

# PUBLIC TRANSPORTATION TRANSFER SYSTEM

## PROBLEMS AND SOLUTIONS

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### ABSTRACT

With the development of economy and urbanization, traffic demand in the city increases rapidly. The public transport system plays an essential role to alleviate the traffic pressure. How to optimize the transfer system is a challenge for the public transport. The problems existing in the current transfer system were analyzed, including the long transfer time, large space occupation of Park&Ride system and rising ticket price. The relevant solutions were studied, including building quick facilities such as the moving walkways and door-to-door transfer system, promoting Bike&Ride transfer system and optimizing fares and transfer price.

**Key words:** public transportation, transfer system, situation analysis, optimization measure

### 1. INTRODUCTION

With the development of economy, the acceleration of urbanization and motorization, people in mounting numbers flood into the city. At the same time, the quantity of private cars increases continuously. The traffic demand has been far beyond the capability of the traffic infrastructure, causing traffic jam, environmental pollution, parking difficulty and other problems. To alleviate the traffic pressure, the government is looking for effective ways to balance the supply and demand in the urban traffic. The public transportation, as a significant part of the comprehensive transport system, plays an essential role in solving the traffic problem and improving the living environment. However, the integration level of the public transportation is relatively low and the ridership in China is lower than the developed countries. How to increase the quality of public transportation is a challenge for the city planners. The current public transportation system in many cities shows a relatively

poor intermodal connectivity such as long transfer time and distance between the bus and railway station, unpunctuality of the urban buses, unreasonable routines etc. The report aims to analyze the problems existing in the transfer system and provide the measures to optimize the transfer system between the urban bus and urban rail.

## 2. THE CURRENT SITUATION OF THE TRANSFER SYSTEM

### 2.1 Long transfer time

When passengers take public vehicles, they always need to take not only one kind of vehicles. In most cases, they need to transfer between bus and rail, car and bus or car and railway. The transfer time exists when passengers have to transfer. The transfer time can be divided into three parts: walking time between two stations, security check and ticket booking time, and waiting time. The delay depends on the distances between two points and waiting time under normal circumstances.[1]

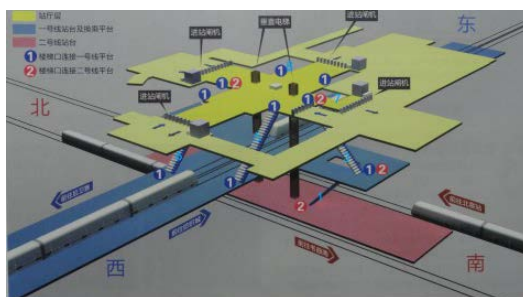


Figure.1-Beidajie Station Transfer Structure

Taking Beidajie Station of Line 2 in Xi'an as an example (as shown in Figure.1), the line 1 and line 2 are both underground but the transfer platform is above the ground, passengers have to walk upstairs and then downstairs to the entrance to line 3 which wastes at least 3 minutes. Besides, the unpunctual arrival of urban buses troubles passengers in some extent. Passengers take 5 minutes in average to wait for the bus when they get out of the railway station, and the waiting time will even be longer in the peaking hours. From the above analysis, it can be estimated roughly that the transfer from railway to bus will cost 10 minutes approximately.

### 2.2 Space problems of P&R facilities

With the rapid development of cities, the city starts to expand gradually. More and more satellite cities appear around large cities, which causes the suburb urbanization. The emergence of the satellite cities generates longer traveling distance and larger traffic demand. As the increase of the private car ownership, Park& Ride has been a new

selection for the citizens in the suburb. Park& Ride means to drive the car to the railway or bus station, and then switch to the public vehicles to the city center. According to the studies conducted, there are three major reasons for the citizens to select P&R: free parking fee, parking difficulties in the city center, high parking fee in the city. [2]However, the large space occupation is the biggest problem that impedes the construction of the P&R facilities. It is estimated that a P& R parking lot occupies 15000 m<sup>2</sup> including 500 parking spaces for cars, driveway, pedestrian walkways, and office building etc.[3] Due to the limitations of the land resources, many empty land cannot be used for the government does not own it. Furthermore, the inevitable displacement and resettlement also impede the development. It is indicated that 71 P&R parking lots were planned but only 45 finally completed. How to solve the land occupation problems is the challenge for the urban planners.[4]

### 2.3 Rising ticket price

Generally, the ticket price of the public vehicles includes the construction cost, operating cost, maintenance cost and others. The ticket making formula is market-oriented. The market decides the price. At the same time, the supply-demand relationship and the passengers' comments affect the price. Taking Beijing metro for example, all the metro lines except the Line 4 are all funded by the government. According to the Beijing financial expenditure report, the subsidy on the traffic is even more than the medical expenditure, ranking the 4<sup>th</sup> among the thirteen categories. Besides, due to the large flow, the metro breaks down once a week on average. To control the flow in the metro and balance the financial expenditure, the government always adopts the way of raising the ticket price.

