

Safety Situation and Policy on Mountain Highway of China

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Abstract: The mountainous area approximately composes 2/3 of Chinese nation. The mountain road safety situation is important to the whole country. The paper starts from the characteristic of mountain road accidents. Through the studies the mountain road accidents shows different. There is higher death rate and more traffic accidents. In the major accidents, more accidents are fall to the roadside and the vehicles type is complex. By the actual survey in Sichuan Chongqing Yunnan and Guizhou four province, the mountain road safety facilities are checked. The characteristics and problems are found. Through the road traffic accidents analysis and the existing status of mountain safety facilities, the mountain road safety technology policies are given, which will provide a reference for managers.

Key words: Rural road, safety policy, traffic accident

INTRODUCTION

Mountain areas account for almost 2/3 of the land in China. Limited to the rugged mountains, roads and other infrastructure are difficult to be built. The main features of mountain roads are in the high steep mountains, winding and near the river and mountains, and have advantageous road side (Ji, 2007; Yang, 2009; Zhen, 2009; Zhu and Liu, 2009; Zhang, 2006). The road is in poor horizontal and vertical alignment, poor sight, and serious geological disasters. Because of the bad natural conditions of mountain roads, there are more traffic accidents and traffic safety situation is serious. In addition many mountain roads are in the western underdeveloped areas of China, it is difficult to build the highway in the early time limited to the economic level. On the road building process, accessibility is a primary consideration and road safety is insufficient. With the development of economy and the increasing of travel demand, the demand for road safety is also increasing. It is important to find the adaptive mountain road safety technology policy by analyzing the characteristics of accidents in mountain road. Li (2003) analyse the major road traffic management measures in western mountains. Xu (2005) analyse the major road traffic management measures in western mountains. Guang and Ma (2007) give the analysis of rural road traffic accidents and traffic safety countermeasures.

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CHARACTERISTICS OF MOUNTAIN ROAD ACCIDENT

The traffic accident on the mountain road has its own characteristics relative to other traffic accidents. According to the statistical data in "road traffic accident statistics report of China (2008)" published by the Ministry of Public Security Traffic Management Bureau, traffic accident under different topographic characteristics is shown in Table 1.

From Table 1, the number of accidents, deaths and injuries in mountain plains region is lower, mainly because in the mountainous western region of China is with less vehicle ownership. However, Fig. 1 shows the death rate and the injury rate of mountain area are higher than that in hills and plains; especially the death rate was 0.39, which means there are at least one person died in three accidents. Injury rate was 1.29 which means there are 1.29 persons in the every accident injury. Figure 2 shows in 2008 the statistics data in different province with more than 3 persons. It can be seen from Fig. 2, a large number of serious traffic accident occurred in Guangdong, Sichuan, Yunnan, Guizhou, Shaanxi and Xinjiang provinces, which have more mountainous terrain. In summary, it is important to study the mountain road safety because of the seriousness of road traffic accidents.

According to the statistical data in "road traffic accident statistics report of China (2008)" published by the Ministry of Public Security Traffic Management

Topographic	Accident no.	Accident rate (%)	Death no.	Death rate (%)	Injury no.	Injury rate (%)
Plain	175351	66.12	46174	62.84	192933	63.27
Hill	59609	22.48	15527	21.13	73016	23.95
Mountain	30244	11.40	11783	16.03	38970	12.78

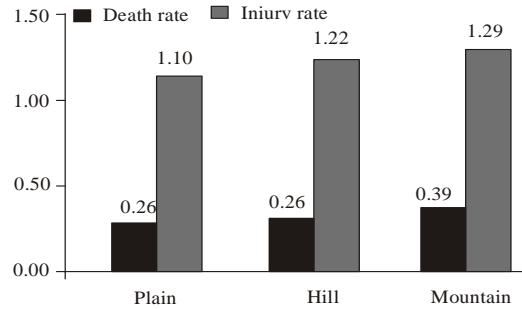


Fig. 1: Death and injury rate under different terrain conditions (2008)

Bureau: there are 29 traffic accidents which more than 10 people died in once, the vehicle type is listed in Fig. 3.

From Fig. 3, the major vehicle type is large sleeper bus-based and common bus because bus carries more persons than other vehicles. In these accidents with serious consequences there are 3 accidents which the vehicle type is tractor or deformation tractor. This means tractors carrying illegal in some areas still exist. It is more significant security risk.

It can be seen from Fig. 4 for the serious traffic accident, vehicle falling accidents accounted for 1/3 of the total amount. The falling accidents usually occur in the higher slope, a timely, mountain road near water. The general guardrail provide less protective to bus than to the car, once an emergency occur it is difficult to restore.

