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Road Safety in the Arctic Zone of the Russian Federation

Alexander M. ISHKOV

Anna E. IVANOVA

Anatoly L. BOYARSHINOV

Nadezhda A. FILIPPOVA

Alexander M. Ishkov[1], Anna E. Ivanova[2], Anatoly L. Boyarshinov[3], Nadezhda A. Filippova[4]

[1, 2, 3, 4] North-Eastern Federal University named after M. K. Ammosov, Yakutsk, Russia.
[2] Yakutsk Scientific Centre of the Siberian Branch of the Russian Academy of Sciences, Yakutsk, Russia.
[3] Academy of Sciences of the Republic of Yakutia (Sakha), Yakutsk, Russia.
[4] Moscow Automobile and Highway State Technical University, Moscow, Russia; North-Eastern Federal University named after M. K. Ammosov, Yakutsk, Russia.
✉ *[4] umen@bk.ru.*

ABSTRACT

The article deals with the issue of road safety in the Arctic zone of the Russian Federation.

The analysis of road traffic accidents over the past 10 years that occurred in the Arctic zone of the Republic of Sakha (Yakutia) was carried out for the first time ever. The study refers to the total number of road traffic accidents, accidents due to the fault of pedestrians, accidents due to the unsatisfied condition of streets and roads, accidents involving children under 16 years of age, accidents involving drivers with signs of alcohol intoxication and accidents committed by drivers without the right to drive vehicles. Based on the data obtained, a coefficient K was proposed that characterises the state of road safety in the Arctic regions in comparison with traffic safety in general in the Republic of Sakha (Yakutia).

The analysis of road traffic accident statistics has shown that many accidents are the fault of drivers without a driver's license and revealed the districts with respectively the highest and lowest number of accidents as per their types listed above.

Despite the huge territory and the small number of inhabitants, and consequently the low population density, the number of accidents in the Arctic zone of the Republic of Sakha (Yakutia) has been increasing every year necessitating efforts to improve road safety.

Keywords: Arctic zone, road traffic safety, road traffic accident, motor vehicle, road component, road condition, seasonal roads.

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INTRODUCTION

The Arctic zone of the Republic of Sakha (Yakutia) (RS (Ya)) includes districts (uluses), most of which are located north of the Arctic Circle. It includes 13 administrative entities (Abyisky, Allaikhovsky, Anabarsky, Bulunsky, Verkhoyansky, Zhigansky, Momsky, Nizhnekolymsky, Olenyoksky, Srednekolymsky, Ust-Yansky, Eveno-Bytantaisky districts), and is the most numerous zone in terms of the number of districts[1]. The area occupied by the Arctic zone is about 1,583,000 square kilometres, which makes 50 % of the territory of the Republic of Sakha (Yakutia), the rural population predominates in this zone. It should be noted that until 2020 the Arctic zone of RS (Ya) had consisted of only five administrative entities.

Table 1 shows data on the territory, population and road network of the Arctic zone of RS (Ya).

According to the data shown in Table 1, it can be seen that the above districts are very different in territory, population and length of roads. On average, about 93 % of the roads in the Arctic zone of RS (Ya) are seasonal roads.

[1] Decree of the Head of the Republic of Sakha (Yakutia) dated April 29, 2022 No. 2424 «On the scheme and program for the development of the electric power industry of the Republic of Sakha (Yakutia) for 2022–2026». [Electronic resource]: http://publication.pravo.gov.ru/Document/View/1400202205040007. Last accessed 24.10.2022.

If the average population density for the Arctic zone of RS (Ya) is 0,04 people/km^2, then these figures differ for each district (Abyisky – 0,06 people/km^2, Allaikhovsky – 0,03 people/km^2, Anabarsky – 0,07 people/km^2, Bulunsky – 0,04 people/km^2, Verkhnekolymsky – 0,1 people/km^2, Verkhoyansky – 0,08 people/km^2, Zhigansky – 0,03 people/km^2, Momsky – 0,04 people/km^2, Nizhnekolymsky – 0,05 people/km^2, Olenyoksky – 0,01 people/km^2, Srednekolymsky – 0,06 people/km^2, Ust-Yansky – 0,06 people/km^2, Eveno-Bytantaisky – 0,05 people/km^2).

Because of low population density and vast territory, due attention has not been given to the issue of road safety.

Therefore, the *objective* of the study the results of which are described in the article was to analyse road traffic accidents (hereinafter RTA) that have occurred in the Arctic zone of RS (Ya) over the past ten years.

