

Development Strategies of Public Transport in Different Types of Cities -- A Case Study of Typical Cities

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Keywords: Urban public transport, development countermeasures, safeguard mechanism, urbanization.

Abstract: Analyze the important role of urban public transport in promoting urban development. Based on the current situation and existing problems of urban public transport in China, combining with typical city cases, the corresponding public transport development strategies for different scale cities are given; From the aspects of policies and regulations, infrastructure construction and financial subsidy, the mechanism to ensure the rational development of urban public transport is given.

1. Introduction

As a key factor affecting urban development, urban traffic has been widely concerned. The coordinated development of traffic and city has become an important research direction in the field of traffic. As an important part of urban passenger transport system, urban public transport can effectively ensure the normal operation of urban production and life, and also improve the overall function of the city. To guide urban development with public transport is an important measure to build a resource-saving and environment-friendly society. The reasonable development of public transport is of decisive significance for optimizing the urban structure and promoting the good development of the city: (1) improving the travel efficiency of urban residents; (2) reducing energy consumption to meet the needs of developing resource-saving economy; (3) easing environmental pressure and improving air quality; (4) reducing traffic congestion and improving the travel safety rate. The long-term practice at home and abroad has proved that reasonable public transport, as a green and low-carbon mode of transport, plays an important role in guiding the urban intensive use of land and energy conservation, protecting and improving the living environment, and promoting the equality of urban and rural public services, which has become an inevitable choice for urban development[1].

The 14th five-year plan period is the key period for China to accelerate the construction of new urbanization. Based on serving the national economic and social development, in order to improve the people's livelihood service and the industry management ability, comprehensively consider the development of urban public transport. To make urban public transport play a good role in three

aspects: first, to adapt to the needs of the new urbanization construction and play a guiding role; second, to adapt to the needs of the scientific development of urban transport and play a leading role; third, to adapt to the needs of the equalization of urban and rural public services and play a push role.

2. The Development Countermeasures of Public Transport in Different Types of Cities

Reasonable development of urban public transport, improving the quality and efficiency of urban travel service, and guiding the healthy and orderly development of the city are the needs of future urbanization development. The reasonable development of urban public transport needs to adapt to the city scale, population and economic development level. It is necessary to develop public transport system in combination with local conditions.

2.1. Super Large-scale Cities

The super large-scale cities in China are mostly composed of one core city and several cluster cities. Traffic congestion is a problem faced by almost all super large-scale cities, especially with the continuous growth of urban population and the expansion of construction land. With the rapid growth of the number of motor vehicles, super large-scale cities are facing severe traffic challenges.

The main framework of urban transportation system is composed of various types of rail transit, expressway, comprehensive transfer hub and other facilities, supplemented by various forms of road public transport, forming a perfect urban public transportation system, giving full play to the role of bicycles in medium and short distance travel, and effectively controlling the travel sharing rate of private cars. It is an effective way to solve the traffic problems of super large-scale cities, especially It is to solve the problem of traffic congestion. In the central urban area, the rail transit network system with large traffic volume and good accessibility is constructed; Between the cluster urban area and the urban center, the BRT system with large traffic volume and fast speed is constructed to provide strong channel traffic capacity and ensure the quick connection between the urban peripheral area and the central urban area; Between the urban areas of the cluster, according to the characteristics of traffic demand, a comprehensive transportation system with public transport as the backbone and road public transport or tram as the leading role is constructed; The construction of comprehensive transport hub has been strengthened, and the seamless connection and zero distance transfer comprehensive hub have been continuously improved (Figure 1).

At present, Beijing, Shanghai and other super large-scale cities improve the travel efficiency and service quality of urban public transport by actively improving various types of rail transit network, enriching the level of public transport system, promoting the development of diversified green public transport, optimizing the layout of ground public transport network, and promoting the integration of rail transit and ground public transport network. By 2017, the proportion of public transport services provided within the radius of 50m and 100m around the rail transit stations in Shanghai has reached 75% and 89%, respectively 8% and 4% higher than that in 2013. During the peak period, the average running speed of the main bus lines in the central urban area is increased to 14 km/h, and the average running speed of the bus lanes is up to 15 km/h. Passengers' satisfaction with rail transit and bus and trolley bus is above 85 points, which is generally satisfactory.

