THE RESEARCH ON HUMAN FACTORS IN URBAN TRAFFIC BASED ON THE CAUSAL RELATIONSHIP

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Abstract: In the traffic system consisting of three parts: human, vehicle and road, the people play a leading role and have a major impact on traffic. From a sociological point, we can summarize the human factors that affect the transportation, construct the causality diagram of urban traffic and human factors, and propose the idea of analyzing the causal relationship and the mechanism between people and traffic by using causality. We hope that through these studies we can provide some reference for the government department's decision-making to improve the urban transport.

1 INTRODUCTION

In recent years, under the situation of rapid urbanization and economic development, China has gradually increased transport development, which is reflected in the transport infrastructure, transport, traffic information and other aspects. However, subsequent issues have been highlighted, these problems mainly in the heavy traffic congestion, frequent traffic accidents and other aspects.

At present, many scholars are researching on the causes of traffic problems; the city government has also introduced various traffic policies, trying to ease the worsening traffic situation. But the effect is poor. Beijing, Shanghai and other cities appear frequent emergency of traffic jams. One important reason is that the existing research on influence factors of urban traffic is not comprehensive. That made the real transport policy difficult to remedy.

There are many factors for urban traffic congestion, such as motor vehicle ownership, road layout, traffic facilities, traffic management, etc. However, the human factor is a crucial factor that cannot be ignored (Fan Xiaoke, 2007) .According to the system theory point of view, in the transport system consisting of the people - vehicle -road, the people played a leading role. Either as participants in traffic, or as a manager, human factors have a significant impact on traffic. A recent survey showed that: the impact of human factors on the transport accounted for more than 30% (Fan Xiaoke, 2007), such as: motor vehicle occupied by non-motor vehicle lanes, vehicle lane change or turn around freely; jaywalking, free across the fence, bus and taxi occupy the driving road when they stop, individual car owners experience little friction, buck-passing and so on. China is the most populous country in the world, the effect of human factors on traffic, relative to developed countries, is more obvious, so under the special circumstances, the research on human factors in urban traffic is very important and urgent.

The paper departures from the practice of urban traffic. It is to explore the impact on traffic and the mechanism between human factors and traffic. Through these studies we hope to provide some reference for the formulation of transport policy.

2 RESEARCH METHODS

2.1 Existing Methods

(1) Analytic Hierarchy Process (AHP)

The AHP, which is short for "Analytic Hierarchy Process", was first proposed by the America operations research expert T.L.Satty in the 1970s in the 20th century. This method was originally used in the service sector. It is a Method of multi-objective decision analysis that combined the qualitative

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analysis and quantitative calculation. The basic ideas of the AHP method to solve problem are as follows (Teng Shaoguang, 2005): Firstly, we decompose the problem to be different factors according to the nature of the problem and objectives to be achieved. Secondly, we stratified the factors to be a hierarchical structure model according to the relationship between factors. Thirdly, we analyze the problem in accordance with the level of the factors. Last, we get the importance weights of the lowest level of factors by reference to the highest (which is the total goals) level of factors.

Teng Shaoguang used the AHP method to construct a hierarchical structure of the factors that influence the public traffic in his paper "Comprehensive analysis of AHP for the factors affecting the public transport". He proposed to analyze the importance of various factors by the AHP method t. At last he got the relative importance of various factors and ranked them (Wang Hongyu, 2009).

(2) Structural Decomposition Analysis

The SDA, which is short for "Structure Decomposition Analysis", was first proposed by Leonfief the research on analysis of the American input-output charts. SDA's basic idea is to divide the change of one target variable into several changes of different elements so that we can identify the degree of the influence of the various elements. Besides, we can also carry on the decomposition step by step according to the need. Ultimately, we can distinguish the influence degree of the target variable of the various factors (Zhu Xianghua, 2008).

Both of the two methods above can quantify the qualitative issue. We can use these two methods to get the relative importance of the factors. It is helpful to grasp the key factors, but the relationship and the mechanism between these key factors are not clear. It is negative for us to find the source of the problem. So we have to introduce the causal analysis method.

2.2 Method of Causality Analysis

At the process of exploring and understanding the world, we always want to answer the 'why' question. That is, we want to find the factors and information to explain the phenomenon. Because of searching the relatively constant causal mechanism under the phenomenon, we have the possibility to get and accumulate our knowledge. In general, the development of social science research is always around the "discovery issue", "understand the problem" and "solve the problem ". As we know, only the "discovery issue" is not enough to the progressing of our society. And we should find the factors under the phenomenon as the entry to solve the problem. Given the validity of causal analysis and Based on the conclusions of the causal analysis, we can predict the future events that may occur under what conditions and find the means of controlling them, which provide the method to develop strategies and to improve our society. Therefore, causal analysis is the key to the social science research (Wang Tianfu, 2006).

