

IMPORTANCE OF TECHNICAL INSPECTION OF VEHICLES AFTER TRAFFIC ACCIDENTS

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Abstract: The factors that affect on traffic safety are human, vehicle, road and environment. In Croatia the leading cause of traffic accident is human, in just 0,2% of traffic accident the cause is some technical defect on vehicle. However, analyzing the information that on the regular annual technical inspection more than 22% of the vehicle did not meet the technical requirements, to assume is that the number of defective vehicles that causes traffic accidents is significantly higher. In order to determine the relevant statistic data of vehicle as a cause of traffic accidents, it is necessary to implement technical inspection of vehicle that are involved in traffic accident. Research objectives are to determine how many defective vehicles were involved in traffic accident, how many of them might have been the cause of a traffic accident, and which elements on the vehicle are possible cause of traffic accident.

Keywords:

1. Introduction

According to the statistical data and analysis in the Republic of Croatia the leading cause of traffic accidents is human in over 97%, while in 0.2% of traffic accidents cause of the traffic accident was a technical breakdown. Analyzing the fact that in the European Union countries in 6-8% of traffic accidents the cause was a technical defect of the vehicle and in Croatia in about 22% the vehicles did not meet on a regular technical inspection, so it can be assumed that the cause of the larger number of traffic accidents was the technical malfunction of the vehicle. In order to achieve the target in the global campaign "Decade of action for road safety" it is necessary to determine the cause of traffic accidents.

The Republic of Croatia has not conducted research on the number of technically defective vehicles that are involved in traffic accidents so they used for example the exploration conducted by the company Dekra. The results of the research led by company Dekra, which since 2001 carried out an analysis of roadworthiness of all vehicles that are involved in traffic accidents with fatal consequences, showed that 26.4% of vehicles are out of order and 6% of investigated traffic accidents were caused by a technical malfunction of the vehicle. The Republic of Croatia has lower standard than Germany and inferior standard contributes to greater average age of registered vehicles in the Republic of Croatia, which in 2015 was 13.5 years. It can be concluded that the number of technically defective vehicles that are involved in traffic accidents increased and thus the technical malfunction as the cause of accidents is higher than 0.2%.

By determining the number of technically defective vehicles that are involved in traffic accidents the methodology of keeping statistics on the causes of traffic accidents improves, and quality measures for the prevention of traffic accidents can be applied.

In order to improve the statistics of the vehicle as a cause of road accidents, it is necessary to carry out technical inspections of vehicles that are involved in traffic accidents. Due to the large number of accidents it is necessary to carry out technical inspections on vehicles that are involved in traffic accidents with fatalities as consequences.

2. Technical inspection of vehicles after traffic accidents

2.1. The mandatory technical inspections of vehicles

In Croatia, all motor vehicles and trailers must access the final inspection. Vehicle Inspection is performed based on the Law on Road Traffic Safety, under the laws governing the operational part of the business, such as: Regulation on technical inspection of vehicles, Regulation on technical requirements for vehicles in road traffic, the Ordinance on the periodic technical inspection. The Act

defines devices and equipment which vehicles must contain, dimensions, total weight and axle load of vehicles and conditions to be met by vehicles in traffic on the roads. Table 1 shows the distribution of technical inspection in the Republic of Croatia.

Table 1: Types of technical inspection

Regular checks	Preventive checks	Exceptional technical inspection
Mandatory for		
<ul style="list-style-type: none"> • Motor vehicles • Trailers 	<ul style="list-style-type: none"> • renta a car vehicles • vehicles for training drivers except the moped, motorcycle and tractor owned by candidates • taxi vehicles • buses • duty vehicles (passenger cars and trailers) if their maximum mass exceeds 7500 kg • ambulance vehicle 	<ul style="list-style-type: none"> • all vehicles after repair of circuits and devices essential to traffic safety, which have been damaged in an accident • vehicles that have carried out modifications or repairs • vehicles that are excluded from traffic by authorized police officer and went to the exceptional technical inspection
exceptions		
<ul style="list-style-type: none"> • work machines 	<ul style="list-style-type: none"> • camping and living vehicles • vehicles for the transport of bees • fire vehicles • vehicles for leisure activities • trailers for tractors 	

Vehicle Inspection is done in order to increase road safety. The laws and regulations on the provision of technical review can be found in the Law on Road Traffic Safety.

