

Evaluation of Highway Traffic Safety

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Abstract: The domestic and foreign scholars mainly focus on the highway safety research, For the research on the characteristics of highway traffic in mountainous areas and the research on the risk of highway traffic in Mountainous Areas are less. So it is very important to strengthen the research on the risk of road traffic in mountain area. Through the study of road condition, vehicle performance and traffic flow for the driver to operate the influence degree of the analysis, evaluation of the road driving risk levels and improve road driving conditions, reduce the risk of driving the vehicle, to protect the safety of drivers driving comfortable.

Keywords: Mountain road; Traffic risk; Safety evalu

1. Introduction

The winding mountain road, bend, small turning radius, steep, down hill braking difficulty, bend and longitudinal slope combined more sections, complex alignment, turning line of sight is poor, road alignment design is not continuous, especially mountainous and hilly area, the more bridges, tunnels and road junctions and other special sections and special sections of the tunnel entrance at light contrast, bridge approach velocity mutation, road surrounding valleys, cliffs, and there are many rivers, vehicle out of the driveway outside occurs rollover and crash, the risk coefficient is larger.

Some statistics show there are more traffic accidents in the mountainous areas of China, especially in the mountainous areas with more than 70% accidents. Our country has a lot of traffic accidents every year, although in recent years, gradually reducing the amount of traffic accidents, but accidents still large amount of base, traffic safety is still grim, casualties and economic losses are still very serious. The following table shows the statistics of accidents in recent years, traffic accidents.

Table 1. Accident investigation table

Year	death toll	Disabled number
2006	89455	431139
2007	81649	380442
2008	73484	304919
2009	67759	275125
2010	65225	254075
2011	62387	237421
2012	59997	224327

Early domestic for driving risk study is less, the fuzzy concept of driving risk, exchange and road safety concept, very few scholars for the mountain road driving risk research is mainly traditional accident to because based on the theoretical model, causing the driving risk from three aspects: the driver's driving behavior, road conditions and vehicle unsafe factors, basic reasons (driver's psycholog-

ical and physiological factors and environmental factors) and the reason analysis, from the road, human, vehicle, environment and management aspects of prevention and control of traffic risk.

The real road traffic began at the end of the century the century at the beginning of introduction of risk theory, 2006 November 25 to 27, by the democracy in China since the founding of the people's Republic of China will jointly sponsored by the Committee of Hainan Province and 5 transportation enterprise management magazine 6 agency "Boao, China 2006 traffic safety and risk management seminar" is to use the conference platform, to achieve a perfect fit of the traffic safety and risk management, road traffic safety and risk management of the combination of truly entered the period starting. The figure is mountainous highway accident scene.



Figure 1. Mountainous highway accident

2. The Flaws of the Relevant Study

- The lateral estimate of the mountain area highway driving risk assessment in our country tend to the study of single factor, and the study of the multi-factor comprehensive real-time risk assessment that the mountainous area highway driving is too less.
- The study of the risk assessment of mountain highway driving and the characteristics driving is lack.

There are many researches of road safety at home and abroad. They are mainly focused on the safety index of road, but there is less study on the risk level for driving the driver's evaluation. The risk evaluation studies for driving in our country start later than many countries, and the real risk theory into road traffic began in the turn of the century, the early literature rarely was too little. The traditional risk assessment methods are mainly mountainous qualitative analysis and evaluation of mountain highway driving risk level.

c) The lack of understanding for the concept of risk driving

Many researchers interchange concept of road safety, traffic accidents and road traffic risk, but the basic meaning of risk, from the concept of risk itself, is uncertainty of loss. The driving risk refers to the non determinacy of the traffic on the driver's driving or the probability of occurrences, and the occurrence of losses caused by traffic accidents, traffic risk is the uncertainty of random probability event.

Due to limitations of time and research conditions, there are major difficulties on how to ensure the Mountain road traffic risk factors can be comprehensive in the design, the demarcation of various factors affect the degree of risk as well as to define between the factors.

