

Guangzhou Transportation Development Strategies for 2035

ZHOU Zhihua, JING Guosheng

Guangzhou Transport Planning Research Institute, Guangzhou 510030, Guangdong Province, China

Abstract: It is important to quickly identify and learn from major transportation problems during the different development stage of a city, which helps to clarify the correct strategy development direction and to move forward with a uniform platform. Based on the current and future strategy development needs, this paper summarizes the impact of the last two rounds of transportation development strategy on cities, and the requirement of urban development in the new era. The paper refines the problems in five aspects: city comprehensive transportation hub, traffic network, public finance, institution, and new technology, which are used as references for the Guangzhou strategic transportation planning. Guangzhou is in an important transition period from “mobility-based” to “place-based” development. It is necessary to focus on upgrading the capacity of urban transportation hubs, improving road users’ travel experience, ensuring the sustainable development of public finance, establishing high-quality institutional operation, and taking advantage of new transportation technologies to promote the transformation of Guangzhou’s transportation from high-speed development to high-quality development. **DOI:** 10.13813/j.cn11-5141/u.2019.0102-en

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To solve the problem of how to choose urban transportation development direction in different development stages, cities usually start with a clear vision and seek the path to achieve the vision, then clarify the policy framework and propose solutions, and finally point out the direction for urban transportation planning, construction and management. This is what transportation strategy studies and its core is the issue of value judgment and selection. Strategy has always been considered to be visionary and impractical. It is not in the statutory planning system and is often mistaken as a concept or blueprint which is not valued. At the actual operational level, because the judgment on the urban transportation development stage is unclear, the key development points are not grasped. When the strategy is treated as a part of urban planning with the intention to cover everything without emphasis, the strategy loses its expected power.

1 Urban transportation development stages

Based on the analysis of the history of transportation development in most cities in China, urban transportation development can be divided into three stages (see Figure 1). 1) Car-based stage. In the early days of urbanization, the government has limited budget. In order to meet the development needs of the traditional manufacturing industry, the focus of transportation development is road traffic with the

main skeleton road network being rapidly built to meet the car-driving needs of 20% population. 2) Motorization-based stage. In this stage, with the development of modern service industry and the increasing demand for motorized travel, how to balance fairness and efficiency is the primary issue. The development of public transportation, led by rail transit, has become the key to meet the motorized travel demand of 60% population. 3) Place-based stage. In this stage, the transportation infrastructure is basically completed. Under the requirements of high-quality development, urban functions must be centered on the transportation infrastructure space layout. Improving travel services is the primary issue, and it is necessary to satisfy everyone’s sense of identity and belonging to transportation space. The first two stages mainly focus on the active supply of transportation infrastructure, with the emphasis to provide transportation to the three major urban functions of work, residence and recreation. The third stage is a stage in which the transportation infrastructure has basically shaped. The formation of urban spatial structure and the allocation of resource elements need to be carried out around transportation infrastructure, and transportation needs to be developed with high quality. Furthermore, more attention is paid to service quality. Most cities in China, including Guangzhou, are currently in the second stage, which are committed to meeting the spatial movement needs of people and goods and to solving urban issues such as traffic congestion.

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First author: ZHOU Zhihua (1978–), male, from Jingjiang, Jiangsu Province, senior engineer, registered urban planner, is mainly engaged in the research on comprehensive transportation planning. E-mail: 382360095@qq.com

