



Thoughts on Urban Rail Transit Development Issues and Innovative Planning

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Abstract. Urban rail transit is the main framework of the urban transportation system. In order to scientifically understand its development rules and do a good job in planning and research, we first analyze the main problems faced by domestic rail transit, then analyze the progress of my country's rail transit construction, and look forward to the development trends and specific measures of my country's rail transit in the future. Finally, based on the statistics of population, land use, economy and other data, we explore and try at the urban planning level to ensure the sustainable development of urban rail transit construction and operation while also reaping the benefits of urban public interests.

Keywords: Rail transit planning; top-level planning; high-quality construction and operation; planning innovation

1 INTRODUCTION

Rail transit has an obvious driving role in urban development. It can not only promote business and land value appreciation through the gathering of people, but also alleviate traffic congestion and environmental pollution [1]. It can even drive up housing prices as shown in Figure 1 below.

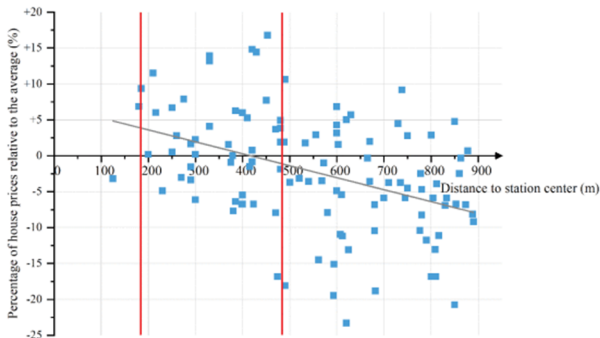


Fig. 1. The relationship between house prices and central station.

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However, due to unbalanced development, the unified coordination of macro management at the national level is still insufficient; policies and regulations are not comprehensive enough, and there is a lack of "Urban Rail Transit Law" at the national level; the industry technical standard system in planning, construction, operation, equipment manufacturing, etc. needs to be improved. There are shortcomings in key technologies and core equipment, insufficient independent innovation, insufficient in-depth and detailed preliminary work, and shortage of professional talents. These factors have affected the development speed and quality of urban rail transit to a certain extent, and are inconsistent with the rapid development of urban rail transit. adapt. In 2019, General Secretary Xi Jinping pointed out when inspecting Caoqiao Station of the Daxing International Airport Line: "Urban rail transit is the development direction of transportation in modern big cities[2]. The development of rail transit is an effective way to solve big city diseases and is also an important step in building green cities and smart cities. An effective way. Beijing should continue to develop rail transit, build a comprehensive, green, safe, and intelligent three-dimensional modern urban transportation system, always maintain the most advanced international level, and build a modern international metropolis."

2 PROBLEMS EXISTING IN THE DEVELOPMENT OF URBAN RAIL TRANSIT

Urban rail transit has become an indispensable part of transportation. It has become people's first choice and important means of transportation because of its advantages such as green, fast, safe, convenient, large passenger capacity, and not affected by climate. However, the construction and development of urban rail in our country is still in its early stages, and there are many problems that need to be solved urgently [3].

2.1 Insufficient Professional Talents

With the rapid development of the urban rail transit industry, the demand for professional talents in construction and operation management is increasing, and there is a shortage of talents in this field. Various positions in the rail transit industry are very professional, complex and systematic, coupled with the increasing number of advanced technologies and equipment, resulting in a shortage of urban rail transit talents, and the demand for talents in this field exceeds supply. The urban rail company requires more than a thousand professionals for each track line, and the staffing standard of 60 talents for each station per kilometer is difficult to meet. Under the conditions of centralized operation of multiple rail transit lines, the demand for operation management personnel will be greater [5]. Once there is a shortage of urban rail transit construction professionals and operation and management talents, or the talent skills and literacy levels are poor, it will seriously affect and restrict the safe operation and sustainable development of urban rail transit.

