

The Impact of Slow Traffic Environment on Residents' Travel Behavior: A Case Study of Xi'an

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Abstract

For a long time, there have been certain misunderstandings in the cognition of the traffic environment among Chinese residents, believing that the transportation system is to serve motor vehicles and ensure the smooth flow of motor vehicles. However, with the progress of society and the improvement of residents' awareness of environmental protection, the status of slow traffic is gradually rising. The so-called "slow traffic" is not an inefficient "slow", but a lightweight, zero-emission, humanized low-speed travel mode compared to motorized rapid transportation. This paper uses the questionnaire survey method to collect residents' opinions and views on the surrounding slow traffic environment, and analyzes its existing problems, so as to put forward optimization and suggestions for the slow traffic environment in the surrounding districts and counties of Xi'an, improve the travel experience of residents when traveling short distances, and promote the gradual improvement of the slow traffic system in Xi'an.

Keywords

Slow traffic; Travel behavior; Traffic environment.

1. INTRODUCTION

In response to the call of the national dual carbon goal, many provinces and cities have listed low-carbon and environmentally friendly travel as the primary goal of urban transportation development in the future. With the concept of low-carbon environmental protection gradually taking root in the hearts of the people, more and more residents choose walking and cycling as their first choice for daily travel. Because of this, the improvement of the slow traffic environment is more and more important. This paper will investigate the actual situation of the existing slow traffic environment in Xi'an, put forward reasonable optimization suggestions, and improve the quality of the urban slow traffic environment.

2. RESEARCH METHODS

This paper mainly adopts the questionnaire method and comparative analysis method. During the Spring Festival in 2023, a questionnaire survey was carried out in Xi'an, a total of 201 questionnaires were distributed, and 201 questionnaires were recovered, including 16 invalid questionnaires and 185 valid questionnaires, with a questionnaire recovery rate of 100% and a recovery questionnaire efficiency of 92.04%. The questionnaire was distributed mainly in Chang'an District and High-tech Zone in Xi'an, and the survey targets were permanent residents of the two districts. SPSS was used to analyze the questionnaire data and obtain relevant results.

3. CHARACTERISTICS OF SLOW TRAVEL BEHAVIOR OF RESIDENTS IN XI'AN

3.1. Travel demographics of Xi'an residents

(1) From the perspective of gender characteristics, there was a difference in the proportion of men and women in the survey subjects, and it was found that the cooperation degree of women was significantly higher than that of men in the survey process, accounting for 65.67% of the total number of respondents, and men accounted for 34.33% of the total number of respondents.

(2) People of different ages have different travel concepts and differ in their behavior in parades. According to the results of this questionnaire, the survey collected the fewest residents under the age of 18, accounting for only 2.3% of the interviewees; Residents over 50 years old accounted for 6.8%; 22.7% of visitors aged 31~50; The proportion of visitors aged 18~30 was the largest, at 68.2%. In general, young and middle-aged people are the majority of respondents.

(3) From the perspective of education level, the education level of the respondents is relatively desirable because they are located in the urban area of Xi'an. Among them, there was no education level below primary school, and the proportion of primary Chinese level was 4.6%; The proportion of high Chinese was 9.1%; Tertiary colleges accounted for 6.8% of the total respondents; The proportion of undergraduates was 45.5%; The proportion of graduate students and above was 34.1%. Because of the large number of colleges and universities in Xi'an, this characteristic is in line with the characteristics of Xi'an urban area.

(4) In terms of occupational distribution, among the occupations of the respondents, the proportion of students studying abroad accounted for the most, 52.3%; The proportion of tertiary service industry, industrial workers and other workers was the same, all at 11.4%; Self-employed accounted for 6.8%; Professional and technical personnel accounted for 4.5%; The lowest proportion of retirees is 2.2.

3.2. Analysis of Urban Residents' Willingness to Adopt Slow Traffic in Xi'an

(1) Residents' willingness to travel

According to the survey results, most residents use slow traffic every month. The number of trips per month was the largest at 77.3%, the number of trips per month was 6~10 times and more than 10 trips, both at 2.3%, and the number of residents who never chose slow traffic accounted for 18.1%.

(2) The concept of slow traffic

Slow traffic refers to the mode of transportation with a speed of less than 15km/h, mainly including low-speed travel modes such as pedestrian traffic and non-motor vehicle transportation. After explaining the concept of slow traffic, 52.3% of the respondents said that they were aware of the concept of slow traffic, while 47.7% of the respondents said that they had never heard of the concept of slow traffic. This shows that most people have a certain understanding of slow traffic, indicating that the status of slow traffic in people's minds is gradually rising.

(3) Residents' willingness to choose slow traffic travel

Residents' willingness to adopt slow traffic for travel is relatively high, and from the results of the collected survey, 72.7% of respondents are willing to adopt slow traffic for daily travel. 27.3% of respondents said they would not go out in slow traffic. Therefore, the investigation and research of the slow traffic environment in Xi'an is particularly important.

