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Integrated Development of the Stock Land and Urban Rail Transit in Shenzhen

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Abstract: Shenzhen faces a scarcity of land resources with very limited developable land. Innovative transit-oriented development (TOD) models are in urgent need. This paper examines the policies, mechanisms, land resources, conflicts between existing zoning plans and landowner appeals, and other issues associated with the integrated development of the stock land and urban rail transit. Shenzhen has achieved coordinated primary land consolidation and secondary comprehensive development around urban rail transit stations. This approach ensures the successful implementation of urban renewal projects while balancing the interests of stakeholders. The paper proposes an integrated development strategy for the stock land and urban rail transit, encompassing policies, mechanisms, the overall coordination of urban rail transit stations and surrounding areas, and establishing an organic integration of rail transit stations and stock land development projects. Taking Bainikeng Area, Meilinguan Hub, and Nanwan Station of Subway Line 17 as examples, the paper summarizes the challenges and corresponding solutions in promoting integrated development of the stock land and urban rail transit. Throughout the entire process of redeveloping the stock land, proactive engagement of subway companies and consensus among relevant governmental departments are highlighted as essential measures. Such measures enable the coordination and balance of interests of stock land, leading to a win-win outcome for all parties involved. **DOI:** 10.13813/j.cn11-5141/u.2023.0402-en

Keywords: urban rail transit; stock land; urban renewal; TOD; benefit coordination of land reorganization; Shenzhen

0 Introduction

The draft *Shenzhen Territorial Spatial Master Plan (2022-2035)*^[1] specifies that the total land area of Shenzhen is 1 997 km², with a restriction on the construction land scale set at 1 105 km². Shenzhen faces a scarcity of land resources compared to first-tier cities like Beijing, Shanghai, and Guangzhou. As a result, there is a need for intensified and strategic land development processes, emphasizing the renewal and reengineering of inefficiently utilized land for sustainable growth. As outlined in the *14th Five-Year Plan for the Protection and Development of Land Spatial Planning in Shenzhen*,^[2] the city aims to establish a comprehensive control model for construction land during this period. The target is to maintain the total construction land scale within 1 032 km², pending finalization based on the Third National Land Survey and the approved Shenzhen Territorial Spatial Master Plan. The plan includes a construction land supply of 58 km², utilizing various redevelopment methods for piecemeal projects, and a direct land supply renewal of 10 km². Looking forward, Shenzhen's all-encompassing urban transit-oriented development (TOD) will predominantly depend on the direct provision of land for renewal and the preparation of existing stock. The issuance of policies like the *Outline of the Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area* and *Opinions on Supporting*

Shenzhen to Construct an Advance Demonstration Zone of Socialism with Chinese Characteristics has bestowed upon Shenzhen a new historical mission. This entails a pressing need to bolster the city's competitiveness, innovate the TOD model, and expand avenues for investment and financing in urban mass transit construction, all against the backdrop of existing land resources. The paper delves into the exploration and practical implementation of comprehensive TOD in Shenzhen, considering the existing land resources. This study serves as a valuable reference for the future development of TOD in urban rail transit projects.

1 Stock land development

The land stock comprises various components such as state-owned land that has been sold, legal construction land in original rural communities, and instances of private occupation of state-owned land without approval. Consequently, the development of land stock differs fundamentally from the development of conventional net land or the typical auctioning of land. Indeed, the development of land stock is marked by the presence of multiple rights holders, a multitude of interests, and intricate historical legacy issues. Effectively addressing these challenges requires the adjustment of the interest mechanism to find a balanced and sustainable resolution. In summary,

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land stock development is the interconnected process of primary and secondary land development, achieved through collaborative efforts between the government and the market^[3-4]. The connection between primary and secondary land development involves the integration of pre-finishing and post-sale stages. Enterprises involved in the primary land development actively participate in urban renewal or land preparation benefits. This collaborative approach ensures a balanced distribution of interests, meeting the needs of all parties involved and securing the successful implementation of the overall project on the ground.

Shenzhen has pioneered a stock land development system tailored to its unique characteristics. This system encompasses various pathways, such as land and housing acquisition, urban renewal, land preparation, benefit coordination, and shantytown renovation, demonstrating a comprehensive and adaptable approach. Urban renewal and land preparation with benefit coordination stand out as the primary avenues in Shenzhen's stock land development. The key distinction lies in their focus—urban renewal primarily targets stock land with a legal land proportion of 60% or more. In contrast, land preparation and benefit coordination address the challenge of stock land that faces difficulties in urban renewal due to an insufficient proportion of legal land.

