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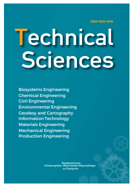

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EVALUATION OF FACTORS AFFECTING THE NUMBER OF TRAFFIC ACCIDENTS

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A b s t r a c t

Year after year, the number of traffic accidents is decreasing. This value in recent years has been influenced mainly by the pandemic. However, the value is still very high. For this reason, every effort should be made to reduce the number of traffic accidents. The purpose of this article is to evaluate the factors affecting the number of traffic accidents according to weather conditions. For this purpose, a random selection was made of 10 measurement points in Poland, for which the following parameters were analyzed: traffic volume on the road and the number of accidents at the analyzed points. Based on the study, it can be concluded that the number of road accidents is most influenced by factors such as good weather conditions, as well as cloudy and rainy days. In addition, based on the study, the weights of factors affecting the number of traffic accidents are as follows: good weather 0.5406; rain 0.1529; cloudy 0, 3065.

Introduction

Road accidents are a serious social problem in every country. The causes of road accidents depend on various factors, such as weather conditions, alcohol, speed, etc. According to the World Health Organization (*Global status report*

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on road safety… 2024), more than 1.19 million people die in road accidents each year, and millions more suffer serious injuries and long-term negative health consequences. Accidents also lead to economic losses. The number of road accidents worldwide is decreasing year by year. This value in recent years has been influenced mainly by the pandemic. However, the value is still very high (Fig. 1). Every day in Poland there are an average of 62 road accidents, in which 6 people are killed and 72 injured. These accidents are associated with increased medical costs, the need for repairs to vehicles and road infrastructure, negative impacts on the environment, such as through leakage of operating fluids. For this reason, all measures should be taken to prevent traffic accidents in order to reduce their number. One such measure is to learn about the factors that affect the number of traffic accidents by eliminating them in the future (*Road safety statistics in the EU* 2024, *Wypadki drogowe*… 2024). The article consists of Literature review, Materials and methods and Results, and concludes with a summary.

Literature review

ZHAI et al. (2019) and HOLLAND et al. (2006) in their study showed that pedestrians are most at risk of traffic accidents because they are less protected than vehicle passengers. In addition, they suffer serious injuries among all traffic participants. Other studies have shown that factors such as alcohol consumption, age or gender of drivers, lighting, road condition, pedestrian behavior, accident scene, vehicle, speed and adverse weather affect pedestrian injury rates (FAVARÒ et al. 2017, AMINI et al. 2019, HAFEEZ et al. 2023, MESQUITELA et al. 2022). Adverse weather conditions and inadequate lighting, especially of pedestrian crossings, often lead to more serious injuries on the roads. However, this depends on the area studied. For example, an article MASELLO et al. (2022) showed that in most cases, weather conditions have little effect on traffic accidents. We can also encounter this research topic in the paper BECKER et al. (2020), in which the authors introduced a model of the

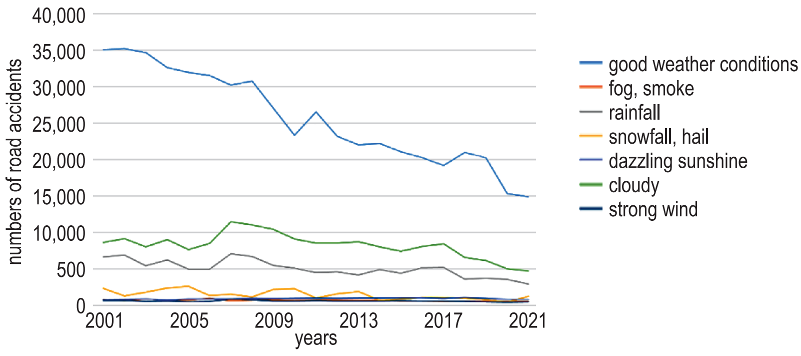

Fig. 1. Number of road accidents in Poland according to weather conditions from 2001 to 2021
Source: based on *Wypadki drogowe*… (2023).

probability of traffic accidents depending on the time of day and the current weather. The relationship between weather conditions and traffic accidents has also been analyzed in works (MILLS et al. 2019, KARLAFTIS, YANNIS 2010, SCOTT 1986).

