DOI: 10.7251/JTTTP1801055M
UDC: 625.712:656.1(497.6RS)

PROFESSIONAL PAPER

Safety Aspects of Freight Traffic in the Republic of Srpska

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Received: December 4, 2017
Accepted: June 4, 2018

Abstract: This paper tries to present the state of traffic safety in the Republic of Srpska based on a statistical sample of traffic accidents involving freight motor vehicles on roads of the Republic of Srpska and Bosnia and Herzegovina. Besides statistics, survey and statistical sample analysis methods were used, as well as analyses of indicators of road worthiness testing station inspections of vehicles in the Republic of Srpska. The indicators of non-regular preventive inspections of roadworthiness tests conducted on the roads by the Auto Moto Association of the Republic of Srpska are especially important. Bearing in mind the age and number of freight motor vehicles in the Republic of Srpska, in accordance with the indicators from chapter 3.4 (Consequence of Traffic Accidents) it is possible to continue the research with a special view on the injuries of the freight vehicle drivers and causes of traffic accidents. According to the data available, most of the fatalities and severe injuries were inflicted to drivers and passengers from vehicles that were involved in accidents with freight vehicles.

Keywords: freight motor vehicle, traffic accident, vehicle road worthiness test, road worthiness testing station.

INTRODUCTION

Freight transport is the dominant transport sector in the Republic of Srpska. As well as traffic itself, the freight traffic is represented in all spheres of our lives, thus occupying an important place in the structure of traffic flows on the roads of the Republic of Srpska. Its importance is also described by the number of registered cargo vehicles. The total number of registered cargo vehicles in 2014 was 28 279, in 2015 this number increased by 1 086 vehicles, amounting to 29 365. By the end of 2016, by statistical processing of data on the number of registered cargo vehicles, the highest increase in the number of registered cargo vehicles was present in the observed period. Data released show that 1 875 vehicles more were registered in the previous year than in 2015, or 2 961 more than in 2014, so in 2016 a number of 31 240 of freight vehicles were registered. The constant increase in registered vehicles shows that freight traffic is more and more present on the roads of the Republic of Srpska, and from the aspect of traffic safety it is necessary to create a clear picture of the safety of this type of transport. These data on the increase in the number of freight vehicles are quite acceptable, since Bosnia and Herzegovina/the Republic of Srpska is a developing country and has suffered great changes in the near past. This again says that traffic is involved in all spheres of our lives and that it plays a major role in the development and progress of the country. At the assembly of the UN, the period 2011-2020 was declared the decade of traffic safety on roads. In 2010, the World Health Organization (WHO) released the data on global safety at which it is clear that 1.24 million people were killed in traffic accidents annually and that traffic accidents at that time occupied the eighth place in the cause of mortality in the world with a tendency to become the fifth cause by 2030. Our country as a member of the UN, along with other members, signed the Declaration of the Assembly of the United Nations, thus accepting the action plan of the systematic solving of this problem. Therefore, multi-sectorial efforts must be invested and a strategy created which will integrate individuals and institutions of the system. For systematic action, we first need to analyse and investigate traffic accidents in a quality way so as to have a clear picture of its participants, consequences and causes of its occurrence. This means that it must be determined which group of drivers are participants, when and where traffic accidents occur, the number of persons who have died, the number of persons who have suffered serious body injuries (SBI), the number of persons who suffered minor body injuries (MBI), as well as material damage.

From the aspect of the safety of freight traffic, technical safety of the vehicles should be considered, that is, the correctness of the active and passive systems of the vehicles themselves. Also, for these parameters, a period of

three years should be analysed, that is for 2014, 2015 and 2016. Inspections of technical safety of vehicles are done through regular annual inspections, regular six-month, and extraordinary inspections of vehicles. The malfunction of some of the active systems can lead to an accident. When all these parameters correlate, the level of safety of freight traffic in the Republic of Srpska is obtained.

RESEARCH METHODS

Analysing the statistical sample of traffic accidents, the participation of freight vehicles in traffic accidents, its characteristics, time and place, etc. is evident. In order to evaluate the level of safety of freight traffic, it is necessary to put the existing values into a mathematical relation, or to synthesise the relative indicators. In this way, already known absolute indicators of the number of traffic accidents and their consequences can be combined with other significant figures (population, number of vehicles, number of drivers, number of kilometres travelled, length of the road section, tons, kilometers ..).

Using the comparative method, conditions have been created for the comparison of certain parameters, that is, this type of traffic with other modes of transport, in order to evaluate the safety aspects of freight traffic.

In this paper, we have separately distinguished traffic accidents in which freight vehicles were involved with different consequences and the causes of its occurrence.

