

# Urban Living Room Model for Integrated Development of Station City--Taking the Southern Hub of Fengtai Station as an Example

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**Abstract:** With the development of China's high-speed railway, railway passenger stations are subtly changing the urban structure, and the fragmentation of the city caused by traditional railway passenger stations should not be underestimated, affecting the development of the city in five aspects: functional composition, traffic organisation, economic development, policy coordination and environmental damage. This paper takes Fengtai Station as an example and summarises the integrated development mode of "urban living room" from macro-industry, meso-planning and micro-design: to enhance economic activation and functional diversity; to increase traffic connectivity and spatial inclusiveness; and to improve environmental adaptability under the concept of sustainability, in order to create a comprehensive, integrated and sustainable urban living room. It provides new construction points and design ideas for the integrated design of rail way passenger stations

## 1. Introduction

In recent years, with the continuous improvement of China's railway planning and large-scale construction actions, China's total railway mileage has grown on a large scale and has become the country with the highest mileage of high-speed railways in the world [1]. The arrival of the high-speed rail era has promoted the leap-forward development of China's rail transit, making the scale and number of railway passenger stations continue to expand. Railway passenger stations and their surrounding areas have gradually become key areas to show the city's style and highlight the city's competitiveness [2].

Beijing Fengtai Station is located in the southwest of Beijing, between the West Third Ring Road and the West Fourth Ring Road. It is the largest railway hub station in Asia, and the maximum number of people gathered is 9600. It mainly serves as the starting and ending operation of passenger trains on Beijing-Kowloon, Beijing-Guangzhou passenger dedicated lines, and Beijing-Shijiazhuang intercity passenger trains. Fengtai Station has convenient transportation and is directly connected to Metro Line 9 and Metro Line 10. 'Fengtai District Planning ( Territorial and Spatial Planning ) ( 2017-2035 )' wrote that 'combined with Fengtai Station Comprehensive Hub to build a comprehensive service core in the south of the station; combined with Fengtai South Road Rail Micro Center, the core of urban life service is built.



**Figure 1** The location of the south hub base of Fengtai station  
(Image source: self-painted by the author)

In the upper planning, at the level of regional planning, Lize Business District Fengtai Science and Technology Park, and Fengtai Station form three major areas of mutual influence. At the station planning level, the station-city integrated TOD theory design within 800m is mainly based on residential land. The residential area was built earlier, including the old communities with imperfect public space and landscape planning in the residential area, such as Niwa Community, which also includes the middle-end residential areas with better green space planning, such as the Third Ring New Town.

The south hub base is located on the south side of Fengtai Station (Figure 1), and the front square is under construction with base area is 5.37 hectares. The north side is adjacent to the entrance hall of Fengtai Station, the west side is Fengfan Road, and the east side is the entrance viaduct. The current status of Fengtai Station is shown in Figure2.

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**Figure 2** Fengtai station east elevated status map (Image source: author's own photo)

## 2. The research status of railway passenger station design strategy under the concept of station-city integration

In the TOD development model, emphasis is placed on the development of public transport by using public transport stations to radiate the periphery of the area and pedestrian walkways as the backbone of neighbourhood development. Related research theories have been developing in recent years<sup>[3]</sup>, in terms of the station-city integration design concept, Xiao Xiao<sup>[4]</sup> (2021) proposed that the station-city integration development concept centered on the station has the characteristics of high-density development, convenient transportation, and three-dimensional development. Liu Zhenyu<sup>[5]</sup> (2016) proposed that the station-city integration process centered on the station promotes economic development, public space development, and sustainable development of the city. In terms of station-city integration design methods, Tang Feng et al.<sup>[6]</sup> (2017) proposing a system for measuring spatial effectiveness. Nie et al.<sup>[7]</sup> (2022) took the comprehensive hub of Xiong a high-speed railway station as an example to summarize the design strategies of traffic integration, structural integration, spatial integration, fire protection, and civil air defense independence and flexible reservation. Zhang Lei et al.<sup>[8]</sup> (2021) proposed the "three-body and one hall" station-city integration characteristic development model, which needs to pay attention to the overall layout, highlight the urban characteristics, emphasize the rational layout, and enhance the green low-carbon capacity. Qiu Yonghan et al.<sup>[9]</sup> (2021) proposed four design strategies for station-city integrated design: selecting benefit complementary industries, combining energy efficiency upgrade space, improving mechanism innovation, and improving shared facilities. Mo Fei et al.<sup>[10]</sup> (2021) proposed that the design of station-city integration needs to integrate urban traffic and activity systems, build an efficient connection system, and build an efficient post-evaluation system based on the design principle of maximizing benefits. Guo Yuanyuan et al.<sup>[11]</sup> (2020) proposed the integration of functional development, integration of factor allocation, integration of space utilization, and integration of connection management.

