

Urban Freight Traffic Management and Control Mode under the Concept of Green Traffic

Haoran Sun

Chang'an Dublin International College of Transportation at Chang'an University, Xi'an, Shaanxi
710064, China

Abstract. In the context of global advocacy for sustainable development, the concept of green transportation has emerged as a core guiding principle in urban traffic reform. With the acceleration of urbanization, the demand for urban freight is growing steadily. As the lifeline of urban economic operations, freight transport not only provides efficient logistics services but also poses significant challenges to urban environments and traffic congestion management. In this context, this paper explores innovative models for managing and controlling urban freight transport based on the principles of green transportation. This effort is not only crucial for improving urban ecological environments but also holds profound implications for enhancing overall urban competitiveness and achieving coordinated development between the economy and the environment.

Keywords: Green Transportation Concept; Urban Freight; Transportation; Management; Control.

1. Foreword

In today's era, the continuous expansion of cities has made urban life rich and convenient, thanks to the strong support provided by freight transportation. Just like the supermarket shelves filled with a dazzling array of goods and various building materials needed on construction sites, urban freight shuttles through the streets and alleys have become an "invisible engine" for economic development. Residents' demands for fresh air and smooth travel have grown increasingly strong, and the concept of green transportation is like a timely rain, offering new opportunities for reshaping the management and control models of urban freight transportation.

2. Overview of Green Transportation Concept and Urban Freight Traffic Management

(1) Green transportation concept

The concept of green transportation has gradually taken shape against the backdrop of increasingly prominent environmental issues and growing resource scarcity. It advocates organizing and conducting transportation activities in a low-pollution, low-energy consumption, and high-efficiency manner to achieve harmonious coexistence between the transportation system, ecological environment, and socio-economy. Its core content encompasses multiple aspects: prioritizing public transportation development by improving the bus network and service quality to attract more citizens to choose public transport, thereby reducing the frequency of private car usage, lowering road congestion, and decreasing exhaust emissions. Encouraging green travel methods such as walking and cycling, building a comprehensive slow traffic system that includes bicycle lanes and pedestrian paths, creating a safe and comfortable environment for slow traffic, which promotes residents' health while significantly reducing carbon emissions. Promoting clean energy vehicles like electric and hybrid cars to gradually replace traditional gasoline-powered vehicles, thereby reducing dependence on fossil fuels in the transportation sector and cutting pollutant emissions at the source [1]

(2) Urban freight traffic management

Urban freight traffic management refers to a series of planning, organizing, coordinating, and controlling activities aimed at cargo transportation within urban areas. Its scope is extensive, involving the operation and management of freight vehicles, such as setting vehicle entry standards, planning routes, and limiting transport times. The purpose of urban freight traffic management is to

ensure smooth urban material supply while achieving efficient, safe, and environmentally friendly freight traffic. Efficiency means optimizing the transportation process, reducing logistics costs, and increasing delivery speed to meet the logistics needs of urban economic development. Safety involves ensuring the safe operation of freight vehicles, reducing traffic accidents, and safeguarding the lives and property of road users. Environmental protection aims to minimize the negative impact of freight traffic on the environment, such as reducing exhaust emissions and noise pollution.

3. The Influence of Green Transportation Concept on Urban Freight Transportation Management and Control

(1) Optimize the urban freight transport structure

The concept of green transportation has prompted urban freight management departments to rethink and improve their transport structures. On one hand, it advocates for the development of high-capacity, low-energy-consuming modes such as railways and waterways, aiming to build a multimodal transportation system. For instance, in some inland cities, there is active construction of railway freight hubs to shift part of long-distance cargo from road to rail transport. Railway transport has a large capacity, low unit energy consumption, and minimal pollution, significantly reducing energy consumption and exhaust emissions during the freight process. It also strengthens the connection between road, rail, and water transport by building integrated logistics parks, achieving seamless integration among different modes of transport and enhancing cargo transfer efficiency. On the other hand, the green transportation concept encourages urban freight companies to plan delivery routes rationally, reducing detours and empty runs. Leveraging big data and artificial intelligence technologies, precise analysis of cargo transport demand optimizes delivery plans, increases vehicle loading rates, and reduces transportation costs and resource waste. For example, some e-commerce logistics companies rely on intelligent scheduling systems to plan optimal delivery routes in real-time based on order distribution and vehicle locations, ensuring vehicles operate efficiently while fully loaded, meeting customer delivery needs and aligning with green transportation requirements.

