

# Contribution of Public Transportation to Urban Social Development-Taking Nanchang City as an Example

Yunqiang Xue<sup>\*</sup>, Wenlong Li, Dilong Zhang

*School of Transportation and Logistics, East China Jiaotong University, Nanchang, China*

*\*Corresponding author. Email: xueyunqiang@ecjtu.edu.cn*

## ABSTRACT

As an important part of urban transportation, public transportation is vital to the development of cities and society. Taking Nanchang as an example, this paper analyzes the four aspects of urban residents' travel, energy and land resources, traffic congestion and traffic safety, and studies the contribution of public transportation to urban social development. Public transportation facilitates the travel of urban residents, saves energy and land resources, effectively alleviates the problem of urban congestion and reduces the occurrence of traffic safety accidents, and makes a positive contribution to the sustainable development of urban society. Finally, the prospects and suggestions for the development of urban public transportation in the future are put forward. It is necessary to continue to improve the public transportation system to achieve sustainable green development.

**Keywords:** *public transportation, social development, contribution.*

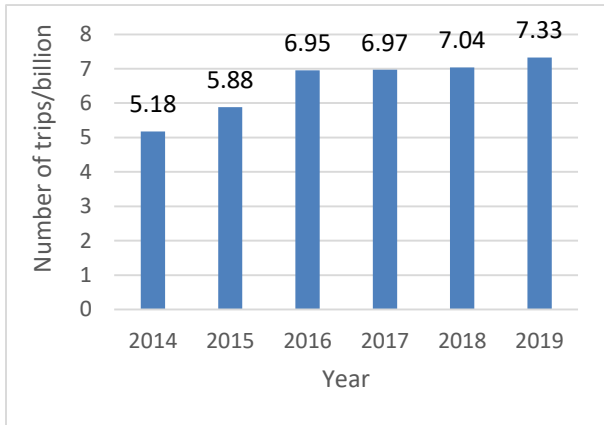
## 1. INTRODUCTION

With the development of society, the urban population and the number of motor vehicles are growing rapidly. Urban public transport plays an increasingly important role in the development of the city. Many scholars have studied its contribution to urban development. Yufan Dai [1] used weight judgment method and correlation coefficient method to screen indicators, Finally, the overall evaluation index system for the adaptability of urban public transport and social economy is determined; Zhong et al. [2] Analyzed the contribution and impact of urban public transport on urban energy conservation based on the current situation of urban transportation energy conservation in Beijing; Jiani Xu [3] takes Shanghai as an example to analyze the effect of the development of public transport in big cities on solving traffic congestion and traffic safety problems; Xue Zhang [4] analyzes the mechanism of social benefits of urban rail transit at various stages by using C-D production function model; Yu et al. [5] Analyzed the annual operation data of 40 diesel buses in four cities in southern China to explore their driving characteristics and fuel consumption characteristics; Tarulescu et al. [6] analyzed the urban transport system of the Brasov metropolitan area, which studies the influence of the traffic route connecting Brasov city and Scele city on

reducing the energy consumption and carbon dioxide emissions of road transportation. Miller et al. [7] presents a critical literature review of the relationship between public transportation and sustainability. Taking Nanchang City as an example, this paper studies the contribution of public transport to urban social development from the aspects of residents' travel, energy saving, traffic congestion alleviation and traffic safety.

## 2. THE CONTRIBUTION OF PUBLIC TRANSPORT TO URBAN RESIDENTS' TRAVEL

Public transportation is the basic service of the city, accompanied by people's daily travel. Due to the differences of travel personal attributes, travel origins and destinations, there are also differences in travel modes. The characteristics of rapid and motorized urban public transport make it widely selected, especially by the elderly and vulnerable groups. If there is no city bus, it will affect the social and economic development to a large extent and reduce the satisfaction of urban residents.



**Figure 1** Public transport volume of Nanchang from 2014 to 2019

As we can be seen from **Figure 1**, from 2014 to 2019, the public transport travel volume of Nanchang maintained an overall growth trend. Due to the completion of Nanchang Metro Line 1 from 2014 to 2016, the urban traffic volume was in a obvious growing trend.

The rapid increase of public transport passenger volume in Nanchang mainly benefits from the following aspects [4]:

(1) The government has increased investment in the construction of urban public transport system. As of the end of 2018, Nanchang has 271 bus lines, an increase of 24 over the same period of last year; the length of operating lines has reached 5757. 2km, an increase of 750. 2km; the number of public transport vehicles has reached 4112. Besides, the government and bus companies will invest a lot of money to buy new energy-saving buses every year.