2.2 Economic Factors Restrict

At this stage, the main characteristics of my country's urban rail transit are its long construction period and large scale. As we all know, in the process of carrying out road projects, road construction operations may involve hundreds of kilometers. This process not only requires a large number of construction personnel, but also requires a variety of machinery and equipment. Only in this way can the project be accelerated. Development speed. In order to meet the above conditions, it is not only necessary to introduce talents and advanced technology, but also need the support of a strong financial chain. Only in this way can the smooth progress of the project be ensured. But now, the funds in the road construction process come from the government's capital investment, which undoubtedly intensifies the financial pressure on the government. In the early investment process, there is only investment without any recovery, which leads to the difficulty of operating income and expenditure in the early stage. Balance, which also directly increases the pressure on loans.

2.3 The Impact of City Size

The planning, design and construction of urban rail transit require a large amount of funds, and the project cost is high and the implementation is complicated. In order to maximize the benefits of rail transit, provide more people with fast and convenient public transportation services, and avoid causing huge waste of resources, the construction of urban rail transit should be applicable to urban areas with a permanent population + floating population of more than 2 million and a city size of Relatively large first- and second-tier cities [6]. These cities have rapid economic development, developed tourism, and strong economic and trade activities, resulting in dense floating populations and relatively congested urban roads. They urgently need to build urban rail transit "according to local conditions" to alleviate the huge traffic pressure, so as to effectively improve urban traffic conditions and traffic conditions, and provide citizens with comfortable, safe, time-saving, fast, low-carbon, environmentally friendly, energy-saving and money-saving travel methods. In the process of construction and development of urban rail transit, the focus is on planning the travel needs of urban residents and the ability to develop the urban economy and build rail transit.

2.4 Issues with Track Design Planning and Connection Mechanism

Since the implementation process of rail transit construction is dominated by engineering design, urban planning departments are often in a relatively passive state when facing rail transit construction. Although the detailed land control plan along the line must be provided as an attachment when submitting a rail transit construction plan for approval. The original intention is to include consideration of planning factors in the project approval mechanism, but in fact most rail transit projects begin construction in full swing as soon as they are approved by the State Council. The design phase is dominated by the time required for engineering design and land acquisition and demolition, and does not include the time and processes required for urban planning optimization. The

concept of TOD is shown in Figure 2. Although the government has the intention to develop TOD, the progress-first operation method in track engineering design masks the requirement for coordination and integration of track and urban planning. Many planning and optimization work along TOD lines are actually started after the track project is completed. Since the space for adjustment of track alignment and station locations is very limited once approved, there is very little room for integration of tracks and properties. optimization suggestions cannot be effectively implemented into track engineering plans, missing the best opportunity to maximize value-added benefits.

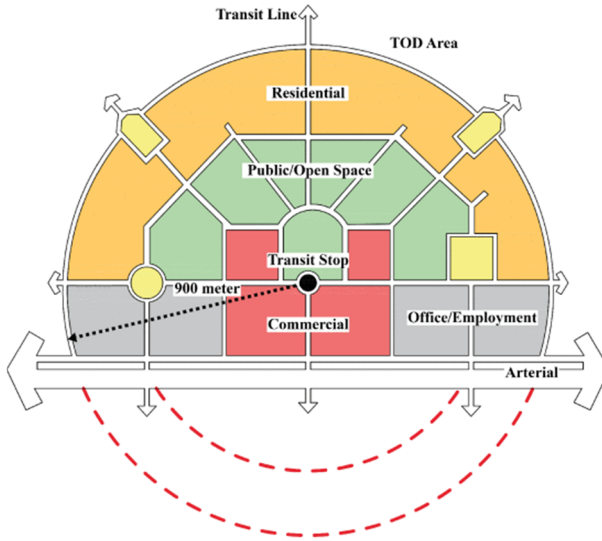


Fig. 2. The concept of TOD.

3 PLANNING INNOVATION OF URBAN RAIL TRANSIT

In 2020 and even during the "14th Five-Year Plan" period, China's rail transit construction and operation will continue to show a thriving development momentum, and the entire industry should take green and high-quality development as a guideline.

