

# Analysis of Space-time Characteristics of Urban Residents' Travel in Chongqing with Customized Passenger Transport

Shuhan Gao<sup>1, \*</sup>, Zhiyong Wang<sup>2</sup>

<sup>1</sup>Department of Traffic & Transportation, Chongqing Jiaotong University, Chongqing, 400074, China

<sup>2</sup>Chongqing Highway Passenger Transport Network Ticket Center Co., LTD

\* Corresponding author: Shuhan Gao (Email: 582039277@qq.com)

**Abstract:** Intercity customized passenger transport as a new travel mode has been widely accepted by the road passenger transport industry and enterprises. Under the guidance and support of national policies, passenger transport enterprises all over the country are actively exploring the business practice of inter-city customized passenger transport, which is booming. In this context, this paper uses python and other analysis software to collect the 2021 operation data of Chongqing Yukexing Company and analyze the distribution of gender, age, and refund rate of customized passenger transport of Chongqing residents throughout the year. In addition, the time and space characteristics of customized passenger transport are explored. And then provide data support for relevant enterprises to provide relevant management innovation programs.

**Keywords:** Customized passenger transport, Temporal and spatial characteristics, Operational data.

## 1. Introduction

With the encouragement of national policies and the support of Internet technology, road passenger transport enterprises achieve the transformation and upgrading of the passenger transport industry by developing customized passenger transport services, maximizing the integration of road transport resources, improving vehicle operation efficiency, and providing safe, flexible and convenient passenger transport services with a market-oriented approach. Customized passenger transport means that users choose inter-city business express, chartered cars, and other customized passenger transport products through various Internet platforms. Customized passenger transport time and stations are flexible and diversified in price so that users can enjoy more personalized travel services.

The most basic purpose of "Internet +" customized passenger transport operation is to meet passengers' travel needs of personalization, diversification, quality, convenience, and differentiation. The distribution of passenger travel age

structure, gender ratio, ticket refund rate, ticket refund rate, age group, and time and space distribution are important indicators to measure the travel characteristics of urban residents, from which the regularity of the current customized passenger transport market can be peered out, to further study the behavioral characteristics of customized travel demand at the spatial and temporal scale. On this basis, the optimization technology means based on customized passenger transport market law is proposed.

## 2. Data Preparation

The customized passenger transport operation data and Chongqing passenger transport network data studied in this paper are provided by Chongqing Yukexing Company. Its company routes are numerous and complex, involving Chongqing, Sichuan, and Guizhou provinces. This paper mainly selects routes within Chongqing, uses keyword selection to eliminate redundant data, and adds the information of administrative districts one by one. Part of the sorted data is shown in Table 1.

Table 1. Sample partial data after processing

Gender	Age	Departure time	Line name	Administrative district	Refund time
1	44	2021/01/01 06:00:00	Rongchang-Yongchuan	Rongchang district - Yongchuan district	
0	39	2021/4/19 18:50:00	Yongchuan -Bishan	Yongchuan district - Bishan district	2021/4/19 14:32:30
1	35	2021/5/22 7:45:00	Airport-Tongliang	Jiangbei district - Tongliang district	
0	27	2021/10/27 08:20:00	Yunyang-Wanzhou	Yunyang district - Wanzhou district	2021/10/26 23:25:56

## 3. Current Situation of Customized Passenger Tickets

### 3.1. Gender and age distribution of passengers

After data sorting and cleaning, there are more than 790,000 effective data, among which more than 380,000 female passengers, accounting for 48.73%, and more than

400,000 male passengers, accounting for 51.27%. The gender difference in customized passenger transport projects is not large, but from the age group, figure 1 and Table 2, 25 to 45 years old is the main consumption power of customized passenger transport, accounting for half of the total, while before 18 years old and after 65 years old two age groups of customized passenger transport consumption groups are the

least.