The following data were analysed:

- Total number of RTA.
- RTA caused by pedestrians.
- RTA due to the unsatisfactory condition of streets and roads.
- RTA involving children under 16.
- RTA involving drivers with signs of alcohol intoxication.
- RTA committed by drivers without the right to drive vehicles.

Table 1

Information on the roads of the Arctic regions of the Republic of Sakha (Yakutia)[2] [compiled by the authors]

No.	District number	Territory, km^2	Population, people	Length of roads, km			Seasonal roads, km	
				total	regional	local	total	ice
1	1	69400	3979	811,13	810,63	0,5	807,03	516,9
2	2	107300	2723	1060,2	219,12	841,1	1060,2	577,16
3	3	55600	3614	315,42	315,42	10	7,22	308,2
4	4	223600	8406	2164	213,23	1951	2155,92	1812,19
5	5	42000	4026	449,75	354,75	95	389,11	11,71
6	6	137400	11155	1965,76	1114,96	850,8	1766,27	471,77
7	7	140200	4187	389,68	295,68	94	383,65	0,67
8	8	104600	3933	1147,05	667,05	480	1126,03	242,96
9	9	87100	4311	642,29	519,79	122,5	634,79	449,23
10	10	318000	4154	1128,65	678,65	450	1128,65	364,47
11	11	125200	7449	1132,24	712,24	420	1114,34	172,73
12	12	120300	7015	1649,04	1136,54	512,5	1419,53	625,79
13	13	52300	2839	472,75	88,75	384	449,09	388,15
	Total	1583 000	67791	13327,96	7126,91	6211,4	12441,83	5941,93

Note: 1 – Abyisky district, 2 – Allaikhovsky district, 3 – Anabarsky district, 4 – Bulunsky district, 5 – Verkhnekolymsky district, 6 – Verkhoyansky district, 7 – Zhigansky district, 8 – Momsky district, 9 – Nizhnekolymsky district, 10 – Olenyoksky district, 11 – Srednekolymsky district, 12 – Ust-Yansky district, 13 – Eveno-Bytantaisky district.

[2] Official information website of the Republic of Sakha (Yakutia). [Electronic resource]: https://www.sakha.gov.ru/o-respublike-saha-kutiya-/atu. Last accessed 24.10.2022.

Table 2

RTA in the Arctic districts of RS (Ya)[3] [compiled by the authors]

No.	District number	2011			2012			2013			2014			2015			2016			2017			2018			2019			2020			2021			Total		
		RTA	k*	i*	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i
1	1	1	0	2	0	0	0	1	0	1	2	0	2	2	0	2	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	8	0	9
2	2	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	3	1	4
3	3	2	0	2	1	0	1	1	0	1	3	0	3	2	0	4	1	0	2	2	0	2	0	0	0	6	0	8	2	0	3	0	0	0	20	0	26
4	4	3	1	6	4	0	5	1	2	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	1	0	1	1	1	0	12	4	15
5	5	1	1	1	1	0	1	0	0	0	4	0	4	1	0	1	2	1	1	0	0	0	2	0	2	1	0	1	2	0	2	1	1	0	15	3	14
6	6	4	1	9	6	1	7	4	0	5	6	2	8	7	1	6	4	1	7	2	0	2	4	1	4	5	1	4	1	0	1	1	0	1	45	8	54
7	7	0	0	0	3	0	3	1	0	2	2	0	3	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	10	0	12
8	8	1	0	1	1	0	1	0	0	0	1	0	3	1	0	1	1	1	0	1	0	1	2	0	2	1	0	1	1	0	1	0	0	0	10	1	11
9	9	0	0	0	1	1	2	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3
10	10	2	0	3	5	0	9	1	0	1	1	1	0	0	0	0	1	1	0	1	0	1	2	0	2	3	0	4	2	1	3	0	0	0	18	3	22
11	11	1	0	1	0	0	0	0	0	0	2	0	2	1	0	1	1	0	1	1	1	0	2	0	2	1	0	1	0	0	0	1	0	1	10	1	9
12	12	4	0	6	5	0	5	2	0	2	2	0	2	3	0	4	1	0	1	4	4	5	5	1	4	1	0	1	1	0	4	0	0	0	28	5	34
13	13	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	2	0	2
	Total	19	3	31	28	2	35	11	2	13	24	4	29	19	1	21	14	4	14	12	5	12	20	2	19	20	1	23	10	1	14	6	2	4	183	27	215

* Note: k-killed, i-injured.

