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TRAFFIC SAFETY IMPACT FACTORS RELATED TO CHANGING THE VEHICLES AMONG DRIVERS IN CLOSED SYSTEMS

ABSTRACT

Work-related road accidents are estimated to contribute to at least one quarter to over one third of all work-related deaths. Changing the vehicle has a major impact on traffic safety. Some studies have shown that drivers' knowledge and practical driver training can improve traffic safety when changing vehicles. The aim of this paper is to determine whether there is an impact of the vehicle change on traffic safety. The research was conducted at the location with cylinders, braking coefficient sensors, and brake pedal force detector, as well as with ten different passenger car brands and types. At the time of the research, all cars were registered and used daily in traffic. Prior to the research, the precision of the measuring instruments at the research site was checked. On the basis of the results, it can be concluded that there are two significant factors: the vehicle and the driver who needs to be trained before starting to drive a new vehicle. When changing the vehicle brand and type within the company, it is necessary to conduct systemic training of drivers which would include theoretical and practical parts and involve at least braking, driver distraction, and active and passive vehicle safety.

KEYWORDS

driver training; work related road deaths; braking force; brake pedal force; braking coefficient.

1. INTRODUCTION

When it comes to traffic safety, the most seriously worrying fact is that approximately 1.3 million people die each year in traffic accidents worldwide, while about 50 million suffer injuries [1, 2]. Another important fact is that numerous organisations make efforts to reduce the number of deaths and injuries in traffic accidents. In the previous period, a large number of organisations at different levels (international level, local level, as well as small companies) have attempted to decrease the number of deaths and injuries in traffic accidents to the best of their ability. In addition, the problem of employee deaths in traffic accidents has had an impact on their companies' business activities, so the companies make efforts to improve traffic safety management measures.

In Australia, the United States, and the EU countries in general, work-related road accidents are estimated to contribute to at least one quarter to over one third of all work-related deaths [3, 4]. For instance, according to Newnam et al. [5], more than 30% of the traffic volume in Australia can be attributed to work-related vehicles, while work-related road traffic crashes are the leading cause of occupational deaths, amounting to about 33% of all work-related fatalities [6].

The significance of the workplace traffic safety is additionally highlighted by the fact that the ISO 39001 standard has been developed. ISO 39001 specifies requirements for a road traffic safety management system to enable an organisation that interacts with the road traffic system to reduce deaths and serious injuries related to road traffic crashes which it can influence [7]. In order to fulfil the aims and improve traffic safety from the local to the global level, workplace traffic safety management is of utmost importance. Workplace traffic safety management is changing its concept from the traditional one to the modern one. The traditional concept was directed at the individual driver, while the modern concept involves management at all levels and from all aspects.

Numerous authors have written about the complexity and importance of workplace traffic management safety [8–15]. So far a series of programs and recommendations have been developed with the aim of improving the knowledge and conscience of managers [10, 16, 17–20] or drivers [21–23] related to identifying traffic risks based on different impact factors – fatigue, stress, pressure for conducting a task in the given deadline, exceeding the speed limit, mobile phone use, and other indicators. In addition to the impact factors related to managers or drivers, vehicles also represent a significant element in workplace traffic safety management. Besides the vehicle's roadworthiness which has to be controlled and which is regulated by law, the change of the vehicle brand and type in the fleet is also extremely important.

Pardo-Ferreira et al. [24] showed the impact of the replacement of the vehicle operated by experienced drivers on traffic safety. In their study related to the replacement of vehicles by low-noise electric vehicles, they determined that there was a new risk type for pedestrians at low speeds. Some studies [25–27] have shown that drivers' knowledge increases with experience and that the in-vehicle systems must be adjusted to drivers. Rauh et al. [25] examined the impact of stress while using battery electric vehicles and concluded that practical driver training was required for reducing the stress caused by adapting to new vehicles and accepting new vehicles.

