Traffic Safety Situation and Suggestions of Safety Policy for China

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Abstract

Traffic crashes increases with the rapid development of highway and motor vehicles in recent years. The objective of the paper is to analyze the tendency and characteristics of traffic safety and to make some useful suggestions for policy makers. The paper introduced the situation of crashes from1990 to 2006, and analyzed the characteristic and tendency of crashes data, and reviewed the domestic and overseas policies on traffic safety these years. Combining the practical experiences with traffic safety situation of China, suggestions were proposed for road safety policies makers.
Key words: Traffic safety, Crash index, Safety policy

1. Introduction

It has been golden years for China to the develop roadways and motor vehicles since 1990's. The number of highway kilometrage increased from 1,030,000 in 1990 to 1,940,000 in 2005. During the same period, the number of vehicles added 126 million to reach 130 million while the number of drivers increased 118.7million and the total reached 134 million, which means the number of vehicles or drivers in 2005 is ten times as many as that in 1990.

The rapid development of highway provides people with convenient conditions and promotes transportation operation efficient. However, some negative effect go with the rapid development of highways and vehicles, such as traffic crashes increase and serious traffic jam, etc. With respect to the number of traffic crashes, it climbed up from250,297 to378,781, which killed more than 1.3 million people in the last 15years. Faced the sharp upward trend of traffic crashes, efficient safety policies has been laid out and adopted by the Ministry of Communication of China (M.O.C) and Ministry of Public Security of People's Republic of China(M.P.S).

The objective of the paper is to analyze the tendency and characteristics of traffic safety and make some useful suggestions for policy makers.

The remainder of the paper is organized as follows. The trend and characteristic of crashes is analyzed first. The changes of characteristics of crashes in 2006 are then discussed to find key and difficult problem of traffic safety. Based on reviewing the domestic and overseas policies on traffic safety, some useful suggestions are made, followed by concluding remarks.

2. Characteristics of Traffic Safety

2.1 Tendency of Traffic Safety

With the repaid development of highway and automobile industry the crash indexes (including number of crashes, number of fatalities and number of injured) have been growing upward form 1990 to 2006.

As is shown in Figure1, there is a sharp increase from 1998 to 2002. It seemed to be peak of the crash indexes in 2002, which involved 562,074 people injured and 109,381fatalites in 773,137 crashes. And the death rate per 10,000 vehicles was 13.71 in 2002.

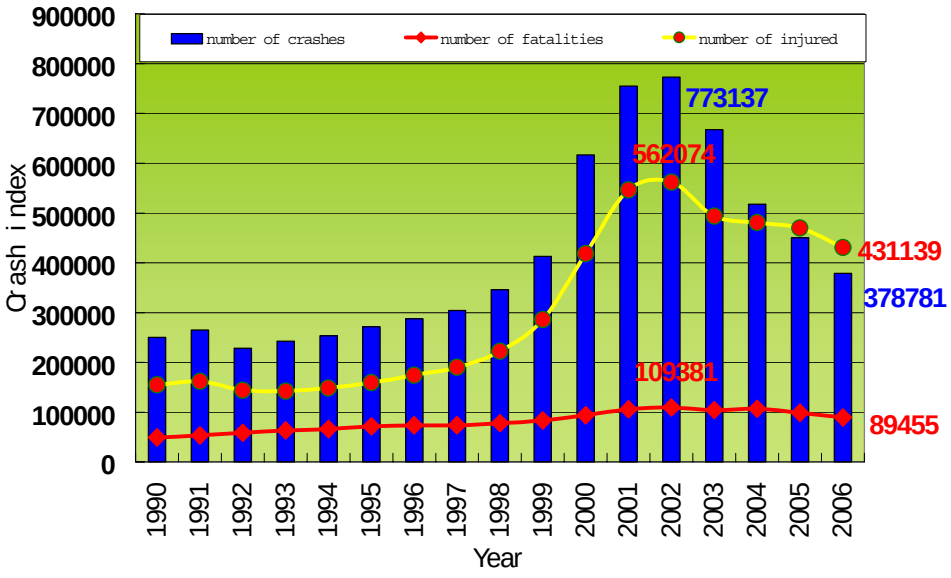

Figure 1 the crashes index trend during 1990-2006

Then the government of China has attached great importance to the traffic safety and taken measures in traffic safety policy since 2002.