2.2.1 Introduction to Causality Diagram

Causal analysis is demonstrated through the Causality Diagram, also known as the special causal diagram, Fish Bone Figure and Tree Figure. Causality Diagram is a mapping method to produce the cause of the problem through the gradual in-depth study. Causality Diagram establishes the priorities of the cause of the problem based on the causality relationship, and display them in the event generation process, so as to make an intuitive understanding of the problem for the project managers. Causality Diagram is a method to find the basic reason of the problem, each "fishbone" represents the cause of the problem. A problem is often caused by a variety of reasons, which can be showed with the graph of trunk, large branches, the branches and twigs according to their importance. So we can understand the problems at a glance and system. The Causality Diagramcan helps policymaker's analysis of the nature of the problem in-depth, develop strategies and achieve the purpose of pre-control.

The Causality Diagram applies for analysing the causes of traffic problems, which has intuitive and logical features and so on. What's more, it can analyze accident overall, analyze individual reasons and even the specific case.

2.2.2 Making Causality Diagram

(1)Working group including Responsibility Person for this issue and other human who have the relations with it, Responsibility Person should have rich instruction and leadership experience, Joint effort from us should be taken to create the friendly, equal, relaxed environment.

(2)The person in charge of the project will identify

the causes of the problem, and then write on the blackboard or a triangle box in the right of the White paper. Meanwhile, draw a horizontal line in its tail that is known as the backbone of the fish.

(3)Members of the working groupneed to draw the lines which form45 angle with backbone, and they are called big bones that is used explain the main reason causing the problem.

(4)Further refinement of the cause of the problem, and then draw the middle bone, small bone and so on, as far as possible all the reasons listed.

(5)Schemata of causality need to be modified to optimize the order

(6)According to the schemata of causality (Refer to Picture 1) for discussion.

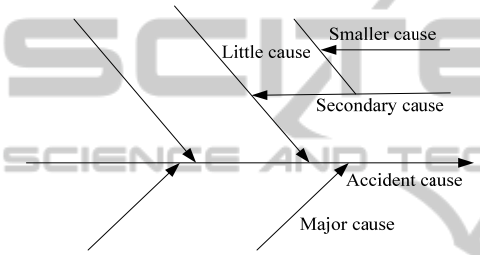

Figure 1: Causality Diagram.

The schemata of causality cannot solve problems presented by numerical values, rather by the arrangement of the level of cause and effect to indicate the relationship. Therefore, it can well describe the qualitative issues. When making the schemata of causality of traffic problems, the designer should pool the wisdom of the masses and try to find the reasons causing the traffic accidents whether large or small objectively and comprehensively, then markers in the map.

Social research methods generally include qualitative and quantitative research. Qualitative research mainly uses interviews or documents and materials by narrative techniques. Although the number of samples is small, the information involved when solving the research problems is extensive and thorough. On the other hand, quantitative research uses statistical analysis methods by taking social survey data. The data of the quantitative research is highly targeted though the sample size is large. This research method usually focuses on several specific aspects of some object of study, and it hopes to draw some general conclusions. The traffic is a complex system consisting of many social factors which are difficult to quantify, therefore, based on the large number of documents and materials, we do only qualitative research to the socio-cultural factors of traffic problems by using Schemata of Causality.

3 THE CAUSAL RELATIONSHIP BETWEEN URBA N TRANSPORT AND HUMAN FACTORS

3.1 Determine the Human Factors in Urban Transportation

Transportation is “the blood circulation system” and the bottleneck of Social and economic system. There is of great theoretical and practical significance in the research of transportation. So, transport problems and the impact factors of traffic attract many scholars’ attention (Liu Zhiping, 2005).

The current study of traffic distributes in industrial theory, economics, urban studies, ecology, geography, environmental science research. However, the existing research is based on the transport system, its elements and related engineering studies, Traffic, especially the social characteristics of urban traffic is of little concern. Zhang Huimei said that: The traffic, as a human instinct behaviour, has a human itarian and social nature, and it is the content of human life. In addition, he considered the current study patterns cannot effectively ensure the sound operation of traffic in the social systems, and it is necessary to do social science research on transport phenomenon (He Yuhong , Xing Yuanmei ,2004).

At present, some scholars began to study the traffic problem from a sociological point of view. Some scholars have proposed some solutions and established precise mathematical models, but they are all simulated in the ideal state. These models can apply in the early case of less traffic in the city, but the modern transport system is a complex system with large random and many influence factors. So, many scholars have studied traffic problems by systems approach.

