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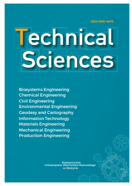

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INFLUENCE OF SELECTED ASPECTS OF THE TECHNICAL CONDITION OF MEANS OF TRANSPORT OPERATING IN WIELKOPOLSKA IN POLAND ON ROAD SAFETY

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Abstract

The aim of the article is an attempt to determine whether the technical condition of vehicles in Wielkopolska has an impact on road traffic. For this purpose, the lighting of 20 passenger vehicles and tires in public transport and driving school cars in Wielkopolska were analysed. The lighting of the subject vehicles was organoleptically tested and their intensity and dipped beam were checked at the vehicle inspection station. In the case of five of the tested vehicles, the luminous intensity was at an unsatisfactory level. In the next step, the tires of 16 randomly selected buses were tested. Tread wear tests were discussed in the analysed buses and the influence of tread wear on tire exploitation was presented. For the tested buses, it is noteworthy that the tires were changed if the tread height was too low. In the last step of the research, the tires of a driving school truck were analysed. It was found that the wear of the tire is not even due to driving on a manoeuvring area. Based on the above tests, it can be concluded that the technical condition of road vehicles is important and affects their operation and safety.

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Introduction

The technical condition of vehicles on roads is important in terms of safety. Each mode of transportation, if it is technically inefficient, may pose a significant threat to health or even life (AMBROŻUK, WESOŁOWSKI 2017, KUŁAKOWSKA, PATYK 2013).

In recent years, there has been a rapid development of motorisation, and this has caused an increase in the number of vehicles on Polish roads (Fig. 1). In the last 10 years, the number of registered cars in Poland increased by nearly 50%.

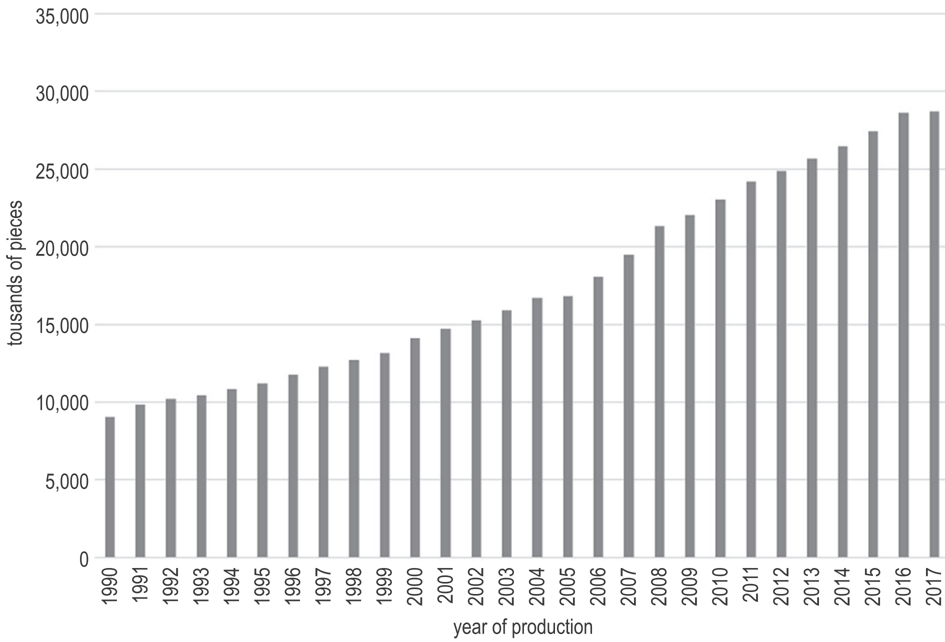

Fig. 1. The number of means of transport in 2001-2017

For this reason, the technical condition of vehicles traveling on the road is significant, affecting not only the safety of road users but also the environment and human health. Poor vehicle technical condition can lead to many accidents resulting in injuries and fatalities. At the turn of 2001-2016, as a result of poor technical condition, there were 1,795 accidents in which 208 people were killed and 2,344 people were injured (Polish Police 2018). These data are presented in Table 1.

The number of road accidents caused by the technical condition is less than 1% of all accidents, however, such cases do occur. Lighting defects in vehicles involved in road accidents in the analysed period amounted to 482, which accounts for

Table 1

Number of road accidents caused by the poor vehicle technical condition

Year	Number of accidents	Number of defects associated with lighting in vehicles involved in road accidents	Number of defects related to the condition of tires in vehicles involved in road accidents	Fatalities	Injuries
2001	19	1	3	2	26
2002	22	2	5	2	41
2003	16	2	1	1	22
2004	14	2	1	1	15
2005	11	2	5	2	16
2006	233	48	57	41	265
2007	114	61	28	21	140
2008	143	76	28	13	185
2009	101	42	21	8	147
2010	66	33	12	13	87
2011	80	43	13	5	97
2012	55	29	12	6	66
2013	53	26	16	6	63
2014	44	36	7	5	59
2015	41	35	7	10	41
2016	64	26	16	8	81
2001-2016	1,795	482	242	208	2,344

Source: Polish Police (2018).

27% of all accidents caused by the technical condition. Therefore, the technical condition of the tires caused 242 accidents in the analysed period. This accounts for 14% of all accidents caused by poor technical condition. For this reason, the article attempts to determine if the technical condition of selected aspects of vehicles in Wielkopolska has an impact on road safety.