Numerous publications have addressed the Road traffic safety issue. Road traffic risk indicators were discovered by PAŁEGA (2017). Provincial-level RTS components were analyzed by WACHNICKA (2012). RAFALSKI (2012) examined RTS in Poland, focusing on big trucks in particular. Moreover, publications KLEPACKI, KOPER (2018) addressed the causes of traffic accidents. GĄDEK-HAWLENA and LOS (2018) examined the many risky behaviors shown by experienced drivers and evaluated the effects of remedies implemented in large automobiles on rear-end collisions. Publications ORŁOWSKI, WSZEBOROWSKI (2020), YANNIS, PAPADIMITRIOU (2021), WOJTAS, SZKODA (2018), ZBYSZYŃSKI (2017) and books BĄK-GAJDA BĄK (2010), WICHER (2012) also include general information about Road traffic safety.

In addition to reducing traffic accidents, prevailing weather conditions also affect traffic volumes and driver behavior, such as their reaction time to the prevailing traffic situation (HAYAT et al. 2013, FRIDSTRØM et al. 1995, HERMANS et al. 2006). In his work, EISENBERG (2004) studied the relationship between precipitation and traffic accidents in the United States, where he showed that more traffic accidents occur during negative weather conditions. A similar topic was addressed by BRODSKY and HAKKERT (1988), who found that accident rates increased by 100% during rainy conditions, while in Denmark the increase was negligible at around 10%. FRIDSTRØM et al. (1995), on the other hand, found that in Norway and Sweden, rainfall had no effect on the change in traffic accidents. On the other hand, in Poland, the highest number of traffic accidents occurs during good weather conditions. Moreover, as the temperature increases and during good weather conditions, the number of road accidents increases (*Wypadki drogowe*… 2023, HERMANS et al. 2006, SABIR 2011).

For the purposes of the work, it was assumed that (KRZYCZKOWSKA 2019):

- good weather conditions are:
  - air temperature > 3°C,
  - no precipitation,
  - wind < 5.5 m/s,
  - visibility > 10 km,
  - pressure difference over the day < 8 hPa;
- bad weather conditions (if one of the following factors is met) are:
  - slippery pavement (temperature < 3°C and occurrence of precipitation),
  - heavy rain (temperature > 0°C, precipitation > 3 mm),
  - snowstorm (temperature < 0°C, precipitation > 3 mm),
  - strong wind (wind > 10 ms/s),
  - dense fog (visibility < 300 m).

In their study, MASELLO et al. (2022) presented a different approach to analyzing traffic accidents. They studied the impact of driver assistance systems on improving road safety. The study was conducted in a variety of traffic situations under different weather conditions.

Weather conditions also affect the relationship between three elements of traffic (the so-called safety triangle), namely: the human being (and his psychomotor state, fatigue, stress, concentration), the vehicle (its technical condition, traffic speed, load) and the environment (road infrastructure).

Based on the presented analysis of the literature on the probability of a traffic accident depending on the prevailing weather conditions, various conclusions can be drawn. For this reason, the article determines the weights of the influence of selected weather factors on the probability of a traffic accident. For this purpose, a random selection of 10 measurement points in Poland was made, for which the following data were analyzed: traffic volume and the number of accidents depending on the weather conditions under which the accident occurred.

Materials and methods

In order to answer the stated goal, the article adopts the following algorithm for proceeding:

1. Randomly selected measuring points.
2. The following parameters were determined for the aforementioned points:
   a. the markings of the road on which the measuring point is located;
   b. traffic speed at the analyzed point;
   c. average annual vehicle traffic volumes for the years: 2007, 2010, 2015, 2021.
3. Determined the total number of traffic accidents depending on the prevailing weather conditions during the incident at the analyzed points from the years: 2007, 2010, 2015, 2021.
4. The number of traffic accidents depending on the volume of motor vehicles passing through the analyzed points in the year, as well as the number of traffic accidents that occurred at these points depending on the prevailing weather conditions, was recalculated. For this purpose, the total number of vehicles passing through the given measurement point was determined, and the % share of the analyzed measurement point was determined taking into account the traffic volume.
5. The total number of accidents at the analyzed points in 2007, 2010, 2015 and 2021 was determined.
6. The number of traffic accidents was recalculated taking into account the % share of traffic volume.
7. The values of the weights of the number of accidents in the analyzed points for the prevailing weather conditions were determined.

