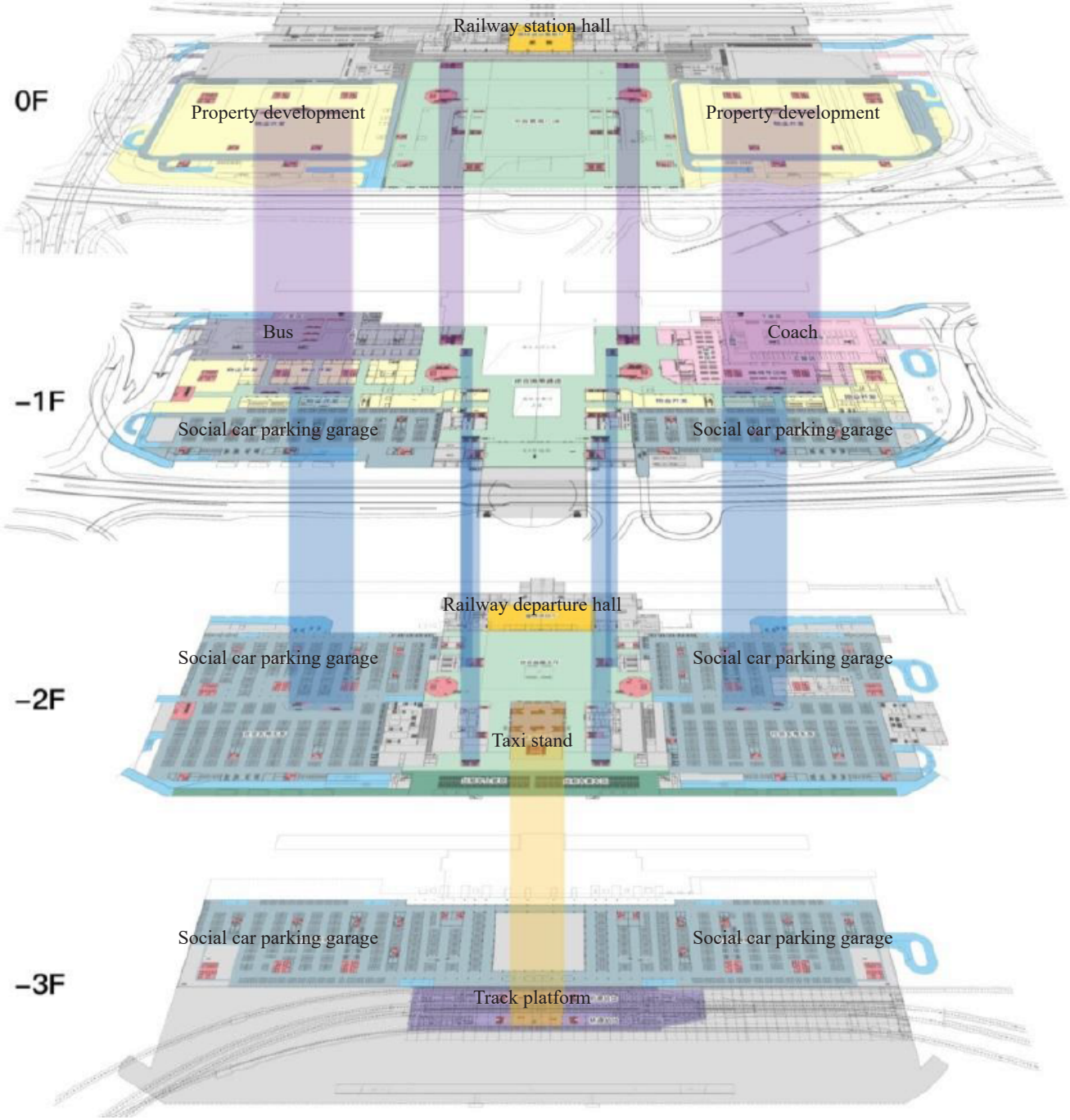

Figure 1. Traffic transfer connection design of Chongqing West Railway Station

3.2.2. Passenger flow distribution and dredging function

Through intelligent scheduling and dynamic guidance system, the passenger flow pressure during holidays or commuting hours is relieved, and barrier-free humanized facilities such as elevators and blind paths are equipped to ensure convenient access for special groups.

3.2.3. Urban services and commercial supporting development functions

Commercial development will be arranged around the hub, combined with retail, catering, and other formats to

meet the immediate needs of passengers and enhance the economic value of the hub.