3. The Methods of Risk Assessment

3.1. Risk source recognition

Applying basic theory of risk researches the generation mechanism of highway traffic risks in mountain area ; Classification method is used to study risk source of driving in the mountainous area , combined with the highway road factors, road traffic environment in the mountainous area and the vehicle type, which will affect to classify the risk of driving hazards, determine the level of each risk source of risk source, especially for the focus of each type of hazard risk hazards of driving in the mountainous area highway , setting up mountain area highway driving risk hazards identification system.

Risk exists in highway traffic risk source in the mountainous area are mainly road linear and linear design, surrounding environment, as well as the vehicle types and so on, different risk source has different risk source

3.2. New ideas of risk evaluation method

Depending on the risk identification of driving system, finds out the risk resource of mountain road traffic , respectively for each class of hazard, application of road danger coefficient method, the road safety index classification assignment method, to determine the risk value of the same level of hazards size, and using the method of accident investigation, data analysis and expert evaluation method to determine the weight value of the same grade child hazards, establishing the risk assessment

model of driving. According to the mountainous area highway accident probability, combining with the severity of the traffic accident, divides the mountainous area highway driving risk into different grades, and determine decision criteria of each level.

1) Road factors

Road linear feature is evaluated by each single factor index of road linear , the influence factors of plane curve to road safety is mainly plane curve radius, the road technical specification clearly stipulate road for different high value corresponds to the plane curve radius size.

Sight of distance is a main factor that should be considered in the design combining horizontal curve and vertical curve[1]. The results show that the drivers' sight of distance will increase when the speed increases, which is a hidden accident danger to transportation. Young from America explored the statistics of accidents happened in the State of California, which found the correlation between sight of distance and traffic accident rate as seen in Table 1.

Table 1. The Correlation between Sight of Distance and Traffic Accident rate

Sight of Distance(m)	under 240	240~450	above 450
Traffic Accident Rate (1/6)	1.5	1.2	1.5

Linear combination is the most important factor influencing road safety. The accident happened in special section of road is mainly because of the unreasonable design of linear combination.

2) Weather factors

Weather factors, such as rain, snow, fog, sand storm and so on, reduce the friction or visibility of road. So it influences drivers' judgment of right operation and the function of vehicle and ultimately, it leads to traffic accident. From the statistics of traffic accidents happened in Chinese highway from 2003 to 2007, we can know that when it meets rain, snow, and fog, the death percent leaded by highway traffic accident is 16.9% of total. It is higher than all the traffic accidents by 6.3%. And the traffic accident death percents happened in rain, snow, and fog are separately 9.8%、5.9%、1.2%, which are higher than all the traffic accidents separately by 1.3%, 4.6% and 0.5%.

3) Vehicle breakdown factors

From what we have talked about above, we know in the first kind of the sources of danger, subsidiary sources of danger include the failure of brake, the poor brake, the failure of steering, the failure of lighting and signal device, and other mechanical failures.

The different vehicles are not the same probability of traffic accidents, traffic accidents cause and severity of accidents caused not the same. The probability of occurrence of car accidents is higher, and drivers have received injuries, causing casualties. Mainly because of a

traffic accident car driving speed is too fast, causing the driver does not brake in time, resulting in rear-end collision, crashing through the guardrail and other accidents. The accidents of bus or large truck are relatively low probability, bus traffic accident was mainly rollover and down the fence, easy to make passengers received injuries; large truck accidents occurred mainly due to brake failure, resulting in a large truck rollover but the driver received injuries is not serious.

4) Management factors

Nowadays, Chinese management of highway is far lower than international management of highway. It could be seen from two aspects. First, the management institution of Chinese highway is unreasonable and it lacks clear responsibilities among each section. Second, there are unsound laws and regulations. It has problems, such as unclear standards of punishment severity, low operation of punishment procedures, in current highway laws and regulations, which couldn't meet the highway management characteristics, such as long distance, wide area, and high speed. Besides, the backward safety management facilities and low management are another factors influencing highway safety[2].