RESULTS OF RESEARCH

The objectives of this research are related to the assessment of the impact of technical safety of freight motor vehicles on the parameters of traffic safety. What is particularly significant is the sample of the number of road accidents involving freight vehicles and percentage in relation to the total number of traffic accidents, as well as the number of persons killed and injured in traffic accidents in the Republic of Srpska for the mentioned period.

On the basis of a sample of preventive inspections and verification of the technical safety of vehicles in 2014, data on the correctness of freight vehicles were obtained. There were 17 systems on-board examined, system of active and passive safety as well as other systems and devices on the vehicle itself.

In Table 1, the results of the technical safety of vehicles in 2014 are presented

Table 1. Control of technical worthiness in 2014

Control of technical regularity of freight vehicles in 2014 (verification, preventive and check of technical regularity)	
Number of registered vehicles in RS in 2014	324 691 (100%)
Number of freight vehicles in 2014.	28 279 (8.7%)
Total number of faults on the systems of freight cargo.	13 157

By testing and checking all the controlled systems of freight vehicles, 46% of vehicles had a fault on one of the systems. As already known as the cause of a traffic accident there can be some of the faults in the system of active safety of the vehicle, that is, the failure of the system itself. The active safety systems that were controlled through regular, preventive and extraordinary technical inspections had errors, malfunctions on 40% of the freight vehicles. Out of the total number of errors, i.e. 13 157, there were 4 934 or 37.5% errors on the braking system. On the management system, 750 or 5.5% errors were recorded. Lighting devices numbered 3 567 errors or 27.1% of the total number of errors. Devices that allow normal visibility had 585 errors or 4.4%. Elements of hangers, shafts and wheels comprise 1 625 or 12.3% errors.

Table 2 shows a fault/error pattern on the equipment and devices of active traffic safety systems.

Table 2. Errors of active traffic safety systems in 2014

Subject of technical testing	Number of errors	%
Braking system	4 934	37.5
Management system	750	5.5
Lighting and light signalling devices	3 567	27.1
Devices that allow normal visibility	585	4.4
Elements of hangers, shafts, wheels	1 625	12.3
IN TOTAL	11 461	86.8

The active safety systems number 86.8% of errors, and 13.2% or 1 714 errors some of the passive safety systems of other devices that are checked through verification, preventive inspection and verification of technical safety of freight vehicles of the N1, N2 and N3 categories.

During the inspections of the technical safety of cargo vehicles, which were performed in verification, preventive control and verification in 2015, the number of errors on 17 checked systems, their subsystems and other devices recorded 18 529 errors.

In Table 3, the results of technical vehicle safety in 2015 are presented.

Table 3. Control of technical vehicle safety in 2015

Control of technical safety of freight vehicles in 2015 (verification, preventive inspection and technical safety control)	
Number of registered vehicles in RS for 2015	335 775 (100%)
Number of freight vehicles in 2015	29 365 (8.7%)
Total number of errors in systems of freight vehicles	18 529

By testing and checking all the controlled systems of freight vehicles, a percentage error was found, of which 63% of the vehicles had a fault on one of the systems. Active safety systems make 54% of the vehicles involved in errors. Out of the 18 529 total errors, 6 235 or 33.6% were recorded in the braking system. There were 1 054 errors or 5.6% on the control system. Lighting devices had 5 519

errors or 29.7%. Devices that allow normal visibility had 880 errors or 4.7% and elements of hangers, shafts and wheels 2 328 or 12.5%.

Table 4 shows a fault/error pattern on the equipment and devices of active safety systems for 2015.

Table 4. Errors of active safety systems in 2015

Subject of technical testing	Number of errors	%
Braking system	6 235	33.6
Management system	1 054	5.6
Lighting and light signalling devices	5 519	29.7
Devices that allow normal visibility	880	4.7
Elements of hangers, shafts, wheels	2 328	12.5
IN TOTAL	16 016	86.1

Active safety systems had 86.1% of errors, and 13.9% or 2 513 errors were on some of the systems of passive safety and other devices that are checked through the control of technical safety.

In the previous year, i.e. in 2016, 17 778 errors were detected on the systems that were inspected as a part of the technical inspection of freight vehicles.

In Table 5, the results of technical vehicle safety in 2016 are presented.