Selection and location of sites Acronyms

In order to determine the weights of the impact of selected atmospheric factors on the probability of a traffic accident, a random selection of 10 points in Poland was made. For these points, the following data were analyzed: traffic volume and number of accidents depending on the weather conditions prevailing during the

Table 1

Coordinates of measurement points

No.	Measurement Point	Road signage	Longitude of the point	Latitude of the point
Point 1	Piła – Wojska Polskiego	DW 179	16.732301	53.151436
Point 2	Piła – Poznańska	DK 11	16.752994	53.126343
Point 3	Piła – Al. Piastów	DK 11	16.737967	53.150107
Point 4	Piła – Niepodległości	DK 11	16.737933	53.163308
Point 5	Manowo	DK 11	16.287356	54.132729
Point 6	Mścice	DK 11	16.080240	54.219427
Point 7	Sianów	DK 6	16.302716	54.230299
Point 8	Strzekęcino	DW 167	16.165485	54.099837
Point 9	Sucha Koszalińska	DW 203	16.266325	54.260465
Point 10	Szczeglino	DW 206	16.384696	54.180654

Source: based on data Generalny Pomiar Ruchu (2023).

Fig. 2. Measurement points within the city of Pila (explanations in the text)
Source: based on Google Maps, modified

accident (Figs. 2, 3). The points were selected on both national (DK 6 and DK11) and provincial (DW167, DW179, DW 203 and DW206) roads. In all assumed measurement points, the permissible speed of vehicle traffic was 50 km/h.

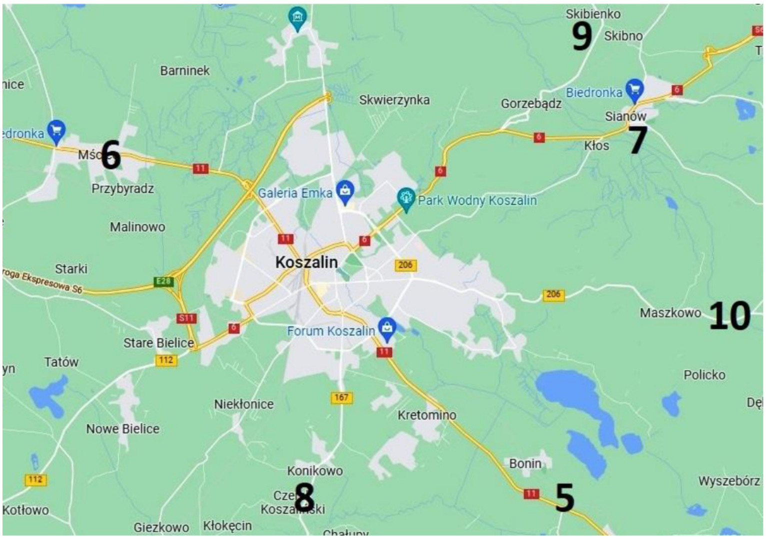

Fig. 3. Measurement points in Koszalin County (explanations in the text)
Source: based on Google Maps, modified

Weather conditions Acronyms

The probability of a traffic accident depends on a number of factors affecting this value. The article evaluates the impact of traffic volume at the analyzed points and the following atmospheric conditions under which a traffic accident occurred:

– good weather conditions
– rainfall,
– snowfall,
– strong wind,
– cloudy,
– blinding sun,
– fog.

Due to the lack of annual data, from the General Directorate of National Roads and Highways (GDDiK) on average annual traffic volumes, data from the following years were used: 2007, 2010, 2015 and 2021, as shown in (Tab. 2). In addition, the total number of traffic accidents according to weather conditions at the analyzed points from the day are presented for the selected points: 2007, 2010, 2015 and 2021 (Tab. 3). Average daily annual traffic (SDRR) was defined as the number of motor vehicles passing through a given measurement point in 24 consecutive hours, on average in one year.