Basic tenets of technical inspection are:

1. Technical inspection of vehicles is an activity of general interest.
2. In order to test roadworthiness for motor vehicles and trailers, with the exception of machines, technical inspections of these vehicles are carried out.
3. Technical inspections of vehicles are regular with testing of exhaust gases of motor vehicles, preventive and exceptional.

4. On the technical inspection shall be determined whether the vehicle has prescribed devices and equipment, whether these devices and equipment are correct and whether they meet the prescribed conditions for participation in road traffic.
5. Record of technical inspection of vehicles shall be kept.
6. Minister of the Interior in agreement with the minister in charge for transport issues carries out regulations on the technical inspection of vehicles.

During technical inspection of the vehicle it is divided into 17 circuits that are reviewed. Table 2 shows the proportion of errors to the circuits on a regular technical inspection in 2015 for all categories of vehicles.

Table 2: The percentage of defects in individual assemblies of vehicles [2]

	Name of the assembly	% defects
00	Identification of the vehicle	1,03
01	Control devices	2,86
02	Braking devices	26,10
03	Apparatus for lighting and light signals	26,67
04	Devices that allow normal visibility	3,53
05	Self-supporting body, chassis and other parts	4,06
06	Axles, wheels, tires and suspension	10,52
07	Engine	5,13
08	The impact on the environment	0,61
09	Electrical equipment and installations	1,27
10	Transmission mechanism	1,24
11	Control and signaling devices	2,91
12	Testing of exhaust gas	8,46
13	Connecting the towing and towed vehicles	0,76
14	Other devices and vehicle parts	0,44
15	Vehicle equipment	4,08
16	Additional testing of vehicles of category M2 and M3	0,01
17	Gas installations	0,31

The highest percentage of failure on regular technical inspections have devices for lighting and light with 26.67% defect, then the braking device with 26.10%, and the circuit elements of axles, wheels, tires and suspension with 10.52% then testing of emissions. Vehicles must meet all conditions. All circuits on the vehicle must be correct or individual circuits directly affect traffic safety. Some circuits from the standpoint of security are more important than other circuits. Testing of exhaust gases of motor vehicles are more significant for ecology but the devices for lighting and light-signaling devices for braking, steering devices and components axles, wheels, tires and suspension are more important for road safety and their malfunction is affecting the safety of road traffic.

Age of vehicles is one of the factors that influence the malfunction of the vehicle. The infrastructure enables drivers of older vehicles movement in high speeds and significantly increases the possibility of accidents with serious consequences. Table 3 shows the analysis of the failure of passenger cars by manufacturers, who have access to regular technical inspection

under 5 years of age, between 5 and 10 years of age and older than 10 years.

Table 3: The percentage of malfunctions of cars under 5 years of age, between 5 years and 10 years and over 10 y. [2]

Under 5years		Between 5 and 10years		Over 10 years	
Vehicle	% malfunctions	Vehicle	% malfunctions	Vehicle	% malfunctions
Audi	2,99	Audi	7,39	Toyota	20,05
Mazda	2,99	Bmw	7,46	Smart	20,26
Volkswagen	3,65	Volvo	8,83	Mercedes	25,03
Ford	3,90	Honda	9,21	Mazda	25,59
Suzuki	4,33	Suzuki	9,67	Bmw	25,65
Bmw	4,59	Mazda	9,78	Volvo	26,07
Nissan	4,59	Mercedes	9,94	Nissan	27,52
Mercedes	4,62	Volkswagen	11,50	Mitsubishi	28,53
Seat	4,68	Nissan	11,94	Honda	28,70
Toyota	4,72	Toyota	12,02	Citroen	28,70
Opel	4,95	Ford	12,84	Peugeote	282,94
Škoda	5,13	Hyundai	13,78	Audi	28,94
Renault	5,27	Kia	14,46	Hyundai	29,12
Kia	5,33	Opel	14,80	Lancia	30,40
Hyundai	5,73	Renault	15,29	Renault	30,88
Dacia	6,16	Alfa romeo	15,94	Alfa romeo	31,06
Peugeot	6,21	Peugeot	16,25	Škoda	31,38
Citroen	6,83	Citroen	16,25	Seat	32,08
Chevrolet	7,98	Seat	16,57	Opel	32,34
Fiat	9,74	Škoda	16,99	Volkswagen	33,68
		Chevrolet	17,03	Daewoo	33,89
		Fiat	17,44	Suzuki	35,42
		Dacia	18,74	Ford	35,50
				Fiat	36,46
				Rover	37,09
				Kia	37,84
				Lada	42,20
				Zastava	48,17

