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**PROCEEDINGS OF THE 20TH SIRWEC CONFERENCE,  
DRUSKININKAI, LITHUANIA (14-16TH JUNE 2022)**

# RELATION BETWEEN WEATHER AND TRAFFIC ACCIDENTS ON THE MAIN ROADS OF LITHUANIA

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## Summary

Despite the significant decrease of overall number of road traffic accidents in Lithuania, weather related accidents are still remaining a challenge for road safety. The original methodology was adjusted to evaluate potential impact of adverse weather on traffic accidents frequency. The research focused on the two main roads in Lithuania during 2017-2019 period. The results proved that the frequency of the traffic accidents increase during adverse weather events and not ideal road surface conditions. The recurrence of accidents reached the highest number on icy and snowy roads.

## Introduction

The Structure of the Road Network of National Significance in Lithuania contains main, national and regional roads and stretches more than 21.2 thou. km. The 50% of cargos and 97% of public transportation are using national road network. In Lithuania, in 2018 for 1 mil. inhabitants 61 fatal accidents were registered, it was 11% less than in 2017 and, even, 43% less than in 2010 [1]. However, the accidents still remain very serious problem; every year about 1.24 mil. people are killed during the crashes all over the world [2].

There are various perspectives how meteorological conditions could have the impact on roads and traffic safety [3, 4]. There are a lot of studies

and methodologies dedicated to weather related traffic accidents [5, 6, 7, 8, 9, 10]. The previous research found that 20-30% of road accidents could be related to weather impact [11, 12] and the potential risk of crash on wet roads increases several times [13]. Snow has a greater effect than rain does on crash occurrence [13, 14], but the precipitation also increase the number of traffic accidents [3, 14, 15]. Moreover, the potential risk of accidents would not disappear in the future [2, 16].

The main objective of this research was to determine possible impact of adverse weather conditions on road traffic accidents by adjusting the original methodology [17] for 2 main roads in Lithuania.

## **Materials and methods**

The main national roads A1 and 'Via Baltica' (sections of A1, A5, A8, A10, A17) were selected for the analysis (Fig. 1). These roads are parts of the international roads E85 and E67 passing through the territory of Lithuania. Two types of data were used: road traffic accidents and road weather (surface) conditions. All the data were provided by the Lithuanian Road Administration under The Ministry of Transport and Communications. The weather conditions data collected from the Road Weather Information System (RWIS) weather stations (WS) which were located on the selected roads: 15 WS on A1 and 7 on 'Via Baltica'. The research covered 2017-2019 period.

The original methodology of potential adverse weather conditions impact on traffic accidents developed for Vilnius city [17] were applied and modified for state roads. Road traffic accidents could be related to road