In fact, the factors except weather, such as vehicle breakdown factors, road factors, management factors and so on, can all be avoided through human efficient management so as to reduce traffic accidents. As weather factors are complex to be refrained, it concerns the weather factors, especially the severe weather influencing highway safety in this research.

3.3. Road Safety

1) Particularly serious

The degree of road traffic safety risk is particularly serious, the probability of road traffic safety incidents is very large and the consequences are especially serious. Once the incidents happen, it will be harmful to regional road transportation system particularly. We need to pay particular attention to it and take special countermeasures. The risk of this level is unacceptable and the corresponding level color is red.

2) Serious

The degree of road traffic safety risk is serious, the probability of road traffic safety incidents is large and the consequences are serious. Once the incidents happen, it will be harmful to regional road transportation system. We need to pay attention and take special countermeasures. The risk of this level is unexpected and the corresponding level color is orange.

3) General

The degree of road traffic safety risk is general, the road traffic safety incidents are likely to happen and the consequences are common. Once the incidents happen, it will damage regional road transportation system. We need to take corresponding measures. The risk of this

level is acceptable with certain condition and the corresponding level color is yellow.

4) Relatively safe

The degree of road traffic safety risk is low, road traffic safety incidents is unlikely to happen. Once the incidents happen, it will do slight damage to regional road transportation system. We need to be careful and there is no need to take corresponding measures. The risk of this level is acceptable and the corresponding level color is blue.

5) Safe

The degree of road traffic safety risk is very low, so the safety level is highest. The probability of road traffic safety incidents is lowest. Once the incidents happen, it will do little damage to regional road transportation system. We need not to pay attention and there is no need to take corresponding measures. The risk of this level is exceptive and the corresponding level color is green.

3.4. Risk control measures

We can take corresponding risk control technology such as linear optimization, linear improvement, information dissemination and environment optimization.

1) Management unit in conjunction with the police department regulates driving behavior, by printing leaflets, road warning information release, prohibiting overtaking in special sections, and other measures for long-term occupation of ultra-lane traffic violations severely punished.

2) By setting the large signs to inform continuous uphill length, adding important issues to prolonged periods of occupation of ultra-lane and other text prompt card, allows the driver to anticipate the road ahead and the road should be noted. Providing on the roadside warning lights every 2K m median strip electronic display set of secure instant reminder system. Setting pavement marking vibration, it forced induction and visual warning.

3) The dispatch center should notify to road, conservation and the appropriate, when there is an abnormal condition of roads and traffic anomalies, and to release relevant information through variable message boards, prompt the driver to drive carefully by the variable speed limit signs.

4) Toll station should be set up security card to prompt the driver to drive safely at the entrance, to tell the driver information of segment.

5) The traffic conditions of abnormal road are particularly bad, at this time, after the single lane closure, it is no longer occupied by the other one lane overtaking lane. May consult the management office and control center, with the consent of, the point has been blocked in the closed lane to be elected at the exit of the toll road was closed before, and set up a stop sign at the point of closure.

4. Security Class

According to the size of the possibility of accidents and the extent of the loss of traffic accidents, road safety level is divided into four grades.

(Level I) The probability of traffic accidents is 80 percent and above, large accidents as traffic accidents, casualties and greater economic losses.

(Level II) The probability of traffic accidents between eighty percent to 50 percent for the general accident incident have personnel suffered minor injuries, and economic losses, but few.

(Level III) The probability of traffic accidents in the fifty percent to twenty percent of the general road conditions, traffic accidents, no injuries, only a small economic loss, mostly collision.

(Level V) The probability of traffic accidents in the 30 percent of the road conditions are good, comfortable driving, traffic accidents, traffic accidents should not happen.

5. Summary

Because now domestic of mountainous area highway driving risk of a late start, early literature is less, for the concept of driving risk blurred, there is no clear defini-

tion, and driving risk evaluation to protect the driver traffic safety, road design lack of awareness; determine the specific evaluation model is established and the related parameters, and mountain road risk grade evaluation criteria and the basis of accuracy and rationality is a big difficulty.

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