Table 2

Vehicle traffic intensity at analyzed measurement points

Points	Average annual vehicle traffic volume [vehicles/day]			
	2007	2010	2015	2021
Point 1	6,377	6,377	5,227	7,559
Point 2	17,080	17,080	15,555	16,566
Point 3	9,971	9,971	8,384	8,433
Point 4	10,418	10,418	9,091	9,399
Point 5	8,973	9,615	9,865	12,398
Point 6	15,099	15,991	15,675	14,208
Point 7	10,613	11,375	13,240	14,740
Point 8	2,796	2,796	2,876	3,213
Point 9	3,584	3,584	4,161	5,886
Point 10	2,278	2,278	2,189	2,698

Source: based on data Generalny Pomiar Ruchu (2023).

Table 3

Total number of traffic accidents according to weather conditions at the analyzed points from the years: 2007, 2010, 2015 and 2021

Points	Total number of traffic accidents	Number of accidents during						
		good weather weather conditions	rain	fogs	strong wind	on a cloudy day	dazzling sun	snowfall
Point 1	277	142	40	2	0	77	5	11
Point 2	203	112	23	0	2	55	8	3
Point 3	152	78	23	1	1	38	4	7
Point 4	106	55	22	0	1	22	4	2
Point 5	35	21	2	0	0	11	0	1
Point 6	94	59	8	0	0	25	1	1
Point 7	133	64	12	1	1	50	3	2
Point 8	8	0	3	0	0	5	0	0
Point 9	12	6	0	0	0	4	1	1
Point 10	6	2	2	0	0	2	0	0

Source: based on *Wypadki drogowe…* (2023).

Taking into account traffic volume and weather conditions, a function describing the probability of a traffic accident was determined, which was assumed in the form:

$$\text{PWD} = f(a^{n1}) \cdot f(b^{n2}) \cdot f(c^{n3}) \cdot f(d^{n4}) \cdot f(e^{n5}) \cdot f(f^{n6}) \cdot f(g^{n7}) \quad (1)$$

where:

PWD – the likelihood of a traffic accident,
$f(a^{n1})$ – the likelihood of a traffic accident in good weather conditions,
$f(b^{n2})$ – the likelihood of a traffic accident during rainfall,
$f(c^{n3})$ – the likelihood of traffic accident during fog, smoke,
$f(d^{n4})$ – the likelihood of a traffic accident during high winds,
$f(e^{n5})$ – the likelihood of a traffic accident when it is cloudy,
$f(f^{n6})$ – the likelihood of a traffic accident when the reason is the blinding sun,
$f(g^{n7})$ – the likelihood of traffic accident during snowfall, hail.

The likelihood of a traffic accident depends on a number of factors, which include good weather conditions, rain, snow, hail, fog, smoke, strong wind, blinding sun and cloudy days. Each of these factors, is determined by a number of variables. Considering the above factor, we can represent the components of the above functions in the form:

$$f(a^{n1}) = f(a^1, a^2, a^3, a^4, a^5, a^6) \quad (2)$$

where:

$f(a^1)$ – air temperature when it is higher than 3°C,
$f(a^2)$ – precipitation does not occur,
$f(a^3)$ – wind is less than 5.5 m/s,
$f(a^4)$ – visibility higher than 10 km,
$f(a^5)$ – the pressure difference during the day is less than 8 hPa,
$f(a^6)$ – the psychophysical capacity of the driver.

$$f(b^{n2}) = f(b^1, b^2, b^3, b^4, b^5, b^6, b^7, b^8, b^9, b^{10}, b^{11}) \quad (3)$$

where:

$f(b^1)$ – occurring rainfall of more than 3 mm,
$f(b^2)$ – impaired mental and physical capacity of the driver,
$f(b^3)$ – headache,
$f(b^4)$ – sleep disorder,
$f(b^5)$ – irritation,
$f(b^6)$ – nervousness,
$f(b^7)$ – cardiac arrhythmia,
$f(b^8)$ – worsening of depressive symptoms.
$f(b^9)$ – sluggishness,
$f(b^{10})$ – fatigue,
$f(b^{11})$ – dyspnea.

