

Research on urban slow traffic planning from the perspective of system optimization

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Abstract: Slow traffic is the main way for urban residents to travel in our country. Protecting and encouraging slow traffic and promoting the benign interaction between slow traffic and public traffic are important ideas for the development of slow traffic. The research on slow traffic optimization aiming at the problems existing in the slow traffic system is increasingly comprehensive and in-depth. The literature reviews the relevant contents of urban slow traffic planning research, summarizes and comments on China's current overall development strategy, research on the spatial composition of urban slow traffic system, urban slow traffic network analysis and network structure hierarchy division, urban slow traffic planning and design technology and detailed design research, etc. It is also pointed out that the research direction of slow traffic planning should be shifted from the internal optimization of slow traffic system to the harmonious development of slow traffic and motor traffic, which can provide reference for urban slow traffic planning research and planning practice.

Keywords: Slow running system; System optimization; Research review

1. Introduction

Slow traffic is the main way for urban residents to travel in China. In the future, the proportion of walking and bicycle traffic will remain at 25%~40% and 10%~15%, respectively. At the same time, protecting slow travel and encouraging the "slow + bus" travel mode has been widely accepted as an important path for the sustainable development of urban transportation. However, in the context of China's rapid urbanization, the planning and construction of the slow traffic system is relatively backward. The research on urban slow traffic planning based on the optimization goal of the slow traffic system has attracted extensive attention from scholars in recent years. In view of the problems existing in the current slow traffic system, domestic scholars have put forward many strategies and measures to optimize slow traffic from the aspects of traffic development strategy, traffic management, slow traffic space and slow travel. However, due to the different disciplinary background and research starting point, the urban slow traffic planning research based on the optimization of slow traffic system needs to be sorted out.

2. Review of urban slow traffic planning

In order to get a general overview of the relevant researches based on slow running system optimization, the relevant researches were searched in the main authoritative databases in China. Using the keywords "slow traffic system", "slow traffic", "walking", "bicycle" and so on to search the domestic literature, through statistical analysis, we can find that the domestic research on slow traffic is mainly concentrated after 2000. Although the practice of urban slow traffic system optimization in China is progressing slowly, the research on urban slow traffic system optimization has been carried out deeply, and there are many achievements from macro countermeasures to micro design research. Not only the planning and construction of the slow traffic system itself, but also the development policy research of the slow traffic system have carried out a lot of exploration.

3. Research status of urban slow traffic planning

The slow running system mainly consists of the slow running space (including the slow running network, the slow running facilities and other material environment), the slow running main body, the

slow running travel and so on. At present, the research on the optimization of slow traffic system mainly focuses on the problems of slow traffic, the optimization countermeasures of slow traffic system, the network of slow traffic, the facilities of slow traffic, the characteristics of slow traffic and the technical means of slow traffic planning. In order to make a systematic review of the general idea of the current research, the author reviews the current research from the aspects of the overall development strategy research, spatial characteristics research, travel characteristics research, planning and design technology research and so on.

3.1. Overall development strategy countermeasures

Start with the concept and strengthen the concept of slow traffic -- slow traffic has been, is or will be an important mode of travel for the vast majority of residents in our country for a long time [1]. The government and the general public need to correctly understand the role of slow traffic and strengthen the concept of slow traffic.

The overall positioning of slow traffic determines the importance of slow traffic in the development and implementation. Chris Bradshaw studied the structural system of urban green traffic and pointed out that slow traffic is the primary component of green traffic and an important part of comprehensive traffic [2]. Under the framework of the overall positioning of slow traffic, it is necessary to study the development mode of slow traffic suitable for cities with different scales, land layout structure and characteristics. Wan Jun et al. summarized three typical development modes of slow traffic [3], and explained the characteristics and applicable regions of the different modes. However, the development modes lack urban background and theoretical derivation, and the characteristics and applicability of each mode need to be further studied.