2 Dilemma of TOD for urban rail transit in Shenzhen under the background of land stock

2.1 Policy and mechanism level

The initial four phases of Shenzhen's urban rail transit construction saw the introduction of pertinent policies focusing on project construction management and land grant levels. Noteworthy among these is the *Regulations on the Construction Management of Shenzhen Rail Transit Projects*, implemented in January 2021 to address issues in planning, construction, and administrative approval. Additionally, the *Interim Measures for Contributing to the Funding of State-owned Land Use Rights in Shenzhen*, established in May 2013, tackled the challenge of land grants in the context of the original abundance of land resources. The "rail + property" net land grant mode has played a crucial role in supporting the construction of Shenzhen's first, second, and third phases of urban rail transit, ensuring its sustainable development. The TOD integrated development of stock land in Shenzhen encounters challenges amid tight land constraints. Unlike counterparts such as Hong Kong, China, and Tokyo, Japan, the government not only lacks comparable policy support but also grapples with the absence of a dedicated TOD integrated development mechanism and management department. Currently, the focus of relevant efforts leans more towards the construction of urban rail transit projects.

In the absence of adequate policy support, the integrated development of land and TOD in Shenzhen primarily relies

on existing urban renewal and land consolidation strategies. Implementing these initiatives within the current policy framework places a significant emphasis on the effective management of urban rail transit enterprises, such as metro companies, highlighting a heightened demand for their involvement in the development of existing land resources. Metro companies bear the dual responsibility of not just constructing and operating facilities but also assembling a proficient urban renewal team. This team is exclusively focused on navigating negotiations concerning ownership, interests, and the planning layout of the land surrounding urban rail transit stations. The challenge in advancing the integrated development of TOD lies in the gap between metro companies and market-oriented real estate firms. This disparity is evident in areas such as market-oriented decision-making systems and market acumen, making it challenging to effectively promote TOD integrated development on existing land stocks.

2.2 Land resources

Shenzhen faces scarcity in land resources, with the city having a limited scale of buildable land that has already been developed and utilized. In order to facilitate TOD, there is a reliance on the renewal and reconstruction of existing land stocks, given the constraints on available land for new development. As of January 2023, Shenzhen boasts an operational urban rail transit network spanning 559.1 kilometers (including 11.7 kilometers of tram lines), with an additional 98.4 kilometers currently under construction. Due to constraints imposed by urban planning factors like land space planning, the basic ecological line, and industrial zone block lines, the availability of net land resources for development along future Phase V urban rail transit and intercity rail transit line construction projects is diminishing. Hence, there is a growing need to leverage rail transit construction as a means to develop the remaining net land resources. Therefore, there is a necessity to undertake comprehensive development across a significant area, centered around rail transit construction. This involves implementing a "rail transit + urban renewal" model, delving into collaborative efforts with multiple stakeholders and ensuring the equitable distribution of benefits among them. This approach ensures that the construction of urban rail transit achieves the intensive use of land and maximizes overall benefits.

2.3 Planning level of existing statutory plans

In the context of existing land resources, traditional statutory plans fall short in coordinating interests related to stock land development. These plans primarily concentrate on regulating the overall development volume, land nature, various control red lines, and the stipulations for relevant supporting facilities. However, they lack the responsibility of harmonizing the interests of diverse urban renewal interest groups. This deficiency hampers the effective

implementation of current plans, consequently impeding the progress of urban renewal projects. Simultaneously, within the framework of stock land, the parties involved often prioritize maximizing economic benefits without giving due regard to the overall considerations of the area. This tendency leads to a continuous escalation of land plot ratios as a strategy to safeguard their economic interests.

To make sure our projects are feasible, the unique plans for revitalizing urban areas within the existing land stock framework will integrate with the current legal plans. The absence of comprehensive and systematic planning for various urban renewal units has resulted in their fragmentation. The cumulative development metrics have surpassed the area's population size and transportation capacity. Meanwhile, integrating the original statutory plans into the program proves challenging, and there is a lack of focus on upgrading local industries and incorporating feedback from urban rail transportation construction.

2.4 Ownership stakeholder interest perspective

Given the current land stock, the area is characterized by numerous ownership entities, leading to a complex ownership structure. The renewal interests of the various subjects are diverse and not uniform. Some require compensation in real estate properties, and others prefer cash compensation. Some seek equity cooperation, and a few opt for independent renewal and development. Coordinating planning and construction through market-oriented approaches poses a significant challenge, resulting in a slow and intricate process for market development entities. The inconsistent timing and difficulty levels in project promotion have led market development entities to selectively choose projects, leaving behind those deemed challenging to promote in the district. This selective approach contributes to the formation of urban scars.

Simultaneously, the scattered ownerships in the area, coupled with varying progress in project establishment and implementation, present challenges in mobilizing and consolidating the land dedicated to urban renewal. This complexity hinders the efficient release of land resources in the area. The primary focus on maximizing economic benefits by the main market development entities has led to a singular approach in renewal and transformation, predominantly favoring residential and commercial aspects. This emphasis has made it challenging to ensure the quality of urban spaces, deviating from the requirements for the high-quality development of the city.