The crash indexes have been moving downward from 2003 to 2006. Especially in 2006, the crash indexes decreased great magnitude which proved new traffic safety policies has been effective on traffic safety.

2.2 Main causes of crash

Many factors contribute to traffic crashes, such as driving skill and experience, driver attitudes to safety law, vehicles performance, roadway and roadside conditions, geometric design deflection, bad weather, etc.

According to the statistical analysis of crashes (Figure 2) , there are six main causes of cashes, i.e. disobeying the rule (or law) of giving way, accounted for about 16.37 percent of total crashes, speeding and driving error caused in 11.49 to 11.69 percent of all crashes; bad vehicle (such as steering device ineffective, break failure, tyre burst, overload) involved in approximately 7% percent of all crashes; illegal turning operation took 5.25 percent of the total.

The results may be different when using different crashes data occurred on different roadway. For example, the reasons that who disobeys the rule of giving way is the greatest portion of cause of crashes on two lane two way highways while diving error and fail to keep safety distance are the most common two reasons of crashes on freeways. However, the six main causes mentioned above are associated with statistically significance. It is hinted policy makers should take into account these main reasons to solve traffic safety problem.

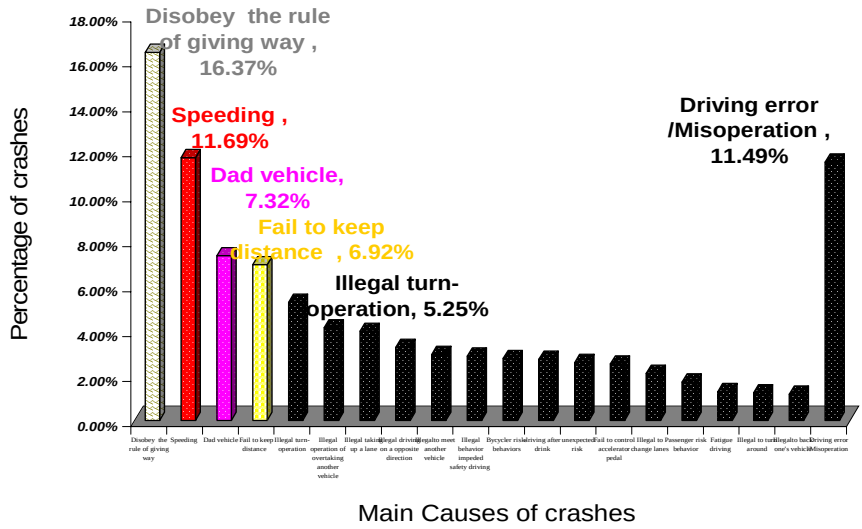

Figure 2 Main Cause of traffic crashes

2.3 Characteristics of Crash Type and Manner of Collision

From the pie graph of characteristics of crash types and manner of collisions (Figure 3), side collision shared the greatest portion, as a 39 percentage of total crashes. Head on collision and rear-end collision ranked the second and the third, taking 26% and 13% of total.

Characteristics of crashes type may differ by different road class. Side collision, head on and rear-end collision are most common type and take up 78% of the total on two lane two way highways, side collision is the first reason.

But the amount of rear- end collisions, collisions with fixed objects, overturned crashes accounted for 73% of the total on freeway. Rear- end collisions take 40% and ranks the first on freeway.