Based on the analysed previous experiences [24–27], it is concluded that the knowledge and experience of drivers regarding the vehicle they drive is extremely important for safe driving, as well as that when changing vehicles, drivers face stress that affects their driving. Drivers must be prepared to avoid negative consequences when changing vehicles. The first step is to determine the influencing factors on traffic safety when changing the vehicles that drivers drive. The aim of this paper is to determine whether there is an impact of the vehicle change on traffic safety with a focus on stopping distance.

If drivers do not know the basic characteristics of the driven vehicle's braking system (dependence of the braking force on the brake pedal force), they will not be able to predict the required braking intensity or the length of the stopping distance. In some borderline cases, they might create a sudden danger in the traffic flow by unnecessary forced braking (if they expect that a significantly greater force on the brake pedal should be applied for the planned stopping distance) or they might not be able to stop (if they expect that a significantly lower force on the brake pedal is required for the planned stopping distance). In order to enable drivers to easily predict braking in the driven vehicle, they must know the basic characteristics of the braking system of the vehicle they operate (the force applied on the brake pedal required for reaching the desired braking force).

The research is based on the following hypotheses:

Hypothesis 1: Braking coefficient values of the same vehicle differ depending on the driver who is braking.

Hypothesis 2: Different vehicle brands and types require different brake pedal force in order to realise the maximum deceleration.

Hypothesis 3: The brake pedal force in the same vehicle depends on the human factor, i.e., the driver who is braking.

Hypothesis 4: Professional drivers operating different vehicle brands and types realise different braking coefficients.

2. METHODOLOGY

2.1 Procedure and design

The research was conducted at the location with cylinders, braking coefficient sensors and brake pedal force detector, as well as ten different passenger car brands and types. At the time of the research, all cars were registered and used daily in traffic. Prior to the research, the precision of the measuring instruments at the research site was checked. Five drivers were selected for operating the vehicles during the measurements. In the research, each driver drove each vehicle (for the sake of one measurement), and the results were obtained from the measuring instruments at the research site.

The braking force, brake pedal force and braking coefficient were measured in order to define the difference in the maximum braking force, the force applied on the brake pedal required for reaching the maximum braking force depending on the vehicle brand and type, as well as the dependence between the measured braking parameters and the driver who was braking.

The braking force is related to the stopping distance and the vehicle's stopping time, while the brake pedal force is significant for the driver who is braking since the driver needs to have the knowledge regarding the brake pedal force required for reaching the maximum or desired deceleration. If the driver is not familiar with the brake pedal force required for reaching the maximum or desired deceleration, traffic safety in the traffic flow might be endangered.

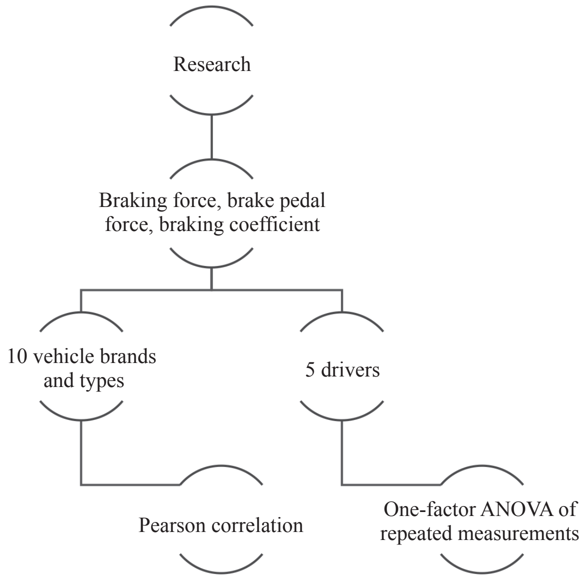

Figure 1 – Research methodology

2.2 Statistical analysis

The survey data were analysed using the Statistical Package for the Social Sciences (SPSS). Continuous variables were presented using mean and standard deviation (SD) and range. Categorical variables were presented using frequencies and percentages.

One-factor analysis of variance of repeated measurements (ANOVA) was used for comparing the values of repeated measurements during the experiment including ten different vehicle brands and types and five drivers for the following variables:
- braking force;
- brake pedal force;
- braking coefficient.

ANOVA provides the answer to the question whether there is a difference between the results measured for five drivers for each of the stated parameters.