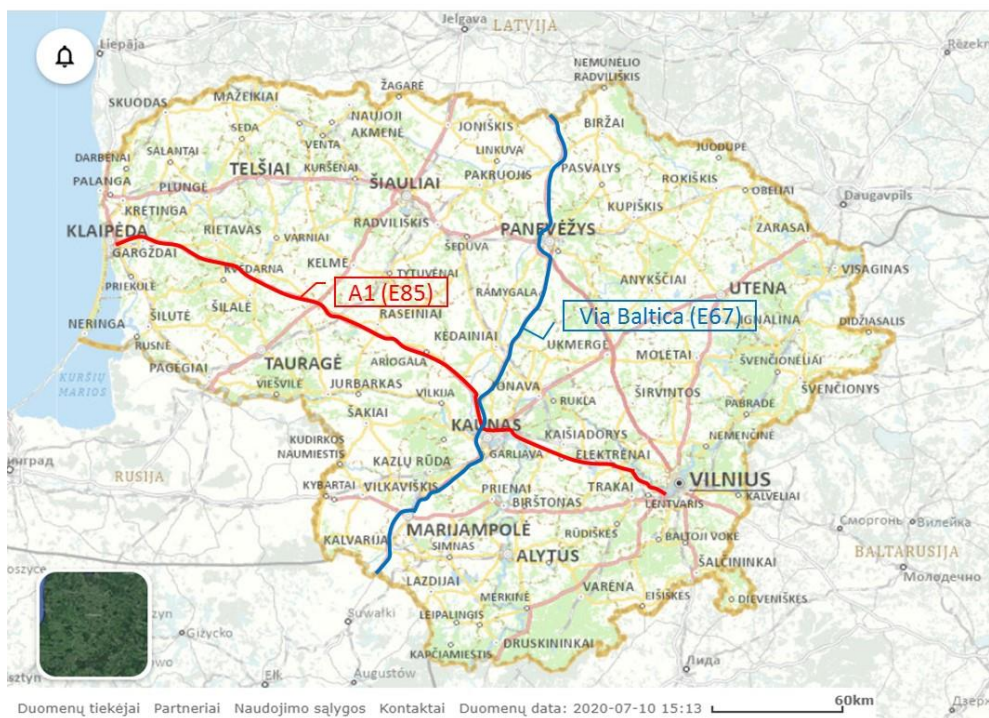


Fig. 1. The main roads crossing Lithuanian territory: A1 (E85) from West to East and 'Via Baltica' (E67) from North to South (modified map, the base taken from [eismoinfo.lt](http://eismoinfo.lt) and GDB10LT National Land Service, 2012)

section, traffic intensity, patterns of weather season, etc., therefore, the accidents were divided: prior to the closeness to WS; prior to weather conditions into warm and cold seasons; prior to traffic intensity into weekdays and weekends. The accident rates on the road during adverse weather conditions (precipitation, wet, icy conditions, etc.) compared with the accident rates in favourable weather conditions (no precipitation, dry road surface). Overall number off traffic accidents and specified road weather (surface) conditions were calculated (Table 1). It was done by attributing every traffic accident to specific weather (surface condition) to the closest WS.

Table 1. Recurrence of road traffic accidents and road weather conditions divided into different groups of weather (surface) condition types in two main roads in Lithuania during 2017-2019 period

Type	Condition	Road traffic accidents, number (%)		Road weather conditions, number (%)	
		E85	E67	E85	E67
Road weather	No precipitation	1278 (79.1)	674 (82.4)	1822150 (88.6)	1857317 (91.0)
	Precipitation	22 (1.4)	0 (0.0)	22864 (1.1)	30731 (1.5)
	Drizzle	44 (2.7)	26 (3.2)	39797 (1.9)	36639 (1.8)
	Rain	152 (9.4)	65 (8.0)	82571 (4.0)	68278 (3.3)
	Sleet	10 (0.6)	4 (0.5)	6187 (0.3)	3955 (0.2)
	Snow	90 (5.6)	43 (5.3)	51947 (2.5)	33122 (1.6)
	Fog	9 (0.6)	3 (0.4)	21760 (1.1)	5973 (0.3)
	Mist	10 (0.6)	2 (0.2)	10638 (0.5)	6695 (0.3)
Road surface	Dry	1059 (65.6)	535 (66.3)	1377721 (67.7)	1497727 (71.0)
	Moist	215 (13.3)	139 (17.2)	427541 (21.0)	378548 (18.0)
	Wet	257 (15.9)	92 (11.4)	208597 (10.2)	206084 (9.8)
	Slushy snow	25 (1.5)	10 (1.2)	7994 (0.4)	9150 (0.4)
	Snow	33 (2.0)	16 (2.0)	8114 (0.4)	12605 (0.6)
	Ice	27 (1.7)	15 (1.9)	5464 (0.3)	4388 (0.2)

### Evaluation of potential accidents risk due to adverse weather conditions

In 2017-2019 period 1713 road traffic accident registered on A1 road in which 2586 people were injured or killed. While on 'Via Baltica' road only 824 accidents there recorded (1359 people affected) in the same period. The

ratio between traffic accidents and injured people is 5 percent higher on A1 road. According to police reports, the most frequent overall accident causes were collision with an animal and with other vehicle, while during adverse weather conditions were drive off the road, run on the obstacle and overturn of the vehicle. Potentially, 6 % of accidents where people were injured and 21% of technical road accidents could be related to adverse weather conditions in 2017-2019.