CURRENT SAFETY SITUATION OF MOUNTAIN HIGHWAY IN CHINA

In order to know the current situation of mountain highway in China, 160 managers and experts related to the traffic safety management from Yunnan, Guizhou, Sichuan, Chongqing are asked to analyze the safety situation of China. The spot survey on the status of mountain highway safety and accident black spots, the mountain road safety facilities of the status quo. Overall, taking over the specific security technologies and measures are different, but mainly include the following:

- Guardrail facilities, including the wave beam guardrail, cable barrier, anti-wall concrete guardrail, etc. Sichuan, Chongqing is mainly wave beam guardrail, mainly considering the unity of protection, aesthetics and environment. Yunnan, Guizhou adopts concrete wall in the protection zone for better protection performance and lower maintenance costs later. The high cost of cable guardrail is mostly used in highway because of better environment and higher technical requirements
- In the mountain road, warning sign is mainly set in the spot of steep slopes, sharp bends, bad sight distance and etc.
- Improvement of sight distance. Because of more steep and winding road slope, and bad sight distance, the major improvements is to increase sight distance, set convex minor, and widen the inside lane.
- Designated marking sign. In some section of the mountain road, the marking sign is made to divide lanes and ensure vehicles on the right lane
- There is always serious geological disaster including landslides, flying rocks, etc in mountain area.

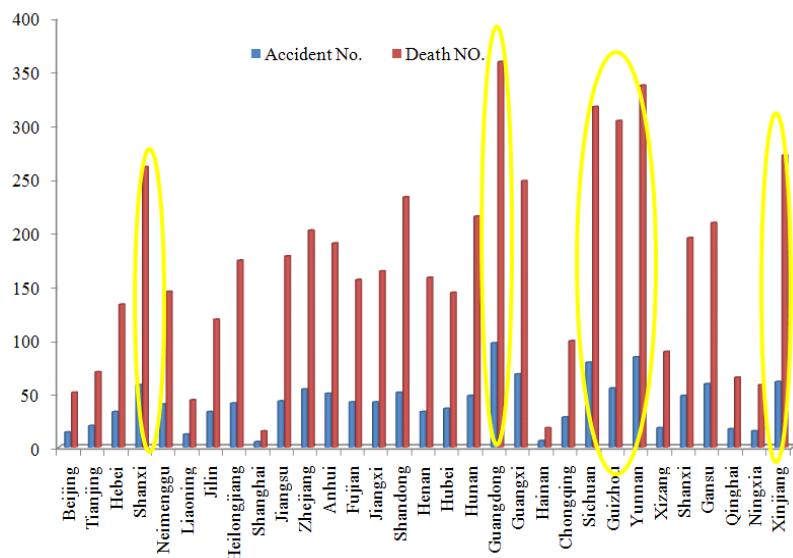


Fig. 2: The accident No. and death No. with more than 3 persons (2008)