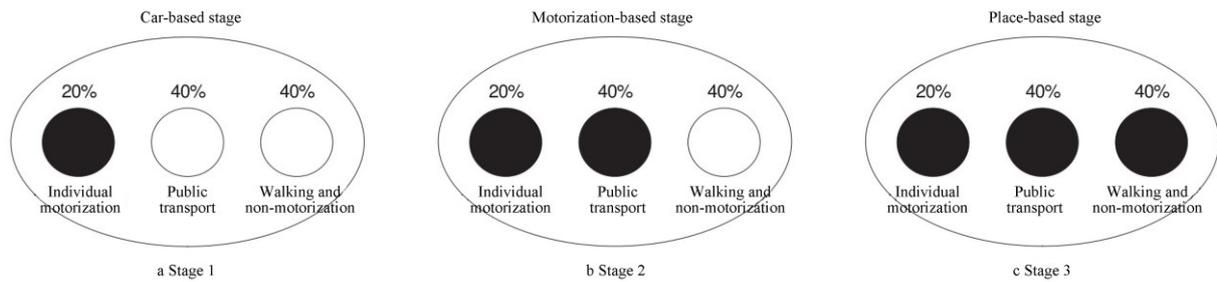


Figure 1 Three stages of urban transportation development

2 The impact of the past two rounds of transportation strategic planning on Guangzhou

The past two rounds of transportation strategic planning of Guangzhou have a profound impact on urban transportation development, and have directly laid the urban spatial pattern of Guangzhou. The first transportation strategic planning occurred in 1993. Faced with the traffic pressure brought by rapid motorization, the government chose to build roads vigorously to fill the gap between travel demand and road supply (see figure 2). Based on the concept of separating fast and slow traffic flows, a group of rapid road networks, represented by “inner ring road + seven radial roads”, were built, which solved the road congestion issue effectively at that time. The average speed of motorized vehicles in the main urban area increased from 18 km/h to 33 km/h^[1]. At the same time, it also changed the one-way expansion mode of the city along the Pearl River to the east, promoted the multi-axial expansion of the city along the radial roads, and formed three circles in space,^[2] so that Guangzhou could plan a greater development in a wider urban space.

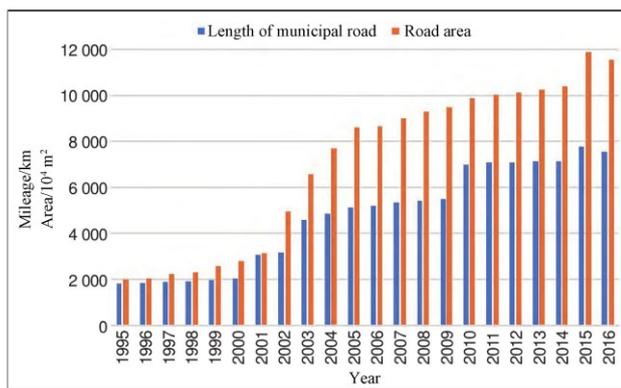


Figure 2 Road mileage change in Guangzhou

Source: Literature [4].

The second transportation strategic planning occurred around 2006. In the context of the rapid development of urbanization in China, the population of Guangzhou has increased substantially (see figure 3), and the old model of relying on road traffic to solve urban transportation problems was no longer sustainable. At the same time, the focus of

urban development has also changed from the original policy of “expanding to the east and south, optimizing in the north, and connecting to the west” to the policy of “expanding to the east and south, optimizing in the north, connecting to the west and adjusting in the central”, paying more attention to the optimization and improvement of the main urban area. In this context, Guangzhou chose rail transit as the starting point, and built a 390 km rail transit network. This rail transit network not only keeps the urban transportation service level above 20 km/h⁻¹ for a long time, but also reshapes the urban space. It transforms the city from the flat expansion mode of the motor vehicle era to the intensive expansion mode along rail transit hubs and corridors, forming a new urban development axis. While accelerating the transformation of the urban core area, it also changes the interconnections of land along the rail transit, improves the land complementary effect, and has an important impact on the land value^[3].

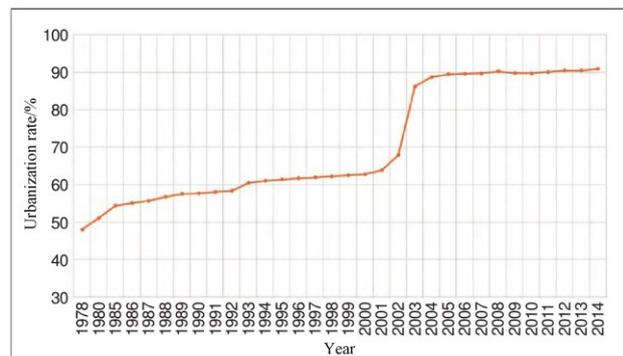


Figure 3 Proportion changes of non-agricultural households in Guangzhou

Source: Based on the Guangzhou Statistical Yearbook.

