Urban Ecological Transportation Planning

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ABSTRACT

According to urban evolution trend, concept of urban ecological transportation system was proposed on transportation environmental carrying capacity. And theoretical framework of urban ecological transportation plan was constructed.1

INTRODUCTION

Urban Ecological transportation based on ecology, and it considered constraint of ecological limit, in order to meet transportation demand in urban transportation planning and construction. It minimized environment pollution and resource consumption caused by normal transportation system operation, and formed ecological evolution of urban transportation system.

THE ECOLOGICAL URBAN TRANSPORTATION SYSTEM DEVELOPMENT GOALS

To Meet the Constraint of Ecological Limit

Normal urban transportation operation needed effective supply from natural environment system. Urban transportation development associated with land occupation, energy consumption, environment pollution and other negative effect. It brought potential threat to long-term maintenance of this supply. The basic carrying capacity of natural environment system was the limit of urban social and economic

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system development. At the same time, it determined by the limit of urban transportation system development. Therefore, to meet the constraint of ecological environment, transportation environment carrying capacity was the basis for normal operation of urban ecological transportation system.

**The People Oriented**

The core of urban ecological transportation was to serve people, comfort, safety and convenience should be fully considered. It not only took into account drivers and passengers, but also included comfort, safety and convenience of cyclists, pedestrians and other transportation. At the same time, it should also take into account harm extent caused by transportation pollution, noise, vibration and so on. The people oriented was not only the highest requirement of urban ecological transportation, but also the most basic requirement.

**The Criteria of Efficiency**

The core goal of urban ecological transportation system was high efficiency. That meant to ensure transportation for fast, safe and comfortable demand, at the same time, to minimize environment load degree, to reduce land occupation, energy and mineral resource consumption, to maximize overall efficiency of urban ecological transportation system.

**Justice, Non-discrimination**

Urban ecological transportation system took full account of social service function justice. Regardless of income, age, sex and physical condition of travelers, everyone had equal right to enjoy high quality travel services. Meanwhile, everyone had equal right to participate in decision-making and supervision on urban ecological transport system planning, constructing and operating.

**TRANSPORTATION ENVIRONMENTAL CARRYING CAPACITY**

**Transportation Environment**

Transportation environment referred to external world of transportation activities. It was not only a simple natural environment, but also a complex environmental system, which included social, economic and natural environment. The system was built around environment main body transportation activists with various combinations. And it was a complex system, which interconnected with main system through material cycle, energy flow and information transfer.

Regional transportation behavior of production and living activities formed social entities, which constituted social environment. Associated with transportation
system, natural resource and ecosystem constituted natural environment. And economic system, which related to transportation development, constituted economic environment.

**Transportation Environment Capacity**

At certain time and area, when realistic or formulated transportation environmental structure did not occur malignant change, and transportation environmental system played normal function, Transportation Environmental Capacity, which was the maximum amount of money, pollutant acceptance and natural resource consumption that transportation system was able to bear.

\[
\text{CTEC} = \eta \times \text{CEC}
\]

In the formula, \(\eta\) was transportation environment sharing rate, represented percentage of transportation environmental capacity in environmental capacity (%).

Transportation environmental capacity was a total characteristic value, which was restricted by following factors:
1) Social and economic development characteristics in transportation system area.
2) Natural environmental characteristics of transportation system.
3) Environmental quality objectives of regional transportation system.

**Transportation Environmental Carrying Capacity**

Transportation environmental carrying capacity (TECC) was derived from concept of environmental carrying capacity. According to specific attributes of transportation system, TECC was the largest scale of the system development, in certain time and area, when the system did not change to malignant direction. TECC mainly included 4 components: Pollution Carrying Capacity, Resource Carrying Capacity, Mentality Carrying Capacity, Economy Carrying Capacity. In case of certain TECC, it depended on discharge intensity, resource consumption, psychological endurance of regional resident and economic development of per unit transportation volume. As different types of characteristics transportation index had significant difference, carrying capacity of different transportation structure was also different. Transportation structure was the best when TECC reaches the maximum value.

**THEORETICAL FRAMEWORK OF URBAN ECOLOGICAL TRANSPORTATION**

According to development target and macroscopic influence factors of urban ecological transportation, urban ecological transportation planning should consider transportation environmental problems, in addition to conventional planning. It forecasted plan service level and environmental status under different policies, measures and technical conditions. According to 2 key index constraint of transportation environment capacity and transportation environment carrying capacity, transportation development plan and corresponding development measures
and suggestions were formulated. Therefore, in addition to general contents, theoretical framework of ecological urban transportation planning involved some new contents:

1) From urban spatial structure, considering transportation environment constraint on city development, reducing consumption of urban transportation resources from aspect of urban spatial structure layout, pollution emission and transportation demand. At the same time, considering feedback requirements of whole transportation planning, it determined reasonable layout of urban spatial structure.

2) The idea of establishing a reasonable mode of transport and structure penetrated throughout planning process. Fully considering transport efficiency of various transport modes. Urban planning, residents' preference choice of transportation behavior, and infrastructure carrying capacity such as roads, vehicles actual carrying capacity and transportation management capability. The transportation activity influence on transportation environment was kept within a certain range. At the same time, the planning theory also explicitly proposed land use development patterns oriented to rational transportation structure, to ensure realization of reasonable transportation structure. In addition, rational transportation structure to meet policy requirement and environmental limit value could not be a single fixed value. It should be a feasible and reasonable range. In this range, the optimal planning scheme was selected by repeated iteration.

3) The plan determination did not passively accept transportation environmental carrying capacity constraint, but considered two-way relationship between transportation system development and carrying capacity. By coordinate optimization, achieved success on both side of transportation development and transportation environment. At the same time, with technology development and introduction of low energy consumption and low pollution vehicles, feature of transportation emission, energy consumption and capital consumption changed correspondingly. Resulting in decline of transportation environment capacity and improvement of environmental quality standards, transportation environmental carrying capacity increased steadily. Development of urban transportation system allowed expansion of the upper size limit.

4) According to forecast result of transportation structure and average travel distance about various transportation modes, calculating transportation environment carrying capacity of the plan, was combined with vehicle emission factor, vehicle energy consumption character, transportation behavior and psychological impact state, use of funds and other parameters. If transportation environment carrying capacity constraint was met, it showed that plan not only met transportation demand, but also met transportation environment constraints. Otherwise, plan should be adjusted, to meet environmental carrying capacity.

CONCLUSIONS

The theoretical framework of urban ecological transportation plan took into
account interaction between transportation environment carrying capacity and transportation development. It could improve urban transportation environment capacity, solve existing urban transportation problems, determine reasonable transportation structure and land use patterns, and promote urban ecological development.

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