Wang Jian, from Southeast University, analyzed the impact factors of passenger transportation in the paper of "prediction of big city ’passenger transportation structure" from the macro, meso and micro level. These factors include economic development, transport policy, transport and travel

characteristics, and etc (Wang Jian, 2006).

Gu Xiaomin, from ChangAn University, analyzed the factors affecting the traffic capacity in the paper of "Factors of urban road capacity "mainly from the point of view of the transportation infrastructure, traffic management and traffic participants (Gu Xiaomin, 2009).

Wang Hongyu， in the paper of " Study of Beijing Urban Transport "， analyzed the traffic problems in Beijing from the perspective of car ownership, mode of transportation, road layout, traffic management, traffic participants' quality and level of civilization (Wang Hongyu, 2009).

Yuan Hongwei considered that in the road traffic system, component of people, vehicles, roads and environmental, people are the only independent variable of the four elements. Therefore, people are the core of the Transport system, and the studies of traffic problems should focus on human factors (Yuan Hongwei, 2006).

From these studies, we can extract the main factors affecting the traffic: transport infrastructure, human consciousness, the quality of traffic participants (including education), transport culture, transportation management, and traffic behaviour and so on.

3.2 The Analysis of the Causal Relationship between Traffic and Human Factors

We've already introduced the main research methods, proposed by current domestic scholars, on traffic problems, such as Analytic Hierarchy Process, Structure Decomposition Analysis. There are also some scholars began to study the traffic problems with causal analysis method.

On the basis of accessing to a large number of documents and experts, Ye Xinna extracted the reasons for causing a traffic accident and analyzed the causes of traffic accidents by causal analysis diagram and AHP in her paper of "Analysis of the causes of Traffic Accidents based on causal analysis diagram and AHP"(Ye Xinna, Yuan Hongchuan, 2008).

Pan Hai analyzed the common and basic cause and effect diagram of transport system in the paper of "The basic causal relationship four transport system" .He also gave a new cause and effect diagram of our transport system based on the current situation and a lot of literature at home and abroad.

Based on the previous research, we believe that the traffic is not only a transport and access systems, but also a social system. Now people generally agreed that traffic is made up of three parts: People, vehicles and road, which is referred to 3S system. People have a very significant effect on traffic.

According to the method of fish bone diagram, we have to draw the cause and effect diagram between urban traffic and human factors. The "fish head" of fish bone diagram said the problems to be solved, that is, the problems the transport system composed of people, vehicles, and road faced. According to the foregoing, we can summarized the cause of transportation problems as four categories from a sociological point of view .That is the quality of the traffic participants, traffic management, Transport facilities and social factors. Each category includes a number of possible factors, such as education level, lack of road capacity, layout is unreasonable, transport policies and regulations are incomplete and so on. The reasons for the 4 class and its related factors are distributed at the trend of fish bones in order to form a fish bone analysis chart. As figure 2 shows:

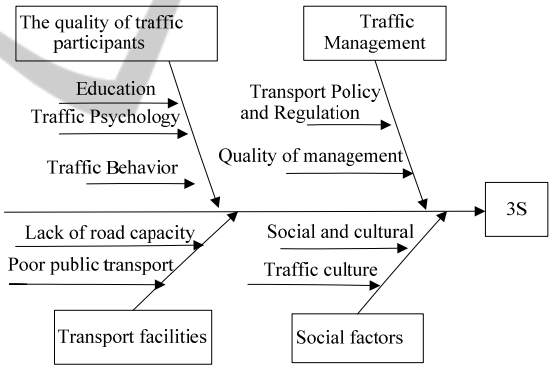

Figure 2: Cause and effect diagram of traffic factors.

It can be seen from the diagram that traffic participants, traffic management, Transport infrastructure, and social factors have an important effect on the transportation system. But the traditional fish bone diagram can only show the causal relationship between the results and the various elements, but cannot explain the relationship between elements. So, we do some changes on the traditional fish bone diagram in order to show the causal relationship between each of the elements.

Arrows in the figure represent the direction of causation, all influence are positive. Describing the causal mechanism means the results of the action process. We can divide Cause and effect diagram

into is a number of causal chain, and choose two chains to illustrate.