After nearly 30 years of rapid development, Guangzhou has achieved good results in the level of external traffic and urban transportation network. In 2017, Guangzhou’s permanent population was 14.5 million with the GDP of 2.15 trillion yuan. The annual passenger traffic of Baiyun International Airport was 65.84 million·a⁻¹, ranking the 13th in the world; the airport cargo throughput was about 1.78 million t·a⁻¹, ranking the 17th in the world; the port cargo throughput was about 590 million t·a⁻¹, ranking the 5th in the world; the container throughput was 20.37 million TEU·a⁻¹, ranking the 7th in the world^[4]. The total number of railway

passengers was 115 million·a⁻¹, with the freight volume of 51.21 million t·a⁻¹. The total length of urban expressways and intercity highways was as high as 1 429 km, and the network density was at the same level as that of New York and Tokyo. Eleven subway lines were opened, with a total mileage of 390 km, an average daily passenger volume of 7.68 million·d⁻¹ and an average passenger intensity of 21 200·km⁻¹·d⁻¹. The share of public transits among motorized trips have been maintained at about 60% all the year round, and the average speed during evening rush hours on the major roads in the central urban area have been maintained above 20 km·h⁻¹ for years. In terms of various evaluation indicators of global cities, the traffic indicators of Guangzhou showed obvious development advantages^[5], which indicates that Guangzhou is taking the lead in solving the traditional spatial mobility issue of people and goods. As the urban development in Guangzhou becomes more mature, there is less room for new roads and rail transit. Therefore, how to make use of existing transportation facilities effectively and guide the optimization of urban spatial structure around transportation facilities has become an important issue.

3 Questions and thoughts

In the new era, the traditional travel demand and transportation service modes have changed, and the level of demand for transportation is becoming higher and higher. In other words, the demand for transportation has shifted from the realization of functions to the pursuit of high-quality services, and the transportation products have also changed from large-scale and mass production to private customization. The transportation system in Guangzhou is in the period of shifting from the motorization-based stage to the place-based stage, and from high speed development to high-quality development. Externally, Guangzhou needs to link to the world's urban network, so as to become an important global transportation hub, and capture new opportunities for its development. Internally, Guangzhou needs to meet the daily work and living needs of 25 million people, eliminate the imbalance and inadequacy in the development of transportation, and build a smooth transportation system that is accessible to everyone, so that everyone can enjoy the beauty of city life while traveling.

3.1 Solving the mismatching between external transportation hubs and urban development

1) Airport

In the context of building Guangzhou as a dynamic global city, Guangzhou Airport is confronted with the problem of insufficient internationalization and insufficient capacity. Guangzhou Baiyun International Airport is not among the top 50 airports by the international connectivity index and its international destinations are less than 50% of that for Hong Kong International Airport (137). The internal service level and transfer efficiency are still far from the world's top

airports. Therefore, it is urgent to improve the international level of Guangzhou Baiyun International Airport, which requires the joint efforts of the airport, airlines and the city government to promote the upgrade of airport's energy level. In addition, it is predicted that the future supply and demand gap will be about 60 million passengers·a⁻¹, and at least one more large airport will need to be built^[6]. From the analysis of existing airports, the maximum passenger throughput of a single airport should not exceed 90 million passengers·a⁻¹; otherwise the operational efficiency of the airport will be greatly reduced. Considering that the construction cycle of a large airport usually exceeds 10 years, Guangzhou must now start the planning and site selection of the second airport, and strive to obtain the project approval before Guangzhou Baiyun International Airport's passenger throughput reaches 80 million passengers·a⁻¹(2020).