$$f(c^{n3}) = f(c^1, c^2, c^3, c^4, c^5, c^6, c^7, c^8, c^9, c^{10}, c^{11}) \quad (4)$$

where:

$f(c^1)$ – fog, smoke present; visibility below 300 m,
$f(c^2)$ – impaired mental and physical capacity of the driver,
$f(c^3)$ – headache,
$f(c^4)$ – sleep disorder,
$f(c^5)$ – irritation,
$f(c^6)$ – nervousness,
$f(c^7)$ – cardiac arrhythmia,
$f(c^8)$ – worsening of depressive symptoms.
$f(c^9)$ – sluggishness,
$f(c^{10})$– fatigue,
$f(c^{11})$– dyspnea.

$$f(d^{n4}) = f(d^1, d^2, d^3, d^4, d^5, d^6, d^7, d^8, d^9, d^{10}, d^{11}) \quad (5)$$

where:

$f(d^1)$ – occurring strong winds above 10 ms/s,
$f(d^2)$ – impaired mental and physical capacity of the driver,
$f(d^3)$ – headache,
$f(d^4)$ – sleep disorder,
$f(d^5)$ – irritation,
$f(d^6)$ – nervousness,
$f(d^7)$ – cardiac arrhythmia,
$f(d^8)$ – worsening of depressive symptoms.
$f(d^9)$ – sluggishness,
$f(d^{10})$ – fatigue,
$f(d^{11})$ – dyspnea.

$$f(e^{n5}) = f(e^1, e^2, e^3, e^4, e^5, e^6, e^7, e^8, e^9, e^{10}, e^{11}) \quad (6)$$

where:

$f(e^1)$ – cloudy day when cloud cover of the sky is at a minimum 5/8,
$f(e^2)$ – impaired mental and physical capacity of the driver,
$f(e^3)$ – headache,
$f(e^4)$ – sleep disorder,
$f(e^5)$ – irritation,
$f(e^6)$ – nervousness,
$f(e^7)$ – cardiac arrhythmia,
$f(e^8)$ – worsening of depressive symptoms.
$f(e^9)$ – sluggishness,
$f(e^{10})$ – fatigue,
$f(e^{11})$ – dyspnea.

$$f(f^{n6}) = f(f^1, f^2) \quad (7)$$

where:

$f(f^1)$ – blinding sun occurs,

$f(f^2)$ – impaired psychophysical performance of the driver (mood, sense of satisfaction and calmness).

$$f(g^{n7}) = f(g^1, g^2, g^3, g^4, g^5, g^6, g^7, g^8, g^9, g^{10}, g^{11}) \quad (8)$$

where:

$f(g^1)$ – there is snowfall, hail, above 3 mm,

$f(g^2)$ – impaired mental and physical capacity of the driver,

$f(g^3)$ – headache,

$f(g^4)$ – sleep disorder,

$f(g^5)$ – irritation,

$f(g^6)$ – nervousness,

$f(g^7)$ – cardiac arrhythmia,

$f(g^8)$ – worsening of depressive symptoms.

$f(g^9)$ – sluggishness,

$f(g^{10})$ – fatigue,

$f(g^{11})$ – suffocation.

On the basis of the data presented in Tables 2 and 3, an analysis was made of the number of traffic accidents depending on the volume of motor vehicles passing through the analyzed points during the year, as well as the number of traffic accidents occurring at these points depending on the prevailing weather