An examination of Table 3 confirms that the age of the vehicle is an important factor in road safety. Vehicles up to 5 years of age have a percentage of malfunction 2.99 to 9.74%, vehicles 5-10 years of age have a failure rate from 7.39 to 18.74% and the vehicles that are older than 10 years have a 20 percent failure, from 05 to 48.17%. With the age of the vehicle an important factor is mileage. For vehicles that have passed less than 50 000 km percentage of defects is from 4.01 to 24.75%, with vehicles that

have crossed 50000-100000 percentage of defects is from 5.69 to 26.73% for vehicles with more 100 000 mileage percentage of defects is 16.32 to 38.10%. In addition to the data presented, the devastating fact is that in 2014 and 2015 in Croatia higher number of used vehicles approached the first regular technical than new vehicles as a result of large imports of vehicles.

2.2. Technical inspection of vehicles after traffic accidents

Vehicles that were involved in traffic accidents are not accessing technical inspection unless technical malfunction is suspected or if requested by the prosecution. Technical inspection of vehicles after a car accident is different compared to the regular technical inspection station. When checking the technical condition of vehicles that are involved in traffic accidents it is allowed to dismantle and assemble circuit boards to determine a malfunction. In order to implement the project "*Check the technical condition of vehicles involved in traffic accidents with fatalities*" the methodology of the technical inspection of vehicles as part of the designed pattern to check the correctness of assembly of vehicles that meet the supervisor during the review was formed. The above pattern is different from the control list in the roadworthiness test, inspection form safety circuits of vehicles consists of 4 pages, which are divided into six main circuits. After vehicle inspection data on the inspection are entered to the application along with photos and other attachments. Technical inspection of vehicles that are involved in a car accident may take longer than vehicle inspection during regular technical inspection..

Example of analysis of the vehicle that was involved in an accident with fatal consequences. Inspection of the vehicles performed outside the station for technical inspection. Inspecting the cargo delivery vehicle brand and type Volkswagen Transporter. Technical inspection starts by entering data on the vehicle and on the person performing the inspection. The form of vehicle inspection is divided into six segments and should be completely fulfilled, to be completed in a way that the individual assembly can be characterized as:

- Properly
- Malfunctioning
- It is not possible to determine the condition before the accident
- Activated (valid for airbags and seat belts)
- The set does not exist

At present vehicle, there were a number of malfunctions of which only some are listed:

- The windshield was damaged, and a mesh rupture passes through the driver's field
- The body is corroded and especially thresholds of the vehicles which weakened structure of the vehicle
- The seat is damaged and as such violates the comfort of the driver visible in the photograph
- In the interior of the vehicle there are sharp parts that could cause injury to the driver and missing safety barrier between the passenger and cargo space, which prevents the entry of cargo into the passenger compartment. Missing interior mirror which originally was improperly secured with chewing gum (Fig. 1)
- Position and high beams do not work
- Drive elements of additional devices are not functioning. Drive belt that drives the hydraulic pump or the steering is missing and even if the belt is correct this is considered defective because the hydraulic control device is subsequently improperly installed (Fig. 1)