Characteristics of vehicle lighting

Technological progress and road safety requirements force constant changes in the construction of car lights. Changing the style and constantly following recent trends also affects the appearance, design and the technology used in vehicle lighting. Road lights at the front of the vehicle have the greatest impact on traffic safety. These types of light sources include spotlights. Depending on the type, there are smooth or ribbed glass panes with a paraboloid or multi-parabolic reflector. Currently found headlights are so-called combined reflectors, which are hard to classify as a whole due to the use of different technologies in one headlamp. An important element are the light sources used in them. Currently, both classic R2 bulbs, halogen bulbs as well as discharge lamps and lenses are in use. Currently, the most popular modern technology in the headlamps is bi-xenon, whose greatest competition is LED technology. Smart lights are also a dynamically developing area.

Research on the impact of the technical condition of vehicle lighting

The study aimed to verify the technical condition of the lighting of vehicles in Greater Poland. For this purpose, 20 randomly selected vehicles were tested at a vehicle inspection station. This study consisted of two parts. First, the operation of the lighting in the tested means of transport was organoleptically checked. For this purpose, the following were checked: operation of the headlights, including an assessment of the condition of bulbs and glass of headlights, stop lights, which should shine much more clearly than the rear position lights. In the next part of the test, the direction indicators are checked. Both the front, side and rear directional lamps should be synchronised. The frequency of the lights should be between sixty and one hundred and twenty flashes per minute. One flash must not be longer than one second. The next stage of the test is to check the operation of other vehicle lamps, such as position, front and rear fog lamps, reversing lamp, emergency lamp. These lights should light up and the lampshades in which they are placed should not have any cracks or be dirty. It should also be checked whether the indicator lamps corresponding to each type of light work and inform the driver about their activation.

The correct operation of the headlights in vehicles is defined in two ways. The first of them is to properly set the tested reflector to obtain the appropriate limit of light and shadow and obtain the appropriate glare effect. The next stage of the study is to determine the physical quantities that characterize the reflector. These include light and luminous intensity. They have a significant impact on the driving comfort of both the driver driving the vehicle and the drivers in the vehicles passed on the road. Lights with inadequate parameters can dazzle the driver coming from the opposite direction or insufficiently illuminate the road. In both cases, there is a risk of an accident. The test was carried out following the guidelines that are used during the technical inspection of the vehicle at the vehicle inspection station.

At the vehicle inspection station, the first measured quantity is the intensity of light, which determines whether the light emitted by the headlamps in the tested vehicle can dazzle drivers driving in the opposite direction to the tested vehicle (Fig. 2). The device's knob is set in the upper position and the photoresistor is in the leftmost position, which simulates the view of the driver's eyes driving in the opposite direction. The value read from the display is considered to meet the requirements if it does not exceed 1 lux.

Fig. 2. Inspection of the technical condition of lighting

The next stage of diagnostics is the measurement of the luminous intensity of traffic lights. For this purpose, the highest value of the light indicated by the photoresistor is selected regardless of its position. The luminous intensity of a single driving beam shall be greater than 30 kcd. At the same time, the sum of the luminous intensity of all traffic lights shall not exceed 225 kcd.

The direct light differences between the values of the right and left luminous lights, which regulate the act, also determine the efficiency of traffic lights. If the higher light exceeds 40 kcd, the difference in its value may not be greater than 30%. If the greater light does not exceed 40 kcd, the difference in its value may not be greater than 50%.

To verify the above data, 20 vehicles in Greater Poland were examined. The vehicles were previously unloaded and the tire pressure was adjusted as per the requirements. The initial inspection of the tested vehicles was then started and the results are presented in the table below (Gołebiowski, Stanisławski 1998, Trzeciak 2010).

The test of the headlight settings in vehicles was made using the USP 20 PS device (Fig. 3). Before checking the

Fig. 3. Device type USP-20 PS

Table 2

Results of the initial inspection of the tested vehicles at the vehicle inspection station

Ordinal number	Make of the car	Year of production	Operation of full beam	Operation of dipped beam	Condition of the headlamps	Stop lights operation	Operation of direction indicators	Operation of the front position lamps	Operation of the rear position lamps	Operation of reversing light
1	VW Golf II	1989	works	works	good	works	correct	works	works	works
2	Opel Astra I	1992	works	works	good	works	correct	works	works	works
3	Opel Astra I	1994	works	works	good	works	correct	works	works	works
4	VW Passat B4	1994	works	works	good	works	correct	works	works	works
5	VW Golf III	1995	works	works	good	works	correct	works	works	works
6	Fiat Punto I	1995	works	works	good	works	correct	works	works	works
7	VW Golf III	1996	works	works	good	works	correct	works	works	works
8	Fiat Seicento	1999	works	works	good	works	correct	works	works	works
9	Opel Astra II	1999	works	works	good	works	correct	works	works	works
10	VW Passat B5	2001	works	works	good	works	correct	works	works	works
11	Renault Laguna II	2001	works	works	good	works	correct	works	works	works
12	Audi A4 B6	2003	works	works	good	works	correct	works	works	works
13	Ford Mondeo Mk3	2003	works	works	good	works	correct	works	works	works
14	Renault Clio III	2005	works	works	good	works	correct	works	works	works
15	Peugeot 206	2005	works	works	good	works	correct	works	works	works
16	Opel Zafira B	2005	works	works	good	works	correct	works	works	works
17	Ford Fiesta Mk6	2007	works	works	good	works	correct	works	works	works
18	Renault Laguna III	2008	works	works	good	works	correct	works	works	works
19	Audi A5	2010	works	works	good	works	correct	works	works	works
20	VW Passat B7	2011	works	works	good	works	correct	works	works	works

intensity and brightness of the vehicle lights, each reflector was appropriately set following the legal provisions regarding the limits of light and shadow.