(2) Improve the service level of public transport. The cooperation between Nanchang public transport and Nanchang traffic management office has improved the real-time and punctuality of public transport information by means of information and intelligence, strengthened the vehicle performance structure, provided better riding environment for passengers, strengthened service terms and service attitude, improved the overall service quality obviously.

(3) Use the Internet, cloud computing, big data, Internet of vehicles and other advanced technologies to create the smart public transportation system [8], and thoroughly realize the technology upgrading from "relying on experience" to "big data analysis". Deep integration of "public transport + mobile payment" has successfully achieved the interconnection of public transport credit card with mobile payment platform such as UnionPay, Alipay, Jiangxi bank and smart card and obtained good economic and social benefits.

With the implementation of the strategy of "public transport first" carried out by Nanchang municipal

government and the completion of Nanchang Metro Line 1 and line 2, the passenger traffic volume of public transport has maintained an overall growth trend. In the future, with the further development of urban transportation (Nanchang Metro Line 3 and line 4, ground light rail, underground rail 1, 2) and other projects in Nanchang, the urban traffic passenger volume will be further improved. .

### 3. CONTRIBUTION OF PUBLIC TRANSPORT TO ENERGY AND LAND RESOURCES

#### 3. 1. Contribution of Public Transport to Energy Conservation

The excessive consumption of energy is mainly reflected in the urban environmental pollution, and the main source of urban environmental pollution is the emission of motor vehicle exhaust. There are two ways to reduce the emission of motor vehicles, one is to limit the number of motor vehicle trips, the other is to improve the motor vehicle power system. Compared with small cars, the passenger capacity of buses is 20 times of that of small cars, which has higher transportation efficiency, can reduce energy consumption and can be conducive to reduce the number of motor vehicles to avoid the aggravation of energy consumption and environmental pollution caused by excessive road vehicles. In addition, the new energy electric bus will greatly reduce the use of energy and its contribution to energy conservation and emission reduction is more significant.

**Table 1.** Air quality statistics of Nanchang in recent five years

Year	2013	2014	2015	2016	2017	2018
Excellent days	222	294	315	318	304	327
Days of mild pollution	96	57	45	35	52	37
Days of severe pollution	17	3	2	3	3	0

In recent years, Nanchang City has actively promoted the use and development of green energy. Through the license plate number restriction, the number of motor vehicle trips is controlled, at the same time, the construction of urban greening, and the use of new energy buses have effectively improved the urban air quality. In addition, through calculation, with the continuous increase of public transport traffic, the total amount of energy saved is also increasing. At present, most of the small cars consume about 8L per 100 Km of fuel, and the per capita fuel consumption of passengers is 3. 2L per 100 Km. Most of the subway and public transport use electric energy for energy supply, the fuel consumption is relatively small compared with the former. The direct benefits are reducing the cost of fuel consumption and oil consumption, the public

transportation can save about 300000 tons of gasoline for the city every year, the economic benefit can reach 2 billion yuan. Moreover, electric energy and other new energy are secondary energy sources, which can be recycled. This is also the huge advantage of public transport in energy saving.

With the continuous development of the concept of new energy vehicles and the continuous improvement of people's awareness of environmental protection, the environment of the city will be greatly improved in the future. The satisfaction of urban residents will also be improved.

### 3. 2. Contribution of Public Transport to Saving Urban Land Resources

With the continuous increase of urban population, the total urban building area is increasing, which makes the available land area of the city decrease continuously and the construction of traffic facilities is greatly restricted. The increasing number of vehicles and parking is becoming more and more difficult. However, the traditional public transport has the characteristics of large passenger capacity, high efficiency and energy saving, which is conducive to improving the utilization efficiency of urban land resources and reducing the land occupation of urban motorized transportation. Such as subway almost does not occupy ground resources, basically achieving the existence of 0 land occupation and alleviating the problem of urban land resource shortage.

**Table 2.** Comparison of bus and car floor area

Vehicle	Bus	Car
Passenger capacity	50	3-5
Area covered ( $m^2$ )	35	10
Per capita Area covered ( $m^2$ )	0.7	2.5

According to the annual development report of Nanchang City, each bus covers an area of about 35 square meters and each car occupies about 10 square meters. However, the bus has the advantage of large passenger volume. From the **Table 2**, Generally, the passenger capacity of the bus is about 50 people per time, while the average passenger capacity of the car is only 3-5 people per time. In terms of the per capita floor area, the per capita floor area of the bus is about 0.7 square meters, that of the car is about 2.5 square meters. The bus can save 1.8 square meters. According to Nanchang City in 2018, the data of the per capita area of bus travel, the per capita area of car travel, the average passenger capacity of each bus and the average number of buses, which can be calculated the contribution of bus saving urban land resources [9]. The calculation formula is shown in Equation (1).

$$M=(m_s -m_g) \times r \times c \tag{1}$$

Where,  $M$  refers that the public transport saves the urban traffic area

$m_s$  refers to the per capita floor area of car travel

$m_g$  refers to the per capita floor area of bus travel

$r$  refers the average passenger capacity of each bus

$c$  refers the average number of buses in the year.