- Evaporation temperature of brake fluid is invalid because the humidity is above 4%.
- The parking brake is not in function
- Tires are worn on the outer part of the tread pattern which indicates an incorrect suspension geometry
- Sidewall tires are damaged, cracked or damaged (Fig. 1)
- Some tires are renewed, and the tread in places began to peel off

A technical inspection has determined that the subject vehicle was defective and as such should not participate in road traffic. A large number of defects was observed on circuits that are important for road safety. Since they do not know the details of an accident it cannot be determined whether it is a technical malfunction of the vehicle causing a traffic accident or some other factor. Defects that were observed on the vehicle in certain situations may be the cause of an accident since the faulty circuits are of active safety.

For vehicles where the percentage of moisture in the brake fluid is higher than 4% and have worn or damaged tires there is a possibility that their braking distance extended in relation to the technically correct vehicle. Visibility of drivers can be reduced if the internal mirror is missing, if he damaged the front windshield even if the light units are not correct. The duration of the review of the vehicles was about one hour and thirty minutes.

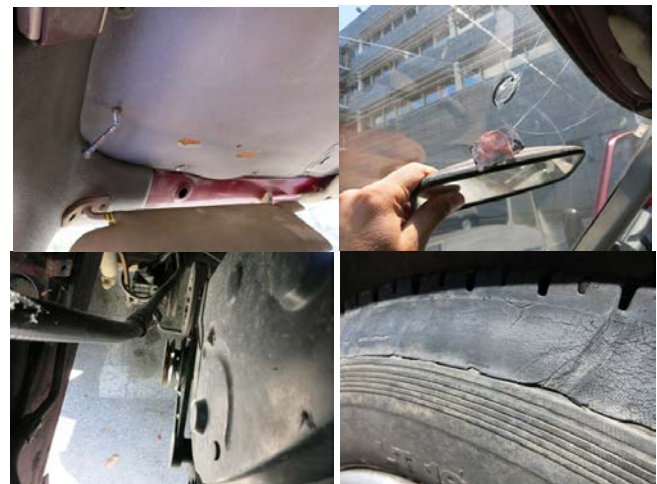


Fig. 1. Examples of some technical defect in the subject vehicle [3]

Information recorded during the technical inspection of vehicles shall be entered in the application created just for the purpose of technical inspection of vehicles that are involved in traffic accidents with fatal consequences [1].

2.2.1. Problems during technical inspection of vehicles after traffic accidents

Technical inspection of vehicles that took part in a car accident is more difficult to perform than a full technical review of the roadworthiness test. Vehicles that are involved in traffic accidents are usually deformed and it is impossible to technically determine in a safe way whether a malfunction occurred before the car accident or the result of a traffic accident. Vehicles are usually reviewed in parking lots or other areas where all workshop equipment is not available, making it difficult to monitor vehicle inspection. The vehicles in which someone is killed can be found traces of blood, and this can cause discomfort to the individual supervisor. When inspecting the damaged vehicle it requires maximum caution because the vehicle is deformed but has sharp edges on which the supervisor can hurt himself. In some cases it is necessary to repair the vehicle in order to examine the individual circuits.

Inspection of the vehicles that were involved in traffic accidents take place in the shortest possible time after the car accident because the atmospheric conditions can modify individual circuits that make it difficult for the monitor to review.

Inspections of vehicles that are involved in traffic accidents are reviewed throughout the Republic of Croatia and need a large number of available professional staff who can inspect the vehicle in any part of the country.

3. Implement technical inspection of vehicle that are involve in traffic accident with fatal consequences

To determine the number of defective vehicles that are involved in traffic accidents with fatal consequences it is necessary when an accident with fatal consequences occurs to retain vehicles temporarily in the local police station. Vehicles that are involved in these traffic accidents must be disposed of in a secure area to protect vehicles from the potential impact of weather conditions. It is necessary to allow the access to the vehicles that are involved in traffic accidents only to authorized institutions and professional staff who would be responsible for reviewing the technical condition of vehicles.