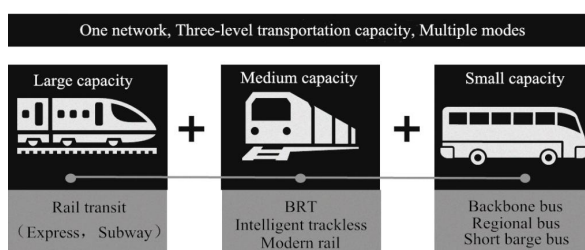


Figure 1: Development mode of public transport in super large-scale cities.

2.2. Megacities

In general, megacities are in a cluster structure, with a strong urban center. The residents living and working in the cluster are basically in balance, and the residents working nearby account for a large proportion. The mode of "Rail Transit Road + BRT + bus + bicycle + walking" meets the traffic demand of megacities. Rail transit should be the main mode of transportation between the urban area and the city center, as well as between the urban areas, and can provide a strong channel transportation capacity; rail transit branch lines and bus trunk lines connect the passenger flow distribution points of the urban groups; the conventional bus system + walking + bicycle system is the main mode of transportation in each urban area.

For mega cities, it is necessary to form a public transport structure with rail transit as the backbone, road public transport as the main body, and a perfect BRT system, and comprehensively implement the development strategy of "public transport priority". In the city center area, especially CBD area, motor vehicle restriction and other measures are implemented, at the same time, the positive role of bicycles in medium and short distance travel should be fully played, self-use passenger vehicles should be reasonably developed, transfer hubs should be scientifically set up, form a diversified modern transportation system. Build an eco-city unit as the basic unit of the city, and take walking + cycling as the main travel mode in the unit. In the central urban area, it is suggested to establish a rail transit system to relieve the traffic pressure. In the surrounding cluster urban areas, it is suggested to develop medium volume urban rail transit systems such as light rail transit, so as to ensure the rapid connection between the surrounding urban areas and the central urban areas and support the development of the new city.

As a typical domestic megacity, Nanjing has formed a multiple public transport network system with rail transit as the backbone, ground public transport as the network, other public transport modes as the extension and supplement, and multiple transport modes seamlessly connected, realizing the convenient transfer of airport, high-speed rail and urban rail transit (Figure 2). By 2017, the share of public transport in the central urban area in motorized travel has reached 63.1%. The city's daily average passenger transport is about 5.3 million, an increase of 1.18 million compared with 2012, and the urban congestion situation has declined significantly. In order to give full play to the positive role of bicycles in medium and short distance travel and effectively solve the "last kilometer" travel problem, Nanjing actively developed public bicycles, and by 2017, 2333 service outlets had been built and 93035 public bicycles had been put into use.

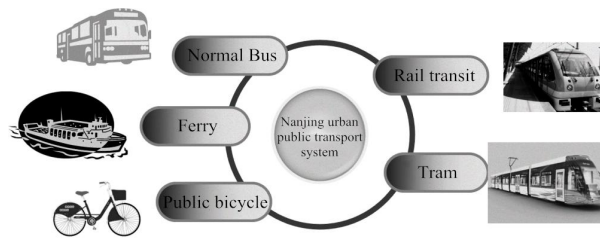


Figure 2: Public transport travel system of Nanjing.

2.3. Large Cities

The traffic development mode of large cities should be "rail transit / BRT + bicycle + walking". If conditions permit, large capacity rail transit can be built along the main passenger flow channels. Form a public transport service system with BRT as the backbone, conventional public transport as the leading, clear functional level, reasonable network layout and convenient travel. Reasonably guide the development of private cars, pay attention to the construction and improvement of slow traffic system, and actively create conditions for walking and cycling.

Rail transit or bus trunk line (BRT, grand rapid train) can provide strong road transportation capacity, and should be the main mode of transportation between the urban areas of the cluster; rail transit and bus trunk line (BRT, large station express, general bus trunk line) connect the passenger flow distribution points of each urban area of the cluster. Along the main travel direction of the city, bus lanes and medium volume, ordinary speed light rail transit are set as the main traffic corridors. Formulate and gradually implement relevant policies and measures of "public transport priority", improve the adaptability of public transport, and form a BRT network system.