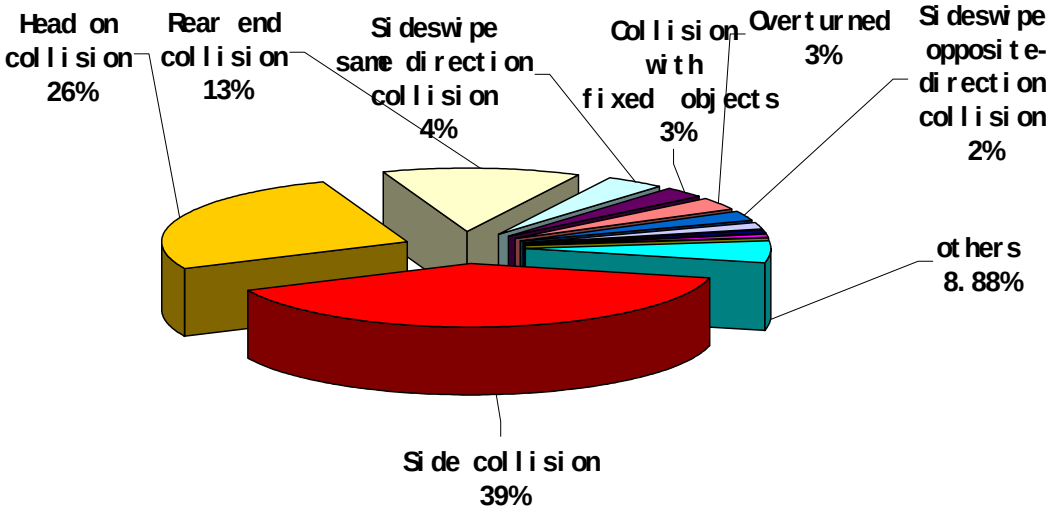

Figure 3 Characteristics of Crash Type and Manner of Collision

2.4 Characteristics of Traffic Safety on Various Type of Highway

Different safety performance appears on different technical and functional classes. Highway divided into five highway classes: Freeway, Class I, Class II and ClassIII, Class IV highways in China. City road divided into expressway, arterial, minor, branch and alley in China.

From table1, it implied the situation of safety on city road is better than the highway. It also implied the situation of traffic safety on Class II and Class III was more serious than that on Freeway and Class I in last several years. Most fatal crashes occurred on ClassII and ClassIII highways. These crashes accounted for 50% of total fatal crashes occurred on all highway and city roads. Because the highway design standards of ClassII and ClassIII is lower and the mileage of Class II and Class III is much longer than that of freeway and Class I.

Table1 Crashes Index in 2005 of Different Highway Class

Type	Class	Number of crashes	Fatality	Injure	Direct losses (RMB)
highway	freeway	18168	6407	15681	50893
highway	I	34009	9335	35384	14569
highway	II	93065	27749	99964	36748
highway	III	70684	19699	77959	22898
highway	IV	27154	6967	31182	6593
highway	others	29760	6532	33301	5864
city road	Expressway	11730	1900	12388	5886
city road	Arterial	98228	11895	95693	27262
city road	Minor	26268	2930	25786	7524
city road	branch	12810	1510	12583	31496
city road	Alley	26485	3597	28092	65806
city road	others	1893	217	1898	4322

But the average crash rate and the severity occurred on class-I highway are higher than those of other classes of highway. As is shown in figure 4, the most dangerous road is the Class I, next is freeway, followed by ClassII and ClassIII and ClassIV. The average crashes number per kilometer of Class I is 174.15, much higher than that of other classes. There are fewest crashes on the ClassIV since there is low speed and low traffic flow operation on them.