It is necessary to form a professional staff that is able to inspect the vehicle in any part of Croatia. To perform the necessary inspection, equipment is needed in order to review the damaged vehicle without certain specialized workshops. If the vehicle after a traffic accident in running the supervisor is allowed to transport the vehicle and inspect the roadworthiness. In addition to these procedures it is necessary to prepare regulations so that during the examination of vehicles of recent production it is allowed to read data from the EDR (event data recorder) which when the airbag is triggered captures certain information that can be used to determine the causes of traffic accidents. The information collected during the inspection of the vehicle can be used by traffic experts if they are making finding and opinion of an accident in which the participants examined the vehicle.

The former performed examinations of vehicles as part of the "Technical examination of vehicles involved in traffic accidents with fatalities" on vehicles which are technically incorrect, it was found that 27.93% had a malfunction on tires and suspension which are active safety factors as these are an important element of security. Table 4 shows the percentages of defects per circuits identified with defective vehicles.

Table 4: malfunctioning of the circuits identified with defective vehicles[1]

Set	% vehicles
Body and interior cabin	30,02
The suspension and tires	27,93
Engine and transmission	15,41
Braking system	11,91
Light signaling equipment	10,51
Driving system	4,22

Table 4 shows that 54.57% defects found are on circuits that are most important for road safety. Malfunction of any circuit on the vehicle endanger participants in traffic and especially malfunction of active safety factors on which the highest number of irregularities are recorded.

4. Results

With the introduction of the technical inspection of vehicles participating in road accidents with fatal consequences the current statistics on the number of defective vehicles that are involved in traffic accidents with fatal consequences would improve. By analyzing traffic accident data and the technical condition/breakdown methodology of collecting data on the cause of an accident would be advanced and changed. Improving statistics on the causes of accidents high-quality measures can be aimed at reducing the number of deaths of participants of traffic.

By determining to what extent a technical malfunction caused a traffic accident, preventive measures can be taken to encourage public awareness about the fatal consequences of the exploitation of technically defective vehicles, because for a large number of defects user of the vehicle is responsible. By raising awareness of the fatal consequences of the exploitation of technically defective vehicles, awareness of vehicle owners about the importance of regular maintenance and control of the vehicle would increase. Pointing drivers to the fact that increased vehicle age and mileage is increasing the possibility of technical failure, and therefore the traffic safety of all participants is violated, and thus the trend of a large number of first time registered used vehicles than new ones could change.

5. Conclusion

By achieving the set target set by the global campaign "Decade of action for road safety", to reduce the number of casualties in road transport by 50% by 2020 is achievable if all causes of traffic accidents are determined in order to impose preventive measures in order to achieve a given objective.

Actions and methodology of inspections of damaged vehicles is more demanding than the inspection of vehicles that approach the regular technical roadworthiness test. In some cases, vehicles are deformed and the supervisor finds it difficult to ascertain the correctness of circuits before a traffic accident. Vehicles should be inspected immediately by the supervisor after a traffic accident and damaged vehicles should be placed in a guarded area to undergo the examination.

To determine the number of technically defective vehicles involved in road transport it is necessary to implement outstanding technical checks on roads by excluding the vehicle out of traffic and performing inspections.

In order to achieve the objective of 50% fewer casualties in road transport by the technical inspection of vehicles that are involved in traffic accidents it is necessary to form a professional staff that is responsible for infrastructure and human behavior. In Croatia, road safety will increase by the application of those measures and by an increase in living standards when citizens will be able to afford new vehicles.

6. References

1. Zovak, G., Nacionalni program sigurnosti cestovnog prometa Republike Hrvatske, "Provjera tehničke ispravnosti vozila koja sudjeluju u prometnim nesrećama sa smrtno stradalim osobama"
2. Kalauz, Z. (2007)., *Tijek tehničkog pregleda*, Stručni bilten broj 119, Centar za vozila Hrvatske, Zagreb
3. Kučinić, T. (2014). *Značajke tehničkog pregleda nakon prometne nesreće*, Diplomski rad, Fakultet prometnih znanosti, Zagreb