Research on Road Traffic Safety Planning Theory

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Abstract: In order to improve the level of traffic safety management and put forward the way to the basic idea of traffic safety planning and development framework, refining the characteristics, from the strategic and tactical two aspects of the interpretation of the American traffic safety planning research context and the main results, summary of traffic safety planning research hot point and technical difficulties, combined with the present situation of road traffic safety in China proposed to effectively promote traffic safety planning in theory and practice to explore the countermeasures. The results show that: the traffic safety planning theory is the current international road transport industry and academia is the most cutting-edge research in one direction, its consideration will take the initiative to safely throughout in traffic system construction and operation of the whole process, emphasizing from macro planning level to micro design in the safety level of forecasting and planning, is expected to bring traditional method of transportation planning and traffic safety engineering and management method of two-way innovation.

Keywords: Traffic engineering; Traffic safety planning; Review; Accident prediction model

1. Introduction

China road traffic scale and the degree of mobility of the rapid growth has brought serious traffic safety problems, road traffic safety level is far lower than Europe and the United States and other developed countries. 2011 revision of the "road traffic safety law" provisions of the administrative work for road traffic safety shall strengthen the scientific research, promotion, the use of advanced methods of management, technology and equipment ", released in 2012" road traffic safety "1025" planning "proposed" by 2015, national road traffic accident mortality per thousand vehicles does not exceed 2.2 ". In the face of the new situation and new requirements of road traffic safety, it is very important to explore advanced traffic safety management theory and establish a scientific traffic safety management system.

Traditional traffic safety analysis of general methods can be divided into four stages, namely black spot identification, safety evaluation, safety improved, effect evaluation, has the advantages of simple operation, wide application, but deficiencies: the essence of the method belongs to "remedy", until the traffic accident has caused serious casualties and property losses, and then take appropriate remedial measures, social and economic costs are relatively high, the improving measures are often limited to patch type micro projects, the lack of consideration of the transportation system of the overall; even to find a corresponding improvement program, often because of the transformation into much of this cannot be executed. In order to overcome the limitation, it is necessary to con-sider the safety level of traffic system in the planning stage.

At the present stage, the traffic planning method focuses on optimizing the structure of supply and demand and alleviating the traffic congestion, which is the key technology to effectively forecast and evaluate the traffic safety level. However, for the impact on road safety level of the overall urban planning, land use type, the road network layout and trip characteristics of non road micro facility level factors must be in the planning stages of safety issues to be considered.

By the end of twentieth Century, the United States through the twenty-first Century transport fair act, the first expressly required, Ministry of transport and the city planning board will be the road traffic safety as an important factor in the whole process of transportation planning". Thus, "traffic safety planning" in developed countries, especially the United States has become one of the important research, its emphasis from the macro planning level to micro design layer facing the safety level of forecasting and planning, after the evaluation of safety improvement method forward prediction of safety planning method is proposed, is expected to bring the traditional method of transportation planning and traffic safety engineering and management method of two-way innovation. As early as 2006, Chinese scholars have recognized the limitations of traditional traffic safety analysis methods, and introduced the idea of traffic safety planning. Wang Yan first introduced the "active traffic safety plan, proposed in the city planning and land use, traffic planning and road network planning stage will be safe as the main

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planning objectives and evaluation indicators, from several aspects of mobility, transportation, land use, road network considering the impact on traffic safety, so that the source on the implementation of traffic accident prevention in advance; Lu Huapu put forward the" road traffic safety management planning "definition, principles and development process, to establish scientific and reasonable road traffic safety management plan, in order to improve the road traffic safety management and improve the level of road traffic environment. However, after the introduction of the concept, China lacks systematic theoretical construction and deep technical exploration, which leads to the lag in the field of safety planning practice.

This paper put forward a comprehensive concept and the framework of traffic safety planning, refining the characteristics; from the explanation of "strategy" and "tactical" two aspects of the traffic safety planning research context and the main results; analysis of safety planning research hotspots and difficulties; combination of Chinese road traffic safety situation, proposed to effectively promote traffic safety planning in theory and practice to explore the countermeasures.

2. Traffic Safety Planning Concept

Traffic safety planning can be defined as active traffic safety principle, the level of traffic safety as the main planning objectives and evaluation indicators, in the traffic system planning, design, construction, operation, maintenance cycle of the whole process, comprehensive consideration of regional characteristics, network characteristics and trip characteristics, traffic organization, traffic characteristics, road conditions, vehicle condition, driving behavior all safety factors around the security objectives to formulate and implement corresponding strategies and schemes, thus the source reduce accident potential and in the operation of reducing the risk of accidents. The new traffic safety planning is an important supplement and innovation to the existing traffic planning methods integrate security into the existing traffic planning, in order to realize the organic integration of efficiency and safety.