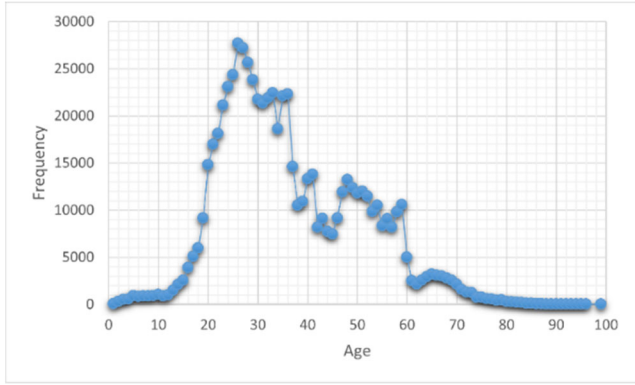


Figure 1. Frequency of ticket purchase in different age groups

### 3.2. Refund rate, refund age distribution

In the process of analyzing the data, nearly 80,000 pieces of data were invalid, that is, tickets were returned or canceled, accounting for 11 percent of the total. As can be seen from Figure 2 and Table 2, there is a significant difference between the purchase rate and the refund rate of the same age group after the age of 45. In particular, the refund rate of the last age group (above 65 years old) increases by 10% from purchase to refund, which reminds enterprises to pay attention to the personalized needs of the elderly for customized enterprises.

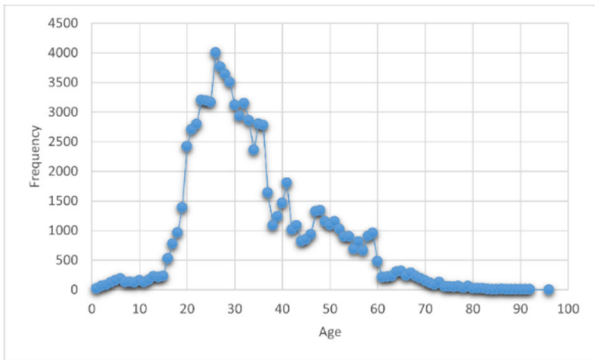


Figure 2. Frequency of ticket purchase in different age groups

Table 2. Comparison of ticket refunds by age group

Age	The proportion of tickets purchased	Percentage of refund	difference
Below 18	3.54%	3.5%	0.04%
18-25	16.28%	17.1%	-0.82%
25-35	34.98%	33.34%	1.64%
35-45	19.75%	16.13%	3.62%
45-55	16.35%	10.94%	5.41%
55-65	9.10%	5.6%	3.50%
Over 65	3.85%	13.4%	-9.55%

### 4. Analysis of Residents' Travel Time Characteristics

The time characteristics of customized passenger ticket data are one of the important references to measure customized bus operation. Focusing on the annual passenger flow changes can clear operational decision-making suggestions for enterprises and provide an important basis for the comprehensive evaluation of customized passenger lines [1].

This paper calculates the monthly passenger flow data from January to December and makes a line chart, as shown in Figure 3. The results show that due to the influence of seasons and policies, the passenger flow in 2021 fluctuates greatly in this year. The difference between the highest passenger flow in April and the lowest passenger flow in January is nearly 50,000. In the second half of the year, the passenger flow reaches a balance in the fluctuation, and the passenger flow trend of the whole year is increasing compared with the beginning and the end.

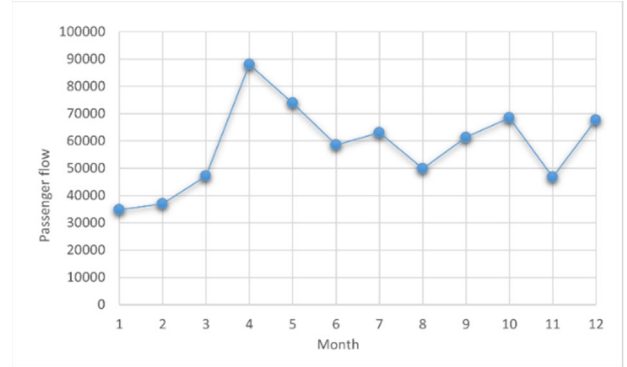


Figure 3. Annual passenger flow changes

### 5. Analysis of Spatial Characteristics of Residents' Travel

Spatial analysis is the main feature and important research content of GIS [2]. This section is based on the spatial location and morphological characteristics of customized passenger stations. Spatial information visualization and other methods are used to excavate the spatial characteristics of bus passenger flow, explore the daily travel rules of Chongqing citizens, and the spatial evolution information [3][4].

