Research on Drivers' Behaviors of Heavy Goods Vehicles Based on Traffic Accident Analysis

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Abstract: Heavy goods vehicles (HGVs) have played a vital role in transporting goods. These goods are closely related to social development and people's lives, including daily necessities and parcels, and even industrial raw materials such as coal and steel. However, for many reasons, the number and incidence of HGVs traffic accidents remain high in all countries. Since HGVs have the characteristics of large volume, large mass and fast speed, the consequences of HGVs traffic accidents are often very serious, causing numerous property damages, and even seriously threatening people's lives. There are many factors that contribute to this tragedy, but it is worth noticing that HGVs drivers played a vital role. Their bad driving behaviors and habits may be to blame for the accidents. This paper identifies the bad driving behaviors and habits of HGVs drivers that may lead to traffic accidents, and analyzes the impact of these behaviors. This paper also attempts to establish the relationship between external factors such as insurance and drivers' driving behaviors, and explores the impact of public policies on traffic accidents. Finally, this paper draws the conclusion that many bad driving behaviors will lead to HGVs accidents, and several actions from drivers, government and companies can be taken to improve traffic safety. This paper adopts the field observation method, the interview survey method and the literature research method.

Keywords: Heavy Goods Vehicle, Traffic Safety, Driving Behavior, Traffic Accident

1.   Introduction

With the rapid development of globalization and the Belt and Road Initiative proposed by China, the demand for road cargo transport is increasing. At present, China's road transport industry is in a period of rapid development. These years have witnessed a constant growth in the need of heavy goods vehicles (HGVs). HGVs transportation has the advantages of large volume and fast speed, so its proportion in road transportation is soaring, becoming an important part of the road freight industry [1]. However, the number of accidents caused by HGVs is also rising year by year, and they also consume more road time and space resources while driving. HGVs drivers have played a decisive role in accidents. Globally, traffic accidents are an important cause of death, and the main cause of traffic accidents in our country is drivers. As the main participants in traffic, HGVs drivers are the receivers, processors, and decision-makers of subjective factors and road traffic information [2]. Driving HGVs is also a high-risk occupation. Therefore, drivers and their driving behaviors are the focus of traffic safety research [3]. This article uses the field observation method, the interview survey method, and the literature research method to analyze the driving behaviors of HGVs drivers that may

lead to traffic accidents. At the same time, external intervention factors, such as commercial insurance will also be discussed. By analyzing the reasons, this paper attempts to explore the impact of public policies on traffic accidents, and finally puts forward suggestions for improvement on this basis. This research is of great significance for reducing HGVs accidents and the huge losses they cause.

2. Research Status at Home and Abroad

Based on the investigation and analysis of the causes of HGVs accidents, this paper deeply analyzes the subjective factors and tells the characteristics of HGVs drivers' driving behaviors. The research at home and abroad is collected, combed and analyzed to lay the theoretical foundation and ideas for this paper.

2.1. HGVs Definitions and Driver Criteria

In China, according to the "Terms and Definitions of Motor Vehicles Types" (GA802-2019), vehicles are divided into passenger vehicles and cargo vehicles. For cargo vehicles, they are classified into heavy, medium, light and micro based on the length, number of passengers or total mass of the vehicles [4]. Drivers of different models need different types of driving licenses, and different driving licenses have different requirements for drivers.

Table 1: Different driving licenses and their permitted driving types

Vehicles Types	Designation	Vehicles Allowed to Drive	Other Types of Vehicles Allowed to Drive
Large Bus	A1	Large Passenger Cars	A3、B1、B2、C1、C2、C3、C4、M
Tractor	A2	Heavy and Medium Trailers	B1、B2、C1、C2、C3、C4、M
City Bus	A3	A City Bus Carrying More Than 10 Passengers	C1、C2、C3、C4
Heavy Passenger Car	B1	Medium Passenger Car	C1、C2、C3、C4、M
Large Truck	B2	Heavy and Medium Trucks; Heavy and Medium Special Operation Vehicles	C1、C2、C3、C4、M

For HGVs, the driver must be at least 155 cm tall and have a visual acuity of 5.0 or above to be eligible for the license. HGVs drivers need a B2 and above license. Drivers who have 5 years of safe driving experience and are over 24 years old can apply for replacement of heavy, medium full and semi-trailer vehicles (A2) [5]. Large vehicles, such as HGVs, have strict requirements for drivers in terms of age, height and driving experience.