Taking the east square of Qinghe Station of Beijing-Zhangjiakou High-speed Railway as an example, Tian Hanwen<sup>[12]</sup> (2021) proposed the station-city integration design strategy of green concept, cultural fit, spatial reconstruction, and landscape corridor. KG Georges<sup>[13]</sup> (2006) used Ottawa as an example to combine architectural transport landscape city, and proposed a conceptual framework that integrates daily experience, visual culture and architectural form to create a multifaceted and integrated urban gateway. T Mafame<sup>[14]</sup> (2017) used Du Toit station in Cape Town, South Africa, as an example to establish a station-city integrated development model, which includes the development density, land use and infrastructural diversity and transformative design to promote the integration of urban transport and district development.

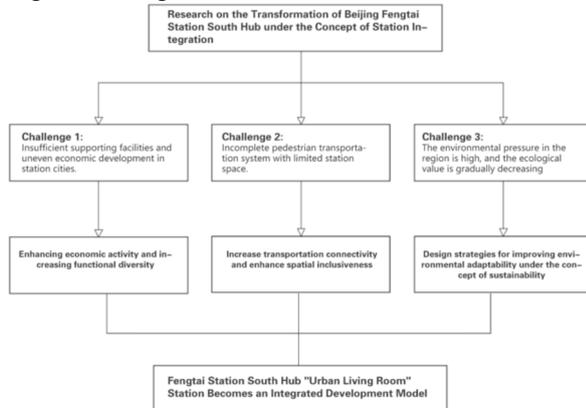
Based on the existing research situation, the domestic research on station-city integration is mainly based on the micro-design level, and the theoretical depth at the macro-planning level is slightly insufficient. The economic and social benefits of station-city integration are more concerned, and the environmental benefits under the concept of sustainable development remain at the level of low-carbon transportation. There is insufficient research on the full-cycle and efficient system of building station facilities.

## 3. Design strategy of the South hub of Beijing Fengtai Station under the background of station and city integration

The transformational design of Fengtai Station station-city integration faces three significant challenges. The first challenge: functionality, there is a lack of coordination and integration between the functions of the passenger station and the city, inadequate supporting facilities, and unequal economic development between the station and the city. The second challenge: in terms of space, the pedestrian transportation system is incomplete, and the elevated structures divide urban transportation into isolated parts, creating remote islands for pedestrians. Additionally, the station-area space is singular and make it complex to meet demands. The third challenge: In terms of environment, in the context of low-carbon and carbon reduction development, the high carbon emission of railway stations increases the environmental pressure of urban areas, resulting in the gradual decline of their ecological value.

Under the concept of station-city integration, an "urban living room" integrated development model has been proposed at the macro-format, mid-scale planning, and micro-design levels (Figure 3). In terms of macro functional formats, it highlights the comprehensiveness of urban living rooms, enhances economic activation, and increases functional diversity. In mid-scale overall planning, it emphasizes the integration of the urban living room, increasing transport connectivity and strengthening spatial inclusivity. At the micro-level architectural and landscape design, it highlights the

sustainability of the urban living room, implementing sustainable design strategies to improve environmental adaptability according to sustainable principles, providing new construction focal points and design approaches for the railway station's station-city integration design.



**Figure 3** technological route (Image source: self-painted by the author)

### 3.1 Enhancing economic vitality and increasing functional diversity

Based on the above station-city integration strategy, the south hub of Fengtai Station will be transformed into an urban meeting room on the track of internal and external personnel (Figure 4), and become a living area full of place spirit. According to the analysis of the classic TOD development model within an 800m radius, the South Hub is located in the TOD development core area, with commercial formats taking the lead. According to the existing economic reports of the TOD commercial complex, The South Hub site is in the core area of tod development, the commercial sector is dominant, according to the existing built tod commercial complex economic report and Fengtai District building height limit to determine the plot ratio of 3.