3.2.4. Regional linkage development function

The transportation function of the hub is coordinated with urban development, and through the circle effect brought by the hub economy, it promotes the economic linkage of the surrounding areas, such as driving the development of urban business districts or new cities.

4. Key points of modern integrated transportation hub design

4.1. The spatial layout is mostly three-dimensional layout

Various modes of transportation introduced into the hub are "layered layout, three-dimensional transfer, and different routes" [4]. The waiting hall is located above the railway platform, and the exit channel is located below the platform. Inbound passengers enter the station through the waiting hall above, outbound passengers exit the station through the exit channel below the platform, and then transfer, separating the inbound flow and outbound flow. **Figure 2** shows the three-dimensional layout of a modern integrated transportation hub.

Figure 2. Three-dimensional layout of modern integrated transportation hub

4.2. Construction of road traffic collection and distribution system

The hub is directly connected with the surrounding dry road network, and the surrounding roads are mostly formed by high and fast roads or main roads to form a "loop", and the intersection nodes adopt the interchange mode to realize rapid evacuation, as shown in the schematic diagram of **Figure 3**.

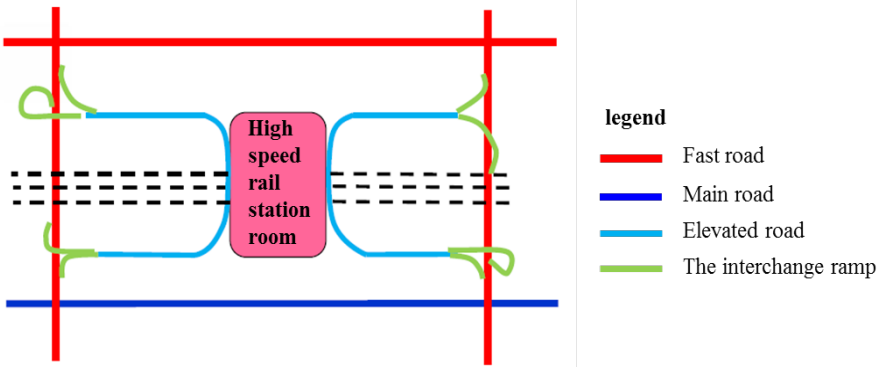

Figure 3. Schematic diagram of collecting and distributing system of high-speed railway junction road

4.3. Construction of rail transit collection and distribution system

As the passenger flow of high-speed rail has increasing requirements on waiting time, "going along" has become the norm, and rapid distribution has become the mainstream. Therefore, large integrated transportation hubs are connected to multiple rail transit, usually three or more, and there are lines directly connecting with the central area of the city [5]. Rich rail access has also greatly improved the coverage level of rail transit in the area around the hub. The major domestic high-speed hubs that introduced rail transit are listed in **Table 1**.

Table 1. List of major domestic high-speed rail hubs introduced rail transit

Hub name	Station and yard scale	Access quantity	Line attachment
Beijing South Railway Station	13 channels, 24 lines	Two lines	Line 4, Line 14
Hangzhou East Railway Station	15 channels, 30 lines	Three lines	Line 1, Line 4, Line 6
Nanjing South Railway Station	15 channels, 28 lines	Four lines	Line 1, Line 3, Line S1, Line S3
Shenzhen North Railway Station	11 channels, 20 lines	Three lines	Line 4, Line 5, Line 6
Chengdu East Railway Station	14 channels, 26 lines	Three lines	Line 2, Line 7, Line 20

4.4. Integrated regional development of hub and station front

Relying on the circle effect brought by the abundant railway and track resources around the transportation hub, as well as a large number of passenger traffic, the multi-hub and the land in front of the station are integrated and integrated with the surrounding transportation facilities for comprehensive development [6].

5. Empirical design of Jinfeng Hub

5.1. Design concept

According to the design concept of "multiple, three-dimensional, cross and seamless", the hub layout scheme is implemented, and the integrated planning of urban pattern, comprehensive transportation, space landscape and development and construction is integrated into the city, and the housing and functions of the high-speed railway station are integrated into the city.

5.2. Function positioning

Jinfeng modern comprehensive transportation hub is positioned as one of the "double hubs" of Western (Chongqing) Science City railway passenger transport. Chongqing High-tech Zone can be conveniently connected with Chongqing Railway Station, Chongqing East Railway Station, Chongqing North Railway Station, Chongqing New Airport and other important hubs, strengthen the traffic radiation capacity of Jinfeng Station, expand the radiation scope to the surrounding areas of West Chongqing, South Sichuan (West Sichuan, Xizang), North Yunnan, North Guizhou and so on, and increase the energy level of the hub to 20 million passengers per year.

