

Research on the Improvement of Green Slow Traffic System under the Guidance of "Healthy City"

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Abstract: The rapid transformation of the world has changed the way people live. The level of urbanization is being saliently improved, material and civilization is becoming more and more abundant as well. Motor vehicles have reshaped our lifestyle. The mobile traffic-dominated planning thoughts has contributed to various problems such as disorder spread of cities, traffic congestion, aggravation of resource energy consumption, inclined allocation of social resources, and deterioration of urban health. In the evolution of urban slow traffic network in China, there are some problems such as the scale imbalance and the lack of humanistic care. In the situation of global low-carbon economic development, green travel and low-carbon transportation have been widely concerned. As a people-oriented, harmonious and low-carbon traditional green travel mode in the urban transportation system, slow traffic has once again become the focus of research. This paper will demonstrate the necessity of the development in slow traffic system under the concept of healthy city, combined with the current development status of slow traffic. The characteristics of green slow traffic system are analyzed from two aspects of goal-oriented (slow traffic subject) and demand-oriented (slow traffic activity). Then this paper will point out the problems existing in the current slow traffic and summarize the theoretical basis for improving the slow traffic environment. The strategic framework of improving the slow traffic system is constructed from the aspect of urban planning to promote healthy urban construction.

Keywords: Healthy city, slow traffic, urban planning

1. Introduction

1.1. Research Background

1.1.1. Health Challenges Posed by the Rapid Urbanization

Urbanization is a process of the transformation of human production, life and living style caused by the improvement of social productive forces. It is specifically manifested in the long-term process of population transfer from rural to urban, the continuous expansion of urban scale, and the gradual strengthening of the main role in urbanized countries and regions [1]. China's population will reach 1.45 billion by 2030, the urbanization rate will reach 70 percent, and the urban population will exceed 1 billion. In the future, cities will play an important role in affecting the health of residents. Urban areas and urban planning processes, particularly in the disposal of land use, housing, transportation,

employment opportunities, social services, and urban environmental quality, are increasingly regarded as pivotal determinants of population health.

Although urbanization has accumulated great material and spiritual wealth, it has also brought many challenges to human health. Urban environmental pollution, traffic congestion and undesirable lifestyle increasingly caused numerous chronic diseases and malignant diseases such as diabetes, hypertension and cancer. Meanwhile, the fast-paced lifestyle and employment competition pressure make people be placed in a highly tense state over a long period of time, leading to a series of problems such as crime, mental health diseases and suicide. Additionally, the mass migration, aging and social inequalities associated with rapid urbanization also pose new challenges [2]. For instance, the climb of the population over 60 living in urban areas from 34.2% in 2000 to 52.0% in 2015 has aggravated the elderly care burden.

Facing these health challenges, the concept of Healthy City has emerged under the guidance of the World Health Organization (WHO), and cities around the world gradually respond to and formulate corresponding improvement measures. The 2015 Government Work Report proposed to build a "healthy China" to ensure the basic needs of residents' health and improve the quality of life. The Outline of the "Healthy China 2030" Plan released by the Chinese government in 2016 states that health is the core content of China's sustainable development. Urban construction should take ensuring the health of residents as the highest standard, and a healthy city is its ultimate goal.

1.1.2. The Realistic Demand to Improve the Slow Traffic Environment

The development of slow traffic in China has not received enough attention. First, the traditional urban spatial form of supporting walking has been destroyed. To be specific, widening streets make speeding easier, creating more safety concerns; expressways to ease increased traffic congestion actually bring in even more traffic; some open spaces damage the fabric of pedestrian streets, demonstrating a lack of humanistic care. Secondly, the slow traffic system is not systematic, showing fragmentation, and the system coherence and accessibility are poor. The slow traffic facilities are not complete, and the slow traffic landscape environment is not attractive.

Confronting with environmental pollution, traffic congestion and a series of urban problems that threaten the health of citizens, the superiority of green, low carbon, health and environmental protection are increasingly prominent [3]. With the aggravation of social problems, cities need to be vitality to attract people, beautiful and livable to retain people, to provide a safer travel environment for children, the elderly and other vulnerable groups, connecting people together through the slow traffic environment to create a humane urban life scene. Slow traffic is not only required to meet the basic traffic functions but is an important spatial carrier for people's daily communication, activities and leisure and entertainment. As an important component of a healthy city, it can effectively improve the healthy living standards of residents.

