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Application Strategy of Green Transportation Concept in Urban Road Design

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Abstract: Urban traffic and urban environmental pollution are important issues that must be taken into account in the process of urbanization, especially in China. Modernization has enabled many developed countries in the west to carry out rational city traffic planning. At the same time, the concept of green transportation has also emerged, integrating low-energy consumption, low pollution, comfort, and safety into urban traffic to effectively solve issues pertaining to traffic and pollution. The concept of green transportation has been widely adopted in China and made popular in many cities, thereby promoting the sustainable development of cities.

Keywords: Green transportation concept; Urban road design; Public transport

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1. Introduction

The urban environment belongs to a complete ecosystem, in which both internal and external disturbances will affect its balance. Although the ecosystem has a certain capacity for self-regulation, there are limitations to it. If the external disturbance exceeds the capacity for adaptation, the balance will be broken. At present, the suburbanization of cities in China is expanding; thus, it is necessary to pay more attention to urban transportation. Although the development of urban transportation has brought greater economic benefits to the city, it has also brought about detrimental effects on the environment and increased energy consumption; the number of vehicles in the city has increased significantly, roads are continuously being widened, parking lot areas are gradually being expanded, and more and more natural resources are being consumed for urban transportation. Therefore, it is necessary to apply the concept of green transportation to the design and development of urban roads so that the issues pertaining to urban roads and urban environment can be addressed.

2. Concept of green transportation

Green transportation is a “green” method. The application of this “green” method can effectively alleviate urban traffic congestion, optimize the current urban road environment, and reduce the impact of exhaust emissions

from vehicles on the environment. Scientific and reasonable means are used to ease the pressure of urban traffic as much as possible in order to promote the mutual development of urban traffic and urban environment. The concept of green transportation includes the principle of bus priority, the design of a slow-moving traffic system, and the optimization of management needs.

2.1. Principle of bus priority

Transportation is an extremely important aspect in the process of urban development and also an impetus for promoting urban development [1]. Public transportation is the most fundamental aspect of the transportation system, in which its development status represents the actual development status and maturity of urban transportation. Public transportation is also a means of green travel. Therefore, in the process of urban development, it is necessary to optimize and improve the bus route, build a relatively complete bus system and network, prioritize buses as the main route in urban road design and planning, and increase the number of bus stops and other supporting facilities. Designers need to understand the essence of urban road development, promote the development of public transportation, and provide people with a good green travel environment, thereby reducing exhaust emissions from vehicles and pollution to the urban environment.

2.2. Design a slow-moving traffic system

A reasonable control of vehicle speed is also an important aspect of urban traffic development. Excessive vehicle speed may lead to traffic accidents, which will not only cause damage to infrastructures, but also threaten the safety of people [2]. Under the concept of green transportation, a slow-moving traffic system can be designed to cultivate the habit of driving at low speed. This system can also ensure seamless connections between urban roads, reduce the probability of traffic accidents, and improve traffic safety.

2.3. Optimization of management needs

With the rapid development of cities, the per capita purchase rate of automobiles has increased sharply. The increase in the number of cars will lead to serious environmental pollution. Exhaust gas emitted from automobiles during driving contains many harmful substances, such as sulfide and carbon dioxide. Under the concept of green transportation, it is necessary to continuously optimize management needs and improve the management and control of vehicles. Reasonable traffic restrictions can be implemented to alleviate urban road congestion and reduce environmental pollution. See **Table 1** for details.

Table 1. Comparison of different travel modes

Travel mode	Capacity (person/h)	Road area (m^2/person)	Speed (km/h)	Features
Subway	30,000–92,000	Does not occupy ground area	40–65	High cost and efficiency
Light rail transit	10,000–28,000	0.5	35–65	High cost and efficiency
Public transit	3,200–9,000	0.3	30–60	Environmental pollution, high consumption, Low emissions per capita
Car	3,000	2.4	35–65	High cost and consumption
Bicycle	1,800	1.5	10–16	Low cost, no pollution
Walking	1,200	0.4	3.8	Fitness, environmental protection, low cost

3. Concept of green transportation plays an important role in urban road design

Sustainable development policies have gradually gained significance in current social and urban development. At present, China has put forward higher requirements for urban road design under the concept of green transportation. The significance of applying the green transportation concept is mainly reflected in several aspects. First, through reasonable application of the concept, we can effectively control the construction cost of urban roads, reduce the input cost as much as possible, and maximize economic benefits [3]. The concept of green transportation emphasizes on making full use of various resources through scientific and reasonable means and addressing the material waste issue that has always existed in urban road design. New renewable energy sources, such as wind and solar energy, can be applied to urban road design. These new energy sources possess certain features, such as low cost, environmentally friendly, and the capacity to lower engineering construction costs [4]. Second, through the application of the concept, the overall urban road design level can be improved. Urban road design is a relatively complex task, which needs to be effectively integrated with the selection of management strategies consistent with the design content. Compared with traditional management concepts and policies, the concept of green transportation is more consistent with urban road design. The application can greatly improve the management effect of the project and also improve the overall construction level. Third, through the application of the concept, the consumption of resources can be controlled, and the effect of urban road design can be guaranteed.