On every section of A1 road, the higher frequencies of potential accidents risk during wet road surface conditions were found (Fig. 2a). There were no obvious margins between road sections, seasons of the year and

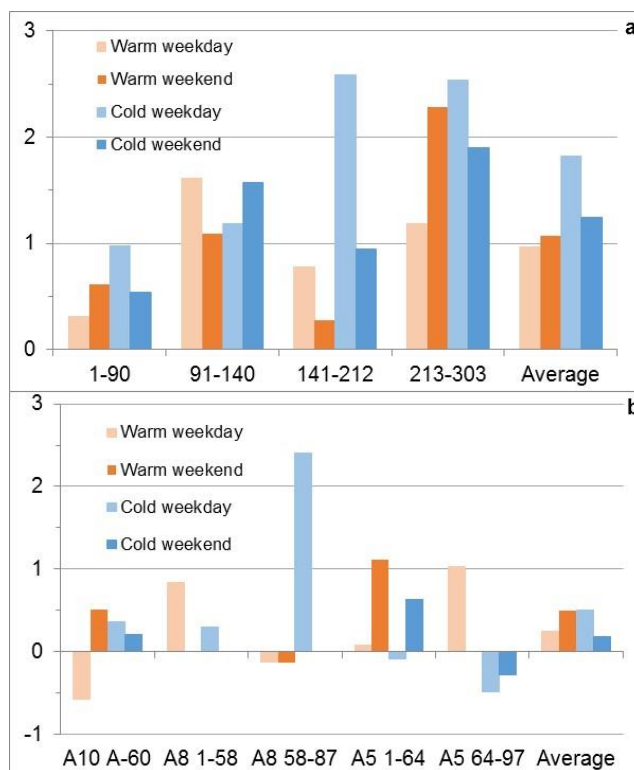


Fig. 2. The comparison (in times) of road accidents between wet road surface and dry road surface conditions on different sections (km) of the roads: a – A1 (E85); b – ‘Via Baltica’ (E67)

days of the week. Overall, wet conditions had smaller effect on accidents on 'Via Baltica' road sections (Fig. 2b). There were more obvious margins between road sections and high frequencies occurred during the weekdays of cold season.

Again, the fluctuations of potential impact of adverse weather conditions in different seasons and days of the week were higher on 'Via Baltica' (Fig. 3b) compared to A1 road (Fig 3a). Moist road had almost no effect on accidents, while, during the rain, the average of potential accident risk was more than doubled (in some cases almost 4 times higher) compared to 'no precipitation' conditions.