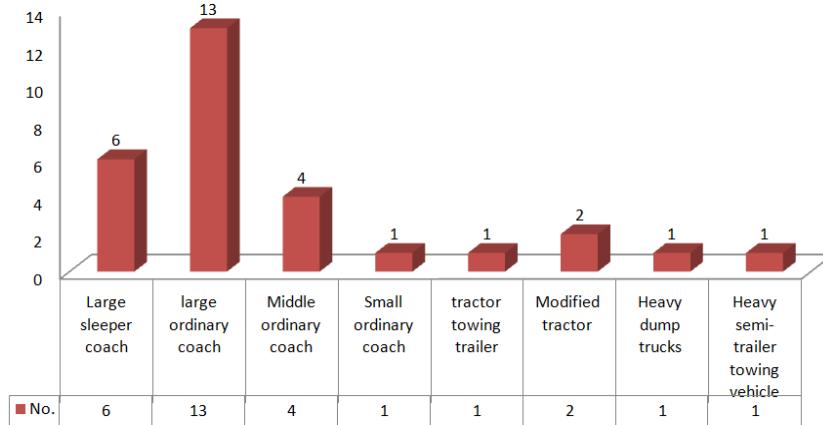


Fig. 3: Vehicle type in large accident

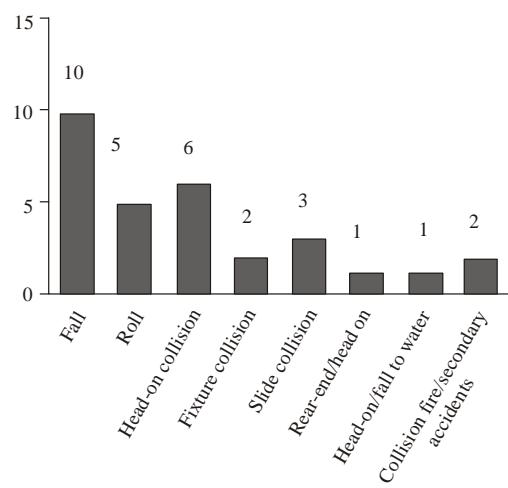


Fig. 4: Formulation of large traffic accident

Different area takes different method, such as doing bolt, concrete, hanging fence, setting up warning signs. Usually nothing is done in most areas, just lie on the maintenance workers' observation and remove danger timely.

- Weather effect the mountain road safety. Ice and fog have bigger impact on the road.
- The tunnel equipment is not complete. There are more tunnels in mountain area, with inadequate safety equipment, and lack of lighting, ventilation and relative equipment, even without reflective signs or any facilities.
- Poor mountain highway alignment. The road in Yunnan, Guizhou, Sichuan, Chongqing is poor, steep slope, sharp curves, long downhill and uphill. For the historical reasons, many roads are rebuilt on the old road, and do not meet the standards specifications. Limited to the funds permit, only the dangerous sections is rebuilt.

In the general, some funds are put in the remediation of hazardous road sections in China. But with social development, the need of safety increase and more efforts should make to improve traffic security situation.

SAFETY POLICY OF MOUNTAIN ROAD IN CHINA

Based on the infrastructure and accident characters, the mountain road safety technology of the policy are given as follows:

Ensures of security facilities maintenance costs:

Under normal circumstances, the maintenance costs are just enough for the facilities installation, and not enough for the post-maintenance. So a lot of guardrails are not repaired after been destroyed. It is recommended that formulation of relevant policies is made to ensure the funding sources.

Economic, adaptability, consistent of the guardrails in mountain road: In the survey, different provinces have different protection facilities. The main problems of the current guardrail are theft protection higher investment and higher maintenance etc. Improvements must be made to the existing safety facilities with full consideration of regional development and mountain features.

Increase the safety awareness of road users is a fundamental strategy: Increase the safety awareness of road users, particularly the residents along the road is very important. In the survey there are many pedestrians cross the road or even the expressway and the motorcycles, tricycles shown in the expressway. The road safety environment is bad. Hence it is necessary to strengthen education and publicity, and enhance the safety awareness of users and residents along the mountain road.

Serious geological disasters in mountain road: Severe geological disasters are a more serious problem in mountain road, especially in Sichuan earthquake area. The landslides, flying rocks occurred sometime. So special treatment and relevant technical solutions should be taken in geological disasters.

Improve the road alignment of mountain road can fundamentally improve road safety: The poor road alignment of road in Yunnan, Guizhou, Sichuan, Chongqing is the one reason of the traffic accident. For historical reasons, many roads are rebuilt on the old road. Therefore, significant improvements in road safety must improve the road alignment.

CONCLUSION

The safety situation in the mountain road will abstract more and more social concerns. After the economic development, more concern on safety is the necessary step in social development. The mountain road accidents and the existing traffic safety facilities is analyzed to find out reasons of the accident and weaknesses of existing facilities, which will help to further improve traffic safety.

This safety situation of mountain road is serious with the analysis of accident and current safety guarding service. Road safety policy is given related to funding, guardrail, road user safety awareness, geological disaster and alignment improvement. It is hoped the policy will

provide to the road manager for further improvement of the mountain road safety.

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REFERENCES

- Guang, X. and C. Ma, 2007. Analysis of rural road traffic accidents and traffic safety countermeasures. *Highway*, 4: 128-130.
- Ji, D., 2007. Analysis and policy of black spot of accident in rural road. *Transportation World*, 6: 116-117.
- Li, S., 2003. Major road traffic management measures in western mountains. *J. Chongqing Jiaotong Univ.*, Vol. 6.
- Xu, W., 2005. Analysis of Traffic Safety in China. *Transport. Technol.* Vol. 5. pp.
- Yang, Y., 2009. Safety engineering implementation in mountain road. *Shanxi Build.* 11: 55.
- Zhang, B.O., 2006. Traffic safety and accident prevention measures in mountain road. *Highway Transport*, 12: 36-38.
- Zhen, W., 2009. Mountain road safety settings. *Traffic World*, 18: 131-132.
- Zhu, H. and T. Liu, 2009. Traffic Safety Analysis and Countermeasures in mountain rural highway. *Highway Transport. Res.*, 8: 139-143.