Planning first, establish the status of slow running system planning - slow running system planning is a new comprehensive subject involving multiple disciplines, and is currently in a stage of exploring and moving forward, with few experiences and models to learn from. It is necessary to consolidate the wisdom of government departments at all levels and integrate all resources for systematic research. Based on the planning and practice of slow traffic in Taizhou, Zhang Ling et al. pointed out that the important role and status of slow traffic in urban traffic and urban development should be clearly defined in government documents, and it should be connected and implemented in the statutory plans prepared by various departments such as economic development planning, urban planning, transportation planning and water conservancy planning [4].

3.2. Optimize traffic management

The research of traffic management measures focuses on the allocation of road resources, optimizing the allocation of road resources from the aspects of traffic demand, road space, traffic signal control, traffic stability and so on, and improving the slow travel environment.

The allocation of road resources should meet the needs of slow traffic. In combination with the different characteristics of urban land layout, corresponding traffic demand management measures should be taken to guide residents to choose slow traffic modes [5]. Reduce motor vehicle lanes in specific sections or periods according to the situation to ensure the traffic needs of non-motor vehicles during peak periods; If there are no hard conditions to restrict motor vehicle traffic or to plan independent special facilities for slow traffic, it is also a worthwhile idea to reduce motor vehicle travel through economic policies and carry out innovation in traffic management. The traffic signal timing can separate the spatially conflicting traffic flows in time to ensure the safety of slow traffic. Optimizing the allocation of road resources through traffic management can improve the comfort, convenience and safety of slow travel. For example, some areas in the Netherlands adopt the traffic signal control method of Green Waves, and every intersection is green when the cycling speed is 20Km/h. The motor vehicle parking line at the intersection is moved back relative to the bicycle parking line, broadening the vision of motor vehicles, and the bicycle signal light turns green several seconds in advance, giving priority to bicycle traffic through the intersection and reducing the impact of motor traffic on bicycle driving safety. At present, traffic management measures suitable for its characteristics need to be studied based on the actual and specific conditions of different places [6].

4. Overall development strategy countermeasures

(1) Start with the concept and strengthen the understanding of the concept of slow traffic - slow

traffic is an important mode of travel for the vast majority of residents in our country, whether in the past, now or in the future for a long time. Peng Yuhong, Zhu Hongjia and Xie Zhen studied the need for the government and the general public to correctly understand the role of slow traffic and strengthen the conceptual understanding of slow traffic.

(2) Clear positioning, study and determine the development mode of slow traffic suitable for the city the overall positioning of slow traffic determines the importance of slow traffic in the development and implementation. Jin Xueqian studied the structural system of urban green traffic and pointed out that slow traffic is the primary component of green traffic and an important part of comprehensive traffic. Under the framework of the overall positioning of slow traffic, it is necessary to study the development mode of slow traffic suitable for cities with different scales, land layout structure and characteristics. Wan Jun et al. summarized three typical development modes of slow traffic, and explained the characteristics and applicable regions of the different modes. However, their development modes lacked urban background and theoretical derivation, and the characteristics and applicability of each mode still need to be further studied.

(3) Plan first and establish the status of slow running system planning -- slow running system planning is a comprehensive new subject involving multiple disciplines. It is currently in a stage of exploring and moving forward, and there are few experiences and models for reference. Therefore, it is necessary to consolidate the wisdom of government departments at all levels and integrate all resources for systematic research. In combination with the planning and practice of slow traffic in Taizhou, Zhang Ling pointed out that the important role and status of slow traffic in urban traffic and urban development should be clarified at the level of government documents, and it should be linked and implemented in the statutory plans prepared by various departments such as economic development planning, urban planning, transportation planning and water conservancy planning.

5. Study on spatial composition of urban slow traffic system

Although the spatial composition of the slow traffic system is slightly different in expression, the common idea is that the basic spatial categories of the slow traffic system include slow zone, slow core, slow node and slow corridor. The slow traffic in the slow traffic core has obvious different characteristics from other urban areas. Many scholars have studied the construction strategy of the slow traffic system in the slow traffic core. He Lele and Chen Shenyang have studied the setting methods of campus speed bumps under different road conditions. Hu Xihan studied the slow walking system of the West Lake scenic area and combined it with the tourists' experience evaluation. However, the research on slow traffic in these special areas is not enough, and the research depth needs to be further strengthened.

