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Integrated Development Strategy of Rail Transit and Conventional Public Transport in Chongqing

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Abstract

In recent years, Chongqing has developed rapidly, the population has maintained steady growth, and the demand for public transportation has also increased simultaneously. The achievements of infrastructure construction are difficult to meet today's high-quality travel needs. The public transportation system has not formed a unified organic whole. It brought a lot of inconvenience and caused some economic losses. Therefore, it is urgent to explore new concepts of public transportation development and to study new ways of rail transportation and conventional public transportation. This paper firstly re-understands the integration of public transport, then analyzes the status quo of public transport in Chongqing and the problems existing in the integration of rail transit and conventional public transport, and finally combines the integration plan of public transport in Singapore to provide new ideas for the integrated development of rail transit and conventional public transport in Chongqing.

Keywords

Rail Transit; Conventional Public Transport; Integration; Strategy.

1. Introduction

As the process of urbanization continues to accelerate, the urban population has maintained a steady growth, and the demand for public transportation has also increased significantly. The imbalance between residents' travel demand and public transportation supply has brought many inconveniences to people's daily travel. Under the priority development strategy of public transport, my country's urban public transport infrastructure construction has achieved satisfactory results, but it has not brought a qualitative leap to the development of our urban public transport, and the development of public transport still faces huge challenges. There is an obvious competitive relationship within the system, and a unified organic whole has not been formed [1]. Therefore, under the increasing travel demand of the people, especially under the current demand for high-quality travel, it is necessary to deepen the supply-side structural reform, explore new concepts of public transportation development, and coordinate various modes of transportation, so as to achieve common progress. The current urban public transportation development needs to be solved urgently [2].

2. Urban Public Transport Integration

2.1 Integrated Connotation

The essence of the integration of urban public transportation is to coordinate the operation and management departments at all levels to organically combine, share and connect various transportation modes in the urban public transportation system by means of technology and management, so as to develop public transportation and realize the public transportation system. Overall cooperation, maximized benefits [3]. Specifically, it includes the integration of resources in technology, management, policy, information and supporting facilities, and the organic combination

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of station construction, business structure, vehicle operation, line network planning, management system, etc. The convenience of life and the harmony of urban development [4]. The integration of urban public transport is a necessary condition for the realization of goals such as facilitating citizens' travel, reducing congestion, saving resources, protecting the environment, coordinating urban development, and building a comprehensive transportation system.

The integration of urban rail transit and conventional public transport is a specific form of urban public transport integration, which makes the two most common and important modes of transportation in the urban public transport system organically coordinated and combined through the use of corresponding technical management methods. To achieve the best overall effect level [5]. Through coordination, the two realize the "four-in-one" development strategy, that is, the integration of network, facilities, ticketing and management [6]. Combined with the current development prospects of public transportation in most cities, with rail transit as the backbone and conventional public transportation as the network, coordination and cooperation, timely evacuation, and efficient operation will eventually form an integrated public transportation system with perfect structure and matching transportation capacity and demand. The transportation network will be the preferred development mode for most cities in the future.

2.2 Integrated Content

In order to ensure the operational speed, operational capability, service level, reliability of quality and operational effectiveness of urban public transport integration, urban public transport integration should include policy mechanisms, planning and design, line network facilities, information sharing, operation management, etc. elements, which are combined to form a complete urban public transport integration.

2.2.1 Integration of Policy Mechanisms

The integration of policies and mechanisms aims to break down industry barriers and unify standards. In terms of policy, a unified standard should be implemented for urban public transportation to avoid unfair competition due to inconsistencies in conventional public transportation, rail transit operation methods, and preferential policies [7]. Specifically, it includes unified technical management specifications, unified laws and regulations, unified industry standards, etc.

2.2.2Integration of Planning and Design

The integration of planning and design is to break the separate planning of various transportation modes in the past in planning and design, and form an interrelated and overall planning layout to avoid planning inconsistencies such as ignoring the planning of stations for connecting buses in rail transit planning.

2.2.3 Integration of Line and Network Facilities

The integration of the line and network is to give full play to the advantages of each public transportation mode, such as the backbone role of rail transit, to adopt layers and grading to the line network, optimize and adjust the bus line network, establish an integrated, multi-level bus line network, adapt to different Demand for public transport on the scale of passenger flow [8].

The main purpose of facility integration is to achieve rapid transfer, and to shorten transfer distance, reduce transfer time, and improve transfer efficiency through well-functioning public transport transfer facilities and various transfer guide signs.