1.2. Research Objective

This paper takes the slow traffic system as the research object, the human health demand as the starting point, the healthy city, slow traffic theory and practical research as the theoretical basis and constructs the slow traffic environment improvement strategy based on the concept of healthy city.

(1) Attach importance to the urban slow traffic environment in the process of urban development and propose that the construction which is suitable for slow traffic is the key to enhance the vitality and attraction and improve the health of the city.

(2) Focus on the connection between urban planning and population health. Study how to make the urban slow traffic environment develop towards a healthy and orderly direction, so that it can provide a high-quality space environment for the physical and mental health of urban residents.

(3) Through the upgradation of the urban slow traffic environment, people are encouraged to use more trip mode such as walking or cycling instead of motor vehicles, so as to reduce the incidence rate of chronic diseases caused by the lack of physical activity and improve the health level of the population. From the perspective of urban planning, it advocates healthier transportation and lifestyle, and proposes improvement strategies for the shortage of the current urban slow traffic environment.

1.3. Research Significance

Directed against the traffic congestion, tilted allocation of social resource, and the deterioration of urban health conditions caused by the planning leading thought of vehicle-oriented, the research on the improvement of urban slow traffic environment has its necessity and positive significance.

(1) Under the tide of rapid urbanization, urban construction pursues the smooth travel of motor vehicles, a large proportion of social resources are allocated to motor vehicles, and the slow traffic resources are seriously insufficient. Advocating slow traffic doesn't mean completely abandoning cars, but reflecting on the dominant thought of "vehicle-oriented". The focus of future urban planning should return to "people-oriented".

(2) By improving the slow traffic environment, create friendly urban space scale in slow traffic, safe and comfortable slow environment and well-developed slow facilities to improve the quality of slow travel and provide high-quality slow travel experience, which makes the urban traffic environment more humanized. Accordingly, creating opportunities for physical activity and providing space for communication, effectively improve the physiology and psychology of residents, the health of urban environment and social relations, promote the healthy development of the city as well.

2. Related Concept Analysis

2.1. Healthy City

The concept of Healthy City was first proposed at the Toronto Conference in 1984. With the outbreak of "urban disease" around the world, public health threats have become a universal problem, and the whole world began to pay attention to the healthy development of the urban environment. In this backdrop, WHO, in order to improve the natural, social and economic environment conditions related to public health and achieve the purpose of promoting health, advocated the "Healthy City Movement" and regulated that: "healthy city should constantly create and improve its physical and social environment, expand the community resources, enable people to support each other, etc." [4]. The emergence of the concept of healthy city has overturned people's traditional cognition of health. People realize that the urban material and social environment are the most important factors affecting people's health. Only by providing people with places and environments to effectively guide healthy behaviors and improve healthy lifestyle can people's basic needs for survival and life be met.

Under the impetus of the "Healthy City Movement", the concept of healthy city planning arises at the historic moment. Urban planning start to focus on the concept of urban economy, society, culture construction, with the aim of health promotion, advocating urban planners to pay attention to public health, integrating healthy development into urban construction and promoting urban planning to assume a broader health role and responsibility [5]. Slow traffic system as the composition of urban system unit, its planning implementation should also conform to the healthy city standards and highlight concerns about the healthy environment of the slow traffic, including the construction of a favorable slow traffic environment, provision of safe slow traffic road and reasonable design of identification and signal control system.

2.2. Slow Traffic System

Slow traffic system usually refers to a human-powered traffic system, such as walking or cycling [6]. This concept was first mentioned in the White Paper on Shanghai Urban Transportation issued by the Shanghai Municipal People's Government in April 2002, including three aspects: "ensuring walking traffic, guiding the rational operation of bicycles and promoting the transfer of moped to public transport". Low-speed and green travel modes such as walking and cycling can effectively guide the development of "slow travel + public transport" trip mode, which contributes to the creation of green, convenient, safe and comfortable urban environment, further improve the attraction of slow travel, and form a virtuous cycle.

2.3. Slow Traffic System Guided by “Healthy City”

The subjects that need to be guided in the slow traffic system include two categories: one is the space environment of the slow traffic system; the other is the user of the slow traffic system. The ultimate goal is to achieve the health state of all things. It is emphasized to construct the space environment of slow traffic system into a sustainable space for users to grow and enjoy their lives, guiding the health activities of users, cultivating a healthy lifestyle, to prompt users to achieve the complete health state in the physiological, psychological and social adaptation. Meanwhile, guide the slow traffic system to develop in a direction conducive to the healthy behavior of users, optimize the material space environment, achieve the health standards of slow traffic system as well [7].