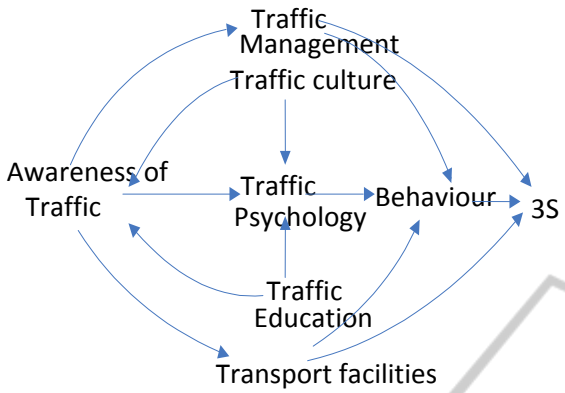

Figure 3: Improved cause and effect diagram of traffic factors.

3.2.1 The Psychological Factors in Traffic

For a society, culture is the most powerful force of habit. A media has published a story that A English teacher in China across the street spend more than a month. Every time the foreigner who took to the streets faced the traffic whiz and had felt overwhelmed, I do not know how to cross the road safely. No matter whether there is a zebra crossing, cars are rarely stopped; At the junctions with traffic lights, regardless of red light or green light, pedestrians often ignore, which made him cannot decide whether to go.

In the first month, the foreigner across the road all by the help of his girlfriend .However more than a month later, the foreigner has been adapted to this way of crossing the road, do the same as people stroll the streets. This shows the level of culture and cultural awareness of participants will affect traffic, poor traffic culture is difficult to breed naturally good traffic civic awareness, resulting in herd, the bad luck of traffic psychology.

The level of education will also affect of consciousness and psychology of traffic participants. By collecting information and observation we found that people with high levels of education tend to have better traffic awareness and traffic psychology.

Weak sense of traffic is bound to have adverse psychological effects on the traffic. The poor awareness of traffic is recognized as a fact by all. A lot of people take traffic rules as child's play. For example, we often run a red light. Red light running has become a common social phenomenon, but the frightening thing is that people mostly don't feel ashamed, and do not feel anything wrong. Some large trucks don't stop but sped away when they meet the red light. Weak sense of traffic will inevitably lead to bad traffic psychology, and thus lead to bad traffic behaviour.

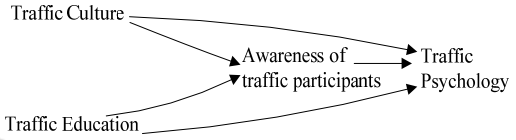

Figure 4: The psychological factors in traffic.

3.2.2 Influencing Factors of Traffic Behaviour

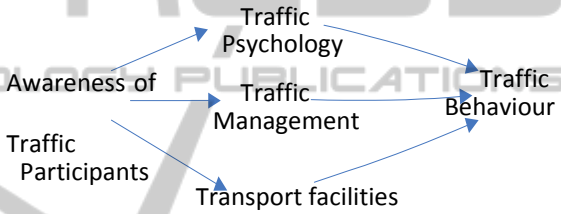

Figure 5: The traffic behaviour in traffic.

Participants of Traffic include transportation planners, decision makers, managers and pedestrians. Traffic awareness of the participants will be able to affect traffic behaviour through the impact on traffic psychology, traffic management and transport facilities, and ultimately affect the entire transport system.

As everyone knows that many defects in planning project decision mainly bring about crowded traffic. Meanwhile, government policy-makers are lack the knowledge about town planning and predictability in some cities. For example, AS parking phenomenon are not take into account, now very many vehicles use parking spaces, which disrupt the normal traffic order. It certainly reflects that the transportation planners and decision-makers should raise traffic awareness.

In addition, the occupation of roads and sidewalks problems has not effectively solved. Many new roads were soon occupied by kinds of vendors, markets and vehicles parks in many cities, which make lacking of roads worse and mainly leading to many negative traffic behaviours.

To have good traffic behaviour, traffic participants must improve traffic awareness, foster good traffic psychology, develop the proper transport planning and improve traffic management.

4 SUMMARIES AND OUTLOOK

Based on previous research, we summarized the human factors of traffic from a sociological point of view. such as: human consciousness, the quality of participants in transportation, traffic culture, Traffic management, and traffic behaviour and so on .Then we figure out the causal relationship between human factors and traffic by the Causal Analysis method.

Under the existing Hardware facilities of traffic, we can largely alleviate the traffic problems through the improvement and adjustment of these factors. Though traffic hardware is important, the human factor is equally important. Only control and improve the both, can we really prescribe the right medicine, and fundamentally solve the traffic problems.

Due to Limited time and the capacity of author, This paper only made a preliminary analysis on urban transport from a qualitative point of view, but doesn't do further research from a quantitative point of view. There still remain some deficiencies and areas for improvement in this paper, and we will improve it in theory Research and practical application.

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APPENDIX

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