Changes in the Era of Sharing: Research on the Characteristics of Shared Bicycle in Xizhimen Transportation Hub in Beijing

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Abstract
To solve the problem, which is called the last mile of short-distance travel within the city, shared bicycle began to appear in every corner of Chinese cities, and the development of bicycle traffic has also ushered in a new round of high tide. Based on the analysis of the field and data of the core area of Xizhimen transportation hub, this paper compares the bicycle usage before and after the emergence of the shared bicycles. Compared difference characteristics between the public bicycle, sharing bicycles, and own bicycles and contrast before and after the emergence of shared bicycles , in order to discuss the change and future development trend of shared bicycles for urban public transport. Finally, the article puts forward the feasibility of "BOD" for biking returning to the city, which is an effective way to build the city's non-motorized system and green travel.

Keywords
Xizhimen Transportation Hub; Shared Bicycle; Characteristic; BOD

1 Introduction Research Review

1.1 Research Background

The development of bicycle transportation in China has gone through a process from the beginning to rapid expansion, then to saturation and gradual decline[1]. As of the end of 2015, the proportion of bicycles in Beijing's transportation modes has fallen to 12.4%[2]. As sustainable development has become a crucial national development strategy, China's urban transportation issues have received significant attention, and the concept of green travel has gained widespread support. As a result, slow-moving traffic represented by bicycles began to return to people's vision. At present, to meet the needs of short-distance travel in the city, the development of bicycle transportation will usher in a new round of climax due to the emergence of shared bicycles.

1.2 Research Purposes and Methods

In order to encourage bicycle travel and solve the problem of "last mile" travel, compared to the limited and fixed parking spots of public bicycles and the restrictions on travel by private bicycles, shared bicycles provide a broader range of use conditions: Use and park at any time. Overnight, bike-sharing can be found in every corner of Chinese cities. However, facing the surge in the number of bicycles shared by Beijing, specific dynamic data analysis, and systematic evaluation of development trends are lacking. Based on the above status quo, the core problem that this research wants to solve is to analyze the changes brought by shared bicycles to urban public transportation through specific data and explore future development trends. The survey mainly used research methods such as status quo observation, questionnaire survey, personnel interviews, comparative analysis, and literature review.

1.3 Research Object

The Xizhimen transportation hub area is a comprehensive large-scale passenger transportation hub that integrates multiple transportation systems and full-service functions of trains, subways, urban railways, public transportation, and social motor vehicles. The subject of this study selected the core site of the Beijing Xizhimen Transportation Hub, which is in the northwest of the Xizhimen Overpass. Its west side is Gaoliangqiao Road, its east side is Deshengmen West Street, its south

Figure 1. Bicycle parking distribution in Xizhimen area. Photo by Zhenkun Gan.

side connects to Xizhimenwai Street, and its north side is adjacent to Zhuanhe. There are Xizhimen Stations of Metro Lines 2, 4, and 13 in this area, including 5 subway entrances, 3 bus stops, and 14 bus lines, which are of high research value.

2 Characteristics of shared bicycles in Xizhimen Transportation Hub

According to the use of shared bicycles in Xizhimen transportation hub, the author conducted field research in the area eight times in December 2015 (before the emergence of shared bicycles) and December 2016 (after the emergence of shared bicycles) on weekdays and weekends. Questionnaires are randomly distributed to different types of users, such as bicycle sharing and private bicycles, to understand the types of bicycle users, the purpose of travel, and the time of use. At the same time, interviews were conducted with bike users, private bike users, traffic police officers, and pedestrians to collect user experience and public evaluations of bike-sharing.

2.1 Characteristics of the Subject Used

From the statistical results, the ratio of male to female using own bicycles is about 1: 1, and the age is widely distributed; the main uses are commuting and schooling; the average number of applications per week is about 5 times. The male to female ratio of public bicycles is 1: 0.8; the age is concentrated in the 30s and above; the purpose of travel is mostly for life; the average number of uses per week is 2-3 times.

The proportion of men and women using shared bicycles is 1: 0.73; 70% of users are 20-40 years old; the users are mainly from office workers and students; the uses are balanced from commuting, commuting to school to living and traveling. The number of shared bicycles used is maintained at about 6-8 times per week, and the length of each use is mostly within 30 minutes. Among them, 69% said that shared bicycles are more convenient to use than public and own bikes.

