

STUDY OF GUARANTEE SYSTEM ON ROAD TRAFFIC SAFETY

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Abstract: With the rapid development of traffic transportation, China is now faced with its serious traffic safety problems. This paper, in the combination of China's present situation, analyzes the macroscopic factors that influence the nation's road safety levels and studies the four aspects of the guarantee system on road traffic safety, such as data system, evaluation methods, fund sources and organization structures.

1. INTRODUCTION

The statistics for China's road traffic accidents has shown that the number of deaths is the second in the world and little lower than that in the U.S.A. The death rate per ten thousand vehicles is also the highest in the world, and many, even tens of times higher than that in the industrialized countries [Traffic Management Bureau (1998)]. On the other hand, China's motorization is developing very quickly and the use of automobiles alone is increasing at the rate of 10~20%, brought about by a rapid growth in the personal ownership of automobiles. It is illustrated in Figure 1. As a result of this, there is great potentiality for a rapid increase in road traffic accidents.

In recent years, the increase in road traffic accidents has caused a great attention of concerned organizations and governments at all levels. They have enacted some traffic

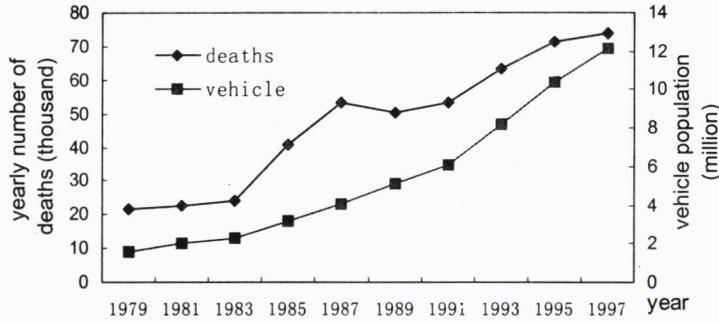


Fig. 1 Vehicle Population and Yearly number of deaths in Traffic Accidents of China

safety laws and statutes and taken some other measures to improve road safety. Local governments have also enacted some safety regulations suited to their areas' conditions. All this work has, to some extent, reduced the occurrence of road traffic accidents. However, as the traffic safety involves many departments including transportation, public security, justice, health care, education, public services and development planning, it is clear that for organization's take measures individually to improve traffic safety is not enough. There needs to be an integrated approach.

As to the measures for traffic safety now in China, there is no way to be sure that they are systematic and scientific. Very often, the limited money is spent on non-effective or not as effective safety projects. Therefore, it is necessary to determine a set of complete, continuous and scientific safety policies that ensure spending the limited money on the most effective safety projects. The success of these policies depends upon having a reliable data system, scientific evaluation methods, sufficient guaranteed funds and appropriate organization structures. Also all traffic management development programmes should take into account both the development and safety problems so as to avoid the past experience of "development first and treatment second", and to achieve good and safe development projects.

This paper discusses the data system, evaluation methods, fund sources and organization structuring and their relation to road traffic safety. It also studies the important roles of these factors in the improvement of the whole nation's road traffic safety levels.

2. DATA SYSTEM

The data system is the basis of the establishing good policies and is also the scientific basis for analysis of safety problems. Comprehensive collection, classification, analysis and explanation of the data can bring about a good understanding of the road system, the safety levels and the relationship between traffic accidents and such factors as health care, economic development, population and transportation plans. A lack of this information will result in a high probability of drawing the wrong conclusions, determining

inappropriate safety policies and spending the limited money on the non-effective projects.

What information to be collected is of great importance to the establishment of a useful data base, which can directly influence the choice of accident reduction plans and the implementation of the first-aid schemes. The maintaining of a continuous and permanent data base allows the state to deal with traffic accidents according to their seriousness and respond to any variations to the transportation system. It can also be used to evaluate the trends in the seriousness and occurrence frequencies of collisions, predict traffic safety and make new policies.

A complete data base should have the following fundamental contents [Rui (1997)]:

(1) Data Recordings at accidents location. The first is the people recordings, which includes the road users' types, ages and the degrees of injuries. The analysis of these simple data recordings can assist in the understanding of the relative importance of casualties between cyclists, pedestrians and drivers, and hence directly influence the preventive measures in safety policies. The second is the environmental recordings, which include the vehicles, accident occurrence time and places, road environment and weather conditions. The data in the environmental recordings will allow scientific analysis of the accident environment and provide preventive schemes with specific targets and clear effects. The third is the recordings for the first-aid process, which include the way of asking for help, the first arrivers at the site and the transport to hospital. Analysis of this data can directly influence the establishment and improvements to the first-aid system.