3. Theoretical Basis

3.1. Compact Green City

Urban sprawl is generally considered as a spatial process of urbanization, characterized by unconstrained urban expansion with the growth of urban population. Numerous studies have shown that urban sprawl measured as low residential density, low employment density, and low "connectivity" is associated with less walking and cycling and more car travel compared with more compact communities.

Therefore, policy and scientific widely accept the require to cultivate Compact City. Compact city is a spatial form characterized by compact material, high-density development and complete public transportation facilities [8]. In North America, Smart Growth describes a similar concept, pedestrian and traffic-friendly urbanization. The Compact City policy aims to address many urban problems, such as land consumption in marginal areas, wasted energy and resources, and air pollution. Arguably it's a more sustainable type of urban residence because it is less dependent on cars and requires less infrastructure. The compact city study focuses on strategies designed to manage urban expansion, increase density, provide mixed land use, reduce public development costs and improve urban architectural aesthetics and quality of urban life.

3.2. “Complete Street”

"Complete Street" is an emerging concept in transportation planning in North America. Its occurrence extends the focus of traffic design from car traffic on the street to all modes of travel, allows active traffic such as walking and cycling, and supports the safety of each type of road users. Thus a complete street is widely defined as a street that can safely accommodate all road users, regardless of mode of travel or capacity. Complete Street projects tend to improve everyone's safety and increase cycling and walking. Compared to traditional transportation projects, Complete Street projects are an

cheap way to achieve transportation goals and are associated with wider economic gains such as rising employment and property values.

The complete street concept is further extended in conjunction with other ideas, actively prioritizing pedestrians or public transit while contributing to environmental sustainability [9]. Some communities are developing complete green street policies to further expand considerations when making traffic decisions. Boston's Complete Street Guide consists of a wide range of "green" facilities, including adding street trees, permeable pavement, etc, to cope with urban runoff and water pollution caused by impermeable streets. Seattle, Boston, New York and Chicago are all implementing complete streets with a focus on creating model shifts, reducing emissions -- This means increasing the options of bikes, walking and public transportation that not only improve safety but also induce people away from cars.

3.3. Slow Traffic + Public Transport

As an extension of public transportation, slow traffic is the first and last step to achieve the destination. Slow traffic and public transport are highly synergistic, with high utilization rate in areas suitable for walking, and in areas with convenient and efficient public transport, walking is also the most common [10].

Transit-oriented Development (TOD) focuses on the provision of bus services along with high-density and multi-purpose development designed to increase the number of public transport passengers, thus reducing car travel for different purposes while providing a pedestrian-friendly environment and better accessibility to facilitate walking activities.

Arefeh Nasri answered the effectiveness in encouraging reduced driving and switching to buses, walking, cycling and other sustainable transportation modes by analyzing the VMT (vehicle mileage) of the residents in Washington, DC, and Baltimore. Its findings suggested that people living in TOD areas tend to drive less often than residents living in non-TOD areas.

Successful Factors of TOD include the implementation of restrictive vehicle use and parking supply policies, the requirement of positive bus service frequency during peak and off-peak hours, and conditions that facilitate walking or bicycle travel. Living in areas with good transport accessibility, as well as other land use characteristics such as high density development and land use mix encourages people to lead a sustainable and healthy life with more public transport use and less driving. This will eventually turn the city into a more pedestrian and transit area.

3.4. Walking and Cycling Friendly Vibrant City

The core of the slow traffic explored in this paper refers to the pedestrian traffic and the bicycle traffic. Slow traffic means vibrant cities. Harvard University professor Robert Putnam, in his published "Bowling Alone", points out that more driving time means less time with family or friends, and less community time. For each additional 10 minutes of daily commute time, citizen participation in community activities is expected to fall by 10%. Walking produces a lot of economic and social benefits, and more importantly, walking adds vitality to the city.

In the study, "Cities alive: Towards a walking world", Arup summarizes the benefits of walking cities in four social, economic, environmental and political aspects. A vibrant city can promote a positive lifestyle, address obesity risks, reduce chronic diseases, and improve mental health and well-being.