2.2 Distribution and Parking Number

There are five centralized bicycle parking spots and one public bicycle parking spot in the area (Figure 1). Bike-sharing is mainly concentrated at the A and B parking spots at the main entrance of CapitaLand Mall and E parking near the subway entrances F1 and F2 Point. The distribution of shared bicycles in the area has a more noticeable trend, that is, parking near commercial clusters and main entrances of rail transit.

The total amount of private bicycle parking between December 2015 and December 2016 did not change much (Figure 2), and the number of parking points at commuting hours on weekdays was less than that during non-commuting hours. That is in line with the essential use of own bicycles in the city. The parking of public bicycles in each period of December 2016 was more extensive than that of December 2015, indicating that the public's use of public bicycles may be gradually decreasing. The total number of shared bicycles parking in the core area of Xizhimen has remained at 40-70. Among them, the number of parking during weekdays during commuting is slightly higher than the number during non-commuting hours, and the parking during weekdays is marginally lower than that during weekends (Figure 3),

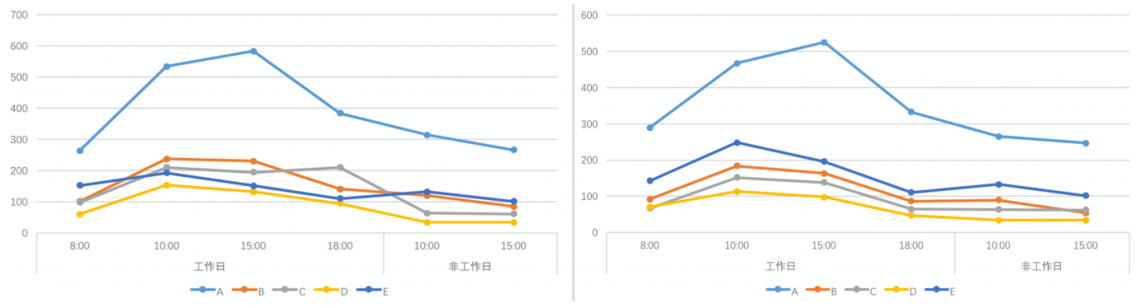

Figure 2. Statistics of private bicycle parking in Xizhimen area. 2015 (left) ,2016 (right) Draw by Lingege Long.

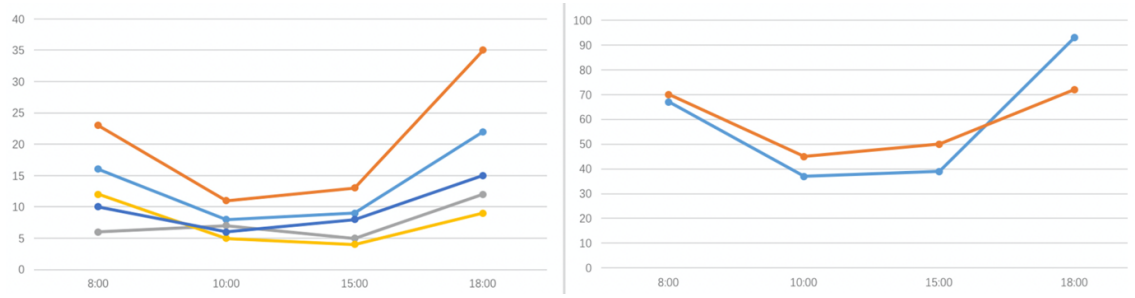

Figure 3. Number of bicycles shared on weekdays (left), Total number of bicycles shared on weekdays and weekends (right). Draw by Lingege Long.

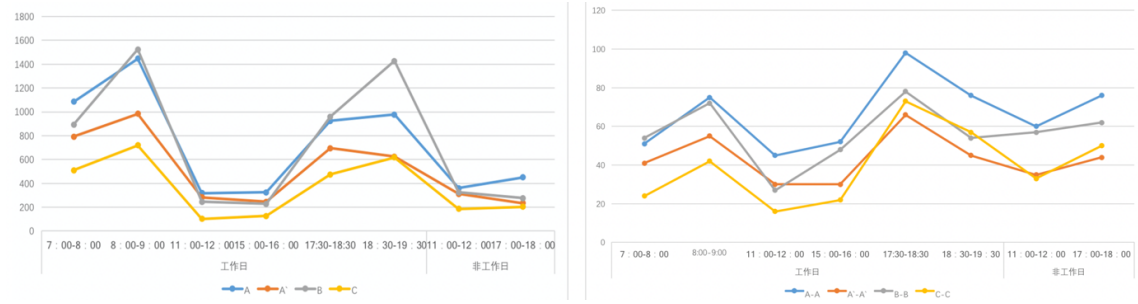

Figure 4. Own bicycle (left) traffic statistics, shared bicycle (right) traffic statistics. Draw by Lingege Long.

indicating that the use of shared bicycles is relatively high.