(2) Statistics for economic loss. At present, the property loss in China's traffic accident records of police only includes the direct loss of vehicles and properties due to traffic accidents. In fact, the actual economic loss should also include the medical treatment expenses of people's injuries, the expenses for the post-crash treatment, the expenses for work loss and the expenses for the first-aid on the spot. The calculations used for the accident loss should use a standard calculation system, in which the shortening of life expectancy and the injuries of bodies can be converted into monetary values and the reduction of life quality and the subsequent sufferings can also be quantified. This system can estimate the total loss, including the expenses for medical treatment of injuries, the expenses for vehicle maintenance and the expenses for the work of traffic police and insurance companies. Accurate cost estimation of traffic accidents is important, so there is correct allocation of funding in the medical schemes to reduce the expenditure of money on traffic accidents. Also, the recordings of the treatment of the injured, the recovery process, the actual expenditure, the restoration of working ability after recovery and the conditions of permanent body injury are of significance to the ongoing improvement of the first-aid schemes.

(3) Fundamental information for evaluation of safety policies. Every region should maintain a continuous and permanent data base, which can be used to evaluate the variation of traffic conditions and the effects of safety policies. If there is no information

before the implementation of traffic safety schemes and no contrast with the first half of the whole process, it is difficult to judge the effects of safety policies and impossible to determine priorities for future investment.

(4) Related data. The establishment of accident data system is often independent work, separate from other related fields. However, the information in these fields often directly influences the evaluation for traffic accidents and the success of safety schemes. The information includes the vehicle registration, traffic volume, mixture of traffic, recordings for hospitalization and death, recordings for driving licence issuing, recordings for traffic violation and the population statistics for road users. This data and the relationship with one another are very important to the judgement for the degree of danger of different methods of travel, and hence can influence the establishment of safety measures and their effectiveness. Figure 2 is the statistical distribution of the number of each vehicle type in traffic accidents from 1992 to 1995 on one section of a highway. The graph seems to show that there is a serious safety problem for heavy trucks, but the actual fact is that there is a high percentage of heavy trucks on this roads. Without the statistics for the traffic flow of different types of vehicles on that section of road, it is difficult to know which types of vehicles represent the greater danger. It is even more important to get the relationship between driver licence data and traffic violation data because it is difficult to change drivers' bad behavior if there is no punishment for the drivers who violate against the traffic rules.

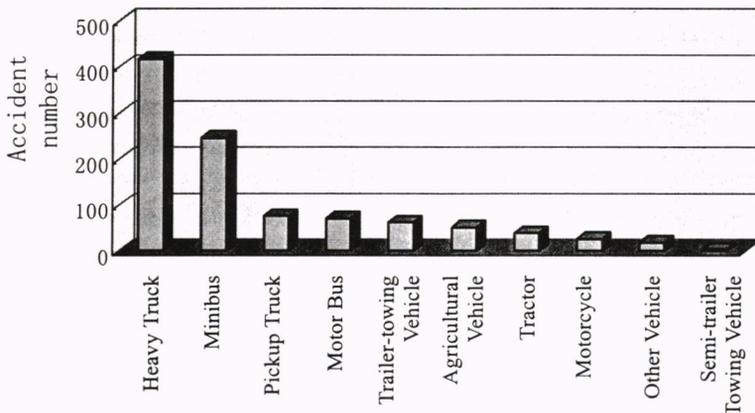


Fig. 2 Vehicle Types Distribution in Traffic Accidents from 1992~1995

Through the use of standard forms by all the state traffic administration, the above data base can be interconnected using computers and the information can be exchanged between Departments. Now in China, the Ministry of Public Security has already prepared unified forms for highway traffic accidents, and all the local public security departments have to do is to complete the forms. The data base system for highway traffic safety in China is therefore being set up and will continue to improve.