**Table.1-The ticket prices of several cities**

City	Basic fare (local currency)	Maximum fare (local currency)	Average monthly income per person (local currency)	The proportion of metro fare to the average monthly income per person (‰)
New York,USA	2.75 \$	2.75 \$	8325\$	0.33
Vancouver,Canada	2.5C\$	5C\$	6411C\$	0.38-0.76
London,UK	4 £	7.7 £	2612 £	1.53-2.95
Sydney,Australia	1\$	4\$	4553\$	0.22-0.88
Tokyo,Japan	170 円	310 円	365620 円	0.46-0.85

The	Beijing,China	3¥	9¥	6906¥	0.43-1.3
	Xi'an,China	2¥	8¥	5870¥	0.34-1.36

ticket prices of some of the cities around the world are shown in Table.1.By comparison of the proportion of metro fare to the average monthly income per person, it is indicated that the basic fare in China is relatively low but the maximum fare is relatively high. For those workers who live far away from the workplace, the rising ticket price adds more burden on them. Besides, passengers usually select to transfer from the metro to the bus, but so far the relevant preferential policies for the short-distance bus transfer have not been published.

### 3. SOLUTIONS TO THE PROBLEMS

#### 3.1 Quick facilities

##### 3.1.1 Moving walkways

For the transfer stations that cost a lot of time to transfer between two lines or between the bus and the metro, the moving walkways can quicken the pace of the passengers. Building the moving walkways properly helps to decrease the time to transfer and improves operating efficiency of the public transportation.

##### 3.1.2 Door-To-Door transfer system

By observation of most metro stations in China, it can be found that passengers always have to get out of the metro station to take the bus which reduce the efficiency of the transfer system to some extend. A Door-To-Door transfer system that helps to shorten the distance from the metro to the bus station is urgently needed. Here are two main ideas of the Door-To-Door system:

###### (1)The One-stop transfer building

Considering that passengers have to walk out of the station to take the bus, an integrated terminal that combines the metro, bus, and taxi can optimize the transfer system. Passengers only need to take the elevator to another floor to change to other mode without getting out of the building.

###### (2)The interchange track

Taking the Beidajie station of Xi'an metro as an example, the Line 1 and Line 2 are on the same plane and the transfer platform in on another platform(Figure.1)which cause passengers to go upstairs and downstairs. It is suggested to build the interchange track rather than the tracks on the same plane.

## **3.2 Bike&Ride system**

### **3.2.1 The brief introduction**

Due to the large space occupation of the P&R system and the inconvenience of the cars, the way used to solve the problem of the last one-kilometer turns into the terminal problem for the urban traffic. Confronted with the problems, taking the convenient and available bicycles to transfer has become popular for the citizens. The B&R facility supplies a certain scale of bicycles centrally around the metro station to make it more convenient to transfer to another public vehicle or go to the destination directly. And the bicycle parking lots will be set in the periphery of the metro stations according to the demand. The B&R system does not only increase the transport efficiency, but also promote the green travel. As the environmental pollution is getting serious, an environment-friendly integrated transport system will be an inevitable choice for the future transport development.

### **3.2.2 The B&R system management**

Due to the flexibility of the bicycles, how to ensure the safety and the security of the bicycles is a challenge for the B&R system. As for the problem, the three following measures are suggested. Firstly, the bicycles should be maintained periodically and maintenance evidence should be shown on the electronic screens of each bicycle to protect the rights of the passengers. Secondly, to prevent those who do not return the bicycles within the given period, there should be a real-name registration system to record the users and the corresponding bicycles. Once the user does not return the bicycle, the messages should be sent to him, at the same time, the relevant punitive measures should be carried out. Thirdly, an online report platform should be established. The citizens can report the bicycles that is parked outside the designated place at any time. The large scale monitoring system can ensure the sustainable development of the B&R system.

## **3.3 Optimizing fares and transfer price**

The raising ticket price weakens the enthusiasm of the passengers to use the public transportation, but the underpriced tickets will reduce the interests of the public transportation enterprises. Therefore, making a win-win preferential system is essential for the current transport system. The principal of making the preferential scheme is to strike a balance between the interest of the passengers and the financial capacity of the government. Here are several preferential schemes on the basis of the qualitative analysis:

### **(1) Transfer privilege**

The transfer privilege will be offered to those who take the bus after metro within a certain period of time. The IC card will record the trace of the passengers and give some discount even free ticket to the passengers according to the interval.

## (2)Time-varying ticket price

To reduce the crowd in the peak hours and alleviate congestion, making a time-varying ticket price will affect the travel time of the passengers. The accurate peak period will be divided, the privilege will be given before or after the half hour of the peak period to attract the passengers to keep out of the peak period.

## (3)Privilege for regular passengers

For the passengers who work in a far place from home, the transportation takes a relatively great proportion in their expenditure. The month card or the year card that provide discounts can benefit those passengers and attract more people to select the public transportation.[5]

## 4.SUMMARY

Increasing the ridership of the public transportation is a common goal for all countries to alleviate the traffic pressure.Compared with the long-term metro and bus stop construction, optimizing the quality of the current public transportation is much more essential. Considering that the passengers always need to transfer among multiple modes to get to the destination, the optimization of the transfer system is a challenge .The problems existing in the current transfer system were analyzed in this paper, and the relevant solutions were discussed on the aspect of transfer time, transfer methods and ticket price. The essay is based on the qualitative analysis, and more detailed quantitative studies are expected to optimize the transfer system deeply.

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