[3] Official website of the Ministry of Internal Affairs of the Russian Federation. [Electronic resource]: http://stat.gibdd.ru.Last accessed 24.10.2022.

MATERIALS AND METHODS

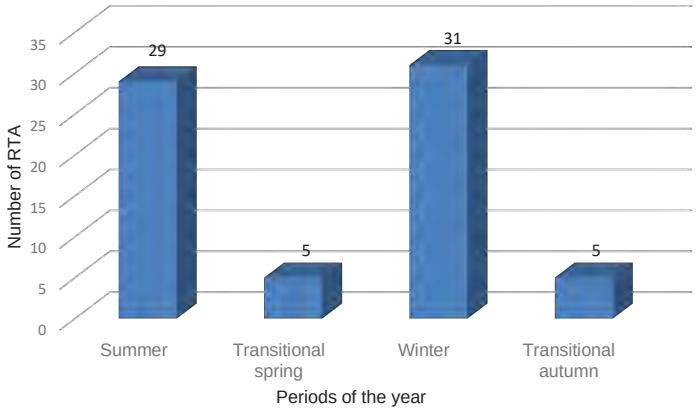
The fleet of vehicles in the Arctic districts for 2021 consisted of 5003 cars, 3184 trucks, 207 buses and 67 motorcycles[2]. Given the number of people living in this territory (67,791 people) and the total number of vehicles, we can conclude that there are a small number of motorists. Only 8 % of the population owns vehicles. And yet, RTA still happen. Detailed data are presented in Table 2.

Table 2 provides information about the accident rate in the Arctic zone of RS (Ya) and shows that the total number of RTA during the observation period was 183 cases, while 27 victims and 215 people injured. The worst statistics was in 2012 (28 RTA). A sharp increase in the number of accidents can be seen since 2018, but in 2020, due to introduction of restrictive measures on mobility due to pandemics, the number of accidents has halved. Based on the results of the analysis of the number of RTA in the Arctic districts of RS (Ya) for the period from 2011 to 2021, it can be seen that the largest number of accidents occurred in Verkhoyansky district (45 RTA, 8 persons died, 54 injured), and the minimum is characteristic of Nizhnekolymsky and Eveno-Bytantaisky districts (with two RTA for each of them).

It should be noted that Table 2 is based on officially recorded RTA. The real picture may turn out to be quite different, as many RTA participants decide not to report them, agreeing to solve the problem on their own.

Tables 1 and 2 show that the higher is the population, the more RTA occur. Verkhoyansky district has the largest number of accidents and the largest population. The lowest rates are in Nizhnekolymsky district, where there were only two RTA per 4,311 people during ten years.

6 % of the population of the Arctic zone of RS (Ya) live in Abyisky district, and over the past ten years, 4 % of the total number of RTA that occurred in the Arctic zone of RS (YA) have occurred on its territory. 4 % of the population live in Allaikhovsky district, 2 % of RTA occurred. 5 % of the population live in Anabarsky district, 11 % of RTA occurred. 12 % of the population live in Bulunsky district, 7 % of RTA occurred. 6 % of the population live in Verkhnekolymsky district, 8 % of RTA occurred. 16 % of the population



Pic. 1. Number of RTA depending on the ambient temperature [performed by the authors].

live in Verkhoyansky district, 25 % of RTA occurred. 6 % of the population live in Zhigansky district, 5 % of RTA occurred. 6 % of the population live in Momsky district, 5 % of RTA occurred. 6 % of the population live in Nizhnekolymsky district, 1 % of RTA occurred. 6 % of the population live in Olenyoksky district, 10 % of RTA occurred. 11 % of the population live in Srednekolymsky district, 5 % of RTA occurred. 10 % of the population live in Ust-Yansky district, 15 % of RTA occurred. 4 % of the population live in Eveno-Bytantaisky district, 1 % of accidents occurred.

Reducing the number of accidents is not an easy task. On the contrary, the last few years have shown the increase. This may be due to the aging of both the fleet and the drivers, and to the uncontrolled growth of motorisation of the population. Despite the seemingly small number of RTA that have occurred in the Arctic zone of RS (Ya) over ten years, it is necessary to minimise their number or, ideally, reduce it to zero.

The authors of the article propose the coefficient «K», which characterises the state of road safety in the Arctic regions in comparison with traffic safety in general in RS (Ya).

$$K = A/B, \quad (1)$$

where K – characteristic coefficient;

A – number of road traffic accidents;

B – number of population.