3 Stock of land and urban rail transit TOD integrated development strategy

3.1 Policy system and mechanism innovation

Kitada Shizuo et al.^[5] systematically compiled the history of Tokyo, Japan's land stock and TOD integrated

development policy. This includes the introduction of key legislation such as the *House Railway Law*, *Urban Redevelopment Law*, *Residential Development and Railway Transportation Integral Promotion of Special Measures Act*, and *Urban Regeneration Special Measures Act*. These legal measures work to clarify the overarching principles of rail transit construction and urban development, emphasizing collaboration. The legislation establishes the priority development status of railway companies, grants functional autonomy in planning around railway stations, and implements a plot ratio incentive policy to support high-density development near stations. By implementing a series of policies to encourage development around rail transit stations, notable success stories have emerged. For instance, the Shibuya Light Complex urban redevelopment project transformed a loss into a profit. From April 2012 to April 2013, and the commercial portion of the project generated sales of 30 billion yen (approximately 1.5 billion yuan at the exchange rate of that time). Similarly, after the renovation of Futako Tamagawa Station, the station experienced a noteworthy population growth of 6% from April 2014 to April 2019, coupled with a remarkable 44.9% increase in land appreciation.

In December 2022, the Beijing Municipal Government released the Implementing Rules for the *Integration of Beijing's Rail Transit Yard Stations and Surrounding Land Use Planning and Construction (Trial)*^[6]. This initiative aims to facilitate the seamless integration of rail transit and urban functions and enhance the efficient use of land in practical applications. The regulations work towards standardizing, institutionalizing, and promoting the integration of rail transit yards and stations in Beijing. They provide clear guidelines on the main responsibilities, procedures, and work content, focusing on aspects such as integrated planning and design, land use management, and the implementation of rail transit integration. In 2017, Chengdu City and, in 2018, Dongguan City both established rail transit construction and development policies following the "1 + N" framework. They delineated TOD integrated development circles. Chengdu City innovatively explored a model that combined allocation and transfer on the same land, integrated above-ground and underground projects, and harmonized business land with municipal facilities land. This layered registration approach for overall land supply has proven to be a new and effective model, providing substantial support for the development of rail transit in Chengdu. As of February 2022, the urban rail transit network in Chengdu spans an impressive 557.8 kilometers, securing its position as the fourth-largest in China.

Shenzhen has promptly distilled the insights gained from the initial three phases of the urban rail transit project's "rail property" development^[7]. This comprehensive analysis delves into key aspects such as the land contribution policy, development models, the symbiotic relationship between property development and urban rail transit construction, and

the strategic focus on maintaining high-quality properties. Simultaneously, Shenzhen is proactively incorporating lessons from other cities. In a strategic move towards policy and institutional innovation, the sixth round of the Shenzhen Municipal Government's implementation has clearly defined responsibilities, aiming to distribute the investment burden across urban areas and effectively implement regional government initiatives. Shenzhen has aligned its efforts with the research on TOD special areas for urban rail transit. At the policy level, there is a push to promote integrated development based on TOD principles, with a focus on urban rail transit stations and hubs as central points. Specific TOD special areas have been designated within a defined scope, accompanied by tailored policies provided by the metro company. The implementation involves incremental pre-control through special planning to ensure the efficient utilization of both the station and its surrounding land. During the policy promotion process, there appears to be a lack of alignment in the perspectives of relevant government departments regarding the TOD special area policy. Therefore, achieving a cohesive and unified approach requires top-level design and support in terms of policy research and introduction from the municipal party committee and the municipal government.

3.2 Integration of urban rail transit stations and hubs around the region as a whole

To realize the high-quality development of TOD for urban rail transit, a crucial step involves integrating high-capacity urban rail transit with a convenient pedestrian transportation system. This entails conducting comprehensive planning, design, and construction guided by the TOD concept. The key is to strike a balance among the interests of various stakeholders, harmonize the development of the areas surrounding urban rail transit stations, and concurrently drive the promotion of industrial upgrading and enhancement of the living environment.

Building on successful experiences both domestically and internationally, Shenzhen has embraced the "urban rail transit + urban renewal" model. The subway company takes on comprehensive planning responsibilities for the areas surrounding urban rail transit stations. This includes delineating land ownership and balancing interests, conducting planning and design research, overseeing engineering construction, and managing operations. Simultaneously, collaborative efforts with relevant district governments along the urban rail transit lines aim to coordinate the interests and demands of all stakeholders. This approach leverages the strengths of each party to address challenges such as rail transit construction financing, increased passenger flow, city image enhancement, improved supporting facilities, and resolution of issues related to the relocation of ownership parties and the income of market development entities. By orchestrating comprehensive coordination, the metro company assumes a leading role in

the development of the vacated hub or vehicle section land, while the market development body spearheads the development of the land plot. The landowner is provided with corresponding relocation property, and the government secures accompanying supporting facilities and net land. This collaborative approach ensures a win-win situation for all parties involved. The overall coordination mode of "Urban Rail Transit Urban Renewal" is shown in Fig. 1.