The reliability of the collected information in the data base is very important to the analysis of a range of specific problems, the selection of the preventive policies and therefore to the

end effects of safety initiatives. Hence, there should be uniform concepts and standards used in the collection and storage of data. For example, there should be unified definitions for deaths and serious injured in the systems of health care, transportation and traffic management, because different calculation methods will result in the different description of the same case and there will be no comparability among the systems. The definition of death due to a traffic accident is laid down by the World Health Organization and refers to the death of the person within 30 days of the accidents occurrence. In most countries, there is a 3% difference between the 30-day death and the long-term effects [Telikar and Johnston (1993)]. In China, the definition for deaths due to traffic accidents refers to deaths within 7 days after an accident. And the injuries are divided into light injury and serious injury with clear judging standards.

The accident related data often comes from a lot of departments like traffic police, hospitals, insurance companies and health-recovery services. To achieve reliability of the collected data, it is necessary to coordinate the work of the departments and set up exchangeable data systems among them, to help improve the better understanding of safety problems.

3. EVALUATION METHODS

Evaluation work includes the road safety audits of highway projects and the prediction and evaluation of the impacts of safety policies.

3.1 Road Safety Audit

In order to improve the safety levels in the road traffic system, it is wisest to prevent the occurrence of traffic accidents and avoid the planning projects and road projects with obvious safety shortcomings from entering the design, construction and service stages. This is the goal of the road safety audit [AUSTROAD (1994)].

Engineering standards and guidelines provide a sound starting point from which a good design can evolve. But standards and guidelines are often developed with many objectives in mind, not only safety. So their strict application does not always result in the safest road environment. In addition, the combination of separate standard requirements can sometimes result in poor safety where the objective of one standard bears no relation to that of another. So it is necessary to conduct safety audit. A road safety audit should be performed by persons who have sufficient experience and expertise in the areas of road safety engineering, accident investigation and prevention. They should view the road projects with fresh eyes and from the point of view of the different types of road users and have the ability to investigate the accident potentials and the road safety situation.

There are five stages at which a road safety audit can be conducted [AUSTROAD (1994)]:

- the feasibility stage
- the draft design stage
- the detailed design stage
- the pre-opening stage, and
- an audit of an existing road

The earlier a road is audited within the design and development process, the better. If an inappropriate concept or treatment is chosen at the feasibility stage, it is very difficult and often impossible to remove the safety problems at later design stages or once traffic is using it. The cost of a road safety audit and subsequent cost of changing a design are significantly less than the cost of remedial treatments once works are constructed. Evidence to date indicates that auditing a large-scale new project (requiring audits at four stages) will add about 4% to 10% to the road design costs. As the design costs can be in the order of 5% to 6% of total implementation costs for larger projects, the increase in total project cost is usually quite small. One British road safety expert [Sabey (1993)] has reported that the systematic application of road safety audit procedures (including Stage 5 – audits of existing roads) across Britain has the potential to give a 3% saving in casualty accidents.

3.2 Evaluation Methods

The choice of any strategy and the popularization of any successful scheme should be established on the basis of comprehensive and rigorous analysis of the effective data. The best evaluation methods are the ones that can be used for statistical data comparison before and after the implementation of the schemes. Distinguishing the effectiveness of different schemes in the different areas that are comparable, then analyzing the results allows the schemes to be listed according to their objective order and the most effective strategy can then be developed.

Before the implementation of a traffic safety scheme, there should be an analysis of the cost/effect or cost/benefit. Absolute value comparison should be used for the analysis of cost/benefit. For example, when considering whether a kind of safety device should be installed in all vehicles, the past information should be used to estimate how many casualties will be avoided if this kind of device is installed in vehicles. The economic cost of these casualties should be calculated and then divided into each vehicle. After this value is compared with the added cost of each vehicle that has the new device, the scheme of installing the new device is considered practical if the economic benefit is higher than the cost. However, the analysis of cost/benefit is based on certain cultural values because in the different cultures the estimated cost for life, death, health, happiness and time are quite different, and there may lead to different conclusions for the same problem [Telikar and Johnston (1993)]. In contrast, the analysis for cost/effect does not need absolute data. There needs to be only local comparison of different schemes to choose the scheme with the least expenditure of money but the same road safety effect. It is unnecessary to conduct

the absolute estimation of economic cost for traffic accidents. Accordingly, the analysis of cost/effect is very reliable for it cannot be affected by some unstable factors.

Before new schemes are widely implemented, there should be small-scale trials so as to avoid unnecessary waste.

4. FUND SOURCES

The research, development and implementation of a safety strategy needs a great deal of investment. A certain percent of funding needs to be guaranteed to keep the country at a proper level in both its highway development and traffic safety. Fig.3 is China's fund flow chart for the highway management, maintenance and road safety. The chart indicates that there is no separate and identified fund source for road traffic safety.