As a result of the calculation the following was obtained:

K1 = 0,0026 for Arctic districts;

K2 = 0,0093 for the Republic of Sakha (Yakutia).

That is, the coefficient K1 is four times lower than K2, while the population of the Arctic regions is 14 times less than the entire population of the Republic of Sakha (Yakutia). It follows from this that special attention should be paid to the problem of road safety in the Arctic districts.

RESULTS

One of the priority tasks in development of the Arctic region should be to ensure road safety [1–4]. Most attention is paid to road safety in large settlements, but in remote, small settlements, RTA still occur.

More than a third of the length of all roads in Yakutia are located in the Arctic zone (13,327,96 km). Many settlements of the Arctic zone of RS (Ya) are cut off from the main road network for most of the year, that is, there is no land transportation in autumn, spring and summer.

Pic. 1 considers the total number of RTA depending on the season. If in the usual understanding each period of the year consists of three months, then the following division is applicable for the Arctic zone of RS (Ya):

- Summer period: May, June, July, August.
- Winter period: January, February, March, October, November, December.
- Transitional period: April, September [5].

Pic. 1 shows that the number of RTA that occurred in the summer period is approximately equal to the number of accidents that occurred in the winter period, but here it should be considered that the summer period is only four months long, and the winter period is six month long. That is, relatively, the largest number of accidents occurs in the summer. During the transitional periods, in April and September, the number of accidents is equally low.

Many motorists of the republic prefer to use vehicles during the warm season, and to «freeze» them in winter. The operation of vehicles in

Table 3

RTA caused by pedestrians [compiled by the authors][3]

No.	District number	2011			2012			2013			2014			2015			2016			2017			2018			2019			2020			2021			Total		
		RTA	k*	i*	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	p	RTA	k	i
1	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
3	3	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	2	0	0	0	3	0	4
4	4	1	0	1	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	4	0	5
5	5	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2
6	6	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	3	0	3
7	7	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	4	0	4
8	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	10	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3
11	11	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
12	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0
13	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	4	1	4	5	0	7	1	0	1	3	0	3	1	0	1	2	0	2	2	0	2	1	1	0	1	0	1	2	0	3	2	0	2	24	2	26

* Note: k-killed, i-injured.

Table 4

RTA caused by unsatisfactory condition of streets and roads [compiled by the authors][3]

No.	District number	2011			2012			2013			2014			2015			2016			2017			2018			2019			2020			2021			Total		
		RTA	k*	i*	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i
1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	2	0	2
2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	2	0	3
3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
4	4	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	3	0	0
5	5	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	4	0	4
6	6	2	1	6	2	1	2	0	0	0	0	0	0	2	0	2	2	0	2	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	9	3	12
7	7	0	0	0	2	0	2	0	0	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	5	0	6
8	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	3	1	2
9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
11	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	2	2	1
13	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	3	1	7	4	1	4	0	0	0	3	0	4	3	0	3	5	1	4	4	1	4	4	1	3	4	1	4	1	0	1	1	0	1	32	6	35

* Note: k-killed, i-injured.

winter involves large financial costs. Fuel consumption increases several times, there is the need for additional winterisation of the engine and car interior, for the purchase of an additional set of winter tires and oil change [6; 7].

Table 3 shows data on RTA caused by pedestrians. The main cause of such accidents is crossing the road in the wrong place.

When analysing Table 3, it can be seen that pedestrians are responsible for 13 % of the total number of all RTA, with 7,4 % of fatalities and 12,1 % of injured as compared to the total number of RTA. The largest number of RTA due to the fault of pedestrians occurred in 2012 (five RTA), seven people were injured. It should be noted that such RTA have not occurred in Momsky, Nizhnekolymsky and Eveno-Bytantaisky districts.

Road conditions have a great impact on safety, and in general on efficient operation of road transport to ensure prompt and reliable delivery of goods to the regions of the Far North and the Arctic zone of Russia [5; 8]. Regardless of the condition of the driver himself and his vehicle, RTA can occur due to bad condition of roads and streets. Given the remoteness of the municipalities included in the Arctic zones of RS (Ya), the roads and streets there are unpaved. Also, a large part of road infrastructure consists of winter roads (seasonal and ice roads) and based on the characteristics of natural and climatic conditions, it is problematic to predict the location and the state of winter roads. Table 4 contains information on the number of RTA that occurred due to the unsatisfactory condition of roads and streets.