4. Development Status of the Slow Traffic System

Slow traffic has become the greenest and lowest carbon means of transportation with its zero pollution. Today with the progress of technology, transportation becomes fast, diverse and

compound. Urban slow network mostly attached to the roadway but lacked exclusive system. Although many cities have carried out related planning and construction in slow traffic, the safety of travel and convenience have failed to be fully reflected.

4.1. Problems Existing in the Slow Traffic Network

4.1.1. The Concept of Slow Traffic Needs to Be Renovated

The construction of slow traffic remains stagnant in the traditional road plane such as sidewalk, the division of non-motorized lanes and the pedestrian crossing channel. The three-dimensional and compound slow traffic system is not considered enough.

4.1.2. The Guidelines of Slow Traffic Planning and Construction Are Insufficient

Slow traffic lacks systematic planning, and the construction often only pays attention to the improvement of local nodes, but doesn't fully consider the coherence and smoothness of the slow traffic and the coordination and interdependence with the functions of the surrounding buildings.

4.1.3. The Slow Traffic Space is Ignored or Even Occupied

All kinds of urban slow traffic ratio in our China are more than the motorized traffic, but the urban traffic planning ignored the slow traffic road design, so that it can't guarantee the continuous slow traffic space and path residents required, resulted in the fact that slow traffic system is attached to motor vehicle traffic, without forming a slow traffic network with complete structure and clear rights-of-way.

4.1.4. Poor Safety of the Slow Traffic Environment

In urban road sections or blocks, the improper travel and random parking of motor vehicles often cause the poor safety of the slow traffic space, especially the speed conflict of the branch road around the community. Improper access management results in high incidence of accidents, reducing the continuity and safety of pedestrian travel.

4.1.5. Slow Traffic Facilities Are Incomplete

The lack of slow street crossing facilities and incomplete bicycle parking facilities are common in most cities in China, which restricts the development of slow traffic. Moreover, there is a lack of humanized design of service facilities around the slow passage, such as garbage bins, maps, directions and other settings of urban furniture. Especially in the transportation hub area, the demand for large conversion of slow traffic flow is complex. Due to the incomplete transfer facilities, the connection between slow traffic and other modes of transportation will not be smooth.

5. Improvement Strategy

5.1. Construct Slow Traffic Street Network

5.1.1. Walking Network Planning and Design

Walking network consists of ranging walking roads and crossing facilities, the planning and design of walking network should clarify the functions of walking traffic and pedestrian road classification according to the traffic, the activity level of street and the properties of surrounding land. Walking network design should also consider the stereo walking system, which is the network integration of

plane walking system, air walking system and underground walking system, and organizes the various types of walking traffic to the overground, ground and underground these three different plane space. Combining with the pedestrian bridge, pedestrian passageway and other facilities could effectively connection stereo and ground walking space [11].

Walking network planning and design embodies the concept of "pedestrian first" walking network. Construct a walking friendly city and establish a safe, continuous, unhindered walking environment with permeability and fun, to increase comfort and capacity and ensure that the walking network, layered structure and environment are corresponding.

5.1.2. Bicycle Network Planning and Design

In the planning and design of bicycle network, it is proposed to give priority to bicycle cycling as a sustainable mode of transportation. Setting up bicycle facilities can ensure the comprehensive implementation of bicycle network planning, provide safe, convenient and interconnected routes, and help cyclists to reach their destination. Equip with bicycle network support implementation, including bicycle parking lot, road signs, shared bikes and connection facilities with public infrastructure.

5.1.3. Greenway Network Planning and Design

Pay attention to the greening on both sides of the road and the series relationship between the greenway and the scenic spots and parks.

5.2. Planning and Design of Slow Traffic Facilities

5.2.1. Planning and Design of Pedestrian Transportation Facilities

Walking traffic facilities layout need to concentrate on the connection of the sidewalk and crosswalk, provide continuous traffic space, refine urban texture, provide multiple choices of path for pedestrians, increase accessibility, meet the demands of pedestrians of all ages [12]. Pedestrian space is ensured by setting barrier-free slopes, monitoring and other ways, and setting curb expansion belt and safety island can shorten the crosswalk distance, so as to provide protection for the walking. In addition, unique street facilities, road signs, landscape, and lighting facilities can create a landmark pedestrian street.

5.2.2. Planning and Design of Bicycle Transportation Facilities

The traffic facilities of the bicycle path should not only provide safety for the cyclists, but also provide clear sight to ensure the comfort and quality of the cycling space, the accessibility and continuity of the route.