After it was determined whether there were differences in the parameter values depending on the driver who was braking, the Pearson linear correlation was used to examine the strength and direction of the linear correlation between the braking coefficient and other analysed parameters: braking force, brake pedal force, as well as the vehicle brand and type.

The Pearson linear correlation provides an answer to the question whether there is a correlation between the braking coefficient value and braking force/brake pedal force and the vehicle. The values were analysed for each driver separately.

3. RESULTS

3.1 Braking force

For the 10 selected vehicles, five examinations of the braking force on all four wheels were conducted. The mean and standard deviation for each measurement are presented in *Table 1*. The results

Table 1 – Mean and standard deviation for the braking force

Driver	Front				Rear			
	Left		Right		Left		Right	
	M	SD	M	SD	M	SD	M	SD
1	3361	633	3300	554	2275	430	2290	543
2	3136	416	2865	354	2256	502	2149	520
3	3028	440	2877	398	2193	514	2152	544
4	2580	460	2477	343	2080	369	2058	437
5	3061	492	2784	492	2233	427	2142	501

Table 2 – One-factor ANOVA of repeated measurements for the braking force

	Left				Right			
	Wilks' Lambda	Sig.	Partial Eta Squared	Pairwise Comparisons	Wilks' Lambda	Sig.	Partial Eta Squared	Pairwise Comparisons
Front axle	0.063	0.001	0.937	1–4 2–5	0.087	0.002	0.913	1–4 1–5 2–4 3–4
Rear axle	0.220	0.036	0.780	All	0.254	0.053	0.746	1–2 1–3 1–5

show that the braking force on each wheel depends on the driver. In order to determine the statistical significance of the defined differences, one-factor ANOVA of repeated measurements for the braking force for each wheel was carried out. The ANOVA results show that there is a statistically significant difference in the braking force values depending on the driver for all four wheels (*Table 2*). Partial Eta Squared indicates that there is a very strong impact on all four wheels, i.e., that there is a great impact of the driver on the realised braking force for all ten vehicle types and brands.

3.2 Brake pedal force

The brake pedal force was measured while estimating the braking force on the front and rear axle. *Table 3* shows the mean and standard deviation for this parameter depending on the driver. The analysis of descriptive statistics (mean and standard deviation) showed that there were differences in the brake pedal force on both the front and rear axle depending on the driver. The lowest force was realised by the fourth driver, while the greatest was obtained by the first driver.

In order to determine the significance of the difference, one-factor ANOVA of repeated measurements for the brake pedal force was conducted. The ANOVA results show that there is a statistically significant difference in the values of the brake pedal force depending on the driver, both on the front axle (Wilks' Lambda=0.167, $p<0.05$, Partial Eta Squared=0.833, which indicates a high impact strength), and on the rear axle (Wilks' Lambda=0.133, $p<0.05$, Partial Eta Squared=0.887, which indicates a high impact strength). The data analysis showed that there was a great impact of drivers on the brake pedal force both on the front and rear axle.

After it was determined whether there was a large impact of the driver on the value of the brake pedal force, the Pearson linear correlation was applied to examine whether the vehicle brand and type had an impact on the value of the brake pedal force. The results of the Pearson linear correlation indicate that there is a statistically significant difference in the values of the brake pedal force (on both axles) depending on the vehicle brand and type, and that the impact strength is high (*Table 5*).

Table 3 – Mean and standard deviation for the maximum brake pedal force on the front and rear axles

Driver	Front axle		Rear axle	
	M	SD	M	SD
1	7.3	2.7	13.0	3.0
2	5.8	1.3	12.9	3.3
3	6.0	1.4	13.3	3.4
4	4.3	1.9	11.5	4.0
5	6.7	2.1	15.2	4.1

Table 4 – One-factor ANOVA of repeated measurements for the brake pedal force and braking coefficient

Parameter	Wilks' Lambda	Sig.	Partial Eta Squared	Pairwise Comparisons
Brake pedal force – front axle	0.167	0.016	0.833	1–4 4–5
Brake pedal force – rear axle	0.113	0.005	0.887	2–5 4-5
Braking coefficient	0.093	0.003	0.907	1–3 1–4 1–5 2–4