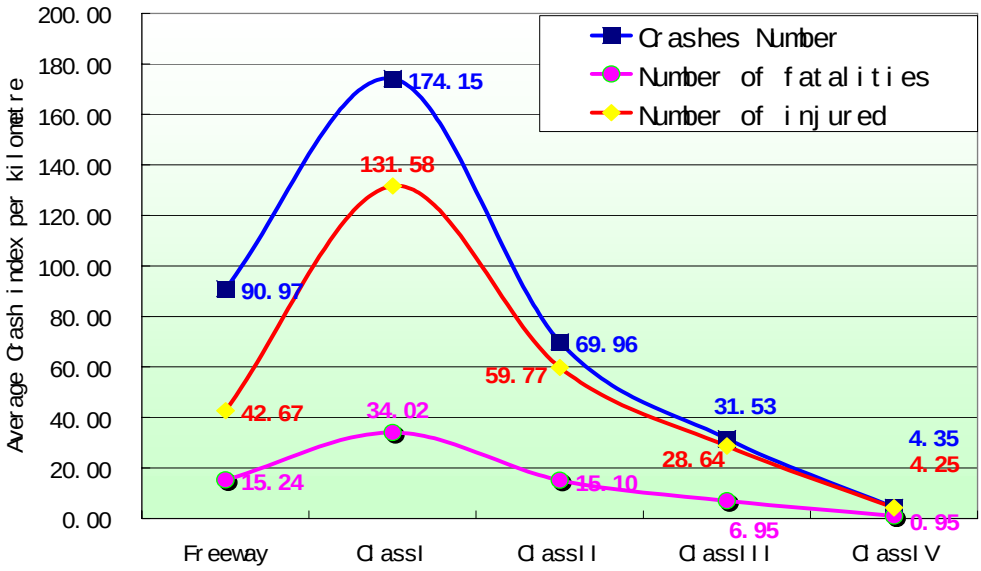

Figure 4 Average Crashes Index per Kilometer (2000-2005) of Different Highway Class

2.5 Characteristics of Driver and Climate

Young people are responsible for 76.44% fatal traffic crashes. The fatal crashes caused by drivers with driving years less than 3 years accounted for 38% of the fatal total crashes in last 5 years.

Bad weathers share very few of percent of whole weathers, but the crashes occurred in bad weathers share took 19% of fatal crashes and caused 1227 deaths in 2005.

3 Changes of traffic safety in 2006

The total of crashes was 378,781 in 2006, which caused 89,455 deaths, 431,139 injured people and $186 million (US dollars) direct property losses. Compared with the crashes indexes in 2005, the number traffic crashes decreased by 71,473 or 15.9% and fatalities dropped 9,283 ,or 9.4%,and the injured people lowered by 38772, or 8.3%, and direct property losses reduced $50 million (US dollars) in 2006. It was noticeable that there were some conspicuous characteristics of traffic safety in 2006.

Comparing with data in 2005, there are some new characteristics in 2006.

Fatal crashes which caused by violation-related of the Road Traffic Safety Law in 2006 decreased distinctly in comparison with those in 2005. There was 16.2 percent decrease in fatal crashes overall, which killed 76,350 drivers because of their violation-related behaviors. Deaths caused by speeding cut down 4,147, decreased by 26 percent of the number (16,015) in 2005. And deaths caused by drinking and fatigue reduced by 21 percent and 25.6 percent respectively

Traffic violation-related fatalities were dropped significantly in 2006, as compared to the same number in 2005. The total number of traffic violation-related fatalities declined 16.2 percent from 87,372 in 2005 to 76,350 in 2006. About 11,804 traffic fatalities involved speeding violations in 2006. Data comparing 2006 with 2005 show that speeding related fatalities experienced a reduction of 26.3 percent, while alcohol-related fatalities decreased by 21 percent. The total number of fatigue-related fatalities declined 25.6 percent from 2,545 in 2005 to 1,909 in 2006.

Fatal crashes involving cars or heavy trucks decreased a great range. Fatal crashes caused by car decline 9.1 percent from 21,491 in2005 to 19,557 in 2006. Data comparing 2006 with 2005 implied that fatalities caused by heavy truck dropped from 21,479 to 16,324 fatalities, as a percentage of 24.1.

Comparing with data in 2005, the number of fatal crashes occurred on the Class II and Class III descended obviously in 2006. The total fatalities occurred on highway was 67,277 and declined 12.3 percent of the data in 2005. Comparing with data in 2005, fatalities declined 14.7 percent from 47,643 to 40,497.