The first of the tests was to determine the intensity of the light of the dipped beam expressed in lux. In the next step, the analysis of the luminous intensity of the road lights was started. The unit for determining the light is a candela. The obtained results are presented in the Table 3.

Table 3

The results of the test of intensity and luminous intensity of dipped beam

Ordinal number	Make of the car	Luminous intensity of the left headlamp [lx]	Luminous intensity of the right headlamp [lx]	Light of the left light [kcd]	Light of the right light [kcd]	The sum of the luminous intensity of the left and right lights [kcd]
1	VW Golf II	0.32	0.32	15	10	25
2	Opel Astra I	0.45	0.36	36	42	78
3	Opel Astra I	0.38	0.41	24	19	43
4	VW Passat B4	0.52	0.47	38	43	81
5	VW Golf III	0.41	0.45	21	27	48
6	Fiat Punto I	0.40	0.42	36	38	74
7	VW Golf III	0.46	0.48	28	29	57
8	Fiat Seicento	0.39	0.43	35	29	64
9	Opel Astra II	0.49	0.49	43	40	83
10	VW Passat B5	0.58	0.54	49	55	104
11	Renault Laguna II	0.54	0.52	67	58	125
12	Audi A4 B6	0.55	0.56	53	49	102
13	Ford Mondeo Mk3	0.42	0.47	56	51	107
14	Renault Clio III	0.53	0.52	53	54	107
15	Peugeot 206	0.57	0.48	52	59	111
16	Opel Zafira B	0.72	0.68	108	120	228
17	Ford Fiesta Mk6	0.28	0.35	47	51	98
18	Renault Laguna III	0.76	0.74	97	104	201
19	Audi A5	0.65	0.66	112	110	222
20	VW Passat B7	0.59	0.62	107	101	208

After analysing the results of the preliminary inspection of vehicle lighting, it can be concluded that all tested vehicles have operational lighting. This is confirmed by the fact that lighting has an impact on road accidents. Each driver can perform such an inspection organoleptically and its results are satisfactory. Upon preliminary evaluation, it appears that the front position, rear position, reversing, stop and directional lamps function as required. The condition of the tested headlamps is also good or, in some cases, very good (no major scratches and cracks in the glass, permanent fixings in good condition). High beam and dipped beam were analysed separately.

According to the requirements, the maximum value of the dipped beam intensity is 1 lux. After testing randomly selected twenty vehicles, the results are shown in Figure 4.

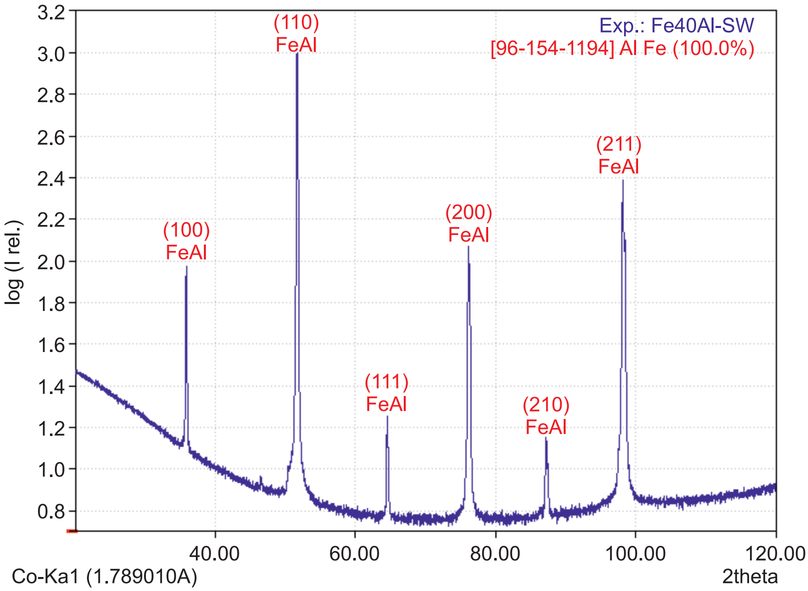

Fig. 4. Luminous intensity of the left and right reflectors [lx]

It was found that all vehicles meet the requirement for the intensity of the luminous intensity of both the right and left reflectors.

The next parameter examined was the luminous intensity of the dipped beam. Pursuant to Polish law, the reflector must shine with a luminous intensity of at least 30 kcd, and the sum of all luminous intensity of the lights must not exceed 225 kcd.

It was found that not all vehicles meet the requirements for traffic lights. In the case of a minimum value of light in four vehicles, it was not reached by the left headlamps, and in five vehicles it was satisfactory. This applies mainly to vehicles manufactured in the early 1990s and earlier, and those in which older technologies were used, both light sources and its radius. In the case of the VW Golf II, the sum of the luminous intensity of all high-beam headlamps did not exceed even 30 kcd, which is why it is recommended to replace the headlamps in this vehicle. In the tested vehicles it was found to be good or very good.