2.2.4 Integration of Information Sharing

The integration of information sharing is based on the existing traffic information infrastructure, with the purpose of providing real and reliable traffic information, unified management of traffic information and integration of resources, and the establishment of an integrated information collection, information management and information service platform.

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2.2.5 Integration of Operation Management

The formulation of reasonable ticket system fares plays a vital role in the entire urban public transportation charging system, which can improve the overall level of the management of the charging system and improve the attractiveness of public transportation. It should be combined with the actual economic and social development of the city, and with reference to the development experience at home and abroad, to formulate a ticket system and fare management policy that is conducive to the development of urban public transport.

Matching capacity and coordinating scheduling. Transport capacity matching means that the transport capacity of urban public transport should match the corresponding passenger flow in the city. Especially in the peak period of daily passenger flow, the matching of transportation capacity is helpful for the efficient and smooth flow of passengers [9]. The matching of urban rail transit and conventional bus transport capacity means that when conventional bus attracts and evacuates passenger flow for urban rail transit, it should match its own transport capacity and rail transit transfer volume, so as to facilitate the timely transportation of passenger flow and meet residents' transfer needs. As the most common technical means, dispatch coordination is widely used, aiming to realize the punctuality and effectiveness of urban public transportation operation by using advanced scientific and technological information technology. The coordination of rail transit and conventional bus dispatch should be to make conventional bus dispatch cooperate with rail transit, minimize the time for passengers to walk to the station and wait time, and try to ensure the continuity and smoothness of the passenger transfer process.

Unified management mechanism. The development of various transportation modes in the urban public transportation system is disconnected from each other, and the coordination between various departments is not coordinated. The specific manifestations include line layout, station layout, operation management, etc., which will affect the coordinated development of various transportation modes, and will bring more customers The negative consequences of the reduction of resources and the promotion of the rise of private cars [10]. Therefore, a unified management mechanism can coordinate and integrate the relationship between urban public transportation in the process of planning, design, operation and management, so that the integrated development of urban public transportation can be implemented smoothly and effectively.

3. Analysis of Chongqing Public Transportation Integration

3.1 Status of Public Transport

The forms of public transportation in Chongqing are complex and diverse, including buses, monorails, subways, river-crossing cableways, escalators, elevators, and river-crossing ferries, among which rail transit and conventional public transportation are the main means of transportation.

As of 2019, there are 8 rail transit lines (sections) in the central urban area of Chongqing, with an operating mileage of 328.5 kilometers. The average daily passenger volume of rail transit is 2.854 million, a year-on-year increase of 21.4%, and the sharing rate is 18.0%, a year-on-year increase of 1.7% ; 9338 buses, an increase of 122 year-on-year, 799 bus lines, an increase of 22 year-on-year, the average daily passenger volume of buses was 4.83 million, a year-on-year decrease of 2.1%, and the sharing rate was 40.5%, a year-on-year decrease of 1.6%.

Through data analysis, with the growth of individual motor vehicle trips in cities, the sharing rate of rail transit shows an upward trend, and the sharing rate of conventional public transport shows a downward trend.

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3.2 Public Transport Integration Issues

3.2.1 The Conventional Bus Station System is Unreasonable, and Some Rail Stations Lack Conventional Bus Interchange Stations

In the existing rail lines, there are no conventional bus stops or bus stops within 500 meters around some rail stations, which become "blind areas" for rail and bus interchange, which seriously affects the integrated development of urban rail and public transport.

The proportion of bus stops for transfer with rail is small, and there are less than 3 bus stops that can be transferred to each rail station. A conventional bus stop system with a reasonable hierarchy of hub stations, first and last stations, parking lots, and stops has not yet been formed. Community buses that need to rely on bus stops cannot be networked, thus affecting the travel of the last 1 kilometer of rail transit.

3.2.2 The Positioning of Bus Stops is Inaccurate, and a Large Number of Stops Need to Assume the Function of the First And Last Lines

More than 1/4 of the rail transfer bus stops need to undertake the function of departure, which exceeds the design capacity of general stops, and there are a large number of on-street parking phenomena, which are easy to affect the passage of other social vehicles, and their scale functions need to be improved.

Most bus stops and rail stations are connected in a separate way, and the degree of integrated transfer is low. The average transfer time of rail buses is more than 3 minutes, and the transfer convenience is low, resulting in direct transfer from bus stations to rail stations. There are fewer passengers, the transfer rate is low, and the overall satisfaction is low.