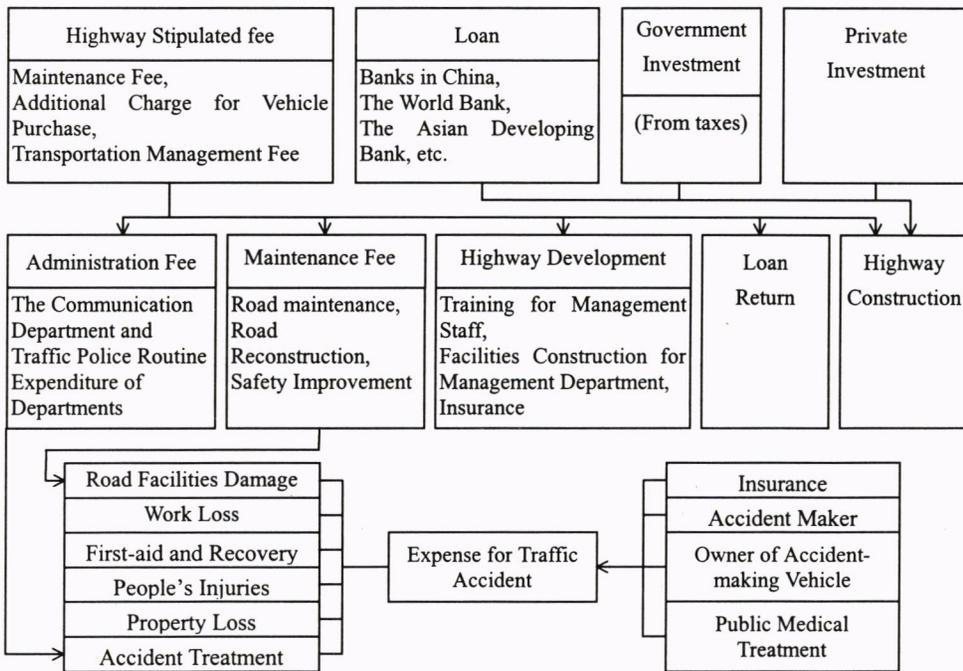


Fig. 3 Fund Sources and Expenditure for Road Traffic

Traffic transportation can bring about very large benefits to the nation, society, enterprises and individuals. At the same time, all these beneficiaries should share the cost of the traffic accidents because the economic loss in traffic accidents is one part of the transportation cost. But Figure 3 shows that only the insurance company, the accident victims and public medical services bears the cost of the economic loss in traffic accidents, which is quite unreasonable. In the vehicle tax policies, there should be reasonable allocations for the economic loss of traffic accidents. For example, all the vehicles should be classified into

types, and different types of vehicles should pay different amount of taxes. The vehicles that have a higher occurrence of accidents should pay additional fee so as to make up for the economic loss of traffic accidents and stop the development of such kinds of vehicles [Rui (1995)]. During determination of the responsibility for traffic accidents in China, the shortcomings of road facilities is rarely cited, which often results in road construction departments not spending the necessary amount of funds to improve the road safety levels. They even think that they don't make much difference to the road safety levels. This serious situation has kept the road safety levels from being improved.

At present in China, a large amount of medical treatment cost for traffic accidents is born by public medical system, which increase the already heavy burden of the public medical system even more. In the vehicle insurance fee provided by the insurance company, the road users who have more traffic accidents should be asked to pay higher premiums so as to make them afford to bear high risks in the road traffic. Another advantage of this practice is that there will be a financial guarantee for medical treatment and the injured can receive sufficient treatment, hence the further development of the first-aid work.

5. ORGANISATION STRUCTURES

The organization structures and the responsibility division between the organizations will directly influence the full effectiveness of their programs. The organization arrangements for traffic and traffic safety are different in the different countries. This is partly because of the different social background and development history. The traffic in China is under the control of both the public security department and communications department (see the organization and function division in Figure 4). According to the present organization structure and function division, the administrative functions of the two departments for road traffic overlap, which can easily result in the problems of unclear responsibility or duplicate management. Traffic safety has its peculiar position in road traffic management. The work for it goes through the whole process in road traffic and it is not a separate program. However, the present management system has separated road safety management from others, done only by the public security department. The serious disadvantage of this is that traffic safety has become the duty of the public security department, and neither the highway transportation management department nor the highway construction department shows the concern for it. To make matter worse, the public security department does not have enough funds and resources to be involved in all the necessary work for improving traffic safety.