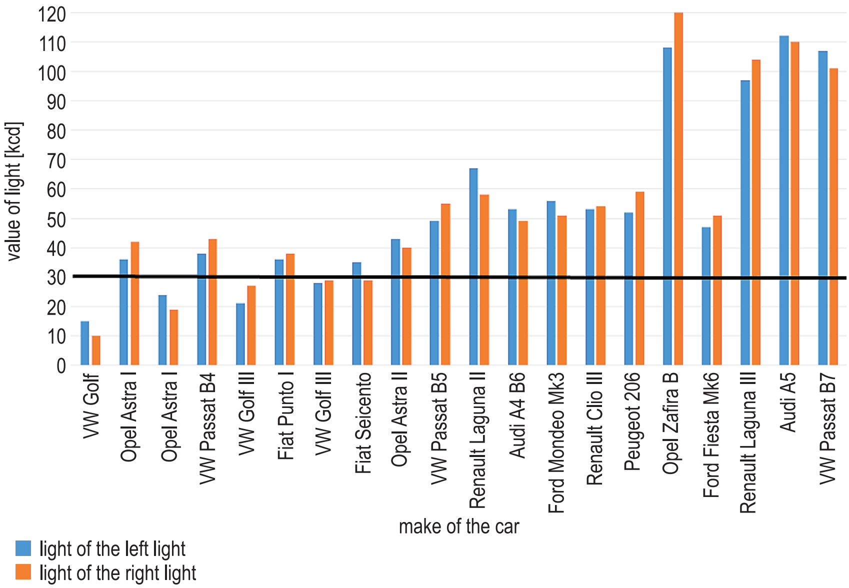

Fig. 5. Light of left and right light

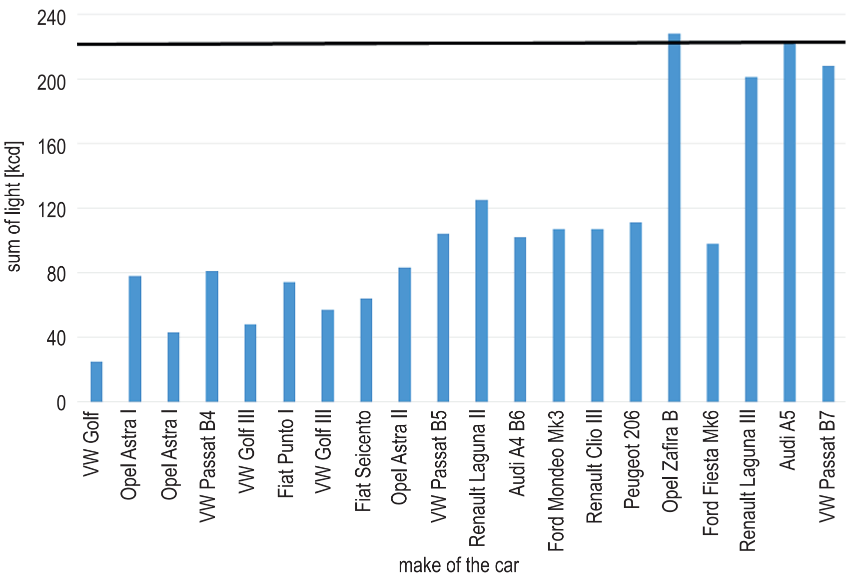

Fig. 6. Total light of lights

The use of new technologies improves visibility on roads, which is especially important in the hours between sunset and dawn. In the diagnostics of vehicles, the importance of examining the technical condition of their lighting is becoming increasingly important, which is why newer and more technologically advanced devices for its testing are being created.

From the research carried out, as well as the statistical data received from the police service, it is clear that most drivers care about the technical condition of the lighting in their vehicles. However, there are significant differences in vehicles in which different technologies are used. The best results of tests are characterised by modern cars equipped with headlamps with discharge lamps.

Characteristics of tires

Tires are another major vehicle component affecting road safety. For this purpose, the tires were tested on public transport buses in Piła, as well as in driving training trucks.

Tires are one of the most important parts of a bus and form part of the vehicle's wheel. One of the elements of the tire is the tread, i.e. the outer part in contact with the road. Depending on what the tire is to be used for and under what conditions it will be used, manufacturers choose the appropriate ridge, shape and hardness of the rubber. The tread pattern is the shape of the grooves, which are designed to drain water so that there is no aquaplaning, i.e. the formation of a thin layer of water between the tire's contact point and the surface on which it rolls. With excessively worn tires, this phenomenon is very common as the tread depth does not allow water to drain away, which results in skidding.

The next element of the tire is the carcass or the bearing part of the tire. It is made of cord, which is connected to the foot. It forms the skeleton of the tire. It is made of several layers of threads arranged at different angles, depending on the type of tire and manufacturer (GORZELANCZYK 2017).

Characteristics of the enterprise MZK PIŁA

The history of Piła urban transport dates back to the 1920s when the first three lines operated. During World War II, the city was so damaged that it was not reopened until July 1, 1957. By the decision of the Provincial National Council in Poznań, the Municipal Transport Plant was established at the Municipal Enterprise of Economy in Piła. Initially, it was located at 10 Kujawska Street. Currently, it is located at 4 Łączna Street (MZK Piła sp. z o.o. 2018).