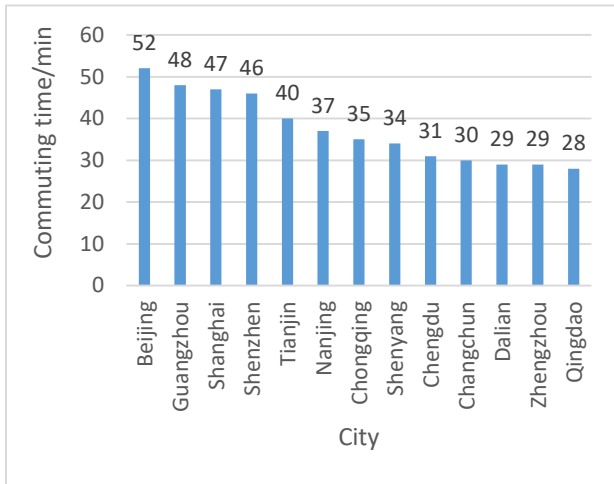
According to the land value data of Nanchang City in 2018, the land value saved by the bus is about 3.435 billion yuan, which shows that the traditional bus can save land occupation significantly. For subway, underground rail and other underground rapid public transportation, the effect is more obvious. Through calculation, Nanchang Metro Line 1 and line 2 can save about 592000 square meters of land, and the value of land saved is about 5.42 billion yuan.

Generally speaking, public transport plays a significant role in saving land resources. With the development of the city, the scarcity of urban land resources will gradually increase, the price of land will continue to rise, and the added value brought by public transport to save land resources will also increase. Besides, The TOD (Transit-orient development) makes reasonable planning for public transport construction. To form a comprehensive community with bus stops as the center, integrating transportation, residence, entertainment and shopping, so as to drive the land price growth along the line and promote the urban economic development.

### 4. CONTRIBUTION OF PUBLIC TRANSPORT TO EASING TRAFFIC CONGESTION

The development experience of most cities shows that the higher the urban population density, the more tense the per capita land resources, which can not adapt to the rapid growth of automobile development mode [10]. Compared with traditional vehicles, public transport has the characteristics of large passenger volume, which can improve the use efficiency and transportation efficiency of the road. At the same time, subway, bus rapid transit and other public transport modes have higher operating speed than traditional transportation, which can reduce the travel time of residents and improve the travel efficiency. Therefore, the development of public transport is of great significance to improve urban traffic capacity and alleviate traffic congestion.

**4. 1. Contribution of Public Transport to Saving Urban Road Resources**



**Figure 2** Commuting time in major cities of China in 2010

As we can be seen from **Figure 2**, most cities in China are still dominated by conventional bus and the development of BRT is not perfect. With the continuous expansion of urban scale, the travel time will be longer and longer. At present, the speed of motor vehicles on the main urban roads in China is far lower than the standard of 20 km per hour in developed countries and the problem of urban traffic congestion is more serious.

But, the public transport passenger volume is large and the per capita road area is small. After calculation, a 14 meter long bus full of passengers can replace a 600 meter long vehicle lane with 40 kilometers per hour. In other words, the capacity of urban roads is certain, but people's traffic demands are growing. Once the demands exceed the capacity, congestion will be occurred. On the premise of not changing the inherent attributes of urban roads, improving operational efficiency has become the best way to alleviate congestion. When buses and small cars undertake the same number of residents' travel demands, there are great differences in resource occupancy and transportation efficiency between both. Therefore, it is of positive significance to continuously improve the public transport system, improve the service quality and enhance the share rate of public transport travel, so as to alleviate urban traffic congestion and save residents' travel time.

**4. 2. Contribution of BRT to Improving Passenger Transport Efficiency and Saving Travel Time**

Nanchang City has accelerated the construction of urban subway. At present, the completed line 1 and line 2 have greatly alleviated the ground traffic congestion the ground traffic volume in the main peak sections has decreased by 4. 4% year on year. However, on the

whole, the annual conventional traffic passenger volume has continued to decline, from 518 million in 2014 to 378 million in 2018. On the contrary, the number of motor vehicles in Nanchang is on the rise year by year, and the growth rate in recent years is more than 10%. It shows that the traditional public transport is still less attractive than the car, but the passenger volume of subway and other public transportation methods are increasing year by year.