As can be seen from Table 4, 17,5 % of RTA are due to the poor condition of the roadway, these RTA caused 22 % of fatalities and 15,3 % of injuries as compared to the total number of RTA. The largest number of accidents that occurred due to the poor condition of streets and roads was in 2016 (five RTA), when four people were injured and one person died. In Nizhnekolymsky, Srednekolymsky and Eveno-Bytantaisky districts, such accidents have not occurred. Also in 2013, not a single RTA was recorded in all 13 districts due to the poor condition of roads and streets, and in 2020 and 2021, only one accident occurred during a year.

Table 5 shows data on road accidents involving children aged under 16. At risk are children-passengers, children-pedestrians, children-drivers of mechanical vehicles, children-cyclists, as well as children who can get into an accident due to their own negligence. To avoid such accidents, it is necessary to make children teach traffic safety rules. Very often, many parents neglect simple rules for transporting children, such as fixing a seat belt or using special restraints (car seat, seat belt adapter, etc.). Compliance with these simple rules would help reduce the number of fatalities or severity of the consequences of RTA.

As can be seen from Table 5, of the total number of RTA, 16,5 % involved children and resulted in 7,4 % died and 15,3 %. The largest number of RTA involving children under 16 years old was in 2011 and 2014 (five RTA), in which five people were injured and one person died in 2011. The minimum number, that is, the absence of such RTA, was recorded in 2021. There have been no such RTA in Allaikhovsky, Nizhnekolymsky and Eveno-Bytantaiskiy districts. Attaining zero child injuries is one of the most urgent tasks of social development of Russian society [9; 10].

According to statistics in Russia, almost every twentieth RTA occurs due to the fault of drivers who were in the state of alcohol intoxication. At the same time, severity of consequences of such incidents is much higher. Drivers in the state of alcohol intoxication cease to adequately assess the situation and their own capabilities and often exceed the speed limit, do not respect the necessary distance between vehicles, and drive into the oncoming lane. Data on the number of accidents involving drivers with signs of alcohol intoxication are presented in Table 6.

Table 6 shows that more than 18 % of RTA occurred due to the fault of drivers who were in the state of alcohol intoxication and caused 18,5 % of victims and 18,6 % of injured as compared to the total number of RTA. The largest number of RTA involving drivers with signs of alcohol intoxication was in 2014 (seven RTA), with eight people injured and one person died. The minimum number, that is, the absence of such RTA, was recorded in 2016. There have been no such RTA in Allaikhovsky, Nizhnekolymsky, Srednekolymsky and Eveno-Bytantaisky districts.

Due to the lack of proper control by the executive authorities, many residents of remote settlements, feeling their impunity, decide to drive a vehicle without a driver's license, which leads to a high probability of RTA. Table 7

Table 5

RTA involving children under 16 years old [compiled by the authors][3]

No.	District number	2011			2012			2013			2014			2015			2016			2017			2018			2019			2020			2021			Total		
		RTA	k*	i*	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i
1	1	1	0	1	0	0	0	0	0	0	1	0	1	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4
2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	2	0	3	1	0	2	0	0	0	5	0	8
4	4	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	4	1	4
5	5	1	1	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	4	1	4
6	6	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	0	1	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	5	0	5
7	7	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
8	8	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	10	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
11	11	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
12	12	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3
13	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	5	1	5	3	0	3	1	1	1	5	0	5	4	0	4	4	0	5	1	0	1	1	0	1	2	0	3	4	0	5	0	0	0	30	2	33

* Note: k-killed, i-injured.

Table 6

RTA with participation of drivers with intoxication signs [compiled by the authors][3]

No.	District number	2011			2012			2013			2014			2015			2016			2017			2018			2019			2020			2021			Total		
		RTA	k*	i*	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i
1	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	3	0	3
2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3	0	0	0	0	0	0	3	0	4
4	4	2	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	1	0	4	2	6
5	5	0	0	0	0	0	0	0	0	0	3	0	4	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	1	0	5	1	5
6	6	1	0	1	0	0	0	0	0	0	2	1	1	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	6	1	5
7	7	0	0	0	3	0	3	1	0	2	1	0	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	8
8	8	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	10	1	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	1	1	0	0	0	0	4	1	4
11	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4
13	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	5	1	8	3	0	3	3	0	4	7	1	8	3	0	3	0	0	0	1	0	4	3	0	3	4	0	6	1	1	0	3	2	1	33	5	40

* Note: k-killed, i-injured.