(2) Promoting technological innovation in urban freight transport

The concept of green transportation has become a key driving force for technological innovation in urban freight traffic. To achieve the goals of low pollution and low energy consumption, freight companies and related research institutions have increased their investment in the development and application of new energy vehicles. In recent years, electric trucks and hydrogen fuel cell trucks, among other new energy models, have continued to emerge. Electric trucks offer significant advantages in urban delivery due to their zero exhaust emissions and low noise levels. Many courier and distribution companies in cities have begun to widely adopt electric trucks, which not only improves air quality but also reduces operating costs. The green transportation philosophy has spurred the development of intelligent technologies for freight vehicles, with autonomous driving technology and smart logistics management systems being applied to urban freight traffic, enhancing transport safety and management efficiency [2]. The autonomous truck can drive automatically according to the road conditions and traffic signals, reduce the traffic accidents caused by human driving errors, optimize the driving speed and fuel consumption, achieve energy saving and emission reduction. The intelligent logistics management system can adjust the transportation plan in time and improve the allocation efficiency of logistics resources by monitoring the cargo transportation status in real time.

(3) Promoting the reform of urban freight management mode

The concept of green transportation has brought about significant changes in urban freight traffic management models. Traditional freight management primarily focused on ensuring smooth cargo transportation, whereas the new model under the green transportation philosophy places greater emphasis on environmental protection and sustainable development. Initially, government departments strengthened environmental supervision of freight vehicles, implementing stringent emission standards and vehicle retirement policies. They enforced the mandatory retirement of old freight vehicles that did not meet environmental requirements, promoting the use of clean energy

vehicles and new models compliant with National VI emission standards. Subsequently, they adopted information-based and intelligent management methods to enhance the precision and efficiency of freight management. A city-wide freight traffic management information platform was established to integrate information on freight vehicles, transportation demand, and road conditions, achieving information sharing and collaborative management. Through this platform, regulatory authorities can monitor the real-time operational status of freight vehicles, promptly address violations, and provide information services to freight companies to help them optimize their transportation plans. Moreover, the green transportation philosophy has facilitated a shift from single administrative management to multi-stakeholder governance in urban freight management, involving the government, enterprises, social organizations, and the public in freight traffic management, forming a collective force.

4. Third, Suggestions on Urban Freight Traffic Management and Control under the Concept of Green Transportation

(1) Improving the policy and legal system

1. Formulate special policies for green freight transport

Under the guidance of green transportation concepts, the government needs to issue detailed policy documents for urban green freight development. It must clearly recognize green freight as a key component of sustainable urban transportation, elevate its strategic importance, and allocate dedicated funds to heavily subsidize companies that adopt new energy vehicles and implement green transport technology upgrades. Just like providing purchase subsidies to companies buying electric trucks, this encourages businesses to accelerate their transition to green transportation, easing their financial pressure during the transformation process. Financial support should also be given to companies building charging facilities for new energy freight vehicles, promoting the establishment of a green energy supply network. This will help companies actively participate in the development of green freight, practicing the concept of green transportation from its roots.

2. Strengthen the enforcement of environmental protection laws and regulations

In accordance with the requirements of green transportation, strictly enforce emission standards for freight vehicles. Utilize advanced technologies such as remote sensing monitoring and electronic police to conduct real-time and precise monitoring of vehicle emissions. If any vehicle is found to be exceeding emission limits, impose fines and point deductions according to laws and regulations; in severe cases, order it to cease operations for rectification. Additionally, strengthen supervision over freight vehicle manufacturers to ensure that vehicles meet stringent environmental standards from the production stage, controlling pollution emissions at their source to maintain urban air quality and align with the green transportation goal of low pollution [3]

3. Optimize freight vehicle access policies

This article upholds the concept of green transportation, formulating differentiated policies for freight vehicle traffic based on urban congestion and environmental protection requirements. In the city center, measures such as truck restrictions and time-limited travel are implemented to guide trucks away from peak hours and congested areas, thereby reducing energy consumption and exhaust emissions. Special provisions are made for new energy freight vehicles and companies that adopt green transportation methods, such as setting up dedicated lanes for new energy trucks, granting them more travel time and area access rights. This encourages companies to prioritize the use of environmentally friendly vehicles for cargo transportation, minimizing the negative impact of urban freight traffic on the environment.

(2) Strengthening infrastructure construction

1. Build a multimodal transport infrastructure network

This article upholds the concept of green transportation, increasing investment in the construction of multimodal transport infrastructure such as railway freight stations and port terminals. It aims to improve the connection facilities between railways, waterways, and road transport, like building supporting road transfer stations around railway freight hubs. This will achieve seamless integration

of different modes of transport, enhancing cargo transfer efficiency and reducing the time and energy consumption during transit. By establishing a comprehensive logistics information platform, it strengthens information sharing and collaborative operations among various modes of transport, optimizes cargo transport organization processes, reduces overall transportation energy consumption, and promotes the development of green multimodal transport.

