

IMPACT OF TECHNICAL VALIDITY MOTORCYCLE FOR ROAD SAFETY IN THE REPUBLIC OF CROATIA

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Abstract: The road traffic safety factor is divided into three basic groups: human, vehicle, road (infrastructure). Technically defective, poorly maintained and technologically obsolete vehicles endanger road safety. The number of technically defective vehicles that are involved in traffic accidents, when checks are carried out by officers of traffic police, is 0.2%. Considering that 21.31% of vehicles are found to be defective by periodical technical inspections of vehicles (PTI), it is expected that the number of technically defective vehicles in daily traffic is considerably higher. By analyzing the data collected by PTI and comparing them with the data obtained during the conducted research "Inspection of the technical safety of vehicles involved in road traffic accidents with fatalities" the real state of the technical condition and safety of vehicles on the roads in the Republic of Croatia is presented here. Two-wheel vehicles (mopeds and motorcycles) represent a particularly risky group.

Keywords: SAFETY, ROAD TRAFFIC, INSPECTION, MOTORCYCLE

1. Introduction

Reducing the number of traffic accidents can only be achieved through active involvement of all traffic participants, optimizing the relationship between safety factors human, vehicle, road (infrastructure). Action measures to better road safety include legislation, education, information, maintenance, modernization and infrastructure construction, increasing passive and active safety, the technical safety of vehicles and the reaction speed of the emergency services. Technically defective, poorly maintained and technologically obsolete vehicles endanger road safety. The Center for vehicles of Croatia (CVH) organizes and conducts periodical technical inspection of vehicles (PTI) in the Republic of Croatia. With the aim of presenting the actual state of technical validity of vehicles on the roads of the Republic of Croatia, the CVH with the Ministry of the Interior (MUP), the Croatian Automobile Club (HAK), the Faculty of Transport and Traffic Sciences (FPZ), the Faculty of Mechanical Engineering and Naval Architecture (FSB) has initiated the research project "Inspection of the technical safety of vehicles involved in road traffic accidents with fatalities"[1]. The aim of the research project is to show the impact and frequency of technical malfunctions in traffic accidents with fatalities in the Republic of Croatia, and propose measures related to the technical validity of the vehicles to further increase traffic safety based on the results of the research. During drivers' everyday use of the vehicle, malfunctions can easily be recognized and detected on critical parts of the vehicles such as tires, suspension, braking system, steering mechanism and light signaling equipment. Although these malfunctions are relatively easy to remove in the average automobile workshop without special tools, the owners are not prone to correct them in the timely manner. Instead, the most common defects are removed just before PTI and some of them only after being identified by the PTI. Therefore, the driver's responsibility is a big gray zone when it comes to the lack of maintenance.

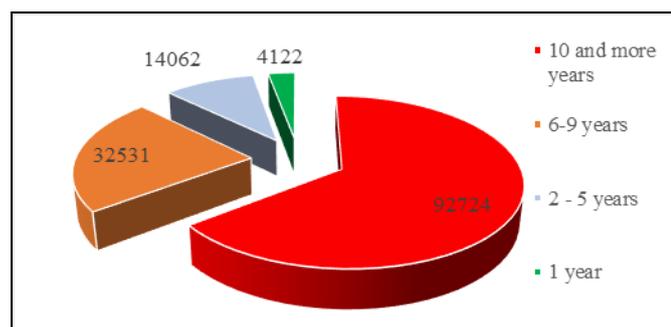


Fig. 1 Mopeds and motorcycles in the Republic Croatia

2. Periodical technical inspections of vehicles

All vehicles involved in road traffic must be without technical malfunction and it must be ensured that their use has minimal impact on the environment. In Croatia, all motor vehicles and trailer based on the Law on Road Traffic Safety are subject to PTI. The period required to conduct the review, the content and scope of the review, as well as the requirements for qualified staff and equipment, are prescribed [2]. The purpose of the vehicle's technical inspection is to detect vehicle defects that could affect the safety of the vehicle and passengers as well as other traffic participants.

2.1. Results of PTI

Vehicles, all their parts and equipment must be completely in working order, but from the safety point of view some circuits are more important than others because they directly affect traffic safety. In 2017, 2.065.038 PTI were carried out [3]. The average percentage of vehicles with malfunctions was 21.31% and the average age of the vehicles was 13.99 years (Fig. 1). Considering the high average age of the vehicle and the fact that the majority of vehicle owners prepare and remove malfunction on the vehicle immediately before the technical inspection, it is realistic to expect a significantly higher percentage of defective vehicles in daily traffic, therefore we consider these data to be the starting point of the research.

