SAFETY ANALYSIS AND COUNTERMEASURES OF MOUNTAIN HIGHWAY IN 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: Mountain highway; safety;

1. 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. 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 increscent 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.

2. CHARACTERISTICS OF MOUNTAIN HIGHWAY IN CHINA

Because the ground is rugged in mountainous area, it is difficult to have infrastructure construction. Due to the terrain conditions, mountainous road improvement is relatively slow. The highway in mountain is in low grade road. Most highways is in steep turn sharp, narrow, without traffic signs and markings, fencing, lighting facilities, traffic safety facilities. Especially in some early highway in the mountainous area, the construction standard cannot meet the requirement, which caused serious traffic accident in some dangerous sections.

Figures 1 to 10 shows the current situation of mountain highway in China. As it can be seen that, the character of the mountain highway's character include small radius, rocks and rivers near the road, poor sight distances. At the same time the vehicles on the road are overloaded and complex type.

Figure1 - Continuous curve

Figure 2 - Poor sight distance

Figure3 - Continuous curve and poor sight distance

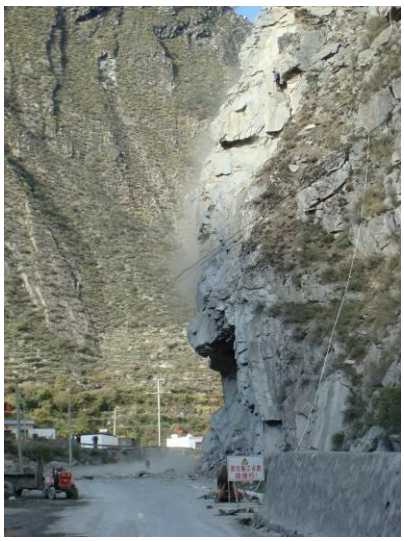

Figure 4 - Rock falling section

Figure 5 - Landslides

Figure 6 - Rocks near the road

Figure 7 - Road near the river

Figure 8 - overloaded vehicles on the mountain highway

Figure 9 - Coal car rollover

Figure 10 - vehicles crash into the house

3. STATISTICAL ANALYSIS OF TRANSPORT MANAGER SURVEY

According to the project survey questionnaire on mountain highway safety technology policy the main problems were analyzed, the main results are as follows:

(1) Suitable for China's mountain highway safety policy

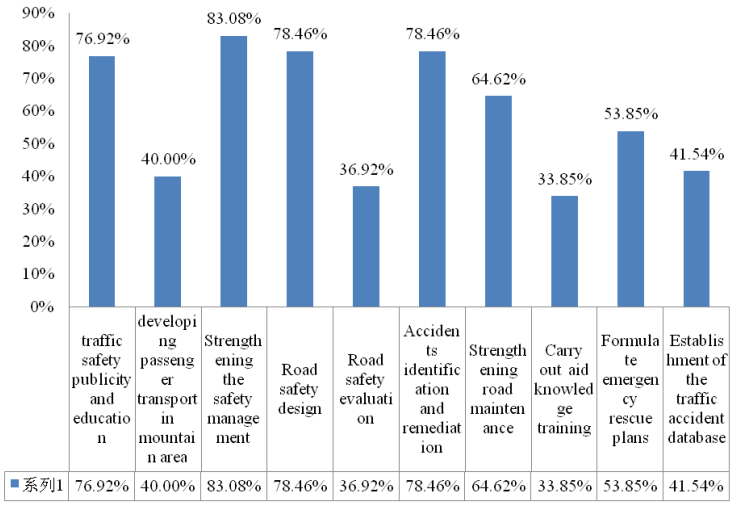

Figure 11 - Mountain highway safety policy Statistical results

The survey questionnaire result shows, strengthening safety management, having road safety design, accidents identification and remediation and traffic safety publicity and education are the most popular mode in the traffic safety managers.

(2)Current key point of transport safety strategy

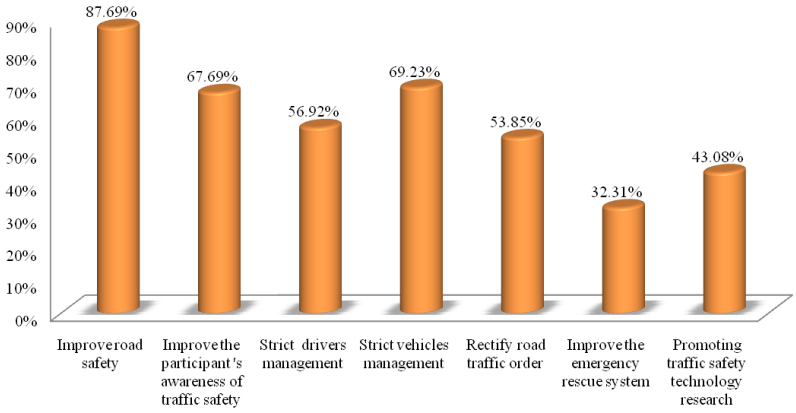

Figure 12 - Current key point of transport safety strategy Statistical results

As for the road safety strategy in mountainous area, 87.69% of the respondents agree with improving road safety. 67% ~ 69% respondents agree with strict vehicles management and improve the awareness of traffic safety involver. The result showed that the safety related factors such as human vehicle and road are all mentioned in the strategy survey. Because the respondents are more concentrated in the highway sector management mechanism, the road safety improvement measures are in high recognition rate.