On December 29, 2000, Miejski Zakład Komunikacji Limited Liability Company in Piła was officially formed as a result of the transformation. At that time, apart from the old rolling stock, the company already had 2 new Neoplan N4009 buses and 8 Neoplan N4016 buses.

There are currently 24 bus lines in Piła. Below is a diagram of the routes. At designated times and seasons they are shortened or extended based on several years of research.

The public transport operator in the analysed city is the Municipal Department of Transport in Pila (MZK). MZK has 47 buses, most of which are low-loader to improve comfort. The brands of used buses include: Jelcz, Neoplan, Solaris and Mercedes (MZK Piła sp. z o.o. 2018).

Tire testing on public transport buses

Tire testing was carried out by measuring the tread height in bus tires in MZK, using an analogue calliper with a depth gauge (PACZYNSKI 2003). This method ensures that correct measurements are made at the level of workshop accuracy. The analogue calliper used for measurements has a measurement accuracy of up to 0.05 mm.

Tread measurements were made in the middle of the tread width. These measurements were made three times for each tire with a 120° shift, which is schematically shown in Figure 7. This allowed measurements to be made at various locations around the circumference of the tires. In this way, it is possible to determine whether the tire has the required tread height or no local wear or wear that disqualifies it from continuing use.

Measurements were made starting from the tire on the driver's side. The next measurements were made in a clockwise direction. The unified measurement process has helped to avoid unnecessary errors in the recording and affiliation of measurement from one particular tire to another (Fig. 8).

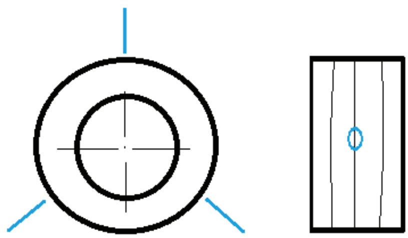

Fig. 7. Places where tread height measurements are made: blue lines characterize the place of measurement at 120°

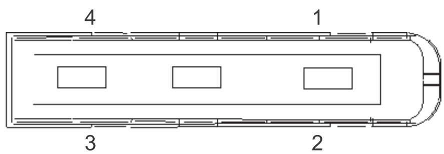

Fig. 8. The order of measurements

Every time the tread height was measured on the bus, the meter reading was recorded along with the date of measurement. This allowed the kilometres travelled and tread wear in the analysed period to be analysed.

The tests covered a four-month period of bus operation in urban traffic conditions. The first measurement was made to determine the output data. The second measurement of the tire tread on MZK buses was made after two months, and the third (last) measurement was made after the fourth month from the beginning of the measurements. The research was carried out on 16 randomly selected buses that are equipped with MZK. The list of selected buses is presented in Table 4.

Table 5 and Figure 9 summarize the average tread height of the first, second, third and fourth wheel after the last measurement. The minimum permitted tread height on the buses in question should be 1.6 mm.

Table 4

List of selected MZK Piła buses for tire wear tests

Bus brand	Bus model	The number selected for testing	Quantity on stock MZK Piła	Bus length [m]
Solaris	Urbino 10	2	4	10
Neoplan	N4411	2	6	10
Neoplan	N4016	4	7	12
Jelcz	120M	2	3	12
Mercedes-Benz	Citaro	3	7	12
Solaris	Urbino 12	3	20	12