3.2.3 The Particularity of the Attributes of Mountain Cities

The terrain of mountainous cities has a great influence on passengers' transfer. The average transfer distance of rail buses is 211 meters. Compared with other cities, the transfer distance is within a reasonable range. However, due to the particularity of Chongqing's mountainous cities, a large part of rail stations It is built deep underground, with a burial depth of even more than 60 meters. Including the walking distance in the rail station, the actual transfer distance may exceed 500 meters. For a rail station that does not plan an integrated transfer, it will seriously affect the transfer of passengers. Passenger satisfaction and transfer rate.

3.3 Analysis on the Integration of Public Transport

3.3.1 Planning and Design Stage

The guiding ideology is not perfect. Due to the late start of rail construction in my country, there is a lack of planning and design experience, as well as related theoretical support and normative guidance. Most of the foreign classic cases are used for reference, and there is a lack of domestic direct experience, and there is little qualitative analysis.

Inconsistency between transportation planning and land development. The TOD model has not been effectively implemented. Under the adjustment of the urban spatial structure, the synchronous optimization of the functional layout has not been achieved, and the tidal phenomenon has become more and more serious.

The transfer facilities are not in place and the layout is unreasonable. The proportion of the overall number of bus stops is relatively low, the number of harbor-style stops is insufficient, the transfer methods are mostly separated, the transfer rate is low, the transfer distance is long, the time is long, the area is small, and the satisfaction is low [4].

Not enough attention has been paid to the "door-to-door" travel chain. The public transport travel chain is incomplete and does not solve the "last mile" problem.

3.3.2 Operation and Management Stage

The operation management system is not unified. The operating enterprises of various modes of transportation are independent of each other, and the operation and management of rail transit and

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conventional public transport belong to different governments and enterprises. Taking Chongqing as an example, both the public transport group and the rail group belong to Chongqing Urban Transport Development and Investment (Group) Co., Ltd., and both parties aim to obtain maximum benefits, which objectively makes it difficult to integrate the rail network and the conventional public transport network. As a basic livelihood project, public transportation construction has social benefits and should be evaluated based on national economic indicators.

The public transportation construction, operation and management system is not perfect, and the marketization is insufficient. The "government-led" model causes losses, increases the financial burden, and further restricts the development of public transport. The "market-led" model lacks supervision and assessment mechanisms, making it difficult to improve service levels.

There is no coordination between conventional bus and rail transit. Departure times do not match, conventional bus speed is slow, punctuality is low, comfort is poor, transfer convenience is poor, overall service level is low, and overall attractiveness is insufficient.

4. Singapore Case

4.1 City Profile

Singapore is an important re-export port in the world and an aviation center connecting Asia, Europe, Africa and Oceania. With its geographical advantages, Singapore has become one of the important financial, service and shipping centers in Asia. The city's population density ranks third in the world, and its global economic competitiveness ranks in the top three for seven consecutive years. It is the fourth largest international financial center after London, New York and Hong Kong, and the most livable city in Asia.

4.2 Public Transportation Status

As of 2016, Singapore's rail system has opened 5 subway lines, with more than 120 subway stations, the line is more than 180 kilometers long, and 3 light rail lines have been opened, with more than 40 light rail stations, and the line is more than 30 kilometers long. There are more than 350 bus routes, more than 5,000 buses operating more than 4,000 kilometers, and more than 25,000 taxis. Formed a public transport system framework in which the subway serves medium and long-distance travel, the light rail serves community-connected travel, buses fill the gaps and deficiencies of rail travel, and taxis provide point-to-point personalized services. In 2016, the peak hours of public transportation in Singapore The traffic sharing rate is as high as 66%, and in 2020 this proportion is 75%.

4.3 The Idea of Public Transportation Integration

4.3.1 Policy Integration

Adhere to the development concept of TOD. Singapore is the first city in the world to realize bus-guided development in planning. Important rail transit stations have been built into neighborhood commercial centers with mixed functions, and the transfer stations of conventional bus systems are also within walking distance around the rail stations.

Transit priority policy. On the one hand, traffic demand management is carried out to reduce the travel of private cars, including the implementation of policies such as the vehicle ownership certificate system, congestion charging, and tax and fee adjustment to promote the development of public transport. On the other hand, oriented to the needs of residents, it will continuously improve the public transport system, provide humanized services, and meet the needs of residents.

other relevant policies. Singapore adopts the unique approach of mutual shareholding between the MRT and conventional bus companies (SMRT and SBS), which integrates the interests of the MRT and conventional buses in a mechanism to ensure the implementation of an integrated public transport network.

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4.3.2 Facility Integration

The transfer route is covered with covered corridors, providing timely and accurate departure information and an efficient transfer system, inducing transfer, ensuring pedestrian priority and a wealth of personal mobility tools to serve the "last mile" travel needs.