2.3 Travel Flow

Four main intersections in the Xizhimen traffic hub area are selected as flow observation points to count the number of own bicycles, public bicycles, and shared bicycles that pass during commuting, non-commuting, and fixed weekend periods. According to statistics, there are two peaks of cycling in the area in the morning and evening, with the evening peak being the largest. These two peaks are formed by commuting, and the peak duration is about one hour. The flow is significantly higher than the non-working day.

Private bicycle traffic in the morning rush hour is generally higher than or equal to the evening rush hour traffic. The time-varying graph is saddle-shaped, and the traffic on working days is significantly higher than the traffic on non-working days. The use frequency of shared bicycles is higher in the evening than in the daytime, and the non-working day traffic has not decreased significantly (Figure 4), which indicates that the purpose of using shared bicycles is more diverse and complicated. Besides, due to the restrictions on the number of public bicycles and their access and parking, the

traffic of public bicycles in each period is far less than the transport of own bicycles and shared bicycles.

2.4 Characteristics of Connection

Connection flow: The total number of bicycle connections in the Xizhimen area on the working day of December 2015 was 1810 person-times / day. In the December 2016 survey, the data changed, and the daily total number of connections increased to about 2100 people. Moreover, there continues to be a growing trend. Shared bicycles have increased the total connection flow of bicycles and become a new connection method.

Connection direction: During the early rush hour, most of the private bicycles flowed to Xizhimen Metro Station, and at late rush hours, own bikes flowed back from Xizhimen Metro Station back to the original starting point. In this regard, own bikes in the area exhibit strong tidally. The traffic flow of bicycle sharing shows a two-way flow during the morning and evening rush hours, that is, there is a connection from the starting point to the Xizhimen area and a connection from the Xizhimen area to the destination. It shows that the own bicycle can meet the travel requirements of the "first mile" from the starting point to the connection point or the "last mile" from the connection area to the destination. Moreover, bicycle-sharing provides more abundant travel options, which can not only meet the "first mile" demand but also make up for the "last mile" travel demand.

3 Evaluation and Development Prospects of Shared Bike

3.1 Evaluation of Current Status of Shared Bike

In fact, since the share-bike blowout development in 2017, China's bicycle utilization ratio has picked up year by year, attracting some walking and short-distance travel to bicycle transportation[3],and it rose to 14.5% in 2018. Bike-sharing provides users with more free use scenarios and more extensive use. It is inspiring the general public to choose bicycle travel from all aspects of living, work, transportation, recreation, and other elements, especially in solving short-distance travel problems, shared bicycles play Important uses (Figure 5).

Shared bicycles have increased the choice of short-distance transportation, making it more efficient for public transport in Beijing. At the same time, the travel mode has been optimized, energy consumption has been reduced, and it has helped to promote and realize environmentally friendly transportation concepts, thereby achieving the development requirements of green travel.

3.2 From TOD to BOD

TOD (Transit-oriented development) model is characterized by public transport-oriented development to maximize the use of public transport. It relies more on the vehicles of public motor vehicles such as subways, light rails, and buses to solve the problem of Long-distance commuting problems, but often lead to 400-800 meters or even 1-2 kilometers of walking distance when connecting to specific destinations in the area. The emergence of bicycle sharing has promoted the birth of the BOD (Bicycle-oriented development) model. It is not a substitute for the TOD model, but rather improvement and optimization of its "last 1 km" travel experience. The travel range of own bicycles mostly stays in the user's common area, while shared bicycles expand the available bicycle resources to the entire city, creating a more productive use situation. This change is not only the traffic structure but also the behavior pattern of people's daily life, bringing a very convenient new experience to urban life.

The shared bicycle on which the BOD model relies is provided by commercial capital, breaking through the dilemma of the government's long-term investment in public bicycles but with little effect. That is not just a transformation from a piled public bike to a pileless shared bicycle, but also an exploration and attempt of the development of urban public utilities from top to bottom to bottom to top. Commercial capital enters the field of public services, giving play to its advantages of innovation, professionalism and flexibility, which can significantly promote the optimization of resource allocation, rapidly expand and improve the scale of social undertakings, effectively enhance the level of services, and make up for many government-level measures Restraint to better meet citizens' multi-level and diversified public service need.