2.2. Research Status of Traffic Safety of HGVs

At present, the research on the safety of HGVs mainly focuses on the performance of the vehicles themselves and their operation safety. For example, a large number of articles at home and abroad have studied the braking safety of HGVs [6-8]. Some foreign scholars have studied the traffic safety of HGVs and their drivers' driving behaviors by analyzing the traffic accident data of HGVs [9]. At the same time, many domestic scholars have studied the characteristics of HGVs accidents based on accident data, analyzed the factors affecting the traffic safety of HGVs, and put forward targeted

suggestions [10]. In addition, there are a small number of studies on HGVs drivers and their driving behaviors. However, most of these studies focus on the analysis of driver characteristics from the perspectives of psychological and physical health. For example, Chinese scholars focus more on studying the fatigue driving of HGVs drivers through simulation or testing [11], while foreign researchers mainly focus on analyzing the characteristics of driver fatigue and developing monitoring measures for HGVs drivers.

To sum up, domestic and foreign studies mainly focus on the operation safety of HGVs, and there are also a small number of studies on HGVs drivers and their driving behaviors, but they are mainly limited to a certain psychological state and a single driving behavior. There is a lack of comprehensive and systematic research on the factors that influence the driving behaviors, and the research on risk prevention measures is still relatively limited.

3. Analysis of Causes of HGVs Traffic Accidents (HGVs Drivers)

Before 2011, drunk driving happened all the time. However, after 2011, drunk driving was written into the Criminal Law of the People's Republic of China. The number of fatal traffic accidents caused by drunk driving has decreased significantly. The Opinions on Handling Criminal Cases of Drunken Dangerous Driving, which came into effect on December 28, 2023 [12], has further improved the supervision and punishment system for drunk driving. Drunk driving is well controlled and will not be discussed in this article. For the HGVs drivers, their subjective causes of traffic accidents mainly have the following aspects.

3.1. Fatigue Driving

It refers to the driver's inattention, slow reaction, and error-prone state caused by fatigue during long driving. HGV drivers' salaries depend on the amount of goods they deliver, so they often give up the opportunities to rest in transit, choosing to drive continuously to shorten the transit time. Driving for a long time leads to the driver's inattention and inability to take timely measures to respond to emergencies on the road. Generally, after 2-4 hours of continuous driving, the driver's central nervous system will produce fatigue, the ability to recognize is greatly reduced, and thus causes illusion, which is easy to occur accidents such as collisions.

3.2. Modification

HGVs are often illegally modified to meet different needs. They always go beyond the design load capacity and function of the original design, including the act of replacing critical components [13]. A trailer is usually modified to be wider and longer, enabling it to carry more cargo. In order to facilitate unloading, the side panels of the cargo compartment were modified to roll over. Also, headlights are often illegally modified with xenon to give a wider view when driving at night. But too bright a light can cause the driver of the opposite car to be temporarily blinded for a few seconds and cause accidents.

3.3. Overloading

As mentioned earlier, HGVs drivers' salaries depend on the amount of goods they deliver. In order to transport as much cargo as possible in a limited time and number of trips, drivers illegally loaded far more cargo than the required load in the carriage. Overload will lead to a rapid decline in the safety performance of HGVs. It may also lead to tire deformation, causing a flat tire, brake failure, rollover, and other situations. It can also cause roads and bridges to collapse. Data shows that 70% of China's

annual road traffic accidents are caused by overload, and 50% of the fatal and serious road traffic accidents are directly related to overload.

3.4. Violating Traffic Regulations

HGVs drivers often travel on secondary roads between cities and towns and are required to drive at night. On these secondary roads, traffic monitoring is relatively less and supervision is more difficult. In these specific sections and time periods, the traffic volume is small, and there are almost no pedestrians and non-motor vehicles. As a result, drivers ignore the traffic rules and drive on the road at will. Their offenses usually include, but are not limited to, speeding, running red lights, overtaking and changing lanes at will. According to the National Road Traffic Accident Statistics Bulletin of the People's Republic of China, 73% of HGVs accidents are caused by illegal traffic.

3.5. Lack of Driving Experience

According to the data of HGVs accidents in 2013, 2016, 2017, and 2019 of the National Statistical Bulletin of Road Traffic Accidents of the People's Republic of China, the driving age of HGVs with relatively high accident rates during the four-year period is 6 to 10 years and 11 to 15 years, while the driving age of the least accidents is about 1 year, and then shows a gradually increasing trend [14]. After 6 to 5 years, the accident rate tends to decline. New drivers with less than 1 to 4 years of driving experience are prone to accidents due to their lack of driving experience and poor emergency response ability.

4. External Intervention

In addition to the subjective factors of HGVs drivers themselves, there are some external factors that cannot be ignored in determining the incidence of HGVs traffic accidents.