In recent years, driven by the new urbanization, Ningbo City has continuously improved the urban public transport system, vigorously promoted the competitiveness and service level of public transport, coordinated public transport and other modes of transport, and established the dominant position of public transport in the urban transport system of Ningbo. Vigorously promote the construction of rail transit, introduce the medium volume public transport system, gradually establish the "fast, dry and support" network system of the conventional public transport network, straighten out the functions of the public transport network at all levels, and form the "four in one" urban public transport system with rail transit as the backbone, conventional public transport as the main body, taxi as the supplement, and public bicycle as the extension. As of 2017, the share rate of motorized travel of public transport is 51.5%, the coverage rate of 500 meters of public transport stations is 93.2%, and the average operating speed of buses and trolleybuses in the morning and evening peak is 15.67 km/h. It effectively improves the efficiency of passenger travel, and passenger satisfaction reaches 87.8%.

2.4. Medium-sized and Small Cities

Medium-sized and small cities are usually characterized by compact overall spatial structure and high degree of land mixed use. Therefore, the traffic development mode of medium-sized and small cities should be based on "conventional public transport + bicycle + walking", and the traffic resources should be inclined to pedestrians and bicycles; in addition, the main channels of the city should be connected by road public transport. Actively create eco city unit as the basic unit of the city.

As the first batch of transit metropolis construction cities in the 13th five year plan, Xuchang City has built a green travel system of "four in one" of public transport (including ground bus and water bus) + public bicycle + walking. As of June 2017, the coverage rate of bus stops in Xuchang City, the access rate of buses and trolleybuses, and the urban-rural public transport operation rate have reached 100%, achieving three "percentages". In Xuchang City, the annual passenger traffic volume of surface bus is 49.01 million person times, that of water bus is 320000 person times, and that of public bicycle is 4.43 million person times. Green travel has become the main travel mode of Xuchang city residents.

2.5. Urban Agglomeration

Urban agglomerations refer to a number of cities of different natures, types and grades in a specific region, which are formed by a certain natural historical environment and economic development mechanism with 1-2 mega cities or above as the core, and through the connection of comprehensive transportation network, the interdependent relationship is formed, and it is increasingly becoming an urban aggregate with economic development, win-win cooperation, complementary advantages, strong industrial relevance and close commercial and trade relations.

The public transportation of each city in the urban agglomeration mainly includes regular bus and trolley, tram, BRT, medium and large volume of rapid rail transit, as well as customized public transport, taxi, cable car and other means of transportation and supporting facilities. Various public transport modes serve passengers at different speeds, carrying capacity, comfort levels and prices to meet the travel needs of different passengers. In addition, cities in the urban agglomeration are connected by intercity transportation. As an important mode of intercity transportation, intercity rail transit has incomparable advantages in speed, comfort, operation mode and convenience in the development of urban agglomerations, such as railway trunk lines and road public transportation, which has become the key to solve the current traffic problems between urban agglomerations. The advantages of intercity rail transit mainly include: high speed, high comfort, good safety, low freight, energy conservation and environmental protection. Specifically, intercity rail transit can effectively save travelers' travel costs; reduce traffic accidents; save land resources and effectively protect cultivated land; save energy and effectively improve energy utilization; reduce air pollution, reduce environmental noise and effectively protect the environment. It can realize "one hour commuting circle" and "half hour commuting circle" of urban agglomeration. At present, Beijing Tianjin Hebei, Yangtze River Delta, Pearl River Delta and other urban agglomerations have initially realized the "one hour commuter circle" connected by intercity rail transit.

As an important part of urban agglomeration development planning, intercity rail transit plays an important guiding role in the development of urban agglomeration. Therefore, it is necessary to make intercity rail transit planning, coordinate with the overall planning of urban agglomeration, truly play the role of intercity rail transit, support and guide the development of urban agglomeration[2]. According to the guiding opinions on promoting the development of urban (suburban) railway issued by the national development and Reform Commission, by 2020, the main lines of urban (suburban) railway will be basically formed in the super large and mega cities in the economically developed areas such as Beijing, Tianjin, Hebei, Yangtze River Delta, Pearl River Delta, the middle reaches of the Yangtze River, Chengdu and Chongqing, as well as the big cities with conditions, and the one hour commuter circle from the core area to the surrounding main area will be constructed[3].

3. Guarantee Mechanism

3.1. Improve the Top-level System Design and Strengthen Legal Protection

Firmly establish the concept of public transport priority development, and adhere to highlight the public welfare of urban public transport. Based on urging the operation enterprises to implement the main responsibility and give full play to the supervision and management responsibility of the departments, strengthen the top-level system design and research, do a good job in the reform of public transport management institutions from the level of national ministries and commissions, rationalize and clarify the work responsibilities of all relevant departments. Form policies and systems covering planning, construction, management, finance, operation, supervision and other aspects to ensure the long-term and sustainable development of public transport priority.