Table 5. Control of technical vehicle safety in 2016

Control of technical safety of freight vehicles in 2016 (verification, preventive inspection and technical safety control)	
Number of registered vehicles in RS for 2016	351 754 (100%)
Number of freight vehicles in 2016	31 240 (8.8%)
Total number of errors in systems of freight vehicles	17 778

Observing the number of registered vehicles in 2016, the number of errors in verification, preventive control and verification of technical safety of freight vehicles is 57% for vehicles N1, N2 and N3. Active safety systems have participated with 48% in the faults of the vehicles examined. The braking system involved 6 101 errors or 34.3%, while the management system participated with 918 errors or 1.7%. Lighting and light signalling devices had 5 235 errors, i.e. 29.4%. Devices that provide normal visibility and elements of hangers, shafts and wheels had 868 errors or 4.8%, i.e. 2 119 errors or 11.9%.

Table 6 shows a fault/error pattern on the equipment and devices of active traffic safety systems in 2016.

Table 6. Errors of active safety systems in 2016

Subject of technical testing	Number of errors	%
Braking system	6 101	34.3
Management system	918	1.7
Lighting and light signalling devices	5 235	29.4
Devices that allow normal visibility	868	4.8
Elements of hangers, shafts, wheels	2 119	11.9
IN TOTAL	13 122	82.1

The active safety systems make 82.1% of the errors of the total errors of all systems and devices on the vehicle, which further implies that the passive safety system and other in-vehicle devices had their share with 17.9% of errors.

CONSEQUENCES OF TRAFFIC ACCIDENTS OF FREIGHT VEHICLES

As it is known, a person, a vehicle, the road and the environment can be the cause of a traffic accident. The errors of some of the active systems can lead to the occurrence of a traffic accident. Here we will integrate traffic accidents where one of the participants was a freight vehicle category N1, N2 and N3.

In the period January 1st - December 31st 2015, totally 15 760 vehicles participated in 8 581 traffic accidents on the roads of the Republic of Srpska, of which 1 623 heavy motor vehicles with material damage, minor and serious bodily injuries and dead persons.Freight vehicles accounted for 18.9% of the total number of traffic accidents in 2014. Out of the total number of vehicles that participated in traffic accidents, the freight vehicles made 10.29%.

The consequences of traffic accidents involving freight vehicles are known as follows:

- 1 364 traffic accidents with material damage
- 175 traffic accidents with minor injuries
- 62 traffic accidents with serious body injuries
- 22 people lost their lives in a traffic accident

Out of the 131 persons who lost their lives in traffic accidents on roads in the Republic of Srpska in 2014, 22 persons were in traffic accidents with a freight vehicle, or 16.7%

In 2015, there were 9 300 traffic accidents, which involved in total 17 219 vehicles, out of which 1 640 belonged to the N1, N2 and N3 category. Freight vehicles participated in 17.6% of traffic accidents, and 9.52% of participants in traffic accidents from the total number of vehicles were freight vehicles. The consequences of traffic accidents involving cargo vehicles are as follows:

- 1 340 traffic accidents with material damage
- 194 traffic accidents with minor injuries
- 81 traffic accidents with serious body injuries
- 25 people lost their lives in a traffic accident

The number of people killed in traffic accidents for 2015 amounted to 150 people, of which 25 persons were killed in accidents involving one of the participants a freight vehicle, which makes 16.6%, speaking in percentage.

The figures show that in the period January 1st – December 31st 2016, there was total of 9 783 of traffic accidents involving 18 419 vehicles, out of which 1 877 were freight motor vehicles. Cargo vehicles participated with 19.1% in traffic accidents, and there was 10.1% of freight vehicles involved in traffic accidents compared to

the total number of vehicles that participated in it. The consequences of traffic accidents in the past year are as follows:

- 1 562 traffic accidents with material damage
- 208 traffic accidents with minor injuries
- 83 traffic accidents with serious body injuries
- 24 people lost their lives in a traffic accident

The number of people killed in traffic accidents for 2016 is 130 persons, out of which 24 persons lost their lives in traffic accidents where the participant was a freight vehicle, i.e. 18.46%

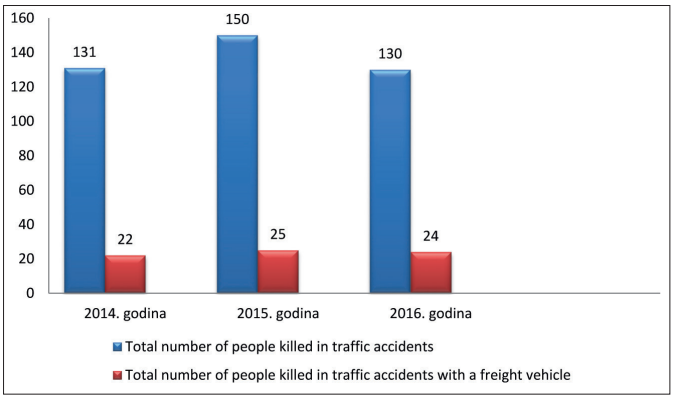

Chart 1. Number of dead persons

The diagram shows the number of persons killed in traffic accidents over the past three years, and particularly integrated is the number of persons who died in accidents with freight vehicles.