The population in the station area is mainly composed of youths aged 22-35 and older people over 55, with a focus on IT and service industries. The shopping visitor population accounts for 16.58%, and the dining visitor population accounts for 17.22%. By conducting on-site visits and assessing the needs of the crowd, it can be concluded that Fengtai Station area can incorporate commercial and hotel activities to revitalize the economy. To avoid overlapping with surrounding upscale commercial areas such as LiZe Commercial District and lower-end commercial areas like Jiacheng Plaza, it is advisable to select a mid-range shopping complex as the commercial target. By targeting the consumer group in the station area, it is recommended to choose a combination of economy and comfort-oriented hotels to stimulate the tourism economy.

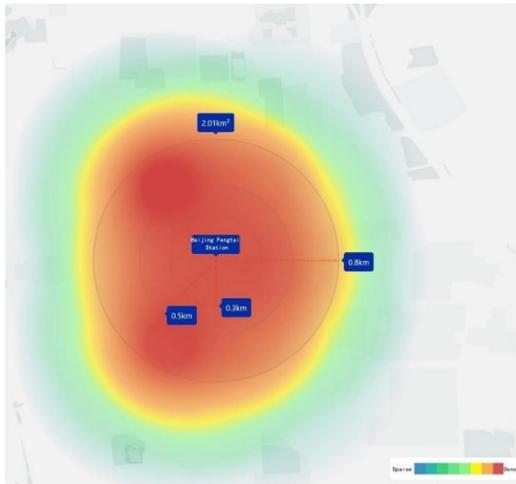
Using Shunwei CityMap to analyse the big data within 800m of Fengtai Station, the surrounding resident population is 54,000 (as shown in Figure 5), and the average monthly passenger flow is 2,218,100 (as shown in Figure 6). The surrounding supporting facilities are mostly companies and enterprises as shown in Figure 7,

and the distribution of surrounding businesses is mainly retail and catering as shown in Figure 8. Through theoretical analysis, data analysis and field visits, it is concluded that the Fengtai station area can be added to commercial and hotel revitalisation economy, and cultural industries to enhance the quality of space. In terms of commerce, in order to make up for the surrounding commercial structure and avoid competition with the same positioning, the commercial selling is positioned as a mid-range shopping complex with commercial retail to attract people along the street. In terms of hotels, in addition to the surrounding residents, the visiting population is mainly tourists, the number of hotels in the vicinity is too small, it is difficult to meet the demand for accommodation, so the hotels in this plot are benchmarked against the combination of economy and comfort.

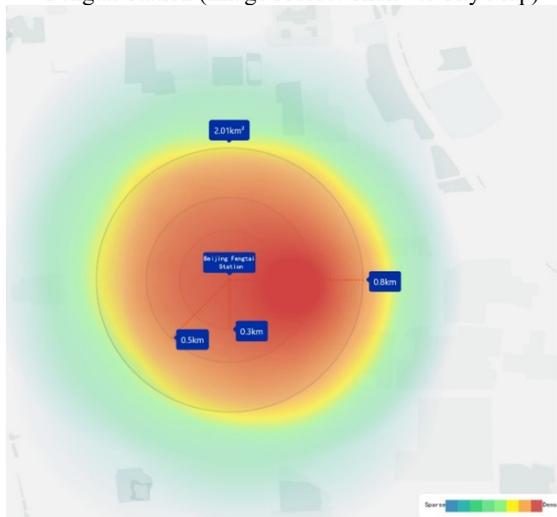
According to the theory of work-life balance, the neighbouring community occupies the majority of the original business; in the crowd portrait, the education visiting crowd reaches 11.4%. In the regional analysis, Fengtai Station can radiate Beijing No. 8 Middle School and Shoukei University, so it is concluded that the Fengtai Station area can make up for the lack of functions by adding education and office functions. According to the research data from the Fengtai government website, the neighbouring residents have more reactions to the lack of cultural and recreational facilities in Fengtai Station, and hope to add cultural and recreational functions such as museums and gyms. The lack of public service functions will lead to the lack of humanistic functions after the station area is developed vigorously, so public service functions are planned for the station area accordingly.