(3) Effective traffic safety propaganda Publicity and education Mode

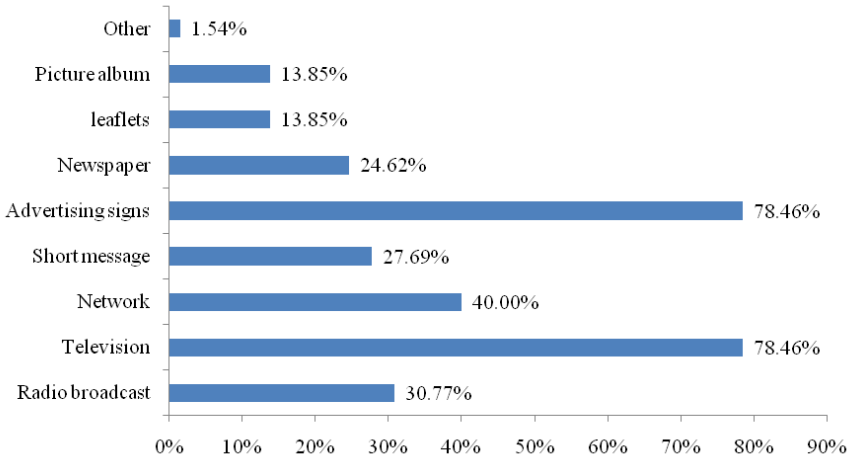

Figure 13 - Traffic safety Publicity and education Mode

In response to a mountainous area highway traffic safety propaganda results indicate, respondents believe that advertising signs and television are the most effective mode, second is the radio. Advertising signs is fixed, and face to some objectives, so the effect is higher for recognition. Television and radio are limited to a specific period of time and coverage, so the effect is lower. In the survey, the flowed broadcasting car is reflected as a good publicity method.

(4) Effects of mountain highway safety level factors

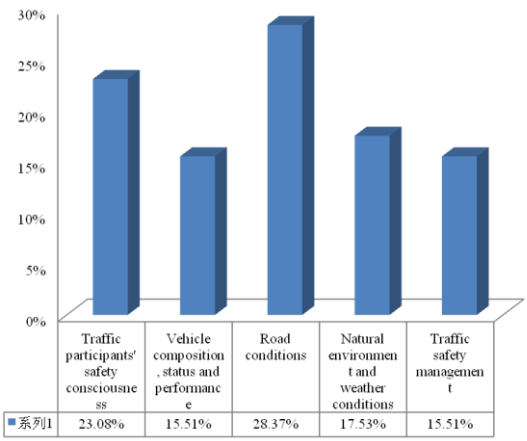

Figure14 - orders of Effects of mountain highway safety level factors

Effects of mountain highway safety factors are asked in the survey to give the priority. According to orders different scores is sorted, statistics of each factor score are given. The final results showed that the road conditions and the participants' safety

consciousness is the first two aspects. At the same time whether, vehicles and management factors are in the relative equilibrium.

4. MAIN CHARACTOR OF MOUNTAIN HIGHWAY CRASH

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 (2010 publishing by the Ministry of Public Security Traffic Management Bureau, traffic accident under different topographic characteristics is shown in Table 1.

Table 1 - the accident statistics Data under different topographic

Terrain	accident No.	Accident rate	Death No.	Death rate	Injury No.	Injury rate
Plain	145145	66.12%	41088	62.99%	159556	62.08%
Hill	4897	22.31%	13892	21.30%	61078	24.04%
Mountain	25402	11.457%	10245	15.71%	33441	13.16%

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 underdeveloped areas which with less vehicle ownership. However, Figure 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 Figure 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.

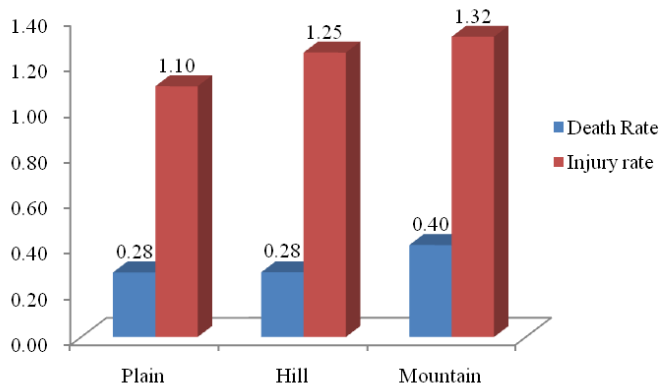

Figure 15 - Death and injury rate under different terrain conditions（2010）

5. SAFETY COUNTERMEASURES OF MOUNTAIN HIGHWAY IN CHINA

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

1) 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.

2) Strengthening the highway safety facilities
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.

3) Improve the passengers transport safety level
In the mountain area, while the passengers' cars run into a crash, it will have large damage on the people and cause serious effect. So it is important to improve the passengers transport safety level, which includes the driver's education and qualification, the passenger's bus inspection, and the management in the passengers transport.

4) Avoid the 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.

5) 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.

6. CONCLUSIONS

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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