Analysis of Influencing Factors in Traffic Accidents of Road Passenger Transport Vehicles

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Abstract—Traffic accidents of road passenger transport vehicles will cause great harm and impact on society and families. Analyzing the factors involved in the accident can find the main reason for the accident. This article analyzes the participating factors in accidents based on the data from the annual road traffic accident statistics report. Combining with the results of historical research, the important influencing factors are classified and analyzed, and some key factors of driving safety are summarized. Transport companies should pay attention to the key factors that may lead to accidents and eliminate these hidden dangers.

1. INTRODUCTION
The safe production of road passenger transportation enterprises is related to the safety of the lives of the passengers on board. In order to prevent the occurrence of traffic accidents, many administrative departments have issued relevant laws and regulations to regulate transportation companies to strengthen the safety supervision of drivers and vehicles. Traffic accidents of road passenger transport vehicles generally cause a large number of casualties and cause greater harm to society. Studying the causes and influencing factors of these accidents can help transportation companies eliminate hidden accidents. Based on the data from the statistical annual report of road traffic accidents and hundreds of road passenger transport vehicle accident cases, the cause of accidents is analyzed, and important influencing factors are analyzed.

2. ANALYSIS OF ACCIDENT FACTORS

2.1. Main Cause of the Accident
The analysis of the cause of the accident can identify the risk factors in the transportation process. Figure 1 shows the statistical results of the main cause of the accident in the annual accident report. It can be seen that, among the accidents caused by motor vehicle fault, the main causes of the accident are: the driver's fault and the mechanical failure. Traffic accidents caused by driver fault accounted for about 85%. Sorted by the proportion of accidents from largest to smallest, the participating factors are: failure to yield, speeding, violation of traffic signals, retrograde, overtaking, driving without a license, illegal occupation of the road, fatigue driving, etc.
2.2. Accident Pattern
Analyzing the statistical data in the annual accident report, the number of collisions between vehicles accounted for about 70%. Figure 2 shows the statistics of collisions between vehicles. It can be seen that the number of side collision accidents accounts for about 40%, and the side collision between vehicles is the main form of accidents. The reason is related to factors such as speeding, illegal overtaking, illegal rushing and other driving violations of operating regulations. Collision, rollover, and crash are the main accident patterns of commercial vehicles.

3. ANALYSIS OF IMPORTANT INFLUENCING FACTORS
Research on the main factors that affect the safety of the transportation process is helpful to sort out the degree of influence of each factor on the safety of the transportation process, and provide a basis for the detailed study of the influencing factors. The following mainly focuses on the main influencing factors obtained from road traffic accident statistical annual reports and collected accident cases, as well as other key factors that may lead to accidents, and analyzes the importance of each factor in the vehicle operation safety.

3.1. Driver Factor
3.1.1. Age: Figure 3 shows the proportion of accidents counted based on age in statistical annual reports. It can be seen that the proportion of accidents is higher in the middle age group and lower in the age groups on both sides. The 26-50 age group has the most accidents. Scholars have conducted research on the correlation between age and accidents, but the conclusions are not consistent. Studies have shown that the accident rate of drivers under 30 is high, which is about 53% higher than the average [1]. The risk is higher under 25 years old [2]. The accident rate of drivers over 30 years old is significantly lower. The accident rate of drivers over 50 years old rises slowly. Other studies have shown that the drivers of responsible accidents are mainly concentrated in the age group of 36-45 or 28-41 years old [3]. The number of responsible accidents of drivers after 41 years old gradually
decreases and stabilizes at the age of 48-52 years old [4]. Therefore, it is concluded that drivers under 25 are at the greatest risk due to their lack of driving experience and impulsivity. Drivers in the 35-40 and 49-54 age groups have lower safety risks. The safety risks for drivers aged 30-35 and 54-57 are average. Drivers under 30 and over 57 are at higher risk.

3.1.2. Driving experience: Figure 4 shows the proportion of accidents based on driving age in the statistical annual report. It can be seen that driving age has a certain correlation with the occurrence of traffic accidents. Drivers with a driving experience of less than 5 years have fewer accidents, and drivers with a driving experience of 6-15 years have a sharp increase in traffic accidents. Scholars have conducted research on the correlation between driving age and accidents. Some scholars have analyzed the correlation between the driving experience and the hazard degree of the accident and found that the hazard degree drops rapidly if the driving experience is less than 5 years. Those driving for 5-14 years have a slower increase in damage. For those driving for more than 15 years, the degree of harm gradually decreases [5]. After analyzing the characteristics of traffic accidents, it is found that the accident rate is obviously higher for driving experience of less than 1 year. Drivers with driving experience under 3 years and over 11 years should be paid more attention [6]. With the increase of driving experience, the number of accidents gradually decreases [7]. Therefore, the conclusions are obtained: (1) Driving age is correlated with safety but not linear. (2) Drivers with driving experience under 5 years have the greatest safety risk. Drivers driving for 5 to 12 years have a greater safety risk. For those driving for 5-10 years, the risks gradually increase. For those driving for 10-12 years, the risk gradually decreases. For those driving for more than 12 years, the risk gradually decreases.