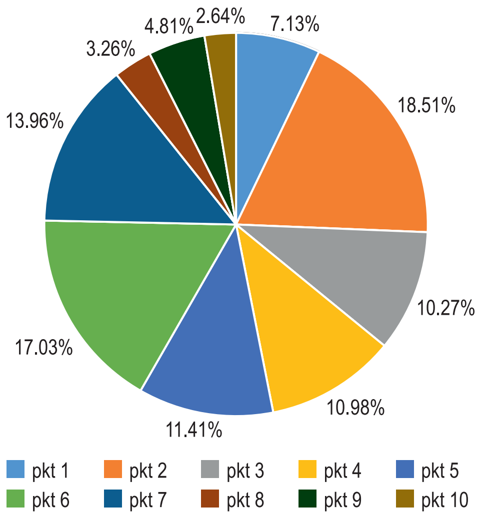

Fig. 4. Participation of each measurement point in the survey
Source: own sources.

conditions. For this purpose, the total number of vehicles passing through a given measurement point was determined, and the % share of the analyzed measurement point with traffic volume was determined (Fig. 4). In the next step, the total number of accidents at the analyzed points in 2007, 2010, 2015 and 2021 was determined (Tab. 4). The number of traffic accidents was then recalculated taking into account the % share of traffic volume, and the values of the weights of the number of accidents at the analyzed points were determined for the prevailing weather conditions (Fig. 5). Based on the data presented,

Table 4

Number of road accidents in analyzed points in 2007,2010,2015,2021

Points	Weather conditions						
	good weather	rain	fog	wind	cloudy	sun	snow
Point 1	142	40	2	0	77	5	11
Point 2	112	23	0	2	55	8	3
Point 3	78	23	1	1	38	4	7
Point 4	55	22	0	1	22	4	2
Point 5	21	2	0	0	11	0	1
Point 6	59	8	0	0	25	1	1
Point 7	64	12	1	1	50	3	2
Point 8	0	3	0	0	5	0	0
Point 9	6	0	0	0	4	1	1
Point 10	2	2	0	0	2	0	0
Sum	539	135	4	5	289	26	28

Source: based on *Wypadki drogowe…* (2023).

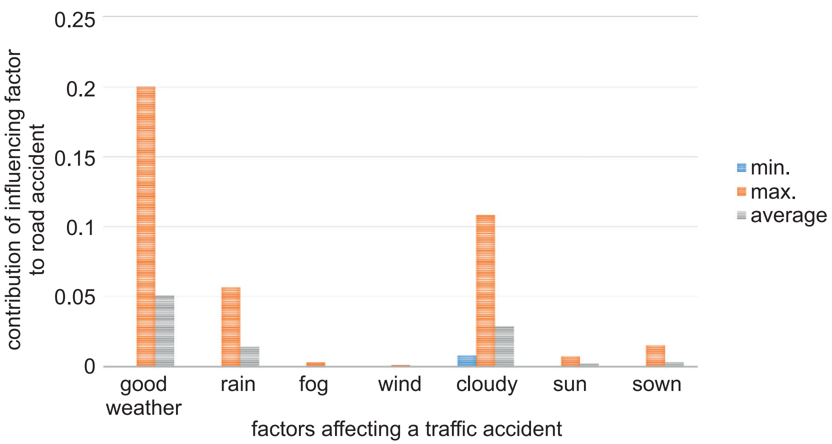

Fig. 5. Number of accidents according to weather conditions
Source: own sources.

it can be concluded that the highest number of traffic accidents occurs during good weather conditions, as well as during strong winds and on cloudy days. In the case analyzed, one can also observe the negligible influence of atmospheric factors such as fog, smoke, blinding sun and snow and hail on the number of traffic accidents. For this reason, these factors were ignored in the next stage of the study.

On the basis of the data presented in Figure 6, taking into account the provisions of formula (1), the weights of the factors affecting the number of traffic accidents in the dependence in the analyzed weather conditions were determined. The relationship is shown in formula (9).

$$\mathrm{PWD} = a^{0.5066} \cdot b^{0.1433} \cdot c^{0.0045} \cdot d^{0.0037} \cdot e^{0.2872} \cdot f^{0.0238} \cdot g^{0.0308} \quad (9)$$

In addition, Figure 6 shows the negligible impact of the following factors on the number of traffic accidents: fog, smoke, blinding sun, and snow and hail. For this reason, a first simplification was made by eliminating the above-mentioned factors.