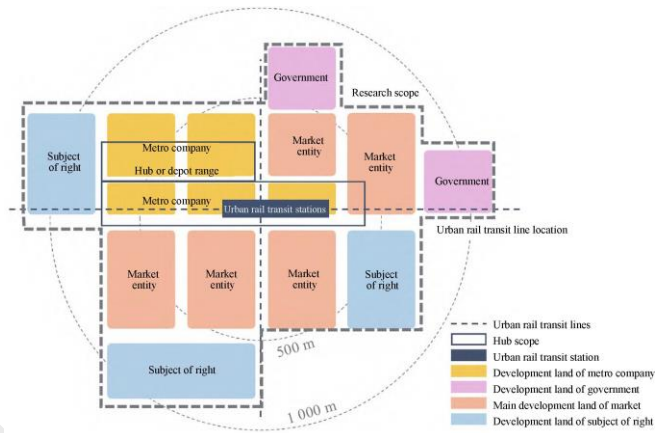


Fig. 1 Overall coordination mode of urban rail transit + urban renewal

3.3 Organic connection between urban rail transit stations and stock development projects

To achieve the development objective of seamlessly integrating urban rail transit with the surrounding city infrastructure, the TOD integrated development project in the context of existing land assets must strategically align with stock property, urban renewal initiatives, land preparation projects, and other ongoing developments. This alignment is crucial to seamlessly link these existing projects with urban rail transit stations, thereby facilitating the comprehensive construction of these integrated transit hubs. If encountering challenges in implementing a holistic integration model for urban rail transit stations and their surrounding areas, an alternative approach could involve providing extension services for the existing properties surrounding the stations. We shall proactively drive the integration of urban rail transit stations with existing real estate properties, as well as with projects awaiting urban renewal and land preparation. We shall actively engage with current landowners, offer technical support to facilitate the connection, expand load reservation services, and provide agency construction and operational support to ensure a seamless link between the station and surrounding properties. Simultaneously, we shall enhance travel services to deliver high-quality experiences, broaden the service radius of the station, and achieve a dual enhancement in both passenger flow and service quality. By engaging the Metro Company, we aim to address property articulation challenges and ensure the safety protection distance of the metro. This collaboration enables the seamless connection between properties and urban rail transit stations,

optimizing land energy efficiency and intensively utilizing land resources.

4 Case study

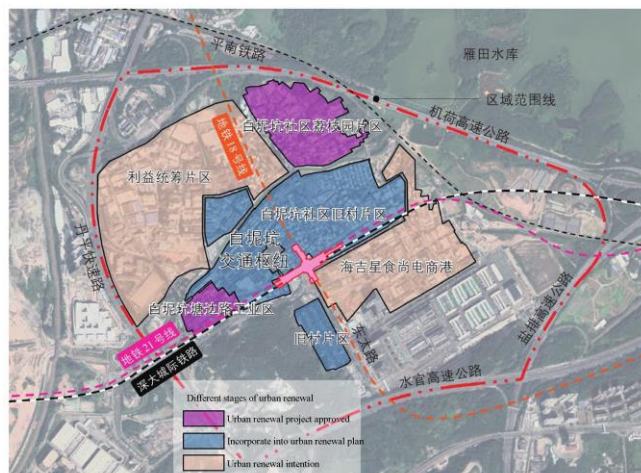
4.1 Exploration of the overall coordination and mechanism of the area around the hub

The Bainikeng Area is situated in the Longgang District of Shenzhen City, strategically positioned at the crossroads of Shenzhen and Dongguan. It is enveloped by three highways and one expressway, namely, Jihe Expressway, Yanpai Expressway, Shuiguan Expressway, and Danping Expressway. The area spans approximately 3.68 km², as illustrated in Fig. 2. Being situated on the outskirts of the city for an extended period, the Bainikeng Area has experienced comparatively slower development. Currently, the land use is predominantly characterized by aging villages, industrial zones, and warehousing and logistics areas. The infrastructure and building quality in these areas are average, accompanied by subpar environmental conditions. Moreover, there is a notable absence of essential supporting facilities for education, recreation, commerce, medical care, and municipal services.