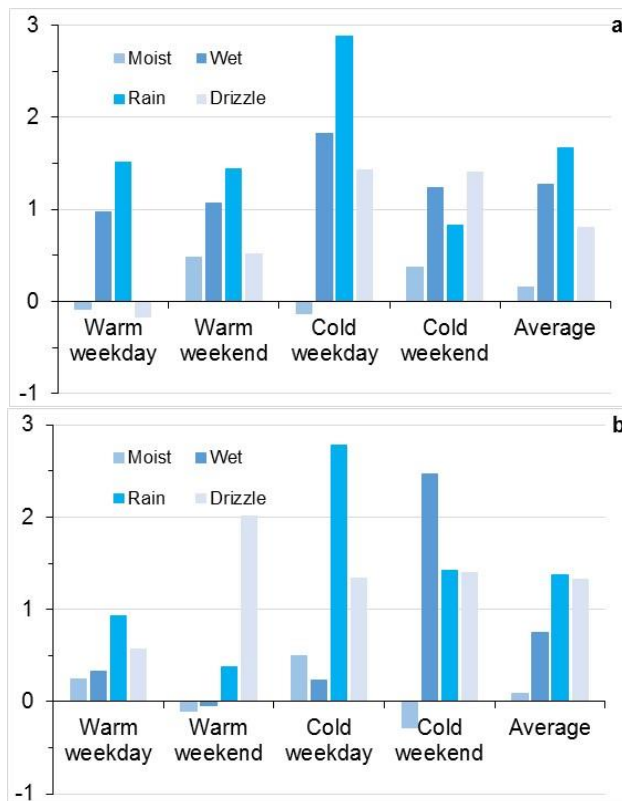


Fig. 3. The comparison (in times) of difference in seasons/ days of the week of road accidents between various road surface (weather) and dry road surface (no precipitation) conditions: a – A1 (E85); b – 'Via Baltica' (E67)

The traffic accident risk due to adverse weather conditions is higher on the A1 road comparing to 'Via Baltica' (Fig. 4), but the differences are not statistically significant. Potentially, the liquid state water (in air and on surface) formed around 1-2 times higher rates of traffic accident compared to normal conditions (Fig. 4a) Meanwhile, from 5 to 17 times higher potential of traffic accidents related to solid state water (Fig. 4b) were found.

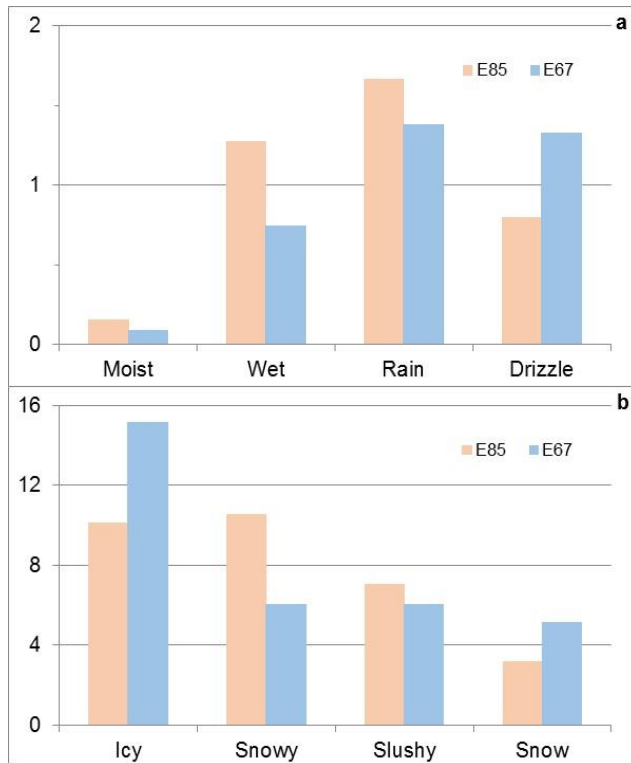


Fig. 4. The comparison (in times) of road accidents between various road surface (weather) and dry road surface (no precipitation) conditions on two main roads in Lithuania. Water state: a – liquid; b – solid

## Conclusions

- On two main roads in Lithuania in 2017-2019 period the overall numbers of traffic accidents were higher during all types of precipitation and wet road surface comparing to normal ones.



Therefore, the accidents could be potentially linked to the adverse weather conditions.

- The potential impact of adverse weather conditions fluctuated in very wide range: from 9% on moist 'Via Baltica' road surfaces (16% – A1 road) to 15.2 times on icy 'Via Baltica' road surfaces (10.1 times – A1 road).
- Cold season impact on road accidents rates were higher because snow and ice had showed very high potential risk of accidents. However, the recurrence of icy and snowy conditions was not frequent (around 1% of all weather conditions).
- Now, the potential impact of all types of rains and wet road surface on road accidents were more frequent all year round, respectively 7% and 10% of all conditions, due to climate change effect (higher temperatures in cold season).

## Acknowledgements

The authors are grateful to the Lithuanian Road Administration under The Ministry of Transport and Communications for providing traffic accidents and weather conditions data.

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