5.3. Analysis of design points

5.3.1. Raised hub energy level

Based on the current introduction of Chengdu-Chongqing passenger dedicated line, the planned introduction of Chongqing-Zi-intercity and Chongqi-Bi intercity, Jinfeng Hub further increases the number of railways introduced to the hub and maximizes the energy level of the hub. The intercity functions of Chongqing-Zi-Chongqing and Chongqi-Bi are positioned as the West and South passenger and cargo channels from Chongqing

to Sichuan, and the passenger and cargo traffic service functions along Chongqing to Xizang, supporting the construction of the integrated development demonstration area of South Sichuan and West Chongqing, and supporting the radiation of Chongqing new Airport to South Sichuan and West Chongqing.

In the area of Chongqing New Airport, the "X" type railway network organization mode is constructed, and the cross-line operation conditions are reserved for Yongchuan East Station, Yongchuan South Station, Chongqing New Airport Railway station, Chengdu-Chongqing high-speed railway, and Chongqing-Kunming high-speed railway are newly introduced into Jinfeng Station. Among them, Chengdu-Chongqing high-speed railway runs from Yongchuan East Railway Station to Chongqing-Zigong Railway, connecting to Jinfeng Station; Chongqing-Kunming high-speed railway runs cross-line from Yongchuan South Station to Chongqing-Bi intercity station and connects to Jinfeng Station, forming a "2 high-speed rail 2 intercity" railway line introduction pattern (**Figure 4**).

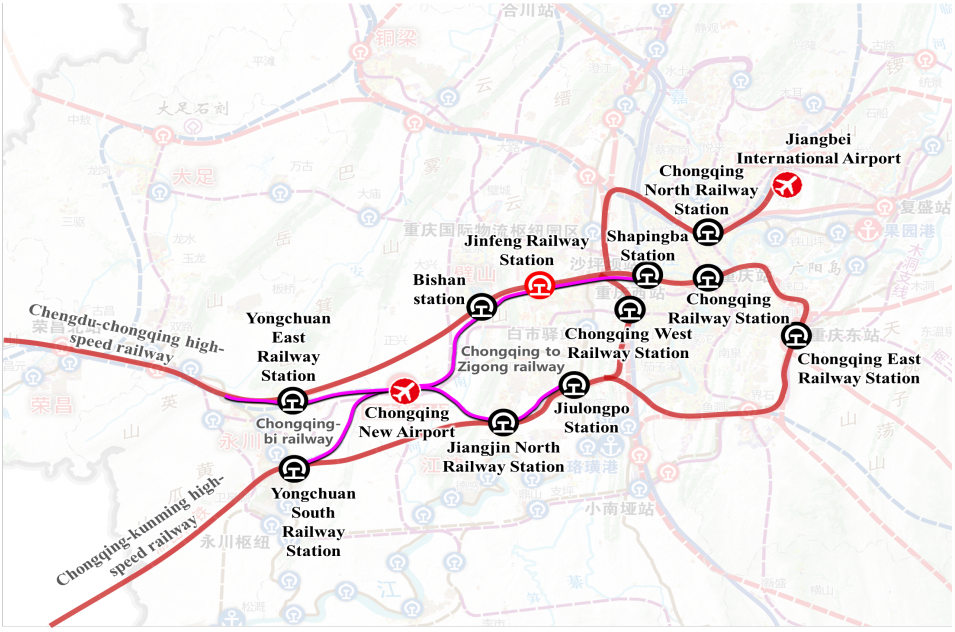

Figure 4. Introduction of "2 high-speed rail 2 Intercity" railway at Jinfeng Junction and the traffic volume forecast

According to the long-term planning of Jinfeng Hub, the arrival and departure capacity of 20 million passengers per year is estimated to be about 55,000 daily arrivals and departures per day. Referring to the long-term sharing rate of various transportation modes determined for the urban comprehensive transportation hub in Chongqing comprehensive transportation planning, the long-term sharing rate of Jifeng Hub passenger flow rail transit is 45%, the conventional bus sharing rate is 25%, the taxi sharing rate is 10%, and the car sharing rate (including online car sharing) is 20%. According to the daily inbound and outbound passenger volume and the share rate of various transportation modes, it is estimated that the long-term peak hourly passenger flow of Jinfeng Hub rail transit is about 3000 person-times /h, that of conventional bus is about 1650 person-times /h, that of taxi is about 650 person-times /h, and that of car (including online taxi) is about 1250 person-times /h.