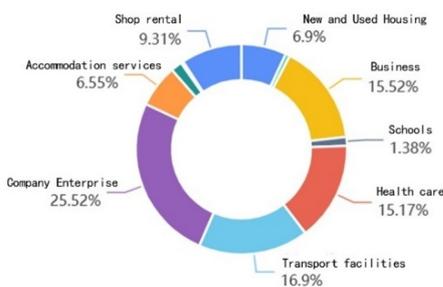
**Figure 4** Design renderings of Fengtai Station South Hub based on the concept of station and city integration (Image source: self-drawn by the author)



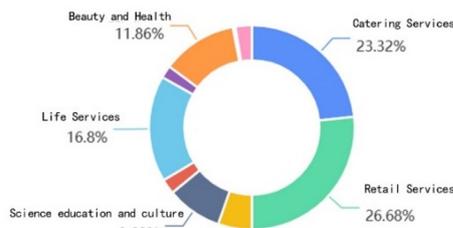
**Figure 5** Heat map of the resident population around Beijing Fengtai Station (Image source: Shunwei City Map)



**Figure 6** Heat map of average monthly passenger flow around Beijing Fengtai Station (Image source: Shunwei City Map)



**Figure 7** Supporting facilities around Beijing Fengtai Station (Image source: Shunwei City Map)



**Figure 8** Businesses around Beijing Fengtai Station (Image source: Shunwei City Map)

### 3.2 Increasing transport connectivity and enhancing spatial inclusivity

Fengtai Station South Hub east side of the elevated forest, the south side of the car parks, city roads are mainly, the city and the station area cut off, become an island of walkers. According to the Fengtai District Government website research data, the surrounding residents put forward the need for Fengtai Station stock areas and new areas of transport links, increase the station city pedestrian access links.

To cater to the public transport commuters, an integrated design of both above-ground and underground infrastructure should be implemented, incorporating transportation hub functions to efficiently connect the exiting metro and bus services. For private transport users, an elevated connecting system should be adopted to enhance the convenience of personal transportation. For pedestrians, the inclusion of pedestrian corridors should be considered to improve the accessibility of the station area and enhance its pedestrian-friendly nature.

Taking the “box space” as the theme, the station, architecture, and installation boxes are linked together through pedestrian walkways, providing usable and recreational space for the station city population, thereby enhancing spatial inclusivity.

In architectural design, the combination and stacking of eastern and western buildings through box spaces are used to create flexible and modular integrated living rooms of different forms. By creating elevated and recessed ground levels to attract active residents to the site and designing the roof as an open roof garden, a three-dimensional open space is made for the station city population.

In landscape design, central installations are designed to combine open and semi-open boxes, creating a box space that integrates landscape and functionality (Figure 9). The boxes include enclosed, semi-enclosed, and open designs, and the indoor space can be flexibly used by scanning a QR code to book time slots, and the functions can be customized. Semi-enclosed and open boxes provide an environmentally suitable gray space for the station city population to explore. The combination of rooftop greenery and traditional flat attracts outsiders to explore the livable and inclusive public space.



**Figure 9** Effect picture of box greening (Image source: self-drawn by the author)

### 3.3 Improving environmental adaptability under sustainable principles

According to the research of Xu Zhicheng<sup>[15]</sup> (2023), the carbon emissions during the operation period of railway station section mainly come from the use of energy products, the use of energy in railway station section is mainly based on electric energy, and the contribution of water resources and wastewater discharges in railway station section to the carbon emissions and environmental impacts should not be ignored. In the context of low-carbon and carbon-reducing development, how to enhance the ecological value of the station building complex is a major challenge.

In spatial design, vertical greening is utilized to increase green coverage by incorporating multi-level greening, achieving a 40% green coverage, and increasing carbon sequestration. From a green technology perspective, technologies suitable for the climate of Beijing and station-city integration, such as a combination of active and passive techniques, are employed. This includes incorporating natural ventilation and solar power generation technologies within the buildings, as well as combining outdoor landscapes with rainwater collection and sponge city technologies to reduce carbon emissions from station facilities and increase environmental carbon sequestration capacity. In terms of low-carbon transportation, the design aims to encourage green and low-carbon modes of travel such as walking and public transit to reduce carbon emissions. Through an integrated design approach focusing on environmental adaptability, a highly adaptable and sustainable station area space is created (Figure 10).



**Figure 10** Effect of public space (Image source: self-drawn by the author)

## 4. Conclusion

Railway stations act as the meeting places between cities. Enhancing the vitality of railway stations and the surrounding areas adds positive catalyst elements to the town, promoting the development of urban economy, society, and ecology. Taking the example of the South Terminal of Fengtai Station in Beijing, the “Urban Living Room” station-city integration development model is proposed, highlighting the comprehensiveness, inclusiveness, and sustainability of the urban living room. This aims to enhance economic vitality, increase functional diversity, improve transportation connectivity, and enhance spatial inclusivity. By adhering to sustainable principles and enhancing environmental

adaptability, the goal is to create a railway station urban space that is economically developed, functionally diverse, conveniently connected, livable, environmentally sustainable, and fully supported throughout its lifecycle.

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