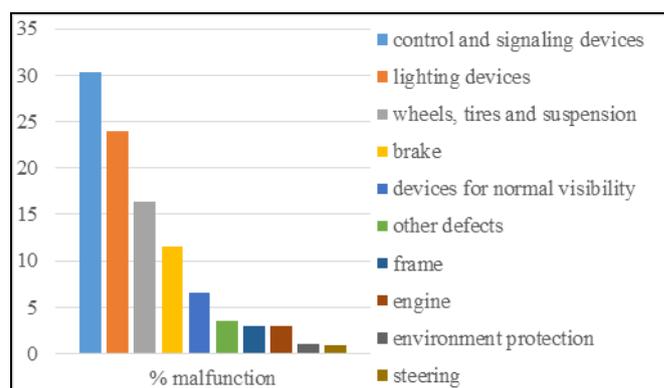


Fig. 2 Distribution of the most common malfunctions by mopeds and motorcycles

There are 143.439 two-wheeled vehicles: 79.873 mopeds, and 63.566 motorcycle. Mopeds and motorcycles in total represent 6.94% of road traffic vehicles and 8.16% of all defective vehicles the highest percentage of deficiencies on PTI of mopeds and motorcycles refer to control and signaling devices 30.28%, lighting devices 23.99% wheels, tires and suspension 16.30%, brakes

11.52%, devices for normal visibility 6.51%, other defects are represented by 3.49%, frame 3.00%, engine 2.94%, environment protection 1.05% and steering of 0.91% (Fig. 2). The age of the vehicle and its usage over time has a significant impact on vehicle malfunction. The average age of mopeds and motorcycles in the Republic of Croatia is 12.3 years, and the average annual travel time is approx. 1.400 km for mopeds and approx. 2.800 km for motorcycles.

3. Research, "Inspection of the technical safety of vehicles involved in road traffic accidents with fatalities"

According to statistical data from the Republic of Croatia, 94.8% of traffic accidents are caused by the human factor, while only 0.2% of accidents are caused by technical malfunctions [4]. In the Republic of Croatia, a technical inspection of the vehicle is not carried out after a car accident, unless there is doubt in the technical malfunction of the vehicle or the competent state authority is requiring the technical inspection. Given the large number of traffic accidents in Croatia, the research project targets groups of vehicles that participated in traffic accidents with fatalities. The technical inspection of the vehicle's technical validity after the car accident is significantly different from the PTI of the vehicle since the vehicles are usually significantly damaged and therefore disassembly, assembly and, if necessary put into operation. It gets carried out as soon as possible after an accident in the field or a workshop with the tool and equipment of an automobile workshop. The results of the inspection are noted on a specially prepared vehicle inspection form, and all collected data and photos are archived in a special application. The aim of the research project is to show the impact and frequency of technical malfunctions in motor accidents with fatalities in the Republic of Croatia, and suggest measures that impact technical vehicle correctness to increase traffic safety based on the results.

3.1. Research results

The data was collected by a team of experts who conducted a vehicle inspection after a traffic accident with fatalities. After reviewing the vehicle, based on the collected data, the members of the expert team gave their opinion on the technical condition of the vehicle and its parts and equipment - classified into three categories (Fig. 3):

- technically adequate,
- technically inadequate,
- it is not possible to determine the condition before the accident.

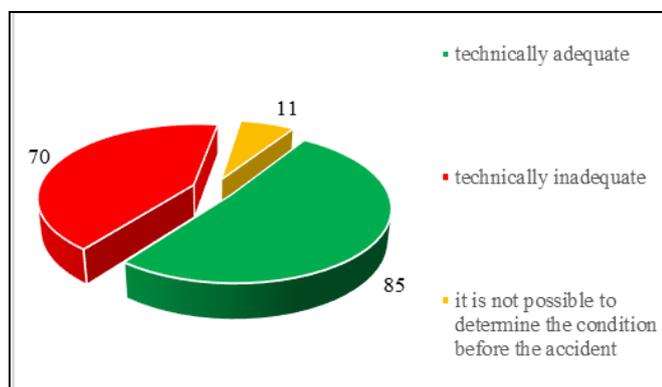


Fig. 3 Structure of vehicles involved in traffic accidents with fatalities according to technical condition.

During the research, 166 vehicles were involved in traffic accidents with fatalities and according to the procedure described, 85 vehicles or 51.20% were technically correct, while 70 vehicles of the vehicle inspected or 42.17% were shown to be technically

inadequate, which is twice as high as on a PTI of the vehicle. The average age of these vehicles was approximately the same 14.54 years, which is in the range of expected values due to the average age of vehicles in the Republic of Croatia and the fact that most vehicle owners service the vehicle before the PTI. For 11 vehicles or 6.63% it was not possible to determine the condition before the accident.

A total of 23 mopeds and motorcycles were inspected, 13 or 56.52% of which were defective and one or more malfunctions were identified on them. By comparing the proportion of mopeds and motorcycles with other vehicle categories and taking into account the extremely small average annual travel distance, these vehicles are a particularly risky group in terms of technically defectives. Although technical malfunctions can often not be identified as a direct cause of a traffic accident, some of the malfunctions are extremely serious and dangerous, the so-called "dangerous mistake". The highest percentage refers to wheels, tires and suspension, 38.46%, brakes 30.77%, engine 30.77%, frame 23.08%, lighting devices 7.69% (Fig. 4). If we compare the data on PTI of mopeds and motorcycles with data determined by research, it is shown that statistical data correlates with the data obtained during the research although there are variations in the order of frequency.