3.1.3. Driving skills: Driving skills are the ability to learn from life or work experience and consolidate, master, and implement complex movements by repeated practice. According to the driver’s main movement mode, it is divided into: motor skills and mental skills. According to the objects to be mastered, it is divided into: driving theory knowledge and actual driving operation. The main factors affecting the safety of operating drivers are safety awareness, potential hazard prediction ability, driving skills and stress response ability [8]. The overall quality of the driver is the core factor for the
transport safety [9]. Driving skills are affected by risk perception ability [10]. Therefore, driving skills are an objective reflection of driver's skills and are related to the safety of vehicle operation.

3.1.4. Safety education: Safety education is the main method to strengthen the safety awareness of drivers. After conducting educational experiments on risky driving behaviors, it is found that risk education methods can significantly reduce traffic accidents [11]. After conducting educational experiments, it is found that the driver’s risk awareness has been greatly improved than before. Conducting a reasonable frequency of education can enhance the effect of education [12]. Therefore, safety education plays an important role in the safety management. Regular and continuous safety education can reduce the occurrence of traffic accidents.

3.1.5. Safety awareness: According to road traffic accident statistics, the occurrence of accidents is related to the driver's safety awareness. Drivers' weak safety awareness and serious violations are the main reasons for the frequent occurrence [13-15]. Relevant studies have shown that the driver’s subjective factors play an important role in the safe operation, and the driver’s weak safety awareness is one of the main reasons for accidents [16]. After analyzing the essential causes that led to the accident, it is found that safety awareness, risk perception and driving skills are the main causes of traffic accidents. Safety awareness affects risk perception ability and driving skills [10]. Therefore, the driver's safety awareness affects the safety of the transportation process, and the low level of safety awareness is the root cause of some serious accidents.

3.1.6. Using mobile phone while driving: According to the statistical data in the accident cases, some accidents are directly caused by the violation of safety operating regulations such as making and receiving calls. The driver's use of mobile phones will have a negative impact on driving safety, and the driver's response time will be delayed by 15% to 40% [17]. Using mobile phones while driving is unsafe driving behavior that will distract drivers, affect their reaction time, and cause accidents.

3.2. Vehicle Factor
With the advancement of automobile technology and the shortening of the renewal cycle of enterprise vehicles, the technical status of passenger vehicles is generally good, and the number of accidents caused by mechanical failure is less [3]. Analyzing the accident investigation report caused by mechanical failure, it can be found that the main factors leading to the accident are: poor technical condition of the vehicle, unqualified vehicle maintenance, and poor management of the vehicle. The failure of brake, steering, tire and other components in an accident is generally the direct cause. In some serious accidents, the occupants did not wear seat belts and caused secondary injury accidents. The impact of seat belts on safety should be considered.

3.3. Road Environmental Factors

3.3.1. Time period: Figure 5 shows the percentage of statistics by time period in the statistical annual report. It can be seen that 6-9 o'clock and 17-20 o'clock are accident-prone periods. The driver's driving speed fluctuates more at night than during the day. The accident rate at 14-18 is much higher than other time periods [3]. Therefore, the impact of time period on driving safety should be considered.
3.3.2. Road line type: Due to the high speed, the straight section is a high-risk area for serious accidents. Curved road sections are also an important factor in the occurrence of accidents [3]. It can be seen from the statistical data of accident cases that the number of road surface linear accidents in descending order is: bends, ramps, cliffs, straight lines, tunnels and near river roads. Analyzing the investigation report of accident cases, bends and ramps are the main causes of accidents. Therefore, the influence of the following road alignment factors should be considered: bends, ramps, cliffs, tunnels and roads near rivers.

3.3.3. Road conditions: It can be seen from the statistical data in the annual accident report that 85% of accidents occur on dry road conditions, which may be related to factors such as speeding or irregular driving operations. Under unfavorable road conditions, wet road accidents accounted for the largest proportion, followed by water and snow road conditions. Therefore, the impact of the following adverse road conditions should be considered: water, snow, ice and other wet and slippery roads.

3.3.4. Weather: It can be seen from the data in the statistical annual report that cloudy and rainy days accounted for the largest proportion of accidents, followed by snow and fog weather. Weather conditions such as rain, snow, and fog will adversely affect the driver's line of sight and road conditions, and affect the safe driving of vehicles. Therefore, bad weather conditions such as rain, snow, and fog should be taken as factors affecting the safety of vehicle operation.

3.4. Management

If passenger transportation companies have weak safety awareness, chaotic management, and poor management of vehicles and drivers, it will cause many negative consequences. The direct result is that the driver’s safety awareness is poor and the vehicle cannot be maintained normally. The company cannot effectively monitor the implementation of vehicles, and will miss the opportunity to correct the driver's unsafe driving behavior. Therefore, transportation companies should correctly play their role in safety supervision.
4. CONCLUSION

Based on the statistical data of the accident annual report and the collected accident cases, the main reasons and participating factors of the accidents were studied, and the key influencing factors were analyzed. In road passenger transportation vehicle accidents, driver factors have the greatest impact on driving safety. Human factors such as driver's weak safety awareness, irregular driving operation and unfavorable management of transportation enterprises are generally the key factors leading to accidents. Accidents caused by vehicle component failures mostly occur in key components such as brakes, tires, and steering, which are generally related to the failure of effective maintenance of the vehicle. Slippery roads and weather such as rain, snow, and fog will affect driving safety. Ramps, curves, waterfronts, cliffs, coupled with brake failures, and tire damage, will seriously affect driving safety. The lack of safety management awareness of transportation companies and the ineffective implementation of management measures will affect the safety awareness of drivers and the normal maintenance of vehicles.

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