4.3.3 Management Integration

The core of the reform plan for Singapore's public transport system is to outsource some of the bus services after the two large monopoly companies, namely the Singapore Mass Transit Corporation (SMRT) and SBS Transit Corporation (SBS), have their bus operating licenses expired. Gradually transform the original market-led behavior into a public-private partnership system.

4.4 Effectiveness

According to McKinsey & Company's survey results, from the perspective of infrastructure availability, financial feasibility, effectiveness, convenience and safety, the world's most developed city is Singapore, followed by Paris and Hong Kong. Its public transportation system has high accessibility, high efficiency, high sharing rate, high satisfaction, and is a veritable public transportation city.

4.5 Revelation

Integrated planning and construction management. Multi-department coordination, and strive to integrate transportation planning and land development, so as to maximize benefits.

Moderate traffic demand management. Historical experience has proved that the construction of infrastructure can never meet the growing demand for motor vehicles.

Prioritize the development of public transport. Almost all big cities in China have the phenomenon of high population density and large scale of land use. It has become an inevitable choice to give priority to the development of public transportation.

5. Chongqing Public Transportation Integrated Development Strategy

5.1 Planning and Design Stage

Integrated design of transportation planning and land development. The transportation planning and land development are carried out simultaneously, and the urban public transportation framework is comprehensively constructed from points, lines, surfaces, bodies and qualities, forming an integrated public transportation system with rail transit as the skeleton, conventional public transportation as the network, and slow traffic as the extension.

Facility design integration. The integrated design of facilities such as pedestrian bridges, underground passages, aerial corridors, and rain shelters shortens the psychological distance of transfers. Refinement design of stations, optimization of the number and location of entrances and exits, consideration of slow traffic, integrated design of slow traffic, and shortening of the physical distance of transfers.

Prioritize the development of public transport. Build P+R parking lots, guide bus travel, optimize "alley bus", and solve the "last mile" problem.

5.2 Operation and Management Stage

new development model. Some services are outsourced by bidding to provide humanized and personalized services; the public transport group and the rail group hold mutual shares to form a community of interests.

Develop a public transportation information system. Integrate passenger travel information, public transportation management and control information, and public transportation operation information, and establish a unified information collection, management and service platform to realize travel information sharing.

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Integrated ticket system and fare system. To optimize the operation timetable, the charging system of "swipe card for travel and daily settlement" can be adopted, and dynamic and integrated adjustment can be adopted.

Integrate various transportation resources to create a MaaS system.

6. Conclusion

By analyzing the status quo of public transportation in Chongqing and the problems existing in the integration of rail transit and conventional public transportation, this paper provides new ideas for the development of public transportation in Chongqing from the aspects of planning, design, operation, and management, combined with the integration plan of Singapore.

Under the people's growing demand for high-quality travel, deepen the supply-side structural reform, adhere to the people-oriented development concept, and aim to improve the level of public transport services and improve the quality of passenger travel, so as to guide public transport travel and ease urban traffic congestion.

References

[1] Wu Yi. (2005). The core issue of urban public transport integration. Traffic and Transportation (3), 1.

[2] Yang Juan. Research on the Integrated Development of Urban Public Transport. (Doctoral dissertation, Chang'an University).

[3] Li Bin. (2020). Research on urban public transportation development strategy based on the concept of integration. Transportation World (1), 2.

[4] Zhang Lixin, ZHANG, LixinChongqing, Transportation, Pivot, & Group, etc. (2012). The Integrated Development Strategy of Chongqing Public Transportation. Journal of Chongqing University, S1(v.35), 112-114.

[5] None. (2020). Accelerate the integrated construction of urban transportation and build a convenient and convenient commuting service. Ningbo Communication.

[6] Qian Linbo, Chen Yang, & Luo Hang. (2022). Dynamically constructing a bus and rail transit integrated service system. (4).

[7] Wang Yichao. (2018). The Exploration and Practice of Singapore's Public Transport Integrated Planning System in China. Sharing and Quality - Proceedings of the 2018 China Urban Planning Annual Conference (06 Urban Transport Planning).

[8] Yang Pingru, Chen Jian, & Tang Xi. (2018). Adaptability Analysis of Transfer Between Conventional Bus and Rail Transit in Chongqing. Transportation Enterprise Management, 33(4), 3.

[9] Li Fangyu. (2017). Practice of Chongqing Urban Public Transport Integration. Urban Public Transport (12), 5.

[10] Wang Yuanyuan. (2016). Integration and enlightenment of German urban public transportation. Transportation Enterprise Management, 31(9), 2.