In the next step, according to the above procedure, the weights of the factors affecting the number of traffic accidents were determined again. In this case, the simplified form of the relationship is presented in Equation 10. On this basis, the weighted average number of accidents at the analyzed points was determined (Fig. 6).

$$\mathrm{PWD} = f(a^{n1}) \cdot f(b^{n2}) \cdot f(d^{n4}) \cdot f(e^{n5}) \quad (10)$$

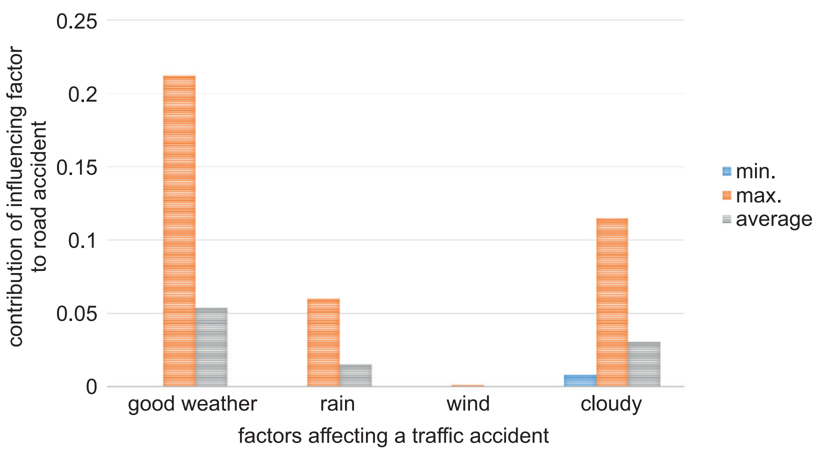

Fig. 6. Number of accidents according to weather conditions – Simplification 1
Source: own sources.

Based on the data shown in Figure 6, taking into account the provisions of equation (10), with the first simplification, the weights of the factors affecting the number of traffic accidents were again determined. In this case, the simplified form of the relationship is shown in equation 11. The relationship is shown in equation (12). Based on this, it can be seen that there is a low probability of a traffic accident during high winds. For this reason, further research introduced another simplification No. 2, in which the previously mentioned factor was not included.

$$\text{PWD} = f(a^{n1}) \cdot f(b^{n2}) \cdot f(e^{n5}) \tag{11}$$

$$\text{PWD} = f(a^{0.5385}) \cdot f(b^{0.1523}) \cdot f(d^{0.0039}) \cdot f(e^{0.3053}) \tag{12}$$

Taking into account simplification number 2, as well as the data from Tables 2 and 3, an analysis of the number of traffic accidents was carried out according to the redetermination of the weights depending on the prevailing weather conditions. The weighted average number of accidents at the analyzed points was then determined for the prevailing weather conditions (Fig. 7).

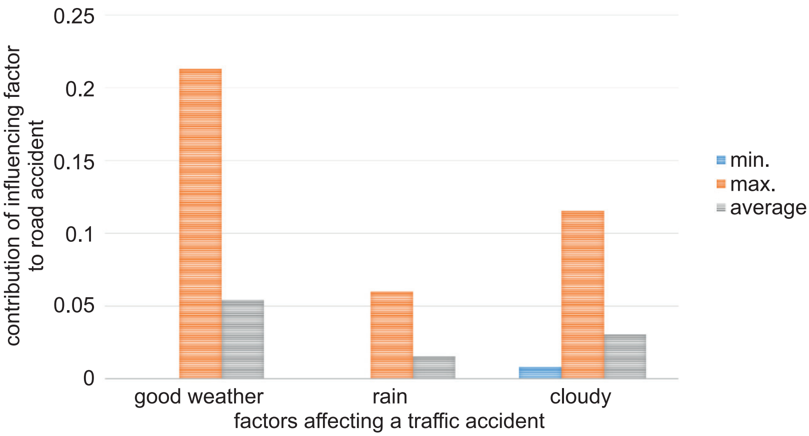

Fig. 7. Number of accidents according to weather conditions – simplification 2
Source: own sources.