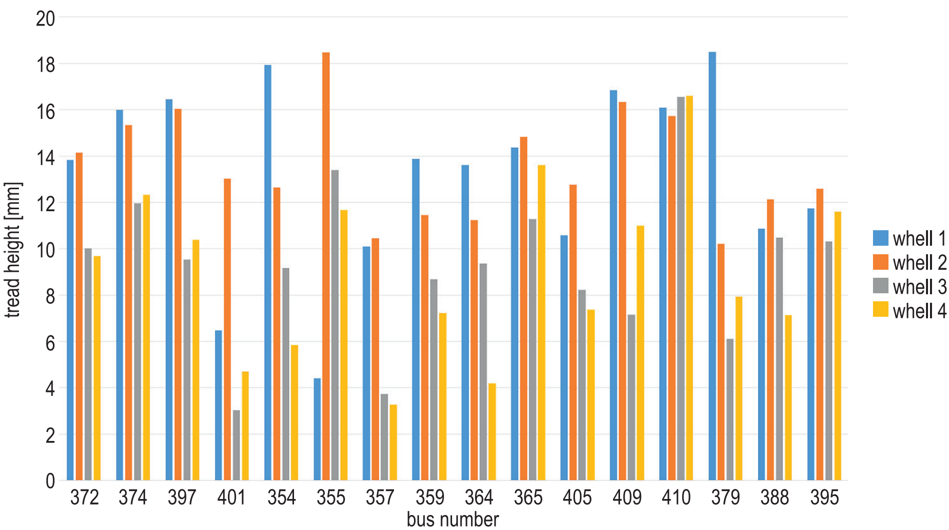

Fig. 9. Bus tread height MZK Piła

Table 5

Tread height in buses MZK Piła

Side number	The average tread height of the first wheel [mm]	The average tread height of the second wheel [mm]	Average tread height of third wheels [mm]	The average tread height of the fourth wheels [mm]
372	13.82	14.15	10.02	9.67
374	16.00	15.33	11.97	12.33
397	16.45	16.05	9.53	10.38
401	6.47	13.03	3.02	4.70
354	17.93	12.65	9.17	5.85
355	4.40	18.47	13.40	11.68
357	10.10	10.45	3.73	3.27
359	13.88	11.45	8.68	7.22
364	13.60	11.23	9.37	4.20
365	14.37	14.82	11.27	13.62
405	10.58	12.75	8.22	7.37
409	16.83	16.33	7.15	11.00
410	16.10	15.73	16.55	16.61
379	18.50	10.20	6.10	7.92
388	10.87	12.13	10.48	7.12
395	11.73	12.58	10.32	11.60
Arithmetic average	13.23	13.58	9.31	9.03

The number of kilometres travelled by buses is presented, compared to the average of all buses. Two Jelcz 120M buses (side numbers 364 and 365) whose drivers enjoyed a holiday break were removed from the list. The tests were conducted for six months of use. The presented data reflect, in a real way, a comparison of buses that are operated in a continuous manner without interruption. The table also shows the sum of kilometres travelled.

Due to the preservation of the actual image data for tire tread wear, buses that had tires replaced in a given wheel or wheels 3, 4 (due to the twin wheels) were excluded from the calculations (Tab. 7 and Fig. 9). These exclusions include buses and selected wheels with side numbers:

– Wheel 1: 364, 365, 379.
– Wheel 2: 364, 365, 355.
– Wheels 3: 364, 365, 372, 374, 388.
– Wheels 4: 364, 365, 372, 374.

Table 6

Bus mileage summary MZK Piła

Number	Side number	Number of kilometres after 1 measurement [km]	Number of kilometres after the 2nd measurement [km]	Sum kilometres [km]
1	372	8,882	7,910	16,792
2	374	7,289	8,401	15,690
3	397	8,408	1,816	10,224
4	401	8,630	9,198	17,828
5	354	6,988	5,460	12,448
6	355	7,677	6,875	14,552
7	357	11,308	6,925	18,233
8	359	8,403	3,174	11,577
9	405	11,996	11,742	23,738
10	409	13,654	15,326	28,980
11	410	8,659	8,007	16,666
12	379	12,339	13,895	26,234
13	388	12,400	14,027	26,427
14	395	11,224	13,234	24,458
Sum		137,857	125,990	263,847
Arithmetic average		9,847	8,999	18,846

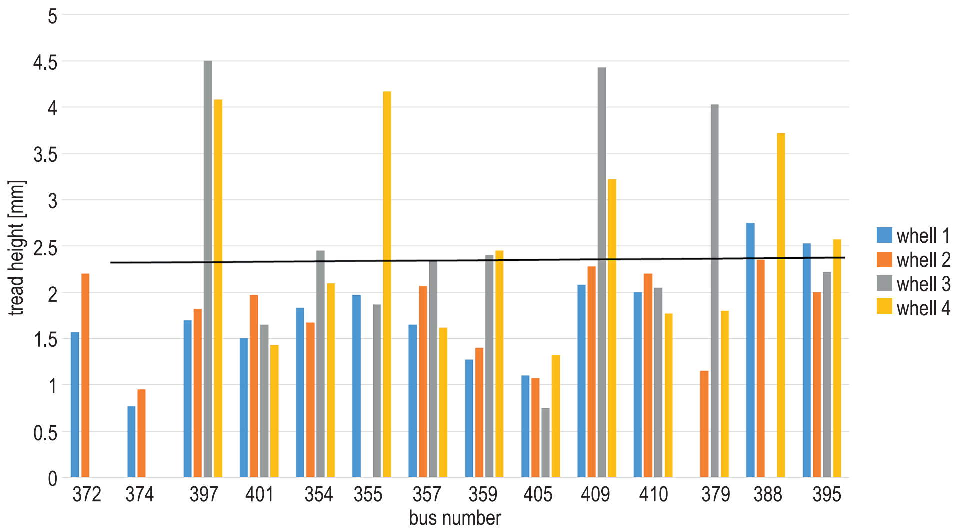

Fig. 10. Consumption of bus tires: minimum permissible tread depth

Table 7

Tread wear for bus tires

Number	Side number	The sum of wear – the front left wheel [mm]	Total tire wear – front right wheel [mm]	Sum of tire wear – rear right wheels [mm]	Sum of tire wear – rear left wheels [mm]
1	372	1.57	2.2	exchange	exchange
2	374	0.77	0.95	exchange	exchange
3	397	1.7	1.82	4.5	4.08
4	401	1.5	1.97	1.65	1.43
5	354	1.83	1.67	2.45	2.1
6	355	1.97	exchange	1.87	4.17
7	357	1.65	2.07	2.35	1.62
8	359	1.27	1.4	2.4	2.45
9	364	exchange	exchange	exchange	exchange
10	365	exchange	exchange	exchange	exchange
11	405	1.1	1.07	0.75	1.32
12	409	2.08	2.28	4.43	3.22
13	410	2	2.2	2.05	1.77
14	379	exchange	1.15	4.03	1.8
15	388	2.75	2.35	exchange	3.72
16	395	2.53	2	2.22	2.57
Sum		22.72	23.13	28.70	30.25
Arithmetic average		1.75	1.78	2.61	2.52

There was a six-month gap between the first and the third measurement. The problem when planning the tests was the possibility of replacing the tires on the bus in which the tread height was tested. For the research to make sense, a larger number of buses were adopted at the beginning. In total, 16 buses from MZK were selected for testing. Two of them were excluded for the period of school holidays, while in five during the tests, one or two tires and sometimes four tires were replaced.