5.3.2. Control the scale of the hub

As shown in **Figure 5**, the scale control of Jinfeng Hub mainly includes the following categories: The first is the station scale. The railway line introduced into Jinfeng Junction adopts the 250km/h dual-line intercity railway design standard, and the railway yard station adopts two 4-line stations. The platform length planning control is 450m, and the platform width planning control is 12m.

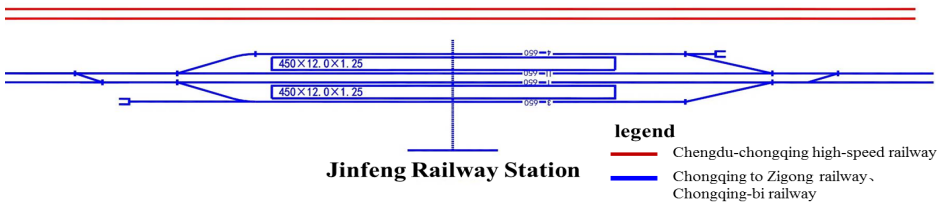

Figure 5. Size control of "2 stations and 4 lines" in Jinfeng Junction

The second is the scale of the station, Jinfeng Hub according to the integrated planning of the station city, to achieve a variety of transportation modes seamless connection, the station adopts the offline + line side design, the station size is controlled by 15,000 square meters, to meet the arrival and departure capacity of 20 million people/year.

The third is the scale of land use. According to the development and construction of the land in front of Jinfeng Junction station and the demand scale of various supporting transportation facilities based on the predicted annual passenger flow distribution volume, the land use scale of 8.7 hectares is generally controlled for railway station buildings and supporting facilities, such as bus hubs, social vehicle parking lots, long-distance hubs and supporting land for rail transit.

5.3.3. Three-dimensional space design

According to the Angle of intensive land saving and improving traffic transfer efficiency, the three-dimensional layout of all kinds of supporting traffic facilities in Jinfeng Hub (**Figure 6**). The ground floor is arranged with railway waiting hall, exit passageway and ground distribution square; the negative first floor is arranged with network taxi, taxi platform, social parking lot, track station hall and buses; the negative second floor is arranged with social parking lot and track station hall; developed vertical traffic is connected between each floor to realize zero-distance seamless transfer of various modes of transportation.

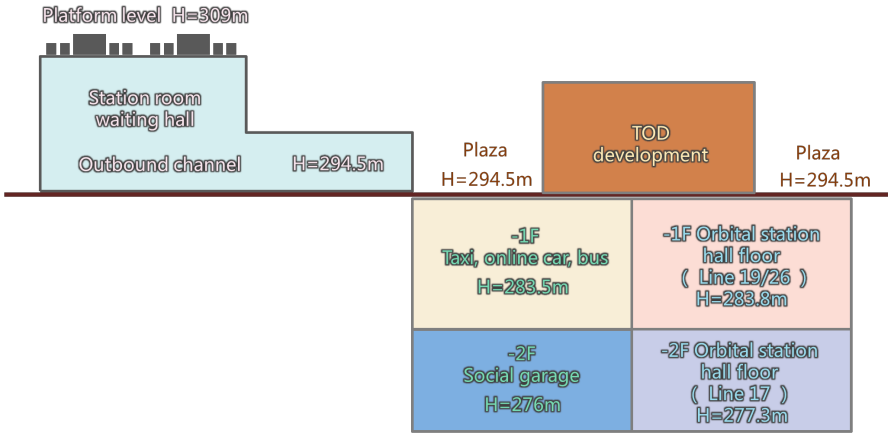

Figure 6. Schematic diagram of three-dimensional layout in front of Jinfeng Junction station

5.3.4. Track collection and distribution design

The rail transit system usually has a high punctuality rate and fast running speed, and passengers can reach their destinations faster, which plays an important role in reducing road traffic congestion. With the help of mass traffic gathering and distribution capacity of rail transit, the introduction of rail transit into the comprehensive transportation hub area can greatly improve the operation and conversion efficiency of the transportation hub,

and realize the efficient connection of railway and rail.