3.1 Top-level Design Planning

Starting from the essential attributes of urban rail transit, combined with the characteristics of the new era, the future integration of technological innovation and operation and production will carry out top-level design planning based on the core concepts of "passengers first, network intensive, digital integration and smart travel, and peace and war integration". The data are obtained from the China Statistical Yearbook, China Urban Statistical Yearbook, and China Urban Construction Statistical Yearbook [11]. The impact of rail transit on urban economic growth(EG) is shown in Table 1.

Table 1. The impact of rail transit on urban economic growth.

Explanatory variable	EG (1)	EG (2)	EG (3)	EG (4)
G	0.676*** (5.38)		0.624*** (8.36)	
D		-0.069(-1.36)		0.165**(2.53)
Per capita GDP			0.019** (2.24)	0.019**(2.39)
Industrial upgrading degree			0.068*** (1.32)	0.624**(2.19)
Government expenditure			-0.285*** (-6.17)	-0.239***(-6.00)
Urbanization level			-0.096*** (-3.29)	-0.078***(-2.98)
Fixed asset investment			0.053**(2.38)	0.061*** (2.72)
Foreign direct investment			0.042*** (4.5)	0.046*** (4.76)
_cons	2.327*** (138.15)	2.424*** (568.45)	5.169*** (7.57)	5.187*** (7.49)

Note: *, **, *** represent significance at the passing 10%, 5%, and 1% levels, respectively.

Efforts will be made to realize the mutual integration of the railway network and the urban rail transit line network, and strengthen the connection between urban rail transit and ground buses, walking, non-motorized vehicles and the microcirculation system transportation modes around the station. Use new concepts and new ideas to guide the top-level planning and design of a new round of rail transit development, achieve the goals of "safety, convenience, efficiency, cost saving, environmental protection, and economic applicability", and realize the deep integration of urban rail transit and urban development. The integration of rail transit with various transportation systems, as well as urban public service systems, infrastructure, production and living facilities, achieves multi-network coordination and builds a unified multi-level network. Form a new urban ecology that integrates urban travel, living, work, consumption and entertainment with station + TOD as the core, strengthen the control of the "land use, transportation environment integration" system, and strengthen urban rail transit planning, construction and management. Adhere to the policy of "act within one's ability and develop in an orderly manner" and plan scientifically to ensure the feasibility of rail transit planning and its synergy with urban planning. For the auxiliary lines in many medium-sized and large cities in the country, demand and supply match. Build an urban rail transit planning system that is satisfactory to the people, technologically advanced, and economically applicable.

3.2 Mechanism Construction of New Innovation System

Establish a new research and development system that closely integrates "government, industry, academia and research" to open up the entire chain from technology research and development, to production and application, to promotion and transformation to generate benefits. The focus is to integrate the entire chain of technology research and

development, industry incubation, data construction, and talent training. innovative resources and accelerate the construction of new innovation systems and mechanisms[8].

Through the application scenarios of the subway, we will integrate upstream and downstream advantageous enterprises in the industry, give full play to the complementary advantages of technological innovation and operation and production, implement an operating mechanism of "openness, flow, union, and competition", and actively incubate high-tech companies with new technologies and new equipment. Actively carry out international exchanges and cooperation, create good scientific research conditions and academic environment, strengthen cooperative research and development with top institutes, scientific research institutions and enterprises in the industry; at the same time, actively attract and gather outstanding domestic and foreign scholars and experts to carry out high-level research in this research field. Research and cultivate high-level technical talents and industry experts to ensure the professionalism, innovation and authoritativeness of research and development activities.

3.3 Strengthen Environmental Protection and Ecological Construction

From the beginning of the planning stage, it is necessary to increase the protection of natural ecosystems and the environment[4]. During the construction and operation stages, resource consumption, environmental damage, and ecological benefits must be included in the evaluation system of economic and social development[7]. In all aspects of rail transit construction, we focus on saving land resources and energy, realizing resource sharing, and improving efficiency to achieve low investment and high output., as shown in Figure 3 below [10].