The Bainikeng area serves as a prototypical illustration of Shenzhen's peripheral urbanization. The World Bank's Global Environmental Facility (GEF) has chosen the Bainikeng Area as a sub-project for its "Pilot Project on Integrated Approach to Sustainable Cities in China". This selection aims to explore the TOD model, fostering high-quality development in suburban areas and providing guidance for sustainable urban renewal. Seizing the opportunity presented by the introduction of the Shenzhen-Dalian Intercity Railway, Metro Line 18, and Metro Line 21 (refer to Figure 3) into the Bainikeng Area, the development of the Bainikeng Transportation Hub is underway. Through comprehensive area planning, a harmonious balance of interests among various stakeholders is achieved, paving the way for significant advancements in urban construction.

4.1.1 Establish a leading group for TOD co-ordination work

As part of the refined urban renewal initiative, a coordinating leading group for TOD has been established. Following the TOD concept, this group comprises representatives from both municipal and district governments. Its purpose is to facilitate the coordination of interests related to land preparation for the Bainikeng area project. The TOD coordination task force oversees and drives the planning and development of urban rail transit hubs alongside the surrounding land planning and construction. Their role involves harmonizing the interests, implementation schedules, and planning among all involved



平南铁路Pingnan Railway; 雁田水库Yantian Reservoir; 区域范围线Regional Boundary Line; 机荷高速公路Jihe Expressway; 白泥坑社区荔枝园片区Bainikeng Community Litchi Orchard Area; 白泥坑社区旧村片区Bainikeng Community Old Village Area; 利益统筹片区Integrated Benefits Area; 地铁18号线Metro Line 18; 白泥坑交通枢纽Bainikeng Transportation Hub; 白泥坑塘边路工业区Bainikeng Tangbian Road Industrial Zone; 旧村片区Old Village Area; 东太路Dongtai Road; 丹平快速路Danping Expressway; 地铁21号线Metro Line 21; 深大城际铁路Shenda Intercity Railway; 水官高速公路Shuiguan Expressway; 盐排高速公路Yanpai Expressway;

Fig. 2 Overall coordination scope of Bainikeng Area

Source: Reference [8].

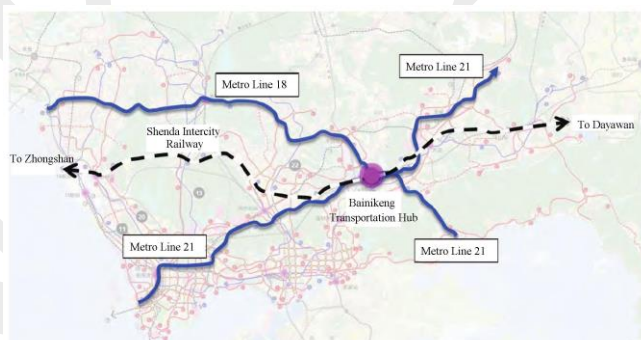


Fig. 3 Distribution of rail transit lines in Bainikeng Area

Source: Reference [8].

parties in developing these transit hubs and surrounding areas. This ensures smooth operations in the short term and stability in achieving long-term objectives. They also guarantee the cohesion and completeness of public spaces, commercial amenities, essential facilities, and transportation systems within the area. This approach aims to realize urban design goals and achieve top-notch urban development, ultimately leading to increased value in the area.

4.1.2 Formation of TOD joint development body for stock land

Given the diverse ownership interests and varying demands related to land stocks, establishing a joint development body for the Bainikeng Area TOD is imperative. This body will be led by the Metro, alongside the respective district-owned state enterprises and major landowners in the area. Leveraging their specific expertise, territorial advantages, and ownership capabilities, this collaborative effort aims to compile a comprehensive TOD

plan for the area. Additionally, it will oversee the phased implementation of this plan, preparing it for submission and subsequent approval. In this scenario, the district's state-owned enterprises act as representatives of the government's goals and public interests, the metro company speaks for the financing and passenger needs within rail transit, and the primary stakeholders in the area voice the prevailing demands. Following discussions and negotiations, the TOD joint development entity aligns the interests of all involved parties through market-oriented approaches. It oversees the implementation of requisite public service and transportation facilities and ecological environmental protection measures and collaborates with the pertinent market development body to drive industrial advancement. Its primary responsibility lies in ensuring the realization of overarching planning objectives. The impact of urban design on the comprehensive execution of TOD in the Bainikeng Area is depicted in Figure 4.



Fig. 4 Illustration of urban design effect with integrated TOD implementation in Bainikeng Area

Source: Reference [8].

The central aim of integrating the area surrounding the hub is to establish a coordinating mechanism. Government departments address planning and approval issues, while the metro company manages ownership distribution, primary land preparation, and secondary comprehensive development endeavors. Given the extensive content, lengthy process, complexity of the subject matter, and other influencing factors involved in integrating the land stock, it becomes imperative to assign a professional team accountable for overseeing the entire process. Furthermore, a continuous, uninterrupted effort is necessary to consistently advance this initiative. Based on the experience gleaned from previous stock area land preparation and benefit integration projects, the initial groundwork typically spans between three and five years. Subsequent secondary comprehensive development usually requires 5–8 years. Consequently, the entire project cycle typically extends over a period of about 10–15 years. Therefore, the successful execution of the comprehensive integration surrounding the hub necessitates the metro company to define objectives and sustainably promote the

initiative, starting from the enterprise's sustainable development strategy level.