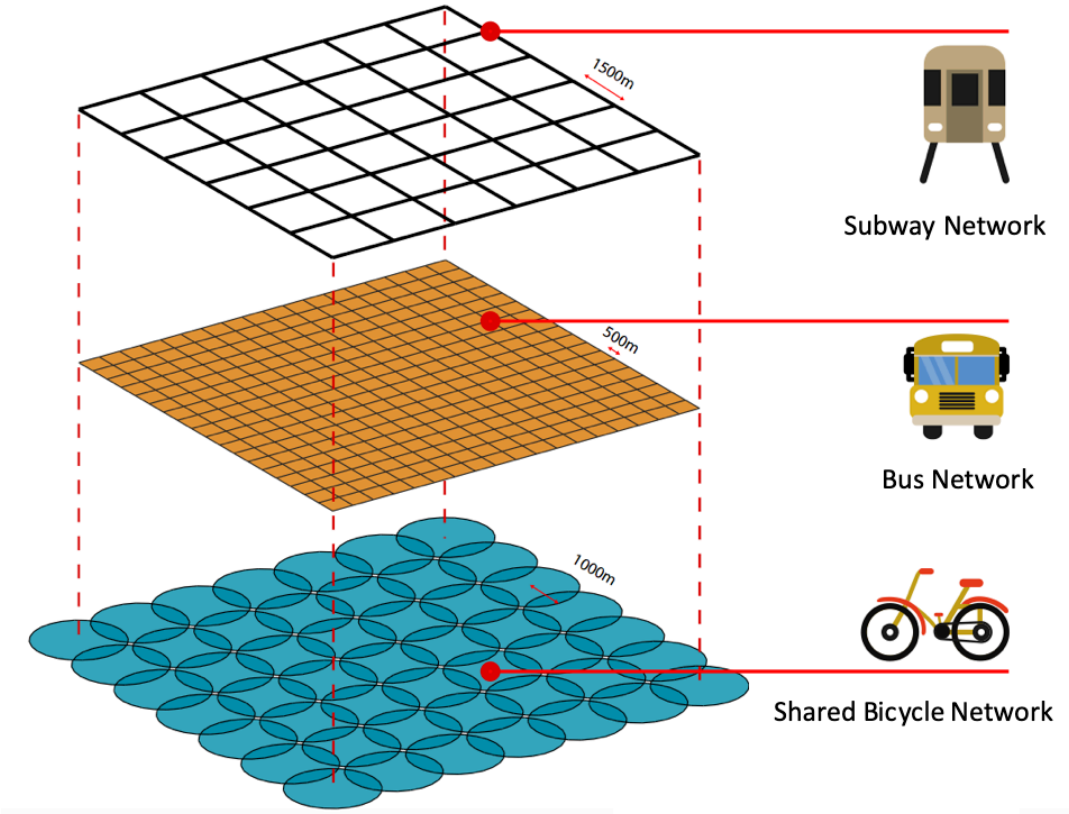

Figure 5. Concept map of urban hierarchical traffic coverage network. Draw by Zhenkun Gan.

While new things such as bicycle sharing have brought rapid changes and development to urban public utilities, many social contradictions and problems have also occurred. Therefore, the government should establish a reasonable mechanism to incorporate the development of new things and accurately guide and manage them[4]. Faced with the marketization of public services, investors have ownership of project ownership and operating rights, and the government has actively played a guiding and monitoring role to enable all parties to achieve higher efficiency than acting alone and improve the quality and efficiency of public services. At the same time, supervision and management should be controlled within a reasonable intensity to avoid rigid management systems and affect market vitality.

4 Conclusions

At present, although bike-sharing faces various challenges and doubts, it is certain that bike-sharing is a feat to promote the development of green cities. It has created the world's first pile-free public bicycle operating system, and China's bike-sharing model It has become a significant innovation of "made in China", which has changed the situation of long-term one-way learning of advanced foreign concepts and is an excellent example provided by China for improving the quality of urban transportation in other regions of the world. As we know, this also means that the various problems encountered in the process of landing operation have no experience to learn from, and the road to sharing bicycles is still long. Despite the rapid influx of capital and fierce competition, the construction of the urban bicycle system is not a one-time project. Maybe it is necessary to slow down the pace of returning bicycles to urban life, but we never stop.

Endnotes

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