In order to assess and determine the safety or non-safety of this group of vehicles participating in traffic on the roads of the Republic of Srpska, it is necessary to determine the traffic risk for the period of the last three years. Traffic risk represents the annual number of people killed in traffic accidents per 10 000 registered vehicles.

Firstly, the traffic risk for the total number of persons killed in traffic accidents in relation to the total number of all registered vehicles in the Republic of Srpska for the specified period was calculated, and then the traffic risk of freight vehicles.

Total traffic risk for 2014 amounts to 4.03, i.e. on 10 000 registered vehicles there were 4.2 persons dead. This means that the traffic risk for freight vehicles is 7.77, i.e. the number of 7.77 persons died on 10 000 registered cargo vehicles.

In 2015, traffic risk was 4.2 and for freight vehicles 8.51. For 2016, traffic risk amounted to 3.69 people per 10 000 registered vehicles. Watching only cargo vehicles, the traffic risk is 7.6.

$$Tr = \frac{Number\ of\ dead\ in\ traffic\ accidents * 10\ 000}{Number\ of\ registered\ vehicles} \quad (1)$$

$$Tr\ freight\ vehicles = \frac{Number\ of\ dead\ in\ traffic\ accidents\ of\ freight\ vehicles * 10\ 000}{Number\ of\ registered\ freight\ vehicles} \quad (2)$$

RESULTS DISCUSSION

By data processing and analysis, an image of the security aspects of freight traffic was created. If only the final results of this survey were observed, this picture of the security aspects of the freight vehicles would not fully describe the real situation. So, through the discussion of the results, the parameters that represent the real state should be considered. If we look at the technical safety of the cargo vehicles, and for this paper, we are particularly aware of the mistakes in the active vehicle safety systems, in 2014, 40% of freight vehicles reported a fault in the active safety system. In 2015, the faults of active systems of trucks were on 54% of vehicles, and in 2016 it was 48%. If we consider also the fact that several faults have occurred on one vehicle on some of the active safety systems, then there is a significantly lower percentage of freight vehicles errors, and consequently a more favourable picture and assessment of the safety aspects of freight traffic in the Republic of Srpska, which is the real situation.

The results show that 16.7% of people were killed in road accidents out of the total number of those killed in 2014. In 2015, the results show that 16.6% of dead people lost their lives just in traffic accidents with freight vehicles. This result for 2016 is 18.4%. According to the number of people killed in traffic accidents, freight traffic is in an unsettled position in relation to bus traffic, and in a better position than the traffic of passenger cars. By obtaining the ultimate results, it can be seen that freight traffic is a medium-sized traffic, where much effort must be made, and it will create methods that will lead to a downward trend in the number of deaths, but also participation in traffic accidents. Regarding the traffic risk of freight vehicles, the obtained results indicate that the largest number of persons is hit by 10 000 registered freight vehicles, and that it is far ahead of other types of traffic.

CONCLUSION

By observing the results, and in particular the number of dead persons in traffic accidents with freight vehicles, it can be concluded that there is no trend of decline in the number of killed in the very incidents. Traffic is a multi-sectorial science, and therefore, in order to solve this problem, and to create a model of solving known facts, it is necessary to include several scientific spheres and that through various case studies, a way to improve the current state and its applications is found. As far as technical safety of the vehicles, Bosnia and Herzegovina/the Republic of Srpska are among the underdeveloped countries in Europe, so the average age of vehicles itself is much higher than in developed countries and members of the European Union. Most freight vehicles used for local and regional transport are older and are

in poor technical condition, while vehicles used in international transport meet the prescribed provisions by the European Union for transport within its borders.

So the example of the European Union should be followed, the level of safety of freight traffic in the Republic of Srpska increased by regulations and laws, where, through constant control by supervisory authorities, and by putting accent on this group of vehicles through various campaigns, the developed countries should be approached. Thus, the underdevelopment and poor performance of the supervisory authorities have also transmitted into the technical correctness of freight motor vehicles, where a large number of errors have been identified during the technical inspections. As already stated, this phenomenon is of multi-sectorial character and further research must determine the method of solution which is to be implemented in all spheres. The causes that lead to this state of traffic safety may be of a different nature and are reflected in the lack of certain finances, poor control of the business operations of the companies and their attitude towards employed drivers, etc., where, with the constant education of drivers and increased control of all relevant institutions of the system, this kind of transport is made safer.

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