4.2 Relying on the hub to integrate the inefficient stock of land

The Mei-Lin Guan area sits within the central axis of Shenzhen's urban development and serves as the primary north-south transportation artery. Mei-Lin Guan was initially established as a checkpoint by the State Council to demarcate the administration line for creating the Shenzhen Special Economic Zone (SZSEZ). While the concept of Mei-Lin Guan exists nominally due to the integration of the SZSEZ, the transportation and municipal facilities associated with the urbanization of the Mei-Lin Guan area have been retained. The Mei-Lin Guan Hub serves as a pivotal urban rail transportation center, encompassing a planned intercity railroad (Guangzhou-Shenzhen Central Axis Intercity Railway), three existing urban rail lines (Metro Line 4, Metro Line 6, and the upcoming construction of Metro Line 22), and conventional ancillary transportation networks (refer to Fig. 5 and Fig. 6). The current traffic capacity at the hub does not align with the number of lanes available, leading to a significant influx of vehicles converging at the Mei-Lin Guan hub and subsequently causing traffic congestion. The present land utilization in the Mei-Lin Guan area is inefficient, characterized by a low plot ratio, indicating an underutilization of available land. The incorporation of the Mei-Lin Guan area into Shenzhen's urban core through municipal land space planning underscores the urgent need for the municipal government to leverage hub construction to transform the current inefficient land utilization status. In light of this context, integrated comprehensive development initiatives were launched around the Mei-Lin Guan Hub to redevelop the underutilized land stock surrounding the hub.

The Mei-Lin Guan Hub adopts four strategies to integrate the inefficient land stock: Firstly, leveraging the hub construction opportunity to maximize the regional location's potential, enhancing industrial functions, and fostering a balanced mix of jobs and housing in the vicinity. Secondly, focusing on reconstructing the public transportation system around the hub to establish a robust hub connection system. This facilitates the seamless interaction between urban rail traffic and commercial activities (refer to Fig. 7). Thirdly, optimizing the area's road network system by implementing a separation of fast and slow traffic. Transit traffic undergoes semi-submerged separation, while internal area traffic crosses the main line via elevated roads, facilitating connectivity between the east and west sides. Fourthly, constructing a three-dimensional pedestrian system linking the transportation hub, the city, and the mountain. This enables residents in the surrounding areas to easily access the transportation hub, bus station, commercial center, and mountain parks through non-motorized transportation means. By implementing these four strategies to revamp the underutilized land in the area, integrated development and

construction centered around the urban rail transit station have been initiated. This transformation aims to reshape the existing pattern of inefficient land use, achieving the integration of station, production, and city (refer to Fig. 8), thereby infusing the area with renewed vitality.

In addressing inefficient land use, the primary focus lies in resolving the conflict between the planning goals of government departments and optimizing the efficiency of integrated development managed by the metro company. To maximize land utilization, boost tax revenue, and create industrial zones, the government intends to convert inefficient land into industrial spaces. Conversely, the metro company often seeks to augment residential indicators within the planning scheme to optimize land's economic benefits, achieving a balanced project economic outcome that accelerates capital return. Therefore, finding a harmonious balance of interests between government departments and metro companies is pivotal in resolving the issue of inefficiently utilized government-held land. Achieving alignment between their objectives is key to effectively addressing this challenge. The primary approach involves meticulous planning and urban design of the urban rail transit hub's surrounding area. Simultaneously, leveraging the metro company's organizational capabilities to coordinate with bureaus and attract top-tier industrial and commercial entities for collaboration becomes crucial. This synergy aims to realize integrated development encompassing station, industry, and city, fostering a mutually beneficial scenario for both government and enterprises.



Fig. 5 Illustration of scope and existing transportation facilities in Meilinguan Area

Source: Reference [9].