6. Urban slow traffic network analysis and network structure hierarchy division

At present, the research on the analysis of slow traffic network and the division of network structure levels is gradually carried out: Zhu Xiaokang and Wu Xun studied that the non-motorized lanes in the urban slow traffic zone can be divided into corridors, distribution lanes, connecting lanes and non-motorized lanes according to functional levels through the zoning planning method. Urban walking network can be divided into roads that control walking activities, important walkways and important walkways that rely on urban roads. Based on the urban road system, the construction and reconstruction are carried out at different levels, and the slow lanes are divided into urban slow lanes, community slow lanes, green landscape slow lanes and waterfront landscape slow lanes.

The above studies mainly put forward the classification of the structural levels of the slow traffic network through qualitative classification methods. Li Congying, Ma Rongguo, Wang Yuping and Wang Zhaofei studied the quantitative classification of the structural levels of the urban slow traffic network by introducing complex network theories and methods into the analysis of the slow traffic network. The importance of nodes in the network is measured by centrality indexes such as node degree, compact degree and intermedium number. Through the cluster analysis of centrality index, the structure level of urban slow traffic complex network is divided into three levels: slow traffic corridor, slow traffic channel and slow travel and leisure road.

7. Research on urban slow traffic planning and design technology

Slow running system planning is the forerunner of the implementation of slow running system in space, and multi-level slow running system planning should be established. Xiong Wen, Chen Xiaohong and Hu Xianbiao pointed out that slow traffic planning should include at least three parts: development strategy planning, comprehensive network planning and special facility planning.

8. Detailed design research

Liu Ying, Luo Ji and Wu Yuexin pointed out that the consideration of slow road space - the main road of the main pedestrian traffic corridor, the width of the sidewalk is more than 6m on each side; The pavement width of the secondary road is more than 4.5m; When the width of the road exceeds 4 lanes, a pedestrian crossing safety island shall be set up, and its width shall not be less than 2m. Intersection turning radius design -- When making intersection turning design, adopt a large radius followed by a small radius design, and set up physical facilities to regulate the behavior of motor vehicle drivers, while ensuring the visibility of pedestrians at the intersection, but also reduce the speed of vehicles crossing the intersection. Reasonably determine the location of the crossing - for large intersections with large non-motor vehicle flow, the non-motor vehicle parking line should be appropriately moved forward to reduce the phenomenon of non-motor vehicles crossing the line, and non-motor vehicles can pass the intersection first to reduce the interference between motor vehicles and non-motor vehicles. At the same time, the crosswalk line also moves forward to shorten the distance of pedestrians crossing the intersection, and the increase of the distance between the vehicle parking line and the crosswalk line also enhances the safety of pedestrians crossing the intersection. Sidewalk design - raise the vehicle entrance and exit to the same level as the sidewalk, and lay pedestrian paving to maintain the continuation of the sidewalk; Add sidewalk dividers and prohibit motor vehicles from occupying sidewalks.

9. Conclusion

Different cities and regions have huge differences in land use layout characteristics, social development environment and stage, residents' habits and other aspects. The specific development strategy of slow traffic planning should be based on the study of urban status and the humanistic needs of residents, so as to meet the actual development needs. It can be predicted that the needs of slow traffic users in specific cities and regions should be targeted. It is one of the important directions of future research to carry out in-depth investigation and analysis and carry out in-depth study of slow traffic planning accordingly. At the same time, the planning research of slow traffic cannot avoid the relationship with motorized traffic. In-depth analysis of the relationship between slow traffic and motorized traffic under different traffic environments and clarification of the right of way allocation relationship under different situations are important prerequisites for the formulation of slow traffic planning strategies. How to reflect the balance between efficiency and fairness in slow traffic planning is also the content that needs further research in slow traffic planning.

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