Accelerate the national level legislation of urban public transport industry, so as to realize and guarantee the management of the industry in accordance with the law, effectively and uniformly. For example, relevant laws and regulations such as regulations on urban public transport management and guidance on pricing and price adjustment of public transport fares should be issued as soon as possible to provide policy support for the development of local urban public transport.

3.2. Strengthen the Construction of Public Transport Infrastructure to Ensure the Priority of Public Transport

In urban construction, the government needs to bring public transport stations and supporting facilities into the old city reconstruction and new city construction planning. When planning the main urban roads, major projects such as harbor type stops, railway stations, long-distance bus stations, passenger transport hubs, residential quarters and large-scale public venues should be planned and constructed simultaneously. It is necessary to take the construction of public transport stations as the important supporting facilities of the project for synchronous design, construction, completion and delivery. The urban public transport is fully demonstrated, and the comprehensive design is carried out from the aspects of time-saving, high efficiency, low-carbon and energy saving, so as to further determine the optimization target of the optimal bus route model.

The competent administrative department and the traffic management department shall cooperate closely, make overall planning, and scientifically set up bus lanes, intersection lanes and one-way priority lanes. To quickly divert people, facilitate people's travel, reduce road pressure, alleviate urban traffic congestion, improve the operation speed of public transport vehicles and the utilization rate of road resources; issue relevant policies to guide the rational use of cars, reasonably control car ownership and travel volume; improve the public transport intelligent management system, strengthen the monitoring of urban public transport lanes, and legally occupy urban public transport. Vehicles on the special lane shall be punished to improve the operation speed and punctuality rate of urban public transport vehicles[4]. Improve the planning and implementation of slow traffic systems such as bicycle lanes and sidewalks.

3.3. Should Further Strengthen Policy Support and Actively Promote the Comprehensive Utilization and Development of Public Transport Land

In view of the social welfare undertaken by the public transport operation enterprises and the expenditure incurred by completing the tasks stipulated by the government, special economic compensation shall be made for them. Through the establishment of standardized cost regulation and policy loss evaluation system, the compensation amount of policies is calculated, issued, audited and supervised, so as to ensure that public transport special funds play their due role. The linkage

mechanism of bus and trolley bus fare system, operator operation cost and government subsidy, and the improvement of multi-level and differentiated bus fare system should be established and improved. Priority shall be given to the land for parking lot, dispatching center, transfer hub and other places determined by urban public transport planning, and the land use shall not be squeezed or changed at will.

The comprehensive development and utilization of public transport land is not only conducive to invigorating the efficiency of land use, improving the level of land conservation and intensification, but also specifically defining the benefits of the comprehensive development of public transport land for the construction of public transport infrastructure and making up for operational losses, which is one of the important contents of establishing the sustainable development mechanism of public transport. At the national level, measures for the comprehensive development of urban public transport land and the management of infrastructure planning and construction should be promulgated as soon as possible to provide normative basis for the development and utilization of local urban public transport land and infrastructure construction.

3.4. Establish a Public Participation Sharing Mechanism and Improve the Public Transport Supervision System

Through the establishment of public transport passenger Committee and other relevant social organizations, which are mainly composed of passengers, operation management units, planning departments and government personnel, public opinions are widely collected specifically for urban public transport problems, urban public transport travel research is actively carried out, and public transport operation service supervision is strengthened. It is necessary to institutionalize and normalize public transport services into the community, "public transport service network face-to-face" and other activities, and form a normal mechanism to listen to public opinions and serve the people's livelihood.

4. Conclusions

In the more than 100 years since the birth of China's urban public transport, it has been developing around the problem of "solving urban travel", and it has also been in a passive development mode. "Driving along the road" is the planning mode of China's urban public transport for many years. Although it has solved the problem of urban travel to a certain extent, it has not actively guided the urban development. With the deepening of the construction of new urbanization in China, the urban development model guided by public transport conforms to the people-centered scientific concept of development, by changing the traditional passive development, planning and implementing urban public transport with the development concept of innovation, coordination, green, opening and sharing, developing public transport in coordination with local conditions, and improving the development guarantee mechanism of urban public transport, it can effectively promote the economic development and social stability of China's cities, and improve the quality of life and happiness index of urban residents.

Acknowledgments

This study was supported by the National Key Research and Development Program of China (No. 2018YFB1600900).

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