2. Improve the urban distribution network

This article, guided by the concept of green transportation, proposes a rational layout for urban distribution centers, logistics parks, and terminal delivery points. Large distribution centers will be built around the core areas of cities to handle centralized sorting and allocation of goods. Terminal delivery points will be set up in densely populated areas such as communities and commercial districts to achieve one-kilometer delivery. By leveraging IoT technology to enhance the informatization of the delivery network, real-time tracking and monitoring of cargo transportation processes can improve delivery efficiency, reduce empty driving distances, lower energy consumption and carbon emissions, and increase the level of green urban delivery [4]

3. Promote the construction of supporting facilities for new energy freight vehicles

In line with the concept of green transportation, we should significantly increase efforts in constructing charging and hydrogen refueling facilities for new energy freight vehicles. We need to develop plans for the construction of charging stations and hydrogen refueling stations, incorporating them into urban infrastructure development. Encouraging private capital participation in these projects is essential. By offering land and tax incentives, we can attract corporate investment. Priority should be given to building charging and hydrogen refueling facilities in areas with high concentrations of trucks, such as logistics parks, freight hubs, and urban distribution centers. This will provide strong support for the operation of new energy freight vehicles, promote their widespread use in urban transportation, and reduce reliance on traditional fossil fuels.

(3) Promoting the application of advanced technologies

1. Accelerate the promotion and application of new energy freight vehicles

Under the guidance of green transportation concepts, we have formulated a promotion plan for new energy freight vehicles, clarifying the goals and tasks. By leveraging policy guidance and promotional efforts, we have enhanced the awareness and acceptance of new energy freight vehicles among freight companies and their employees. We encourage businesses to purchase and use these vehicles, gradually increasing their share in urban freight transport. Continuously strengthening technological research and innovation in new energy freight vehicles will improve vehicle range, payload capacity, and safety, while reducing acquisition and operating costs. This will drive the transformation of urban freight towards a green energy-driven model.

2. Promote the application of intelligent technology for freight vehicles

This article actively applies intelligent technologies such as autonomous driving, vehicle networking, and smart logistics management systems to urban freight transportation. This aligns with the concept of green transportation. Autonomous driving technology can enhance the safety and efficiency of freight vehicles, reducing traffic accidents and energy waste caused by human errors. Vehicle networking technology facilitates information exchange between vehicles and between vehicles and infrastructure, enabling intelligent scheduling and route optimization, thus reducing energy consumption. The smart logistics management system monitors the status of cargo transportation in real-time, optimizing logistics resource allocation and improving operational efficiency, comprehensively supporting the development of green freight [5].

3. Apply green and energy-saving technologies

This article encourages freight companies to adopt green and energy-saving technologies, implementing technical upgrades on existing vehicles to embrace the concept of green transportation. For instance, promoting the use of energy-efficient tires and aerodynamic devices can reduce vehicle energy consumption and exhaust emissions. Using lightweight materials for truck bodies can lighten the load, improving fuel efficiency. Additionally, it is essential to enhance training for drivers in

energy-saving driving practices, such as proper gear shifting and smooth driving, to minimize energy consumption during vehicle operation and reduce carbon emissions.

(4) Innovative management mode

1. Establish an intelligent freight management platform

This article centers on the concept of green transportation, integrating information on freight vehicles, transportation demand, road conditions, and traffic flow to establish an intelligent urban freight traffic management platform. By leveraging big data analysis and artificial intelligence technologies, the platform conducts real-time monitoring and analysis of freight traffic operations. This enables smart scheduling, route optimization, and dynamic supervision of freight vehicles. Management departments can promptly adjust traffic management strategies based on the information provided by the platform, enhancing the precision and efficiency of freight traffic management, reducing energy waste and environmental pollution, and promoting green freight management.

2. Promote self-regulation in the freight industry

This article aims to fully leverage the role of freight industry associations. Guided by the concept of green transportation, it promotes companies to strengthen self-discipline. The association will formulate industry self-regulation norms and standards, organize enterprises to conduct green freight demonstration activities, commend and reward outstanding companies, enhance communication and cooperation among enterprises, promote information sharing and resource integration, and collectively address the challenges and issues faced by the industry's green development, fostering an atmosphere of green development within the industry.

3. Strengthen regional coordination and management

Adhering to the concept of green transportation, urban freight traffic management should strengthen regional coordination and establish a cross-departmental and cross-regional freight traffic management coordination mechanism. This will enhance the planning alignment and management synergy between cities and between urban and rural areas in terms of freight traffic. For example, building joint logistics parks around cities can facilitate centralized distribution and transfer of goods, reduce the number of freight vehicles within cities, and lower energy consumption and pollution emissions. Strengthening information sharing and law enforcement cooperation among regions will help combat illegal transportation activities, fostering a positive order for green freight traffic.

5. Conclusion

In summary, the concept of green transportation is like a guiding star on the path of urban freight traffic transformation and development, illuminating the way to sustainable development. By adopting comprehensive policies and regulations, strengthening infrastructure, promoting advanced technologies, innovating management models, and enhancing public education and awareness, these measures work together to help urban freight traffic gradually break free from traditional constraints and move steadily toward a greener, more efficient, and sustainable direction. It is hoped that in the near future, urban freight traffic will coexist harmoniously with the ecological environment, continuously providing green momentum for the city's prosperity and development, painting a beautiful picture where green logistics and convenient travel promote each other.

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