In many countries, the organization structure for traffic transportation management is similar to that in China. The only difference in some countries is that there is another organization --- a safety organization besides the communication department and public security department. This organization is responsible for the nation's traffic safety and for laying down the safety schemes of the nation. In the U.S.A, there is National Highway Traffic Safety Administration (NHTSA) and in Australia there is Federal Office of Road

Safety (FORS). They are not subordinated to the communications department or the public security department. In Japan, the state police department is responsible for traffic safety. Management practice has shown that a separate national organization is more efficient for traffic safety than the work from many departments.

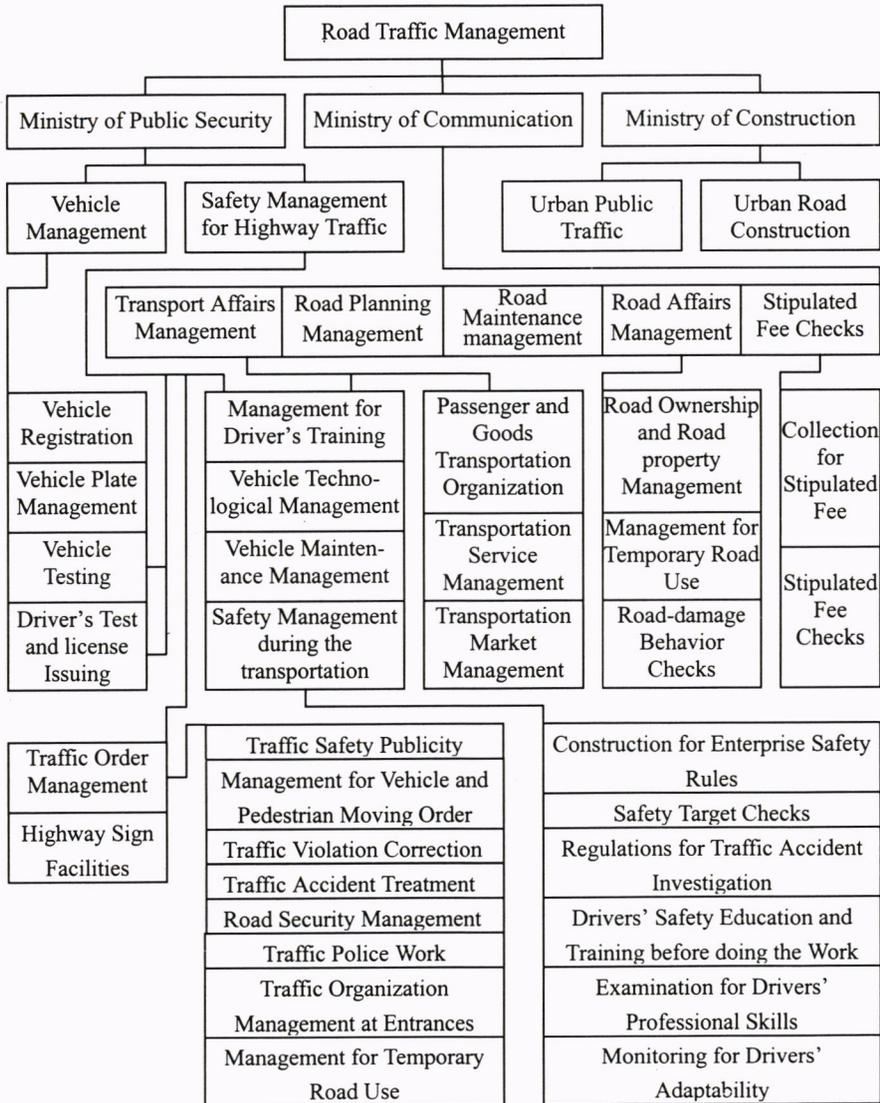


Fig. 4 Road Traffic Management Organizations in China and Their Function Divisions

Organizational adjustment is now being done in China. In some provinces (like Henan), a more effective management mode for traffic safety is being tested. Figure 5 shows that in the provincial traffic management mechanism, a new organization --- traffic safety coordination group will be structured to perform the functions of traffic safety coordination, planning and research. It is also suggested that a traffic safety organization in the state

management be instituted to do the work of stipulating traffic safety schemes, making safety laws, working out road safety standards, distributing safety funds, and making traffic development plans and other coordination work.