4. INVESTIGATION AND ANALYSIS OF SLOW TRAFFIC ENVIRONMENT IN XI'AN

According to the survey results, 70.4% of respondents believe that the existing slow traffic environment in Xi'an meets the basic requirements of their travel, while 29.6% of respondents believe that the existing slow traffic environment does not meet their expectations.

In the design of the questionnaire, in order to understand and elaborate on the slow traffic environment, this data adopts the method of Li Keqin scale, and asks respondents to use five levels of "very satisfied" (5 points), "satisfied" (4 points), "fair" (3 points), "dissatisfied" (2 points), and "very dissatisfied" (1 point) to evaluate the satisfaction of each index of slow traffic. In the final 185 valid data collected, the SPSS statistical software was used for data analysis.

4.1. Slow traffic system signs and markings

(1) Slow traffic system signs and marking information are correct

According to the survey results, respondents are satisfied with the marking information of slow traffic signs in Xi'an, with 38.4% of residents satisfied with this indicator and 45.4% of residents thinking that it is average. Only 16.2% of residents believe that the information on the marking of slow-moving traffic signs does not meet their requirements.

(2) Clear guidelines for slow traffic system signs and markings

In terms of marking guidelines, 41.1% of respondents are satisfied with the clear attitude of the existing marking guidelines in Xi'an, and 44.9% of residents believe that they basically meet their own requirements. The remaining 14 percent of respondents gave a score below the passing mark.

4.2. Slow traffic system infrastructure

(1) Perfect barrier-free facilities for slow traffic system

In the survey, 29.7% of respondents gave a satisfactory rating, and 52.4% of residents felt that the level of perfection was average, while the remaining 17.9% were not satisfied with this indicator.

(2) Slow traffic system Sufficient lighting at night

According to the survey results, 35.7% of respondents felt that night lighting facilities met their needs, and 43.8% of residents maintained a pertinent attitude. The remaining 20.5% of respondents believe that this indicator needs to be improved.

(3) Adequate recreational facilities for slow-moving traffic systems

25.4% of respondents believe that the leisure facilities of the slow traffic system meet the requirements of their own travel, and 54.6% of respondents gave a general rating. The remaining 20% of the surveyed residents believe that the existing recreational facilities are not sufficient to meet daily needs.

(4) The slow traffic system has complete floor crossing facilities

The flat crossing facilities are also basically in line with people's daily requirements, with 29.2% of respondents satisfied with the existing flat crossing facilities, and the vast majority of residents giving a pertinent rating, accounting for 52.4%. The remaining 18.4% of residents believe that the crossing facilities are inadequate, and that crossing requires a long detour.

(5) Protective warning facilities in dangerous sections

In this indicator, 29.7% of respondents have a positive attitude towards the installation of hazard warning facilities, and 47.6% of residents believe that this indicator is average. 22.7% of the respondents believed that the warning facilities were not clear enough and did not meet the requirements.

(6) Slow traffic system vegetation greening construction

In terms of vegetation greening construction, respondents were satisfied with the greening facilities of the slow traffic system, 47.6% of the residents thought that the vegetation greening of the slow traffic environment was perfect, and 43.2% of the residents thought that it was average. Only 9.2% of residents are not satisfied with the greening of existing slow-moving spaces.

4.3. Slow lane management

(1) Slow lane continuity

38.9% of the respondents believed that the continuity of slow roads in Xi'an met the requirements and gave a satisfactory score. 45.4% of respondents gave a pertinent opinion. The remaining 15.7% of respondents were not satisfied with the existing slow walkway, which may be due to the age and serious damage of the slow road in the old town.

(2) Slow lane violation

In this indicator, the number of people who are dissatisfied with the illegal parking control of slow roads is higher than the number of satisfied people, accounting for 31.9%, while the number of satisfied people accounts for only 27%. The remaining 41.1% of respondents thought it was fair. This indicator shows that the illegal control of slow roads in Xi'an is indeed unsatisfactory.

(3) Easy parking for bicycles

According to the survey results, 38.4% of residents are satisfied with the existing bicycle parking area, 31.9% of residents believe that bicycle parking basically meets the requirements, and the remaining 29.7% of residents think that parking bicycles is inconvenient and cannot meet their needs.

(4) Easy to transfer to bus/subway

45.9% of the respondents thought that the existing slow lanes in Xi'an were more convenient for bus or subway transfers, 40.5% of residents maintained a pertinent attitude, and only 13.6% of residents thought that the transfer between slow lanes and buses and subways was not convenient enough.

(5) Street detour distance

In this indicator, 29.2% of residents were satisfied with the detour distance of the slow road, 50.3% thought it was fair, and the remaining 20.5% thought that the detour distance was too long and was not very satisfied.

(6) Rationality of isolated roadway facilities

27% of respondents believe that the separation measures between slow lanes and motorways are reasonable, and 56.8% of respondents think that it is fair. 16.2% of respondents believe that the quarantine measures are unreasonable and there are potential safety risks.