Compared with the traditional methods of traffic safety analysis, traffic safety planning has three key characteristics:

Initiative. Active safety is the essential characteristic of the traffic safety planning, namely before the accident, through preventive measures, avoid accident occurrence, thus changing the "headache cure head, foot painful medicine foot" passive safety concepts and methods.

Overall. Traffic safety planning throughout the cycle of the whole process of urban planning and land use, comprehensive traffic planning and road network planning, road design, traffic design, road construction, road transport and traffic organization and management etc.. Traditional traffic safety analysis emphatically on road envi- ronment and condition, condition of the vehicle, driving behavior at the micro level factors, and traffic safety planning stressed predictions from macro to micro the security situation analysis and development trend.

Metrology. Implementation of safety goals to quantify the set; in the planning period to a safe level quantitative prediction; on safety effect of various planning scenarios of cost - benefit analysis; the plan after the implementation of the security to improve quantitative assessment of the effectiveness.

Anyway, by the traditional traffic safety engineering to the change of traffic safety planning is to achieve: let traffic planning in each stage and content contains security level quantitative index and safety improvement process; let the traffic management to fully understand all aspects of a variety of road facilities safe level and improvement effect; let every traveler to advance understanding of the articles of the alternative paths of accident risk, quantitative path selection Nakade Yukihiroyoshi costs "security" meaning.

3. Research Status of Traffic Safety in the United States

This section from 2 aspects of strategic planning and technical support to explain the United States in the field of traffic safety planning research context and the main results, to provide a reference for China's road traffic safety management approach. In order to effectively improve the road traffic safety situation, the United States has developed a series of traffic safety strategy plan.

In order to implement the security strategy and implementation of safety measures, the national highway traffic safety administration, the Federal Highway Administration and transportation research board, main traffic safety management departments and research institutions issued a series of guidance for road traffic safety, and analysis tools.

4. Research Hotspots of Traffic Safety Planning

4.1. Accident prediction model

Reduce the risk of accident, reduce the severity of the accident is the 2 core objectives of the study of traffic safety. Based on the safety evaluation of historical accident data, accident prediction model to a variety of risk factors associated with the level of traffic safety facilities and human vehicle road environment system, safety levels in each factor with different values and combinations conditions that predicts the to obtain an effective improvement measure to improve the safety level of the. Commonly used traffic accident forecasting methods include regression analysis, time series forecasting, grey forecasting, neural network prediction, etc.. In contrast, statistical regression model has always been dominant in

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traffic safety analysis, because the accident prediction model requires a clear evaluation and revision of the safety effects of various factors. From the beginning of the occurrence of the accident as a Poisson process, the research of the accident prediction model has been carried out in many aspects.

However, traditional accident prediction models are aimed at a single road element, which can only reflect the security characteristics of the micro level of a single type of road facilities, which is mainly due to the limitations of the typical regression model for the modeling of similar objects. Traffic safety planning is put forward in the planning stage of the region or the safety level of the road network to effectively predict the requirements of the regional accident prediction model came into being.

4.2. Regional accident prediction model

With the gradual understanding of the importance of security level space, the regional accident prediction model of Europe and the United States and other major developed countries gradually strengthened at the macro level. The spatial analysis unit of the regional accident prediction model includes the state, the state, the county, the administrative division, the traffic analysis District, the census area, the geographical grid and so on. The research mainly analyzes the characteristics of the road network, traffic flow characteristics, weather characteristics, land use characteristics and various social, economic and demographic characteristics. As far as the statistical method is concerned, the traditional accident prediction models, such as the commonly used Poisson gamma model and the Poisson log normal model, assume that the distribution of the accident is not related to the space. However, the security data has complex spatial distribution, which will greatly affect the accuracy and robustness of the security level estimation. In order to overcome the limitation of the traditional model of accident prediction, the spatial statistical analysis method, especially the Bias spatial and temporal statistical model, has gradually become a leading research direction in the field of security analysis.

4.3. Key technical issues

Forecasting model of regional accident is one of the core technology of traffic safety planning, but it is still in its infancy. In the process of the development of the theory of traffic safety planning, some key technical problems need to be attached importance.