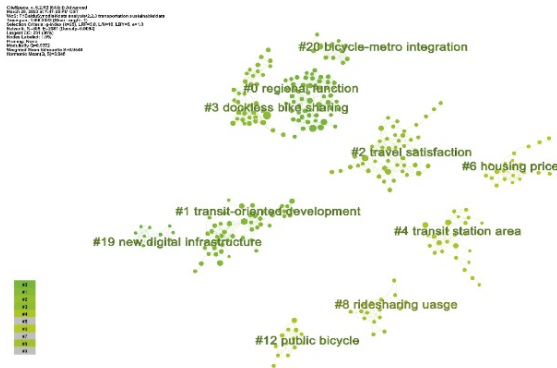


Fig. 3. The analysis of sustainable development of rail transit.

Select energy-saving products and equipment to optimize the transportation energy structure. Promote the application of new energy and clean energy, promote urban rail transit equipment and construction machinery, and realize electrification, new energy and cleanliness. Reasonably select vehicle formats and groupings to reduce the area occupied by vehicle depots, optimize operation organization, reduce traction energy consumption, and recover renewable resources.

4 CASE ANALYSIS

4.1 PPP Model of Beijing Metro Line 14

(1) Project Status

Beijing Subway Line 14 has a total length of 47.3 kilometers and a total of 37 stations. It is the transportation link from southwest to northeast of Beijing [9]. The backbone line has a large passenger flow. The line is mainly to strengthen the connection between the central city and the edge residential areas. It passes through multiple large business districts and large residential areas, and is connected to important transportation hubs. The PPP model was used to introduce social investors, with a market-oriented investment scale of 15 billion yuan.

According to the different responsibilities of the investment entities, the Line 14 project entities are divided into two parts, A and B.

Part A mainly includes civil engineering (cave, station, etc.), land acquisition and demolition; Part B mainly include track engineering, vehicles, communications and other electromechanical equipment. Government and social investors divide and set up projects. The interface coordination mechanism clarifies their respective investment scopes and responsibilities. The government is responsible for investment and construction of part A, and the government is responsible for part B. Social investors are partly responsible for the investment and construction. As shown in Figure 4.

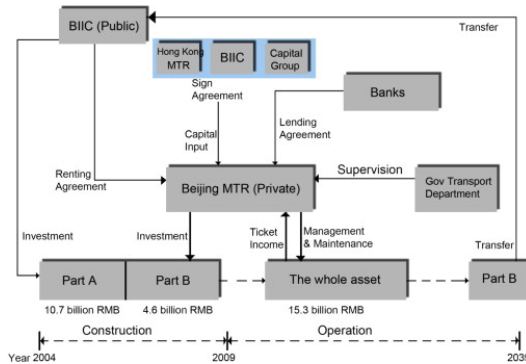


Fig. 4. Joint venture structure in Beijing No. 14 Metro line project.

(2) The significance of the project

Beijing Subway Line 14 uses a project division method to clarify the respective investment responsibilities of the government and social capital. Established a feasibility basis for introducing social capital into the project. Cooperation between government and private capital emphasizes project risk disclosure, the principles of cooperation include equal sharing of burdens, sharing of benefits, and giving priority to public interests. A comprehensive analysis of the impact of risk factors such as forecasts, fare changes in the road network ticket system, and price changes was conducted.

Set up corresponding risk treatment methods based on the principle of equivalence of interests and risks; evaluate possible project outages based on passenger flow

forecasts. The existing excess passenger flow revenue has set up a sharing mechanism between the government and social capital to promote PPP project companies continuously improve project service levels.

The Beijing Subway Line 14 project adopts the PPP model for investment and operation, and drives the overall development of the project through changes in property rights. Changes in the institutional mechanism have not only introduced social capital and solved financing problems, but more importantly, is the introduction of advanced management mechanism, breaking industry monopoly, improving industry efficiency and government supervision level

5 CONCLUSION

The main application value of this article is that it can provide a reference for the sustainable development of rail transit, and it also has reference significance for rail transit in other cities.

The shortcomings or the need for further research are: due to limited level and lack of experience, this study also needs to further deepen the research in the specific implementation link to ensure the implementation of the strategy.

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