4.3 Integrated development of land preparation projects and urban rail transit stations

Nanwan Station, now known as Shibaling Station, serves as an interchange hub for both Metro Line 14 (currently operational) and Line 17 (scheduled for construction). It holds significant importance as a pivotal station for

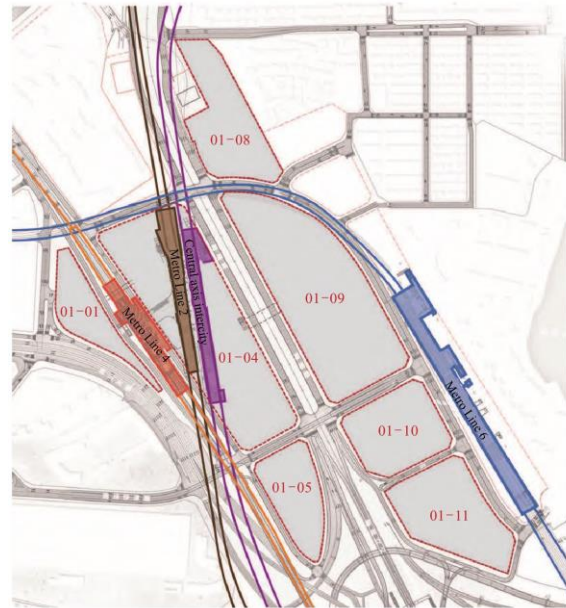


Fig. 6 Distribution of existing and planned rail transit lines in Meilinguan Area

Source: Reference [9].

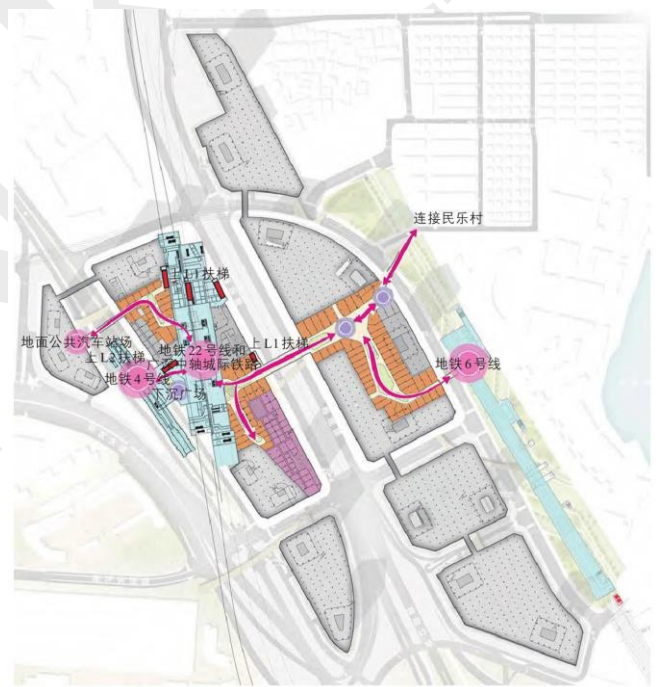


Fig. 7 Illustration of integrated urban rail transit passenger flow and commercial passenger flow by centering on the Meilinguan Hub

Source: Reference [9].

integrating city and station elements, a key priority at both city and district levels [8]. The Nanwan Station of Metro Line 17 partially intersects with the land preparation project in the central area of Nanwan Street, Longgang District. This



Fig. 8 General layout of Meilinguan Hub after urban renewal
Source: Reference [9].

station coincides with the land preparation project, sharing an overlap of approximately 3 980 m² (Fig. 9). To heighten project value, optimize land usage, achieve station-city integration, and broaden the service scope of urban rail transit stations, the metro company has engaged in extensive discussions and negotiations with landowners. This collaboration aims for mutual benefit, wherein the metro company provides technical support for the comprehensive development of the station's upper structure. Additionally, it involves load reservation and reinforcement of the column network adjacent to Nanwan Station, as well as offering connectivity services for corresponding metro entrances and exits.

The landowner has proposed executing the development of the land stock using the land preparation and benefit coordination approach. This project encompasses 13 land parcels with a collective land area spanning 19.236 hectares (or 19.236 hm²). The project includes 13 lots totaling 19.236 hectares. Through land consolidation, approximately 6 hm² (Lots ①, ②, and ③ in Fig. 9) are earmarked for development, with a planned gross floor area of 450 000 m². The remaining land will be allocated to the government for the construction of public supporting facilities. Lot ① partially intersects with Metro Line 17 Nanwan Station, with an overlapping land area of approximately 3 980 m² and a planned gross floor area of around 3 840 m². Lot ① itself covers a total area of roughly 1.2 hectares with an intended gross floor area of about 110 000 m².

Under the traditional development approach, the overlapping section between Metro Line 17's Nanwan Station and the landowner's site would typically undergo greening, with the Metro project separated from the interfaces of the development project. In pursuit of maximizing land utilization, boosting urban rail transit ridership, and enhancing real estate property value, the Metro Company engages in discussions with the landowner. They mutually agree to reserve load-bearing capacity for the



Fig. 9 Scope of benefit coordination of land reorganization in the central area of Nanwan Sub-district
Source: Reference [10].

superstructure's podium during station construction. Simultaneously, the agreement includes reserving five access interfaces. The podium's reserved load-bearing structure does not exceed five floors. To achieve this, a deformation joint is utilized to disconnect the podium structure from the main structure of the tower. Detailed schematics outlining this specific program can be found in Figs. 10 and 11.