Based on the data presented in Figure 7, taking into account the provisions of formula (12), with the second simplification, the weights of the factors affecting the number of traffic accidents were redetermined. The relationship is shown in formula (13):

$$\text{PWD} = f(a^{0.5406}) \cdot f(b^{0.1529}) \cdot f(e^{0.3065}) \tag{13}$$

Results

In order to check the validity of the proposed mathematical model, the total number of traffic accidents was substituted into equation (13) (Tab. 3), and then the resulting data was compared with the number of traffic accidents recorded at the analyzed points. The following prediction errors, determined from equations (14-17), were used to calculate measures of excellence for the considered relationship. A summary of the errors for the analyzed measurement errors is presented in Table 5.

- ME – mean error

$$\mathrm{ME} = \frac{1}{n}\sum_{i=1}^{n}\left(Y_i - Y_p\right) \tag{14}$$

- MAE – mean everage error

$$\mathrm{MAE} = \frac{1}{n}\sum_{i=1}^{n}\left|Y_i - Y_p\right| \tag{15}$$

- MPE – mean percentage error

$$\mathrm{MPE} = \frac{1}{n}\sum_{i=1}^{n}\frac{Y_i - Y_p}{Y_i} \tag{16}$$

- MAPE – mean absolute percentage error

$$\mathrm{MAPE} = \frac{1}{n}\sum_{i=1}^{n}\frac{\left|Y_i - Y_p\right|}{Y_i} \tag{17}$$

where:

n – length of the forecast horizon,
Y – observed value of traffic accidents,
Y_p – the forecast value of traffic accidents.

Table 5

Summary of errors

Points	Errors	Good weather conditions	Rainfall	Cloudy	Points	Errors	Good weather conditions	Rainfall	Cloudy
Point 1	ME	-1.93507	-0.59125	-1.97368	point 6	ME	2.046401	-1.59414	-0.95226
	MAE	7.136556	4.091161	4.633099		MAE	2.046401	1.641191	1.347187
	MPE	-0.07656	-0.62055	-0.16773		MPE	0.130015	0	-0.17484
	MAPE	0.192146	0.832898	0.305077		MAPE	0.130015	0	0.240658
Point 2	ME	0.565632	-2.01182	-1.80382	point 7	ME	-1.97424	-2.08533	2.309569
	MAE	5.000353	2.047071	2.367754		MAE	2.270642	3.255897	2.309569
	MPE	0.009549	0	-0.19631		MPE	-0.15433	0	0.197379
	MAPE	0.195028	0	0.236586		MAPE	0.165733	0	0.197379
Point 3	ME	-1.04199	-0.0618	-2.14621	point 8	ME	-1.08116	0.444116	0.637042
	MAE	2.040579	1.826471	2.242541		MAE	1.081157	0.444116	0.790281
	MPE	-0.05492	-0.14962	-0.27235		MPE	0	0	0
	MAPE	0.107321	0.354316	0.28198		MAPE	0	0	0
Point 4	ME	-0.57534	1.447032	-2.6217	point 9	ME	-0.12174	-0.45883	0.080563
	MAE	1.560868	2.552925	2.903666		MAE	1	0.458827	0.612958
	MPE	-0.04945	-0.27475	-2.07118		MPE	0	0	0
	MAPE	0.115365	0.831147	2.111458		MAPE	0	0	0
Point 5	ME	0.519936	-0.83824	0.068308	point 10	ME	-0.31087	0.270587	0.040281
	MAE	0.655434	1.108831	1.020141		MAE	0.310868	0.423529	0.34676
	MPE	0.141831	0	0		MPE	0	0	0
	MAPE	0.155381	0	0		MAPE	0	0	0

Source: own sources.

Conclusion

The article evaluates the factors affecting the number of road accidents depending on weather conditions. For this purpose, a random selection was made of 10 measurement points in Poland, for which the following parameters were analyzed: traffic volume on the road and the number of accidents at the analyzed points. Based on the study, it can be concluded that the number of road accidents is most influenced by factors such as good weather conditions, as well as cloudy and rainy days. The analyzed method can be used to predict the number of traffic accidents at a specific place and time.

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