Table 5 – Pearson correlation coefficients between the measured values of the brake pedal force depending on the vehicle

		V1		V2		V3		V4		V5		V6		V7		V8		V9		V10	
		Front	Rear	Front	Rear	Front	Rear	Front	Rear	Front	Rear	Front	Rear	Front	Rear	Front	Rear	Front	Rear	Front	Rear
V1	Pearson Correlation	1	1	.602	.752	-.370	.752	.796	.875	.895*	-.425	.817	.375	.301	.973**	.857	.325	.675	.569	.891*	.583
	Sig. (2-tailed)			.283	.143	.540	.143	.108	.052	.040	.475	.091	.534	.622	.005	.064	.593	.211	.317	.042	.302
	N	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
V2	Pearson Correlation	.602	.752	1	1	.519	.789	.210	.729	.828	.008	.698	.790	-.196	.864	.861	.326	.105	.758	.739	.894*
	Sig. (2-tailed)	.283	.143			.370	.113	.734	.162	.083	.990	.190	.112	.753	.059	.061	.592	.867	.138	.154	.041
	N	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
V3	Pearson Correlation	-.370	.752	.519	.789	1	1	-.617	.561	.005	-.528	-.082	.263	-.581	.746	.079	-.242	-.620	.962**	-.100	.478
	Sig. (2-tailed)	.540	.143	.370	.113			.268	.326	.994	.360	.896	.670	.304	.147	.900	.695	.264	.009	.873	.415
	N	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
V4	Pearson Correlation	.796	.875	.210	.729	-.617	.561	1	1	.702	-.015	.692	.470	.684	.867	.678	.547	.959**	.440	.810	.769
	Sig. (2-tailed)	.108	.052	.734	.162	.268	.326			.186	.981	.195	.424	.203	.057	.209	.341	.010	.458	.096	.128
	N	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
V5	Pearson Correlation	.895*	-.425	.828	.008	.005	-.528	.702	-.015	1	1	.822	.503	.144	-.275	.986**	.570	.565	-.386	.981**	.415
	Sig. (2-tailed)	.040	.475	.083	.990	.994	.360	.186	.981			.087	.388	.818	.654	.002	.315	.321	.520	.003	.487
	N	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
V6	Pearson Correlation	.817	.375	.698	.790	-.082	.263	.692	.470	.822	.503	1	1	.540	.576	.885*	.672	.713	.266	.856	.886*
	Sig. (2-tailed)	.091	.534	.190	.112	.896	.670	.195	.424	.087	.388			.347	.309	.046	.214	.177	.666	.064	.046
	N	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
V7	Pearson Correlation	.301	.973**	-.196	.864	-.581	.746	.684	.867	.144	-.275	.540	.576	1	1	.215	.425	.860	.587	.314	.722
	Sig. (2-tailed)	.622	.005	.753	.059	.304	.147	.203	.057	.818	.654	.347	.309			.729	.476	.062	.298	.607	.169
	N	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
V8	Pearson Correlation	.857	.325	.861	.326	.079	-.242	.678	.547	.986**	.570	.885*	.672	.215	.425	1	1	.580	-.349	.977**	.614
	Sig. (2-tailed)	.064	.593	.061	.592	.900	.695	.209	.341	.002	.315	.046	.214	.729	.476			.305	.565	.004	.270
	N	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
V9	Pearson Correlation	.675	.569	.105	.758	-.620	.962**	.959**	.440	.565	-.386	.713	.266	.860	.587	.580	-.349	1	1	.704	.481
	Sig. (2-tailed)	.211	.317	.867	.138	.264	.009	.010	.458	.321	.520	.177	.666	.062	.298	.305	.565			.184	.412
	N	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
V10	Pearson Correlation	.891*	.583	.739	.894*	-.100	.478	.810	.769	.981**	.415	.856	.886*	.314	.722	.977**	.614	.704	.481	1	1
	Sig. (2-tailed)	.042	.302	.154	.041	.873	.415	.096	.128	.003	.487	.064	.046	.607	.169	.004	.270	.184	.412		
	N	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