2) Port

Guangzhou Port faces the problem of how to transform and upgrade from big quantity to high quality. Guangzhou Port containers have always been dominated by China, Southeast Asia and Africa shipping routes, in which China's shipping routes accounted for about 62.6%^[7]. The hinterland resources are a big advantage, but Guangzhou Port does not have sufficient global routes, far behind Hong Kong and Shenzhen Port. Obvious defects exist in the comprehensive business environment, including shipping agencies, finance, ship management and maritime law (The 2018 Xinhua-Baltic International Shipping Centre Development Index Report shows that Guangzhou Port ranks the 18th). In order to build an international shipping center, Guangzhou has to face the transformation from domestic trade to foreign trade, and from quantity to quality. Through the increase in the foreign trade volume, Guangzhou needs to promote the development of shipping service industry, so as to enhance its discourse power in international shipping. Therefore, it is necessary to seize the opportunities brought by the Belt and Road Initiative and the eastward movement of the international shipping center, and learn from the comprehensive service environment of Hong Kong Port and Singapore Port. Guangzhou should also proactively undertake the spillover shipping business of Hong Kong Port and Shenzhen Port, optimize the port transportation structure, lay out three networks of inland rivers, highways and high-speed rails, and accelerate the construction of inland waterless ports in combination with urban logistics centers.

3) Railway

The railway in Guangzhou is facing the problem of weakened hub status and the difficulty of getting high-speed rails into the city central area. Guangzhou has been relying on the Beijing-Guangzhou corridor to develop the hinterland of central China. The scale of national railways and inter-city railways is relatively insufficient and the density is relatively low. The connection with East China, the eastern coast and Southwest China is not close. Some important corridors

(Beijing–Guangzhou, Guangzhou–Shenzhen–Hong Kong, and Guangzhou–Zhuhai inter-city) are facing problems such as saturated traffic capacity^[8]. In the new national railway master plan, the Beijing–Kowloon high-speed railway and the coastal high-speed railway pass through the east and the south with no direct connections with Guangzhou, and the status of Guangzhou as the southern rail hub is weakening. The new strategic planning proposes to focus on supplementing direct corridors to the Yangtze River Delta and the Chengdu–Chongqing urban agglomeration, introducing the high-speed rails into the city central area, which requires the government to make up its mind to solve the corridor capacity problem. In addition, a railway hub not only is the transportation and transfer center of a city, but should be the city's commercial business center. The existing three major railway stations in Guangzhou are all within 15 km from the city center, and it is difficult for them to support the urban multi-center development pattern. If a new station is built on the outskirts of the city, there will be problems such as whether the station development can match the land use of surrounding areas and how to connect it with the downtown station. From the analysis of foreign cases, the railway station should be integrated into the city, and its main function is to serve the surrounding area within the 5 km range. Therefore, it is very important to greatly increase the probability of completing a trip by one direct transfer with a non-motorization mode, so as to realize the integration between the transportation hub and the city.

3.2 Solving the problem of coordinated development of streets and roads

In recent years, street reconstruction upsurges across the world. During his tenure as mayor of New York, Michael Bloomberg initiated the “street fight” to create more space for walking, cycling or sitting on carefully selected streets. Drawing lines on some streets to distinguish sidewalks, non-motorized lanes and bus lanes makes streets safer and more accessible. However, data shows that traffic congestion on the road network is getting worse. The average speed on the road segment south of the 60th street in Manhattan could maintain at 9.1 miles·h⁻¹ (about 14.6 km·h⁻¹) in 2010, and it was reduced to 7.1 miles·h⁻¹ (about 11.4 km·h⁻¹) in 2017. It was only 5 miles·h⁻¹ (about 8.0 km·h⁻¹) in the busiest area, Midtown Manhattan, which is only slightly faster than the normal walking speed (3.1 miles·h⁻¹, about 5 km·h⁻¹). Such a change is acceptable to New York and London, but it is doubtful whether it is acceptable to most cities. The understandings of fairness are different at different stages of development.

Guangzhou is famous for its elevated roads. In order to solve the problem of road traffic congestion, Guangzhou has long been focusing on the rapid transformation of roads. By establishing continuous traffic flow, purifying vehicle types and taking other measures, Guangzhou improved the speeds on city roads, but did not pay enough attention to street space. Deficiencies exist in the construction of street places, the

safety and cleanliness of the pedestrian system, and the use of street gray space. To solve this problem, it is necessary to have a clear understanding of the development stage of urban transportation and the functional positioning of the facilities to be reconstructed in the citywide road network. The basic network should be sorted out first to ensure the distribution function of the whole network, and then the conversion conditions of streets and roads are analyzed in depth to adopt differentiated strategies for different regions.