4.1. Mode of operation

Most of the private HGVs drivers earn money through affiliate operations. Because they have no transport qualifications after purchasing vehicles, they carry out legal road transport operations in the name of qualified enterprises. Affiliated enterprises only provide business qualifications for them and charge management fees. This mode of operation is not prohibited by law, and affiliated transport enterprises cannot supervise the drivers and traffic safety of affiliated vehicles. Therefore, this model is also a difficult problem in terms of government supervision and market norms of the road freight industry. This type of drivers have a low entry threshold, some may not have received formal driving safety technical education and regular safety awareness training. Their traffic safety education is relatively lacking, and the level of driving safety is relatively low. It greatly affects the safety of traffic and transportation.

4.2. Commercial Insurance

At present, HGVs drivers tend to participate in vehicles damage insurance, third party liability insurance, on-board personnel liability insurance and non-deductible insurance, which is widely called full-insurance. It is undeniable that these insurance policies do greatly protect the HGVs drivers and the other party in the accidents. However, the interview survey found that, due to comprehensive insurance and high insurance premiums, many HGVs drivers appear lucky. Drivers tend to ignore traffic rules and drive dangerously, believing that with insurance coverage, the financial cost of their mistakes will be much lower anyway. The drivers involved in many accidents have even shown retaliatory and aggressive driving behaviors, which pose great security risks.

5.   Suggestions

5.1. HGVs Drivers

▪ (1) Comply with traffic laws and regulations: drive in strict accordance with road traffic laws and regulations, use seat belts properly, do not speed, do not run red lights, do not illegally modify vehicles, do not occupy emergency lanes.

▪ (2) Check and maintain the vehicles regularly: Check the vehicles regularly before departure and on the road to ensure that the brake system, steering system, lights, and other key components are in good condition.

▪ (3) Avoid tired driving: driving for a long time is easy to cause fatigue. Drivers should arrange their trip reasonably, take a rest every 4 hours or so, and change the driver if necessary.

▪ (4) Avoid distracted driving: Do not use cell phones or other electronic devices while driving, and avoid distracting behaviors such as eating and smoking.

5.2. Law Enforcement Department

▪ (1) Strengthen road inspections: increase the frequency of patrols, especially on highways around cities and traffic accident-prone sections, to detect and correct violations in time. Increase the cost of violating the law, and form an effective deterrent.

▪ (2) Make law enforcement inspections strict: regularly carry out special rectification actions to investigate and deal with illegal acts such as overload, speeding, fatigue driving, and illegal modification.

▪ (3) Make full use of technology: use electronic monitoring, intelligent bayonets, vehicles GPS, and other technical equipment to achieve real-time monitoring and dynamic management of HGVs.

5.3. Commercial Insurance

One issue that remains controversial is whether the so-called full-insurance pays HGVs drivers so excessively that the cost of their mistakes is too low. Excessive protection for HGVs drivers may infringe on the rights of other vehicles on the road to some extent. The author proposes that the relevant departments and insurance companies may work together to improve the content and coverage of insurance on the basis of negotiation. For instance, on the basis of the identification of traffic accident liability, the scale of insurance payment is determined according to whether the main responsible person is the driver of HGV. That is to say, if a traffic accident occurs because of the bad driving behaviors and habits of the HGV driver, then the insurance company will provide the driver with very limited insurance money. On the contrary, if the HGV is not responsible for the accident, or if it bears the secondary responsibility, the normal compensation process can be followed. The above assumptions will be based on the written confirmation of traffic accident liability issued by the traffic department. It is believed that such measures and improvements would certainly go a long way in deterring the bad behaviors of HGVs drivers who rely on high insurance premiums.

6.   Conclusion

Through the analysis of the main influencing factors, this article innovatively transforms the probability control of traffic accidents into the control of HGVs drivers' main influencing factors, so as to improve the driving behaviors of HGVs drivers and provide a scientific basis for the development of measures such as the correction of improper driving behaviors of HGVs and training of active driving behaviors. The main conclusions are as follows:

(1) This paper reviews the relevant research results in this field at home and abroad, and puts forward the main research problems based on the systematic review of the literature, which lays a theoretical method for the research.

(2) Based on the relevant literature and interviews with practitioners, this paper divides the main drivers' subjective causes of HGVs traffic accidents into four aspects. Other external factors contributing to driving behaviors and traffic accidents are discussed, such as the mode of operation and the dialectical role of commercial insurance.

(3) Based on the analysis of the main factors affecting the traffic accidents of HGVs drivers, prevention measures and suggestions to reduce the probability of traffic accidents of HGVs drivers are put forward.

At the same time, it is undeniable that this study has certain limitations, and there is a lot of room for improvement. Due to the limitations of the search methods, much of the data used in this article is not current statistics. Some past data may be different from the present, which may leads to the inaccuracy of the research and the deviation of the conclusion. In addition, the innovation of this paper is limited in the suggestion part, and the proposed improvement measures for commercial insurance are only at the tentative stage, which means their feasibility remains to be discussed and verified. The future research will focus on the policy research part, trying to make a breakthrough in the policy suggestions.

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