** Correlation is significant at the 0.05 level (2-tailed)*
*** Correlation is significant at the 0.01 level (2-tailed)*

3.3 Braking coefficient

In the next part of the research, we analysed whether the braking coefficient value depended on the driver who was braking and whether it depended on the vehicle brand and type. The obtained braking coefficient values are presented graphically (*Figure 2*). The x-axis represents different vehicle brands and types (from 1 to 10), while the y-axis represents the values of the measured braking coefficient. It can be seen in the diagram that there are differences in the braking coefficient values depending on the driver and depending on the vehicle brand and type.

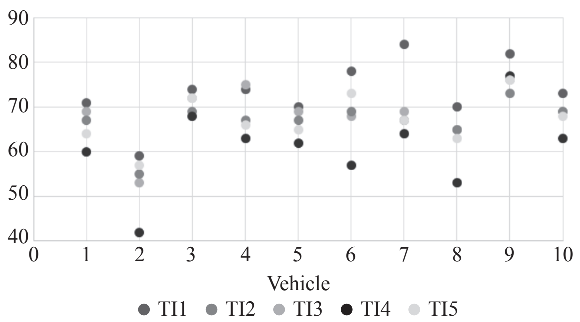

Figure 2 – The value of the braking coefficient for each tested vehicle depending on the driver

After the differences in the braking coefficient values were determined, one-factor ANOVA of repeated measurements of the braking coefficient was applied to determine whether this difference was statistically significant. The results show that there is a statistically significant difference in the braking coefficient value depending on the driver and that the impact strength is high (Wilks' Lambda=0.093, $p<0.05$, Partial Eta Squared=0.907). Therefore, there is a statistically significant difference in the realised braking coefficient values depending on the driver who was braking.

The Pearson linear correlation was applied to examine the impact of the vehicle brand and type on the braking coefficient value. The Pearson correlation coefficients between the measured braking coefficient values for ten vehicle brands and types show that there is a statistically significant difference in the braking coefficient values depending on the vehicle brand and type and that the impact strength is high (*Table 6*).

4. DISCUSSION

On the basis of the previous experiences related to analysing traffic accidents with fatalities (including new vehicles of different companies), it was perceived that drivers highlighted that their vehicle had not been braking at the time of the accident. This was not an acceptable explanation having in mind the result of the motor vehicle test following the accident. The detailed analysis of individual cases highlighted that in the previous five years these drivers had operated the vehicles requiring more than two times lower brake pedal force for reaching the maximum braking force, as well as that they had operated the new vehicles for less than a month prior to the traffic accident. During the initial period of driving new vehicles, other drivers in the companies also underlined the problem related to the weaker braking of new vehicles. In order to inspect the differences in the brake pedal force required for reaching the desired deceleration, we selected ten different vehicle brands and types and five drivers. Numerous authors point out the importance of determining influential factors and applying educational measures based on research results [28–30].

In this paper, the braking force, brake pedal force, and braking coefficient were measured, in order to determine the difference between maximum braking force, required brake pedal force to achieve maximum braking force depending on the make and type of vehicle, as well as the dependence of measured braking parameters and a driver who brakes.

Our study showed that the braking force, brake pedal force, and braking coefficient depended on the vehicle brand and type, as well as on the driver who was braking, which indicates that when changing the make and type of vehicle, drivers must be trained. If drivers do not know the basic characteristics of the driven vehicle’s braking system, they will not be able to predict the required braking intensity or the length of the stopping distance. This indicates that the drivers’ training after changing the vehicle brand and type is extremely significant for traffic safety. Similarly, Pardo-Ferreira [24] proved that training was extremely important when altering vehicle types. Vivoda et al. [28] found which parameters had an influence on traffic accidents. In the study conducted in 70 companies, they determined that there was a statistically significant relationship between traffic accidents and certain parameters, one of which is the provision of driver training. Other studies [29, 30] also showed that the in-vehicle driver feedback combined with coaching significantly reduced risky driving behaviours among those who drove for work.