3.3 Ensuring the sustainable development of transportation finance

A healthy and affordable transportation system is critical to the sustainable development of a city. Cities such as New York and London are generally facing difficulties in raising funds. Guangzhou has also been facing problems such as single financing channels, insufficient use of social capital, and heavy financial burden. To solve this problem, it is necessary to establish a sustainable investment and financing mechanism, actively strive for diversified policy channels, and achieve a virtuous cycle of funds. It is also necessary to improve the level of the investment and financing platform, and establish a coordination mechanism for planning, investment, financing, pricing and tax. Guangzhou should pay attention to the feedback of investment and financing on planning, link transportation planning with financial investment and financing planning, and include financial analysis in the evaluation of planning and construction projects. In the planning stage, the financing feasibility analysis and the comparison of financing schemes should be conducted as early as possible to help control investment risks.

In recent years, to alleviate the pressure of road traffic and increase the value of land use, China's large (mega-) cities have focused on the development of rail transit. As the scale of the rail transit network becomes larger and larger, the passenger structure has also changed. The passenger volume of rail transit in Shanghai (2014), Beijing (2016) and Guangzhou (2016) all exceeded that of conventional buses (as shown in Figure 4). However, a large-scale rail transit system will inevitably bring about high maintenance costs. How to improve the self-balancing ability of rail transit development and how to develop high-quality transit-oriented development (TOD) are essential. According to a survey, the passenger flow of the Guangzhou rail transit network is unbalanced (47% of the lines only carry 14% of the passengers), and the land development around stations is not compatible (29.5% of the area within 800 m around rail stations is used for agriculture, forestry, village, industry, logistics and warehousing, etc.), which affects the sustainable development of rail transit^[9]. To solve this problem, it is necessary to make the principle clear that land use has to coordinate with the construction of rail transit. A reasonable income distribution mechanism among different development entities should be established around the station and incentive policies should be implemented, so as to provide quality services, improve the radial direct pedestrian network around the station to gather passenger flow, and realize high-quality TOD.

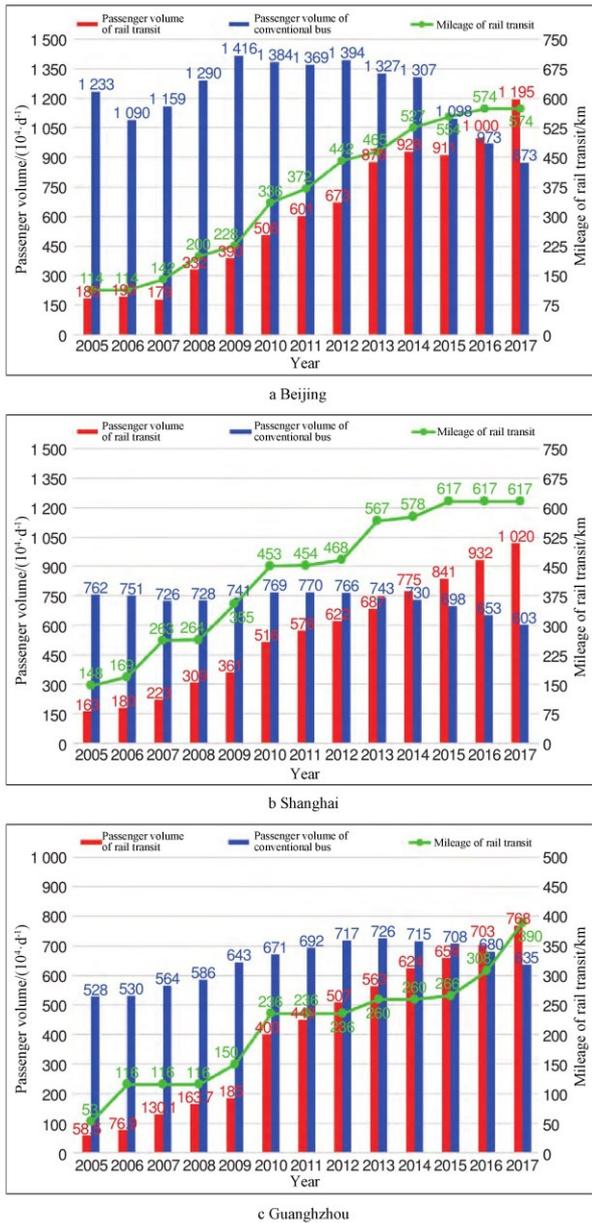


Figure 4 Changes of metro and bus passenger volumes in Beijing, Shanghai and Guangzhou

Source: Based on the annual urban traffic report.