About 38 tremendous crashes (i.e. more than 10 deaths in a crashes) occurred in 2006, about 20 percent less than that of the previous year.

The death rate per 10,000 vehicles was 6.2 in2006, which cut down to the lowest level of history.

Although a great progress has been made, the situation of traffic safety is not desirable.

Crashes occurred on expressway and freeway climbed up in 2006, as compared to the number of the same period in 2005. The total number of fatalities occurred on expressway increased by103.6 percent from 1900 in 2005 to 3868 in 2006, while the number occurred on freeway added 3.5 percent of the data in 2005 and reached to 6631 in2006.

Comparing to the number in 2005, crashes caused by private vehicles rose rapidly in 2006, as 55.7 percent increase, which led to 39730 fatalities, accounting for 23.7 percent of the fatal total crashes.

Traffic fatalities involved violations of meeting and using lanes and overloading went up in 2006. The total number of traffic violations of meeting vehicles increased by 38.1 percent from 2,894 in 2005 to 3,996 in 2006. And 6,050 traffic fatalities involved violations of using lanes in 2006. Data comparing 2006 with 2005 show that violations of using lanes related fatalities experienced a increase of 34.8 percent, while violations of overloading increased by 33.6 percent. The total number of overloading fatalities added 33.6 percent from 1,987 in 2005 to 2,654 in 2006.

Traffic fatalities occurred at dusk and on Sunday raised in 2006. About 27,235 fatalities which occurred from 17:00 to 22:00 took 30.6 percent of total fatalities, while 13,448 fatalities which occurred on Sunday took 15.1 percent of total fatalities in 2006. It was noticeable that there were 4,280 fatalities from 17:00 to 22:00 in Sundays, accounting for 31.8 percent of the total fatalities occurred on Sundays and 15.7 percent of the total fatalities occurred from 17:00 to 22:00.

The new characteristics of changes of traffic safety should be considered in the traffic safety policy in the next years.

4. Road Safety Policy and Suggestion

4.1. Strategic Plan for Improving Road Safety

The impetus for a strategic plan emerged from the climate of reducing the traffic injures and improving traffic safety in many countries. Because many traffic safety problems to be solved and to solve each problem needs a longer range (such as 20 years) and a lot of money, different key missions to improve road safety should be emphasized during a certain period.

It is encouraged strongly that the government initiates to develop a strategic plan to improve road safety.

The strategic plan is multi-faceted, multi-organizational approach to improving road safety. For progress to be made in road safety there has to be a strategic, multi-organizational approach that involves all members of the road safety community working together to maximize the effectiveness of their coordinated efforts through the formation of strategic partnerships. The road safety problem should be recognized not only by Ministry of Communication of China (M.O.C), Ministry of Public Security of People's Republic of China(M.P.S), Ministry of Construction P.R. China (M.C), but also by different organizations including Ministry of National Development and Reform Commission N.D.R.C Health of People's Republic of China(M.H.P), Ministry of Finance of People's Republic of China(M.F.P) , Insurance Institute for Highway Safety ,State Administration of Work Safety (S.A.W.S) and others.

The road safety strategic plan provides a comprehensive, coordinated approach to reducing road crashes and their associated societal costs. The road safety strategic plan contains missions, goals, objectives, and action items.

Missions- describe the traffic safety task of a period.

Goals - statements of desired outcomes under each mission.

Objectives - specific aspects of a goal which can be measured to determine the degree to which a goal is met.

Actions - Activities that can be taken by one or more entities to satisfy an objective.