The research shows that the tires at the back of the buses wear one and a half times faster than the tires on the axles at the front of the vehicle. This is mainly due to frequent braking and acceleration, turning of the wheels during manoeuvring, bruising the sides with curbs and the implementation of courses with fully filled buses contributes to the intensification of tire wear. In addition, brushing against curbs causes a negative impact on the tire structure and shortens the service life, despite sufficient tread height.

Tests of tires in the truck

The subject of the research were tires mounted on two MAN trucks with trailers used by one of the driving schools in Piła. Below is the scope of the research carried out. Possible tire damage includes uneven or excessive tire wear or mechanical damage to the tires.

The measurement of tires includes an assessment of the technical condition of the tires (the nature of tread wear, depth of tread pattern, number, dimensions and the distribution of damage on the circumference of the tire).

When inspecting the wheels, special attention was paid to:

– compliance of used rims and tires with the requirements of the manufacturer of the given vehicle,
– tread depth,
– the nature of tread pattern wear,
– assessment of noise emission from the work of tires,
– checking the arrangement of tires and rims after assembly,
– checking for damage or deformation of rims,
– checking for the presence of foreign bodies in the tires,
– checking for mechanical damage (bulges, cracks, tire defects).

Tests on the condition of truck tires used for driving lessons consisted of measuring twenty-four tires at regular intervals, at the same points using an electronic calliper. The MAN TGL 12.240 + Trailer and MAN FH2000 + Trailer were used for the tests.

Fig. 11. MAN TGL 12.240 + trailer

MAN year of production 2009 – a vehicle used only for driving lessons. Trailer year of production 1996 – also used only for driving lessons. Both the car and the trailer were used unladen.

The first is: MAN year of production 2009. The vehicle was used only for driving lessons. This set also included a trailer from 1996 used only for driving lessons.

Fig. 12. MAN FH2000 + trailer

The tire tread height test was carried out at three points on the tire width, in the inner, middle and outer parts of the vehicle. The tests took place after every 40 hours of work of a given research object.

Fig. 13. Places of measurements

Figures 14-17 show the measurement results (mm) of the tread depth of individual tires. There were a total of 30 measurements, once a week, from August 30, 2014 to February 1, 2015 (it was each Sunday after the end of work). The starting point of the charts was set at 1.6 mm as the minimum tread height allowed for traffic. The exception is the chart showing the tread height of the MAN FH2000 trailer tires, due to the low tread height.

The research shows that in trucks used for driving lessons, tire wear is not uniform over their entire width. Tires wear out as follows:

1. With the front axles, the tires wear out in the shape of a trapezium – internal and external parts more than the middle. The effect on this way of wear is probably due to driving on the manoeuvring square, where the maximum turns are performed at a standstill almost every time during parking manoeuvres.

2. With the rear axles, the outer part of the right-hand outer tire is the most worn. This kind of wear is also caused by driving on the manoeuvring square (e.g. driving on a curve).

3. For trailers, almost 75% of the course is spent on the manoeuvring square where one of the most difficult tasks is driving in a lane forward and backward in an arc that requires turning to the right. Trainees practicing this manoeuvre mainly use the tire located on the front axle on the right outer side.

4. Additionally, the surface of the manoeuvring square used by the studied driving school is concrete, which wears tires much more than asphalt.

5. It is advisable to replace the front right tires, both inside and outside, with the MAN FH2000 car trailer, due to the tread height being too low. It was done immediately after the measurements.