Before studying the spatial characteristics of customized passenger flow, the distribution of passenger stations and passenger lines in Chongqing should be investigated and counted in advance. As shown in Figure 4, the customized passenger stations of Chongqing are not evenly distributed in Chongqing administrative region, but it is obvious that the stations near the main urban area of Chongqing are concentrated and numerous, while the stations outside the main urban area are few and sparse.

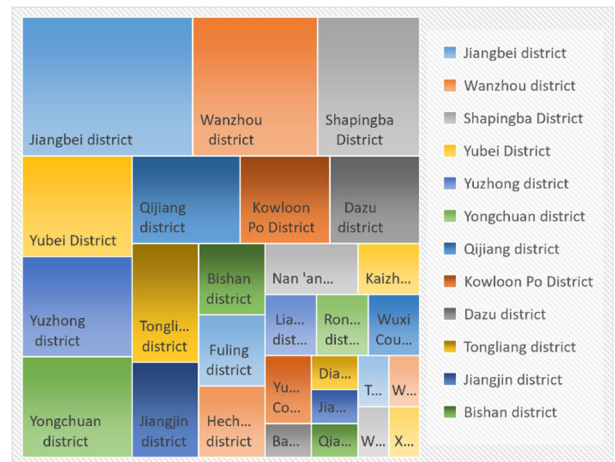


Figure 4. Number of customized passenger administrative region stations

Then, this paper calculates the frequency of ticket

purchases of customized passenger transport in each administrative region and the passenger flow of each line. According to the statistical results in Figure 5, the frequency of ticket purchase of customized passenger transport in each administrative region of Chongqing is not uniform, with the most passengers departing from Tongliang District, Yongchuan District, Yubei District, and Jiulongpo District, accounting for about 70%. Jiangbei District, Yuzhong District, and Yongchuan district accounted for nearly 70% of the passengers. From the perspective of spatial location, the passenger flow is more concentrated in the main urban area of Chongqing and its surrounding cities, which tends to flow from the surrounding areas to the city center from west to east[5] [6].

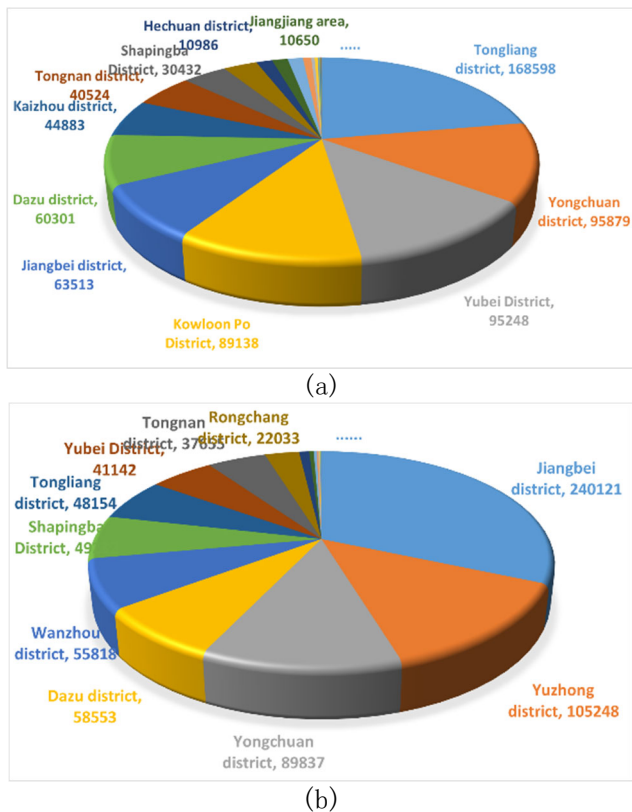


Figure 5. Starting point (a) and end point (b) Frequency of ticket purchase in each administrative region

## 6. Conclusion

This paper collects and collates the customized passenger

transport travel data of Chongqing in 2021, specifically analyzes the age and gender distribution of customized passenger transport users, and calculates the age distribution of people with a high incidence of ticket refunds. The time and space distribution characteristics of data are visualized to provide basic information for enterprise management and industry development. In the next step, the researcher will continue to carry out a field investigation, analyze the structural situation of supply and demand of customized passenger transport in Chongqing, apply the professional model method, provide a scientific basis for the decision of customized passenger transport service, and complete the planning suggestions for the future development of customized passenger transport represented by Chongqing.

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