Combined with the planning of the regional rail transit network, the traffic collection and distribution efficiency of Jinfeng Hub is enhanced by introducing Metro Line 17 and 19 into Jinfeng Hub, and introducing rail express Line 26 (Urban Railway C4 Line) into Jinfeng Hub through rail line 19 and setting up stations, and the track entrance and exit directly connect with the railway entrance and exit. At the same time, it is planned to control the extension of the rail entrance and exit to the surrounding urban development land in front of the station, so that the rail transit can not only serve the hub traffic, but also serve the urban traffic.

5.3.5. Road collection and distribution design

First, relying on the high, fast, trunk road network to organize regional traffic, the regional expressway in front of the station mainly has the expressway around the city, Chengdu-Chongqing expressway, the expressway mainly has the science and technology Avenue, Science Avenue, and the main road has the Xinjin Avenue, Xinzhou Avenue, Xinsen Avenue, Gaoteng Avenue, and Gaolong Avenue.

The second is to use the "one horizontal and two vertical" road to organize the traffic in front of the station, the overall layout of Gaoteng Avenue, Science and Technology Avenue, Xinzhou Avenue and other main road network and other secondary trunk roads to form a road collection and distribution system, the traffic organization in front of the station suggests the use of one-way circulation, improve the road distribution capacity around the station, and facilitate the organization of buses, taxis and other temporary parking.

5.3.6. Integration of hub into urban design

Make full use of the concept of integrated development of stations and cities, take transportation hubs as nodes to gather rich transportation resources, promote the agglomeration of urban and industrial service functions, enhance the value of land around the hubs, and drive the coordinated development of the surrounding areas [7].

The integrated development of station city cannot only efficiently and intensively use land, realize the composite utilization and high-intensity development of land resources, save precious land resources for urban development, but also realize the composite development of transportation hub, commercial area, residential area and comprehensive functional area by gathering diversified urban functions, which helps to improve the functional layout structure of the city and stimulate the vitality of the city. It became the economic engine of the city [8]. At the same time, the integrated development of the station city not only realizes the function of the hub to undertake internal and external traffic connection and regional liaison, but also can undertake various functions of serving the city's commerce, office, leisure and other functions, realize the organic combination of transportation and various business functions, meet the diversified needs of passengers, enrich the sense of travel experience of passengers, and effectively improve the convenience and comfort of travel.

6. Conclusion

The planning and design of modern integrated transportation hub should be in accordance with modern design concepts, combined with hub function positioning, overall planning of various transportation modes, from the aspects of spatial intensive layout, construction of rail and road collection and distribution system, integration and development with the station front area, etc., to create a modern integrated transportation hub model of "multiple, three-dimensional, cross and seamless", and realize urban passenger flow and railway passenger flow. And zero distance seamless transfer between various modes of transportation in the city.

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Disclosure statement

The authors declare no conflict of interest.

References

[1] Wang M, 2016, On the Practical Application of Modern Integrated Transportation Hub Design Concept. Urban Architecture, 2016(17): 002–005.

[2] Zhou M, Wang Z, Shi P, 2020, Research on Design Concept and Technology Reference of Large-Scale Integrated Transportation Hub Rail Transit. Journal of Suzhou University of Science and Technology (Engineering & Technology Edition), 2020(01): 41–45.

[3] Wang H, 2012, Regional Traffic Design Concept of Tianjin West Railway Station. China Municipal Engineering, 2012(4): 13–15, 116–117.

[4] Gu Y, Ji W, Yang C, 2017, Building a Comprehensive Transportation Hub System with Perfect Functions and Efficient Connection: A Case Study of Haikou Comprehensive Transportation Hub System Planning. Proceedings of the 25th Cross-Strait Urban Transportation Symposium, 51–57.

[5] Song Y, Liu Y, 2015, Key Points of Landscape Design of Square in Front of Comprehensive Transportation Hub Station: Practice and Reflection on Design of North and South Square of Nanning East Railway Station. Urban Architecture, (11): 255–255, 259.

[6] Xu X, Zhang W, 2022, Integrated Design of Comprehensive Transportation Hub of Lanzhou Zhongchuan International Airport. Railway Economic Research, 2022(01): 65–68, 72.

[7] Han C, 2013, Research on the Reconstruction and Expansion Planning of Large-Scale Railway Comprehensive Passenger Terminal Station: A Case Study of Changchun Railway Station. Railway Standard Design, 2013(6): 118–122.

[8] Su B, 2024, Research on Land Comprehensive Development Design Around Xuzhou Station Under the Background of City and Station Integration. Architecture and Decoration, 2024(15): 1–3.