Multi layer data structure. From traffic safety engineering to traffic safety planning change inevitably puts forward to the road traffic multilayer data structure to analyze the challenge. In this context, the micro safety effect of road facilities and the impact of macro factors on road network security are analyzed. At this stage, the regional accident prediction model while considering the society, economy, population and land use characteristics of macro factors, but not at the same time, the integration of the specific property of road elements, and don't to macroscopic traffic planning, traffic safety level in a large extent depending on micro road safety facilities design; road network level, lack of effective algorithm to joint modeling road heterogeneous elements, still can not be achieved effectively evaluate and forecast of local road network or corridor traffic safety level.

Traffic safety is proposed to cope with the challenges, Huang and 5 * ST model, the traffic safety data broadly divided into geographical division layer, road facilities, traffic accident layer, vehicle unit layer, the car occupant layer and consider geographical division layer and road infrastructure layer of temporal and spatial correlation characteristics. The research systematically put forward the hierarchical framework of security data and the Bayesian statistical method system which can fit the data structure effectively, which provides the foundation for the development of the accident prediction model. However, the screening of factors at each level and the calibration of the accident correction factors need to be systematically studied in order to form the results of the practice of traffic safety planning.

Trip data, including trip generation and traffic assignment. The number of trips, the purpose and way of travel have a significant impact on the level of traffic safety. Compared with the existing studies consider the social, economic and demographic factors, the travel data is direct reflection of the opportunity of the accident, how will the traffic characteristics and distribution of traffic safety level of association is an important research problem.

Traffic division unit. There are few safety related factors in the current traffic analysis community, but most of the research on regional security is based on the existing zoning plan as the basic unit. Even in the traditional traffic planning method, it is short of the measurement and evaluation method for traffic safety condition of traffic analysis area. Huang based on letter subject classic plasticity area unit and division method of research, according to the homogeneity area adjacent to the security principle proposed concept of residential traffic safety analysis, which widens the thinking for traffic safety planning division theory, but technical framework construction still needs to a lot of research.

Research on application technology system. The breakthrough of the core technology will significantly promote the development of the theory of traffic safety planning. Obviously, theoretical breakthroughs in core technologies enhance requires the integration of technological innovation resources, complete transference of technology system construction, also need to consider from theory to explore the practical application problems. answer by study on the technique system, including the

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policy basis, basic data and core technology of, for the regional highway network, highway network and the urban system, in the planning, design and management level established methods, can we truly achieve the traffic safety programming key technology and the basic theory of the organic integration, and gradually form the traffic safety planning theory system.

5. Implications for the Study of Traffic Safety in China

In reference to the experience of developed countries in road traffic safety research and practice, combined with the current situation of road traffic safety in China, this paper puts forward the Countermeasures of promoting the theoretical research and practical exploration of China's traffic safety planning.

Perfect basic data collection and integration. The research process of traffic safety planning largely depends on the quality of the basic data. On the one hand, the security objectives to quantify the set, on the safety level of quantitative prediction, on safety effect of plan cost benefit analysis and the plan after the implementation of the safety improvement quantitative assessment of the effectiveness of etc. are dependent on the accuracy and completeness of the basic traffic data; on the other hand, from the macro planning level to micro design layer face safety levels predicted by the proposed requirements for road network macro data and road infrastructure micro data integration and analysis.

Strengthen basic theory research and application technology development. Traffic safety planning theory breakthrough and technological innovation need large-scale, continuous research accumulation. In the United States, for example, the United States in 1997 to develop strategic plan for road safety, clear the 22 key special research and after up to 10 years of accumulation, and gradually formed a to the road safety handbook is an important representative of the mature theory frame and scientific response system; and at the same time, will "road safety manual" research results of effective application in practice, American Association of state highway and transportation specializes in the development of security analyst software.

6. Conclusions

Systematically expounded the basic idea of traffic safety planning and development framework; from strategic and tactical 2 explains the American traffic safety planning research context and the main achievements; summarizes the traffic safety planning at present the research hotspots and difficulties; combination of Chinese road traffic safety situation proposed effectively promote traffic safety planning in theory and practice to explore the countermeasures.

Traffic safety planning concept emerging has achieved rapid development, but it is still in its infancy. On the one hand, some key scientific issues need to be broken through, on the other hand, many problems faced by theoretical research to practical application need to be solved. For example, under the existing system of China, how to integrate the concept of traffic safety planning and requirements into the process of transportation planning, still need a lot of practice to explore.

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