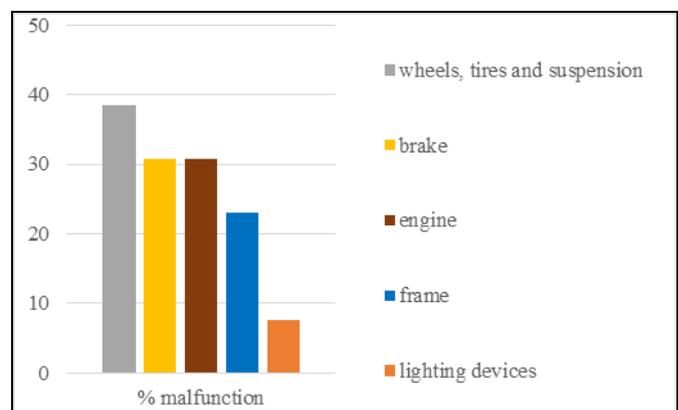


Fig. 4 Overview of "dangerous mistake" on mopeds and motorcycles

4. Conclusion

Technically defective, unmaintained and technologically outdated vehicles compromise road traffic safety. The numbers of the technical malfunctioning of vehicles involved in traffic accidents is 0.2%, when checked by traffic police officers and it is published in the bulletin of the Ministry of the Interior. Research of traffic accidents with fatalities for mopeds and motorcycles, which account for only 6.94% of road traffic vehicles, indicate that in 14.3% of traffic accidents technical failure is a possible cause of traffic accidents. The differences in the values determined from inspection carried out by traffic police officers can primarily be attributed to the different methodology of data collection and analysis, the way of keeping statistics, the conduct of the evidence, the determination of the causes of the accident, the record of the cause of the accident and due to the fact that police officers organize extraordinary technical examinations only if they doubt that there are technical defects of the vehicles involved in a car accident. The high percentage of established malfunctions through the conducted research confirms the experience and expertise of team members as well as the advantages of individual analysis of the possible technical causes of the accident. Technical malfunctions are certainly not the main cause of accidents involving mopeds and motorcycles. Much more accidents happen due to human error, however, accidents due to technical malfunctions can be avoided (or reduce the consequences) if these malfunctions were detected on time and fixed or if the vehicle is maintained in a technically correct condition. Through the research we established that mopeds and motorcycles are technically defective, which alone

with their short annual period of use and a small distance travelled makes them exceptionally risky, also enhanced by their performance and unprotected drivers. Motorcycle aging has a very negative impact, and it is very likely that a malfunctioning or insufficiently maintained motorcycle will be the cause of a traffic accident or is more likely to affect an adverse event.

The results of the research, data on the causes of the accident, the technical condition of the vehicle and the methodology of vehicle inspection should be directed towards reducing the number of accidents in road traffic. It is necessary to carry out promotional campaigns and educational actions with the aim of informing the public about the importance of technical correctness of vehicles, maintenance and control and the fatal consequences of the use of technically defective vehicles. The formation of a multidisciplinary team of professionals who will use their skills and with special equipment will be able to reconstruct the course of traffic accidents, analyze the technical validity of the vehicle, the driver's behavior when driving and the impact of the infrastructure is necessary, propose measures to increase traffic safety. It is recommended to increase the number of technical inspections of the motorcycle in everyday traffic as well as to carry out technical roadside inspections, and raise attention to critical parts and motorcycle assemblies during PTI of the vehicle. Pointing to the fact that increased age and distance traveled increase the possibility of using a defective vehicle, measures to stimulate the purchase of new vehicles should be proposed.

References

1. Zovak, G., Nacionalni program sigurnosti cestovnog prometa Republike Hrvatske, "Provjera tehničke ispravnosti vozila koja sudjeluju u prometnim nesrećama sa smrtno stradanim osobama", Zagreb, 2016
2. Dorić I., *Tijek tehničkog pregleda, mopedi i motocikli* " Stručni bilten broj 128, Centar za vozila Hrvatske, Zagreb, 2009
3. <http://www.cvh.hr/tehnicki-pregled/statistika/>[Access 1.3.2018]
4. Republika Hrvatska Ministarstvo unutarnjih poslova, *Bilten o sigurnosti cestovnog prometa 2016*, Zagreb 2017, ISSN 1331-2863
5. Zovak, G., *Importance of technical inspection of vehicles after traffic accidents*. Proceedings of the XXIV INTERNATIONAL SCIENTIFIC-TECHNICAL CONFERENCE "trans & MOTAUTO '16", 2016, P.P. 44-47. ISSN 1310-3946