Through the planning and design of the traffic facilities of the bicycle path, it is proposed to select different bicycle isolation measures according to local conditions, increase road signs, establish shared bicycle stations, provide safety island for cyclists, and improve the level and frequency of use of the bicycle path.

5.3. Enhance the Safety of the Slow Traffic

At present, western countries take measures to stabilize traffic to limit the rapid driving of motor vehicles in residential land and ensure the safety and comfort of pedestrians and activities. Common methods include widening sidewalks and reducing the width of highways. In the case of a two-lane road, the road is usually narrowed down enough to accommodate two cars to limit the speed and provide a more spacious and comfortable walking space.

Pedestrian crossing facilities should be designed with full consideration of convenience and safety. Set up street crossing facilities and reasonably control the spacing of crossing facilities according to the requirements of pedestrian crossing facilities. Except for the main traffic road, the distance between the general street crossing facilities should be controlled within 100 meters, and the maximum distance should not exceed 150 meters. Walking street crossing facilities should be kept on the ground corridor and underground passage as a supplement and should be reasonably located to achieve a good connection between walking and other modes of transportation. The crosswalk should conform to the pedestrian flow and avoid the detour. When the road width of the road intersection is greater than 4 lanes, a safety island should be set at the center of the crosswalk. Roads with a central partition belt can combine the safety island with the partition belt. The width of the safety island shall not be less than 0.8 m, and the length of the resident area shall not be less than the width of the connecting crosswalk [13].

5.4. Improve the Comfort Level of Slow Traffic

5.4.1. Appropriate Spatial Scale

A good street should have a sense of enclosed street boundary, which will make people have a sense of security and belonging. A street should form an orderly spatial interface through the street trees, street buildings and walls. Street space and building volume catering to the human body scale are optimal, and the aspect ratio of adjacent buildings and streets is crucial to determine the sense of space of the street area.

5.4.2. Abundant Street Planting

Street planting includes border trees, street green space, elevation greening, isolation facilities and isolation belt greening, etc. Road greening has various functions such as landscape, ecology, environment and disaster prevention. Favourable road greening can improve the spatial scale relationship of road, create positive road landscape, absorb harmful substances, degrade dust, reduce heat island effect and reduce noise [12].

5.5. Realize the Humanization of Slow Traffic

Mixed residential, office and commercial Spaces such as bars, restaurants, cafes and local commerce can attract people and make the environment more safe and friendly. Diversified functions can drive additional activities to keep the space safe: more pedestrians on the streets can curb crime.

6. Conclusion

6.1. The Necessity of Green Slow Traffic Improvement Based on the Concept of Healthy City

The 21st century is confronting with significant global health challenges, prompting a rethink of ways to prevent disease, and urban planning is now considered as part of an integrated solution to adverse health outcomes. Well-planned cities have a broader potential for promoting health and well-being. This can be achieved by reducing car dependence, traffic exposure, pollution, noise and urban heat island effects, while enhancing mental health and promoting climate change mitigation, as well as safe, comfortable and ideal ways to promote walking and cycling.

With the development of society, the share of slow traffic decreases with the passage of time, and cars gradually become the dominant urban planning. With the new integration between modern urban planning and public health, slow traffic has also experienced a process of returning from dominance to decline. As an important part of healthy city planning, slow traffic is inextricably linked to public

health problems. A range of environmental problems resulting from increasing reliance on motorized traffic has prompted increasing attention to the non-motor vehicle model, or "slow traffic" as a way to improve public health.

6.2. Urban Development Focuses on “People-oriented”

Make the city people-oriented, habitable, fair, social and enjoyable to maximize the city's opportunities for health and well-being as well as the economy and business. By encouraging and promoting active and participatory urban life, many current problems, such as physical inactivity, overweight and obesity, mental illness, exclusion of economically and socially disadvantaged groups, and exclusion of older adults, can also have positive effects.

6.3. A Strategic Framework for Green and Slow Traffic Improvement

From the two levels of urban scale and street scale, constructing a strategic framework to improve the environment of slow traffic is not to completely abandon cars, but to promote the realization of the multi-modal transport mode of slow traffic, public transport and mobile transport. Slow traffic needs to be based on public transportation, with the gradual revival of slow traffic, the development of public transportation will be effectively promoted, so as to reduce the dependence on private cars to a certain extent.

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