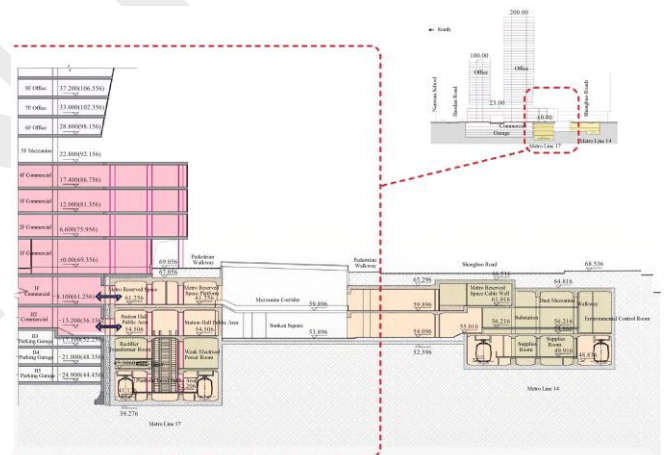
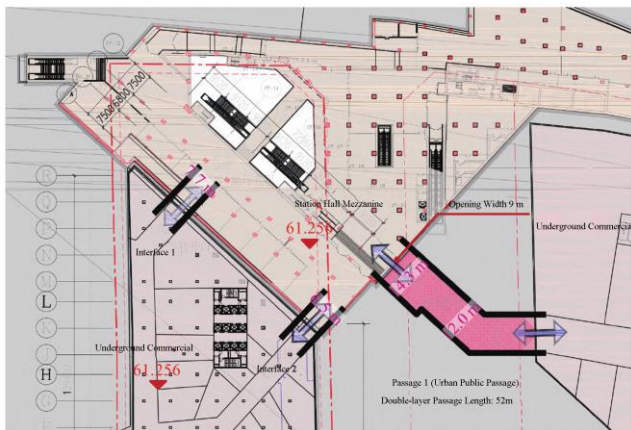


Fig. 10 Illustration of the reserved overlying at Nanwan Station of Subway Line 17
Source: Reference [10].

With the aid of specialized planning and approval, the metro company addresses the safety protection zone concerns surrounding urban rail transit stations. This initiative not only seamlessly integrates the construction and operation of urban rail transit but also generates added value income for landowners in the vicinity of the station. Consequently, this fosters a cooperative relationship between the metro company and the landowners. Undoubtedly, the process of integrating urban rail transit stations with the city faces numerous challenges. These include issues associated with



(a) Ground floor



(b) Second underground floor

Fig. 11 Illustration of entrances connecting Nanwan Station of Subway Line 17 and reserved land

Source: Reference [10].

land zoning complexities, management interface divisions, and the necessity for coordination among multiple government departments, among others. To circumvent these hurdles, landowners sometimes opt to withdraw from the protected red line of urban rail transit or choose not to connect to the urban rail transit station. Unfortunately, this decision often leads to the wastage of valuable land resources. Therefore, to achieve seamless integration between the land development project and the urban rail transit station, it becomes imperative to establish effective collaboration among construction, development, operation, and other pertinent departments within the metro company. Addressing landowner concerns collectively and creating a standardized operational process are crucial steps toward fostering willingness among landowners to collaborate with the metro company.

5 Conclusion

Under the context of land resources, Shenzhen is pioneering the “rail + property” model, embarking on

comprehensive research and practical experimentation. This initiative delves into policy mechanisms, overall coordination strategies, integrated development of urban rail transit stations, and the revitalization of underutilized land for municipal facility enhancement. Throughout the land reclamation process, the metro company must proactively drive and sustain relevant initiatives. Simultaneously, government departments should cultivate a consensus on TOD integrated development concerning land stock and extend necessary support. This approach aims to harmonize and balance the interests of all involved in land stock, ultimately achieving a mutually beneficial outcome for all parties involved. Navigating the exploration phase comes with several persistent challenges, particularly regarding the substantial interests tied to land resources. Balancing these interests proves arduous, leading to sluggish project progression. This directly impacts the construction timeline of urban rail transit systems. Indeed, the introduction of TOD special area policies is poised to influence the urban real estate market, prompting certain concerns within government departments. Mitigating the impact on the real estate industry can be achieved by pinpointing specific local zones within the city for TOD comprehensive development exploration. However, convincing the government of this approach will necessitate greater advocacy from urban rail transit practitioners. In essence, TOD integrated development of land stock presents an opportunity for innovative and intensive land resource utilization. This approach can enhance the city’s overall image and simultaneously address funding challenges in urban rail transit construction. Additionally, it can bolster passenger flow, fostering the sustainable development of both urban rail transit construction and operation.

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