Table 6 – Pearson correlation coefficients between the measured braking coefficient values depending on the vehicle

		V1	V2	V3	V4	V5	V6	V7	V8	V9	V10
V1	Pearson Correlation	1	.781	.755	.915*	.998**	.788	.772	.949*	.357	.947*
	Sig. (2-tailed)		.119	.140	.029	.000	.113	.126	.014	.555	.015
	N	5	5	5	5	5	5	5	5	5	5
V2	Pearson Correlation	.781	1	.783	.574	.766	.977**	.626	.936*	.209	.910*
	Sig. (2-tailed)	.119		.117	.312	.131	.004	.259	.019	.736	.032
	N	5	5	5	5	5	5	5	5	5	5
V3	Pearson Correlation	.755	.783	1	.778	.763	.866	.799	.799	.655	.827
	Sig. (2-tailed)	.140	.117		.121	.133	.058	.105	.105	.230	.084
	N	5	5	5	5	5	5	5	5	5	5
V4	Pearson Correlation	.915*	.574	.778	1	.936*	.607	.692	.784	.437	.786
	Sig. (2-tailed)	.029	.312	.121		.019	.278	.195	.116	.462	.115
	N	5	5	5	5	5	5	5	5	5	5
V5	Pearson Correlation	.998**	.766	.763	.936*	1	.771	.752	.938*	.348	.932*
	Sig. (2-tailed)	.000	.131	.133	.019		.127	.143	.018	.566	.021
	N	5	5	5	5	5	5	5	5	5	5
V6	Pearson Correlation	.788	.977**	.866	.607	.771	1	.759	.929*	.413	.934*
	Sig. (2-tailed)	.113	.004	.058	.278	.127		.137	.022	.490	.020
	N	5	5	5	5	5	5	5	5	5	5
V7	Pearson Correlation	.772	.626	.799	.692	.752	.759	1	.755	.832	.844
	Sig. (2-tailed)	.126	.259	.105	.195	.143	.137		.140	.081	.072
	N	5	5	5	5	5	5	5	5	5	5
V8	Pearson Correlation	.949*	.936*	.799	.784	.938*	.929*	.755	1	.308	.989**
	Sig. (2-tailed)	.014	.019	.105	.116	.018	.022	.140		.615	.001
	N	5	5	5	5	5	5	5	5	5	5
V9	Pearson Correlation	.357	.209	.655	.437	.348	.413	.832	.308	1	.436
	Sig. (2-tailed)	.555	.736	.230	.462	.566	.490	.081	.615		.463
	N	5	5	5	5	5	5	5	5	5	5
V10	Pearson Correlation	.947*	.910*	.827	.786	.932*	.934*	.844	.989**	.436	1
	Sig. (2-tailed)	.015	.032	.084	.115	.021	.020	.072	.001	.463	
	N	5	5	5	5	5	5	5	5	5	5

** Correlation is significant at the 0.05 level (2-tailed)*
*** Correlation is significant at the 0.01 level (2-tailed)*

The results of this study indicate that the systemic training of drivers in companies is required when changing the vehicle brand and type in order to help drivers understand the new vehicles' characteristics and use them for participating safely in traffic. The drivers' knowledge of the characteristics of new vehicles' braking systems would help reduce traffic accident number during the initial periods of driving new vehicles.

This study highlights the potential unreliability of court decisions regarding the drivers' guilt, having in mind the observed differences between the braking forces realised by different drivers under the same measuring conditions. When calculating the stopping distance, court proceedings use the braking forces measured during motor vehicle tests by drivers, which might differ significantly from the conditions at the time and place of the accident.

Within the field including braking, drivers must be trained to understand what changes can be expected when altering the vehicle brand and type; for example, what brake pedal force is needed to realise the desired deceleration for the vehicle they are starting to drive.

5. CONCLUSION

The aim of the presented study was to examine the factors affecting traffic safety when changing the vehicle brand and type, and to define the measures intended for vehicle users in order to ensure more efficient workplace traffic safety management.