4.2. Road Safety Management Planning

Road Traffic Safety Law has brought into effect since 1st, May, 2004. To improve road safety the centre government and local governments are required to make Road Safety Management Planning (RSMP). RSMP goal is to integrate a focus on safety Management throughout the transportation planning process and routine management. RSMP is a most important component of Strategic Plan for Improving Road Safety (SPIRS). RSMP requires cooperation, collaboration and integration of the planning processes of several agencies including traffic police administration, highway administration, municipal administration, etc. RSMP includes traffic management policy planning, highway safety system planning, road safety information system planning, road safety propagand and education planning. RSMP is required to prepare and update periodically.

Now some cities government has launched on RSMP since 2004 and put RSMP into practice.

4.3. Road Safety Audit

Road Safety Audit (RSA) is viewed as a proactive, low-cost approach to improve safety. A road safety audit is a formal safety performance examination of an existing or future road or intersection by an independent audit team. Road Safety Audits may be conducted at various times such as project planning, preliminary design, final design, and construction.

Road safety audits have been a formalized analysis process for more than two decades. These formal safety-focused analysis started during the early 1980's in the U.K., moved to Australia in the early 1990's and New Zealand then on to many Europe countries (like Netherlands, England, Sweden) and North America.

The introduction to China started in the latter 1990's, and the Guidelines for Safety Audit of Highway of China issued by M.O.C in 2004.

Now the RSA has been successfully implemented in some important projects, such as Chang-Wan Freeway, Cheng-Tang Freeway. But the feasibility of integrating Road Safety Audits into all phases of road project has not proved. So RSA has not been an obligatory process of all road projects.

The promoting and implementing of RSA is going on and will be applied in more projects.

RSA may be an integral part of the M.O.C Strategic and Performance Plans.

4.4. Eliminating Crash-prone and Design Defects

According to the data of Ministry of Communication of China (M.O.C), there are 170,000 crash-prone road segments (nearly a total length of 50,000 km) on the national highway system. M.O.C initiated and sponsored a nationwide campaign in 2004 — the Safety Enhancement Project (TSEP). The objective of TSEP is to improve its safety performance by rehabilitating some dangerous segments of national highway and eliminating crash-prone in the next few years. Now the TSEP has been successfully implemented in many provinces and reduced traffic fatalities these years.

To eliminate design defects, New Safety Design Concepts (such as roadside forgiven design concepts, human centered design concepts) has been recommended by the M.O.C in recent years.

4.5. Protecting Vulnerable Road Users

Vulnerable traffic members main include pedestrians and bicyclists in China. 37,725 vulnerable road users were killed and 142,879 were seriously injured in 2005. Pedestrians and bicyclists comprised the large proportion of victims among road user casualties, accounting for 38.3% of fatally injured victims and 30.4% of those with serious injuries.

Crashes involved Pedestrians and bicyclists are usually occurred at huge intersections, narrow road without sidewalk. It is suggested that road design provide measures (such as speed management, traffic calming, hazard shielding design) to improve the safety of vulnerable road users.

4.6. Emergency and Medical Rescue Services

Emergency and Medical Rescue Services Systems (EMRSS) is a comprehensive program aimed at reducing the traffic injures and fatalities once crashes occur. “Give A Minute - Save A Life” reflects the golden minutes to save a life after crashes. Many crashes occurred on remote highway, freeway and rural highways. But some wounds would have saved if medical rescue was available in time. It is suggested to build EMRSS as early as possible.

4.7. Enforcement campaigns

Studies shows enforcement campaigns have significantly increased safety effects in recent years. Eight special campaigns initiated by the M.P.S in 2006, such as Competition of Reducing Crashes in One hundred Days, Identifying Hazard Road, Getting rid of Illegal-vehicles and ill-vehicles, Speeding Enforcement and Public Information campaigns. It has proved that these enforcement campaigns has positive behavioral and are evident effect immediately after the adoption of the program.