3.4 Promoting high-quality development of transportation from the perspective of system and mechanism

Transportation is an open system, managed by the state, provincial and municipal authorities at all levels. A high-quality transportation system is not a simple physical connection, but a comprehensive integration of systems and mechanisms from planning, construction and operation. For a long time, the city has been disjointed from the development of external transportation hubs, and the service quality of comprehensive transportation hubs has become a weak point of urban transportation services (such as Guangzhou Railway Station). In the context of global cities, transportation hubs need high-quality development to enhance passengers' sense of belonging and identity. Large facilities such as airports, ports and railway stations should become real urban hubs and should be highly integrated with urban life. Therefore, it is necessary to design a guarantee mechanism to promote strategic work under a unified consensus (see figure 5).

The new round of Guangzhou transportation strategy has been written into the working document of the municipal party committee, which laid a good foundation for the formulation of strategic planning. However, to ensure that the planning is not deviated from the original goal, the consensus of all departments, especially the major transportation industry authorities, is needed to truly reflect the concept of co-construction, sharing and co-governance. In addition to doing their own work (urban distribution system, high-quality urban hub demonstration, necessary incentive and compensation measures, etc.), the city government should strengthen the research on topics related to the large transportation system, unify the negotiation context, and improve the dialogue ability.

3.5 Dealing with the impact of new transportation technologies

The impact of new technologies on urban transportation is one of the issues considered in this round of Guangzhou transportation strategic planning. On the one hand, new technologies may bring revolutionary influences; on the other hand, ride-hailing and bike-sharing are gradually returning to

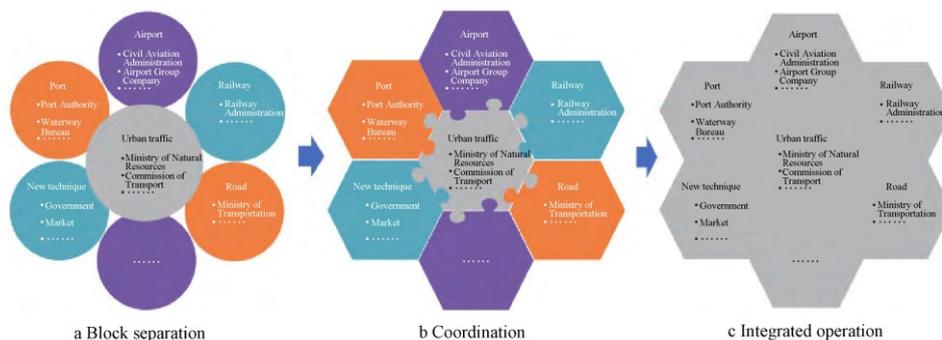


Figure 5 Synergetic development model from block separation to integrated operation

rationality. Urban life requires self-discipline, and the strategy to prioritize the development of public transportation meets this basic requirement, as well as the city's high-concentration requirement for various resources. However, new technologies, represented by autonomous driving, offer alternatives that are more flexible and user-friendly. They meet protection (ecology) and high-quality usage (work & life), and recognize the locking effect of transportation on urban space (changing from proactively connecting the three major urban functions of work, residence and recreation to guiding the urban spatial distribution). Good strategic choices can only be made by sticking to the theme of sustainable development and considering transportation problems on the level of social issues.

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4 Conclusion

Transportation problems are social problems. The solutions lie in sociology, and will not be found by just discussing without actions. Therefore, the process of formulating strategies is actually a process of seeking broad consensus. In order to make a good strategic choice, in addition to necessary case studies and scenario deductions, the judgment on the development stage of urban transportation and the problem grasping are particularly important. Under the background of the current national spatial planning, transportation strategy planning must grasp the two key points of high-level

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