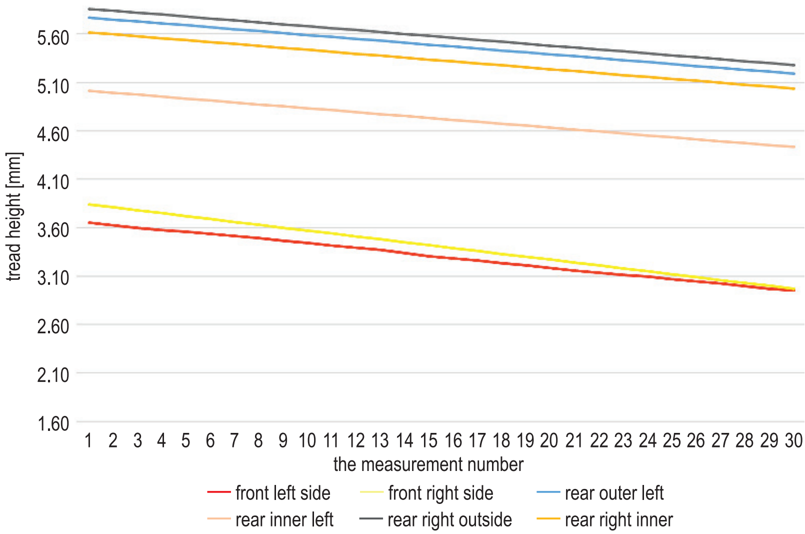

Fig. 14. Tire tread height MAN TGL 12.240

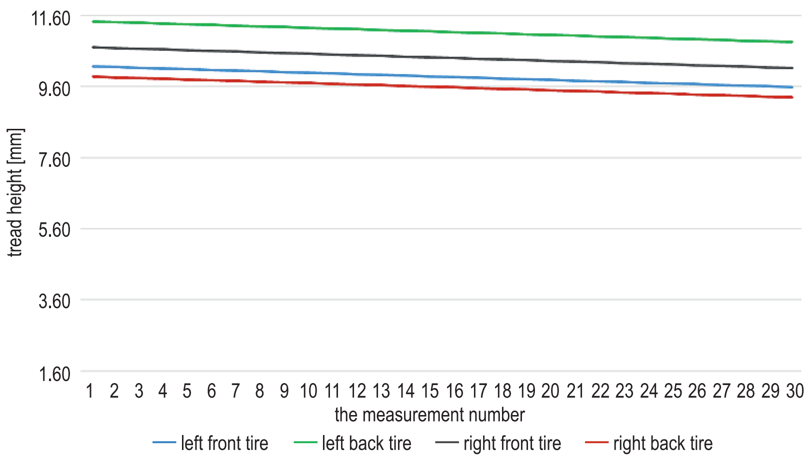

Fig. 15. Tire tread height of the car trailer MAN TGL 12.240

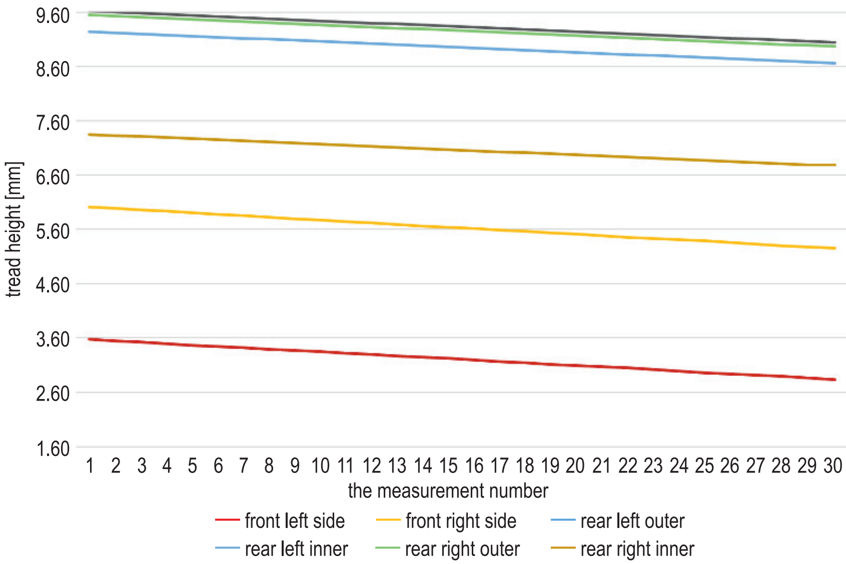

Fig. 16. Tire tread height MAN FH2000

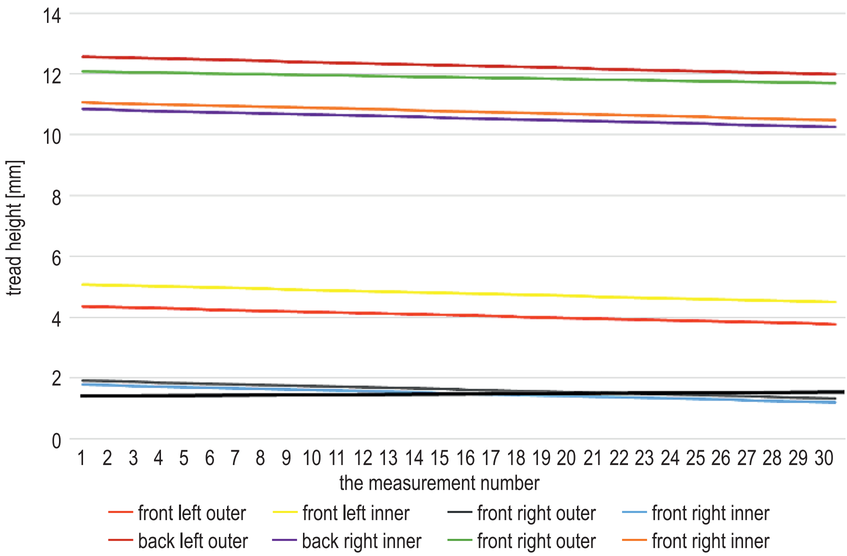

Fig. 17. Tire tread height of the car trailer MAN FH2000

Conclusion

Based on the tests, as well as the statistical data received from the Police Headquarters, it is clear that most drivers care about the technical condition of lighting in their vehicles and the truck tires used for learning to drive and buses are in good condition and this should not affect the safety of vehicles on the roads in Greater Poland and Poland.

The tested vehicles can travel on roads without affecting safety. However, according to police statistics, there are accidents resulting from deficiencies in lighting or disability every year. Although these are only a small fraction of the total number of accidents, however, with an appropriate diagnostic approach and subsequent repair of damaged components, these events could be avoided.

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Compliance with ethical standards
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