5. Conclusion

Traffic crashes increase with the rapid development of highways and motor vehicles in recent years in China. This paper summarized main characteristic of traffic crashes and reviewed domestic and overseas roadway safety policies. Combining the practical experiences with traffic safety characteristics of China, suggestions were proposed for road safety policy makers. After analysis of paper, it included:

- The crash indexes (including number of crashes, number of fatalities and number of injured) have been presented upward trend form 1990 to 2006.
- After the government of China took some effective traffic safety policy since 2002, the crash index has moving downward from 2003 to 2006, especially in 2006 the crash indexes decreased great magnitude.
- Six main causes (i.e. disobey the rule of giving way, speeding, driving error, vehicle with ill-operation, illegal-turn operation, fail to keep safety distance) contributed 57 percent of total cashes.
- Side collision, head-on collision and rear-end collision, collisions with fixed objects, overturned crashes are most common crash type in recent years.
- Different safety performance appears on different highway technical and functional classes. It was implied more crashes on highways, especially on Class II and Class III, while the severity of crashes on freeway and expressway are more serious than that on other roads.

- The upward trend has been controlled from the data of crash in 2006. It brought lower crash rate that has not appeared these years. Some characteristics of data means the recent traffic safety policy has come into effect. The change characteristics of crash in 2006 implied the safety policy and strategic should be update.
- With the domestic and overseas policy practical experiences, some useful suggestions were made in the paper, including: establishing Strategic Plan for Improving Road Safety and road safety management planning, promoting road safety audit, eliminating crash-prone, using safety design concepts, protecting vulnerable road users, setting up emergency and medical rescue service etc.

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Reference

1. Appleton, I., and Jordan, P., "Road Safety Audit: Progress in Australia and New Zealand," Proceedings of the New Zealand Land Transport Symposium 1994, Volume 1, pp. 101B106.
2. Australian Transport Safety Bureau (2001). The national road safety strategy2001-2010. Commonwealth Department of Transport and Regional Services,Canberra
3. C.J.L. Murray and A.D. Lopez, eds. The Global Burden of Disease: A Comprehensive Assessment of Mortality and Disability from Diseases, Injuries, and Risk Factors in 1990 and Projected to 2020. Boston, Harvard University Press, 1996
4. Elvik, R. (2004B). A framework for a rational analysis of road safety problems.Paper to be presented at ICTCT workshop in Tartu, Estonia, October 28-29,2004
5. Evans, L. 1991. Traffic Safety and the Driver.Van Nostrand Reinhold,New York, 405 pp.
6. Finnra. 1998. Finnra's strategy for traffic management. Helsinki: Finnish National Road Administration,Traffic Services.
7. Ministry of Public Security P. R. China 1990-2006, Crashes of Data of China Annual Report.
8. Navin, F., “A Model for Road Safety Planning; the Theory and a Policy Example,”Transportation Research Board, Washington, D.C., in press, 1999.
9. Peltola, H. 2000. Seasonally changing speed limits: Effects on speeds and accidents. TransportationResearch Record, 1734, pp. 46-5 1.
10. Proctor, S., Belcher, M., “The Use of Road Safety Audits in Great Britain”, Traffic Engineeringand Control, February, 1993, pp. 61-65.
11. Road Safety 2000CThe Plan for Road Safety in New South Wales Progress Report 1991B1994, Road and Traffic Authority, Sydney, NSW, Australia 1995.
12. Safety Enhancement Project will be Initiated by the Ministry of Communication of China (M.O.C) http:// news.xinhuanet.com/ zhengfu/2003-12/01/ content_1206208.htm
13. Sayed, T., Rodriquez, L., Feng, S., “Accident Prediction Models for Signalized Intersections in British Columbia”, Proceedings of the 1998 Annual Meeting of the ITE, Toronto, August, 1998.
14. Zhong Xiaoming Wang Haizhong Sun Xiaoduan Liu Xiaoming. Study on New Concepts of Highway Safety Design. 85th Transportation Research Board Annual Meeting,Washington D.C. (CD-ROM , January 2006
15. Zhong, XiaoMing. Study On Traffic Safety Models For Highway Three-Leg Unsignalized Intersections, Ph.D. Dissertation, Beijing University Of Technology, 2006.