4. Application strategy of green transportation concept in urban road design

4.1. Rational use of vacant land

Since most cities in China are developing in the direction of modernization, it is inevitable that there will be some abandoned and vacant lands. Although the area of each of these lands is insignificant, the total land area is relatively large. Some vacant lands are located in the center of the city, and the reason for this may be the small area, high planning cost, or serious pollution [5]. Therefore, in urban road design, designers need to make reasonable use of these vacant lands, which can be set up as bus stops, parking lots, *etc*., so as to continuously improve the utilization rate of urban lands [6]. We must determine the actual state of each piece of land, including the reasons for vacancy, and carry out reasonable planning for these lands so as to effectively improve the regional planning and design level, reduce land development costs, and increase economic benefits.

4.2. Improving bus routes

Public transportation is an important part of urban transportation and an important manifestation of the green transportation concept. Travelling by public transportation is more economical and environmentally friendly than travelling by car. Therefore, public transportation is a key component in urban road design [7]. Optimizing and improving bus routes can alleviate road congestion, ease urban traffic pressure, and shorten residents' travel time. Therefore, we should design special lanes for public transportation, integrate the concept of green transportation into it, and comprehensively consider various factors when designing urban roads to ensure smooth traffic flow [8]. In addition, setting up special signs in lanes dedicated to public transport may prevent vehicles from occupying these lanes. Regular maintenance and repairs of these special lanes should also be carried out to keep the road clean and ensure that they are in good condition. When utilizing these special lanes, it is necessary to ensure that the management work is done well, improve supervision and management, and reduce the probability of traffic accidents as much as possible. There are several specific measures that should be considered. First, improve the bus lines. As the urban transportation network develops with time, it

is impossible to make large-scale route changes over a short period of time. However, with the development of various areas in the city and the travel patterns of passengers, the bus lines can be arranged or planned in such a way that the rationality of the lines and convenience for travel are guaranteed. Second, improve the transfer system. Designing a transfer system is not an easy task. During the design process, it is not only necessary to ensure that the location of the transfer station is convenient for people, but also essential to consider the connection of the transfer stations. Transfer points can be set up in areas with a large flow of people to shorten the distance between transfer stations and ensure convenience for bus transfers [9].

4.3. Implementing traffic stabilization and purification measures

Optimizing the road environment is an important aspect in urban road design. Therefore, under the concept of green transportation, it is necessary to realize harmonious development between traffic and nature as much as possible and create a city with good traffic and environment for people [10]. At present, the residential areas adjacent to roads are faced with serious noise pollution, which has a serious impact on the residents' daily life. Moreover, the large amount of exhaust emissions may damage the ecological environment of the city and affect the ecology as a whole. Therefore, in urban road design, it is necessary to integrate the concept of green transportation and implement traffic stabilization and purification measures. Relevant practice and research have shown that these measures can improve safety and people's quality of life by reducing pollution from exhaust gas, alleviating the noise problem, and providing people with a good living environment [11]. The main measures include the following: (i) construction of traffic island flower beds; building traffic islands in the center of large intersections will not only improve road traffic safety and reduce potential safety hazards, but also enhance aesthetics; (ii) installation of speed bumps; the speed of vehicles can be controlled by installing speed bumps on the road, which would also improve safety; (iii) construction of S-shaped lanes; the curbs on both sides of the road can be extended to build S-shaped lanes so as to alleviate the noise problem.

5. Conclusion

Generally speaking, in recent years, China has gained a deeper understanding of the concept of green transportation and gradually strengthened its emphasis on this concept. By applying this concept to urban road design, the effect of the design can be optimized, the costs can be reasonably controlled, and urban environmental problems and road congestions can be solved. Moreover, through the application of the green transportation concept, we can make full use of the lands in a city, improve the overall effect of the design, and promote urban development.

Disclosure statement

The authors declare no conflict of interest.

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