Based on the results of the research we can conclude:

- there is a statistically significant difference in the values of the brake pedal force,
- braking coefficient and braking force depend on the vehicle brand and type,
- values of the brake pedal force, braking coefficient and braking force for the same vehicle differ statistically significantly depending on the driver who is braking,
- we found two traffic safety impact factors related to changing of the vehicles among drivers in closed systems: the vehicle and the driver.

Four hypotheses were defined and all of them were proven:

Hypothesis 1: Braking coefficient values of the same vehicle differ depending on the driver who is braking. The research determined that the realised values of the braking coefficient on the same vehicle differed significantly depending on the driver.

Hypothesis 2: Different vehicle brands and types require different brake pedal force in order to realise the maximum deceleration. The results show that there is a statistically significant difference in the values of the brake pedal force (on both axles) depending on the vehicle brand and type, and that the impact strength is high.

Hypothesis 3: The brake pedal force in the same vehicle depends on the human factor, i.e., the driver who is braking. The data analysis showed that there was a high impact of the human factor (driver) on the value of the force applied on the brake pedal on both the front and rear axle.

Hypothesis 4: Professional drivers operating different vehicle brands and types realise different braking coefficients. The Pearson correlation coefficients between the measured values of the braking coefficient indicate that there is a statistically significant difference in the braking coefficient values depending on the vehicle brand and type, and that the impact strength is high.

On the basis of the results it can be concluded that there are two significant factors: the vehicle and the driver who needs to be trained before starting to drive a new vehicle. When changing the vehicle brand and type within the company, it is necessary to conduct systemic training of drivers which would include theoretical and practical parts and involve at least the fields of braking, driver distraction and active and passive vehicle safety.

Drivers are part of the human factor which has an impact on traffic safety by means of different elements. Some of the significant elements which were not considered in this study but can affect the analysed parameters are drivers' gender and age, as well as their driving experience. The limitation of this study is the fact that the research did not include female drivers, and that it did not analyse the drivers' age or driving experience.

Future research should include a larger sample of drivers and the vehicles they use at work. In addition, studies should analyse other impacts of the human factor (gender, age, driving experience, etc.) on the braking force, brake pedal force, and braking coefficient values. Furthermore, future research should be directed at the development, implementation, and monitoring of workplace driver training, as well as understanding the effects of the applied measures.

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UTICAJNI FAKTORI PRI PROMENI VOZILA KOD VOZAČA U ZATVORENIM SISTEMIMA SA ASPEKTA BEZBEDNOSTI SAOBRAĆAJA

REZIME

Procenjuje se da saobraćajne nezgode u vezi sa radom doprinose najmanje jednoj četvrtini do preko jedne trećine svih poginulih na radu. Promena vozila ima veliki uticaj na bezbednost saobraćaja. Neka istraživanja su pokazala da znanje i praktična obuka vozača mogu poboljšati bezbednost saobraćaja pri promeni vozila. Cilj ovog rada je da se utvrdi da li postoji uticaj promene vozila na bezbednost saobraćaja. Istraživanje je sprovedeno u servisu sa cilindrima, senzorima za merenje *koeficijenta kočenja i detektorom sile na pedali kočnice. Istraživanjem je obuhvaćeno deset različitih marki i tipova putničkih automobila. U trenutku istraživanja svi automobili su registrovani i svakodnevno korišćeni u saobraćaju. Pre istraživanja proverena je preciznost mernih instrumenata na mestu istraživanja. Na osnovu rezultata može se zaključiti da postoje dva značajna faktora: vozilo i vozač kojeg je potrebno obučiti pre nego što počne da upravlja novim vozilom. Prilikom promene marke i tipa vozila u okviru kompanije potrebno je sprovesti sistemsku obuku vozača koja bi obuhvatala teorijske i praktične delove i koja bi obuhvatala najmanje sledeće oblasti: kočenje, ometanje vozača i aktivnu i pasivnu bezbednost vozila.*

KLJUČNE REČI

obuka vozača; poginuli radnici u saobraćajnim nezgodama; sila kočenja; sila na pedali kočnice; kočni koeficijent.

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