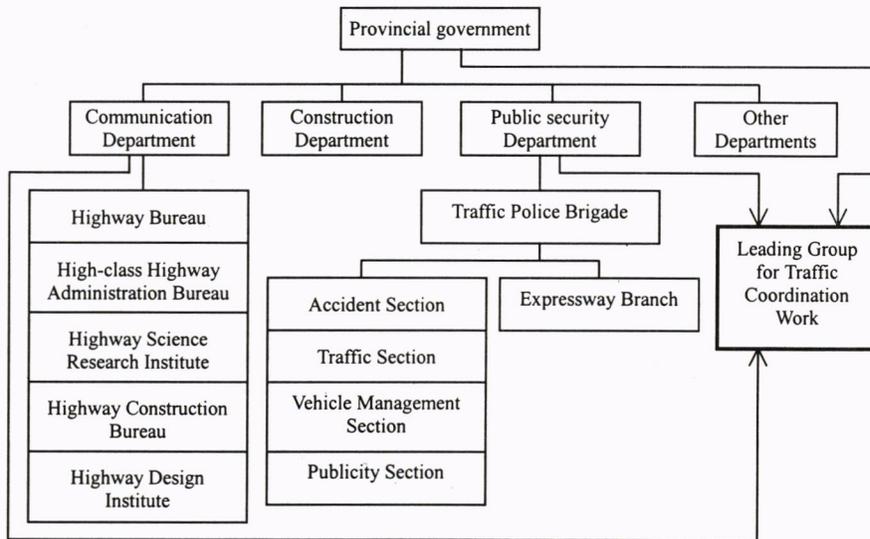


Fig. 5 Traffic Management Mode for Provincial Highways

There should be government-supported research institutions for traffic safety, whose research objectives should go with general safety policies of state. But these institutions should be separated from the implementation departments and they should not take part in the policy implementation in order to maintain their independent functions. The objectives of the institutions should not be restricted by the short-term goals so as to keep their work advanced in nature. At the same time, the researchers and the research institutions should always keep in touch with the policy-makers to make sure that their research results give a sound basis for policy making. In addition, the subjects and research plans of the research institutions should have practical values to gain support from other departments such as automobile manufacturers, insurance company, transportation departments and public health services. In this way, they can get more money from them and achieve high-levelled research projects. The professions in the research institutions should cover all the relevant fields like medicine, engineering, law, economics and education to avoid the one-sided work and to help the policy-makers lay down more effective and proper policies.

Now, the existing research institutions are playing a big role in research work for traffic safety. However, they are seldom involved in the implementation work for accident-reduction measures. As they are strong in their profession, well-informed and powerful in research work, they can provide professional advice for the policy-makers. Also, from the point of view of the profession, they can conduct objective research and evaluation for policies, which is very important to their issuing.

6. CONCLUSIONS

China is now developing its road transport on a large scale and a modern highway transportation network system is being formed. During this period, it is very important to stipulate comprehensive strategies because more and more problems will appear with the development of transportation. And in the long run, it is also the most economical and effective practice. However, there needs to be a secure material basis and sound policy environment to develop a complete and scientific set of traffic safety policies and keep the safety levels of the whole country at appropriate level.

From the above discussions, the following conclusions can be obtained:

- (1) The occurrences of traffic accidents involve many fields and complicated problems. Therefore, it is necessary to adopt scientific methods to analyze, understand and solve that, and also necessary to establish a complete and reliable data base.
- (2) There needs to be effective and proper organizations to solve the traffic safety problems.
- (3) The problems that resulting in traffic accidents cannot be solved by one department. So there needs to be cooperation between departments to deal with them.
- (4) The economic targets always influence the stipulation of traffic safety policies and the development of schemes. When there will be a choice between the social benefit and economic target, the analysis of cost/benefit and cost/ effect can be used to properly assess the targets, which is very important to the stipulation of proper policies.
- (5) Before the popularization of safety policies, there should be tests in some regions and a thorough evaluation conducted. The purpose of this is to ensure that the limited funds are spent on effective projects and to avoid any waste.
- (6) A guaranteed amount of investment is essential for the improvement of safety levels in the country. The sources of fund should be on the principle that those who gain benefits bear the cost. Through the improvement of laws and clear duties, the concerned departments in the government and enterprises should bear their responsibility and take their tasks for traffic safety.

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