Therefore, based on the preliminary formation of the traffic trunk network, Nanchang city needs to strengthen the operation optimization of traditional public transport, improve its travel speed and travel comfort, and attract urban residents to choose public transport. Simultaneously, in the future, Nanchang should speed up the construction of metro lines 3 and 4 improving the urban public transport system and providing various options to meet the travel demands of urban residents. In the same way, economic means can be used to reduce the travel expenses of public transport, and create a new concept of public transport travel mode.

**5. CONTRIBUTION OF PUBLIC TRANSPORT TO TRAFFIC SAFETY**

Road traffic accident is a serious traffic problem currently [11]. It is also an important cause of death and injury all over the world. It brings great harm and economic loss to individuals, families and society. The rapid growth of motor vehicle ownership in China in recent years has also directly led to frequent road traffic accidents. According to the statistical data of China's transportation department, since 2000, the deaths caused by road traffic accidents in China have exceeded 100000 and the direct economic loss caused by traffic accidents is about 1 billion yuan. The main causes of road traffic accidents are: speeding, failing to give way according to regulations, drunk driving and fatigue driving, etc.

For public transport, it is driven by full-time drivers with rich driving experience and operated by professional companies and enterprises. Compared with other motorized transport modes, it is safer and more formal, with lower traffic accident rate and lower mortality rate. According to the statistics of the federal Traffic Management Commission of the United States, from 2003 to 2009, the death rate of buses per million kilometers was 0. 05%, that of small cars was 1. 42% and the Railways was about 0. 03%. We can learn that the traffic accidents and mortality of small cars are far greater than that of buses.

Compared with traditional motorized traffic, the safety of public transport is mainly reflected in the following aspects:

- (1) Public transport enterprises and relevant departments have strengthened the public transport

safety standards and established strict vehicle safety inspection and maintenance system [12]. So as to keep the bus in good technical condition during operating. Besides, there are also professional firefighting devices and escape tools on the bus, which are not available for individual traditional motor vehicles.

(2) Public transport enterprises can manage and educate bus drivers in a unified way, regularly carry out traffic safety training and learning and regularly carry out safety level assessment, which can improve the traffic safety awareness of bus drivers, so that bus drivers can abide laws and regulations in the process of driving, so as to improve the overall level of public transport safety.

(3) Public transport enterprises have established a safety supervision and management system from the state to the local, with clear responsibilities, consistent coordination and efficient optimization, ensuring the scientificity, systematization and completeness of public transport safety crisis management. With the cooperation of relevant departments, public transport enterprises have established an efficient emergency mechanism, which can quickly and rescue the accident in time and deal with it after the accident, forming an efficient rescue and treatment system [13].

Every year, Nanchang public transport will carry out safety education and special rectification actions among all employees to build up a safe and stable defense line and effectively curb traffic accidents. The annual rate of public traffic accidents decreased by 20% to 40% year-on-year, the cost of accident decreased by about 5% per 10000 km and the traffic accidents of public traffic casualties decreased by about 70%. On the whole, the number of road traffic accidents in Nanchang is on the rise every year. We can be seen from **Table 3**, in 2018, a total of 478 road traffic accidents occurred in the city, causing 221 deaths and 376 injuries, with a direct economic loss of about 2053414 yuan. The number of accidents increased by 171, the number of deaths decreased by 9, the number of injured increased by 172, the direct economic loss increased by about 1.2 million yuan. The comparison of the two shows that the safety of public transport in traffic safety is higher than that of traditional cars and public transport has positive significance for improving road traffic safety.

**Table 3.** Statistics of traffic accidents in Nanchang in recent years

Year	2013	2014	2015	2016	2017	2018
Number of traffic accidents	313	287	294	294	307	478
Death	224	224	230	231	230	221
Mortality (%)	0.04%	0.04%	0.04%	0.04%	0.04%	0.04%
Injured	216	228	230	218	204	376
Economic loss (ten thousand yuan)	53.34	60.87	140.57	124.06	85.26	205.341

## 6. CONCLUSION

Public transport is an indispensable part for the development of a city. It facilitates the travel of urban residents, saving the energy and land resources of the city, effectively alleviating the problem of urban congestion and reducing the occurrence of traffic accidents. Its construction concept fully conforms to the concept of sustainable green development, which is contributing to the stable and orderly social and economic development greatly.

## AUTHORS' CONTRIBUTIONS

Yunqiang Xue contributed to the conception of the study; Wenlong Li performed the data analyses and wrote the manuscript; Dilong Zhang helped perform the analysis.

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