(7) Less pedestrian/bicycle mix

According to the results, this indicator is more serious, 27.6% of residents believe that there are fewer pedestrians and bicycles on the slow road, 36.2% of the residents said it is acceptable, but the remaining 36.2% of the residents believe that the pedestrian and bicycle on the slow road are seriously mixed and are very prone to safety accidents.

4.4. SPSS statistical software data analytics

The above statistics were analyzed using SPSS statistical software, and the results are as follows:

From the content of the table, it can be seen that the occupancy of slow lanes by motor vehicles, the mixing of pedestrians and bicycles, and the squeezed slow space are the three problems that residents are most dissatisfied with, so it is particularly important to propose optimization and improvement measures for these problems.

Overall, the Cronbach α reliability coefficient value of 17 slow traffic environment surveys was $0.761 > 0.7$, indicating that the reliability of these 17 items was good and acceptable.

Table 1. Investigation and Analysis of Slow Traffic Environment in Xi'an

indicator	number	minimum value	maximum value	average	standard deviation
The marking information is correct	185	1	5	3.20	0.931
Clear marking guidelines	185	1	5	3.29	0.979
Perfect barrier-free facilities	185	1	5	3.12	0.942
Sufficient lighting at night	185	1	5	3.10	0.981
Adequate recreational facilities	185	1	5	3.01	0.921
Perfect floor crossing facilities	185	1	5	3.12	0.897
Protective warning facilities in dangerous sections	185	1	5	3.03	1.040
Vegetation greening construction	185	1	5	3.45	0.840
Slow lane continuity	185	1	5	3.21	0.997
Slow lane violation	185	1	5	2.86	1.018
Easy parking for bicycles	185	1	5	3.06	1.140
Easy to transfer to bus/subway	185	1	5	3.35	1.053
Street detour distance	185	1	5	3.09	0.868
Rationality of isolated roadway facilities	185	1	5	3.03	0.961
Less pedestrian/bicycle mix	185	1	5	2.78	1.193
Slow lane space is open	185	1	5	2.94	0.971
Slow road surface leveling	185	1	5	3.30	0.918

5. SUGGESTIONS FOR IMPROVING THE SLOW TRAFFIC ENVIRONMENT IN XI'AN

5.1. Slow traffic space

(1) Solve motor vehicle parking violations

Increase penalties for illegal parking of motor vehicles on sidewalks and non-motorized lanes, and encourage residents to report motor vehicles that illegally occupy slow lanes. Appropriately increase the height of the road edge and the number of isolation facilities to ensure the independence and integrity of the slow travel space.

(2) Distinguish between sidewalks and non-motorized lanes

Plan and build independent slow travel spaces on urban expressways and main roads, refine the difference between pedestrian areas and non-motor vehicle areas, avoid conflicts between pedestrians and non-motor traffic, and ensure the comfort and safety of the slow traffic environment.

(3) Guaranteed slow traffic travel

Build a continuous slow traffic system to ensure the right to drive slow traffic. Motor vehicle parking spaces along the road must not impede the normal movement of non-motor vehicles and pedestrians. It is strictly forbidden for vendors to set up stalls on the slow road without authorization to ensure the continuity of slow traffic.

5.2. Slow traffic facilities

(1) Set up isolation and greening facilities

Use barriers or green belts to separate motorized and non-motorized lanes, non-motorized lanes and sidewalks to ensure the safety of residents who choose different ways to travel.

(2) Optimize the slow-moving traffic system across the street

Improve pedestrian crossing facilities at intersections, optimize traffic light signal timing, add lighting systems and signage systems, and improve the efficiency of slow traffic crossing streets. Setting up a three-dimensional crossing system according to specific needs can solve the problem of people-vehicle conflicts and achieve the purpose of alleviating urban traffic pressure.

(3) Improve bike parking space

When planning and designing the parking space of shared bicycles, the size of shared bicycles and the space required when people park should be fully considered, and the parking space should be further enriched and optimized on the basis of meeting the reasonable size of the space.

6. SUMMARIZE

Based on the questionnaire survey, this paper conducts a survey interview with permanent residents in two districts of Xi'an, and asks about the impact of slow traffic environment on residents' daily travel. From the survey results, it is found that there are different degrees of problems in the slow traffic environment in Xi'an: the phenomenon of illegal parking of motor vehicles occupying slow traffic space is frequent, pedestrians and bicycles in non-motorized lanes are seriously mixed, and the slow traffic space is compressed in order to ensure motor vehicle travel. Such problems have led to frequent traffic problems, forming a vicious circle, aggravating the frequency of safety accidents, causing serious traffic congestion, and not conducive to the development of urban transportation in the direction of people-oriented and low-carbon transportation. This paper focuses on the investigation and research of the slow traffic environment in Xi'an through questionnaires, summarizes some methods to improve the slow traffic environment in Xi'an in view of the many problems of the current slow traffic environment, and puts forward planning measures and suggestions from several aspects such as slow traffic space and slow traffic facilities, so as to achieve the purpose of promoting the people-oriented, low-carbon and environmental protection development of urban transportation in Xi'an.

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