Table 7

RTA committed by drivers without the right to drive vehicles [compiled by the authors][3]

No.	District	2011			2012			2013			2014			2015			2016			2017			2018			2019			2020			2021			Total		
	number	RTA	k*	i*	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i	RTA	k	i
1	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	1	0	2
3	3	0	0	0	0	0	0	1	0	1	2	0	2	0	0	0	1	0	1	1	0	1	0	0	0	5	0	7	2	0	3	0	0	0	12	0	15
4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	1	1	0	3	1	2
5	5	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	0	1	0	0	0	1	0	1	1	0	1	1	0	1	1	1	0	7	1	6
6	6	0	0	0	0	0	0	0	0	0	1	0	1	3	0	3	2	0	2	2	0	2	3	1	3	3	1	2	0	0	0	0	0	0	14	2	13
7	7	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
8	8	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1
9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	10	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	2	0	0	0	4	1	4
11	11	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	1	0	1	1	0	1	0	0	0	1	0	1	5	0	5
12	12	0	0	0	0	0	0	0	0	0	2	0	2	2	0	2	0	0	0	1	0	4	2	1	1	0	0	0	0	0	0	0	0	0	7	1	9
13	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	2	0	2	7	1	6	11	0	11	7	1	6	5	0	8	7	2	6	12	1	14	5	0	7	3	2	1	59	7	61

* Note: k-killed, i-injured.

presents statistics on the number of accidents committed by drivers without the driver's license.

Table 7 shows that drivers who drove a car without the license have committed 32,2 % of the total number of accidents, and due to those RTA 25,9 % persons died and 28,4 % were injured out of the total number of RTA victims. The largest number of such accidents was in 2019 (12 accidents), in which 14 people were injured and one person died. The minimum number, that is, the absence of such RTA, was recorded in 2011 and 2012. There have been no such accidents in Nizhnekolymsky and Eveno-Bytantaisky districts.

After analysing Tables 2–7, it can be seen that out of the considered causes of the occurrence of RTA, the biggest number of RTA is associated with RTA committed by drivers without the license. Over the past two years, the number of such accidents has been low, but this may be due to introduction of restrictive measures due to the coronavirus pandemic. If the annual rate of RTA due to other causes does not exceed five, in rare cases attaining the figures of 6–7, then the annual indicators for the number of accidents involving drivers without license reached a maximum of 12 accidents in 2019 and 11 accidents in 2015. During the period under review, from 2011 to 2021, 12 and 14 such accidents occurred in Anabarsky and Verkhoyansky districts. The largest number of people injured in RTA, 15 and 13, respectively, were recorded in those districts.

DISCUSSION AND CONCLUSIONS

This article considers the issue of road safety in the Arctic zone of the RS (Ya). Based on statistical data, the total number of RTA that occurred in the Arctic zone of RS (Ya) for the period from 2011 to 2021 and the following data were analysed:

• Total number of RTA.

• RTA caused by pedestrians.

• RTA caused by unsatisfactory condition of streets and roads.

• RTA involving children under 16 years old.

• RTA involving drivers with signs of alcohol intoxication.

• RTA caused by drivers without the driver's license.

This is the first time such an analysis has been carried out for this territory.

It can be noted that in some of the considered districts the number of RTA due to various causes of their occurrence is minimal, or equal to zero. This can be explained by the difference in population, territory, and length of roads in the above 13 districts that are part of the Arctic zone. For example, in terms of the total number of RTA, Verkhoyansky district has the highest rate. Of these districts, it has one of the maximum values for the territory (137,400 km^2), the maximum population (11,155 people) and the largest length of roads (1965,76 km). Districts in which, due to any cause, the occurrence of RTA, for all ten years not a single accident has been recorded, have a population of just over two thousand people.

The configuration of the road network varies significantly depending on the time of the year. During the summer period, only hard-surfaced roads function, and most of the territory of the Republic is inaccessible to road transport.

With the help of the analysed data, recommendations can be made to improve road safety[4]. The main factors that affect the accident rate are unpreparedness of drivers and poor development of intelligent transport systems [3; 4; 11–25].

The following indicators can be distinguished to improve road safety in the Arctic zone of RS (Ya):

• Respect of traffic rules.

• Creation of a system of information influence on the population to advocate and popularise a negative attitude towards road traffic offenders.

• Improving driving culture.

• Increased requirements for driver training when obtaining driver's license and requirements for driving schools providing such training.

• Introduction of modern intelligent transport systems.

For further analysis, it is possible to single out settlements in which accidents occurred, season, day of the week and time of day. It is also possible to consider additionally the types and causes of RTA. Such an analysis will allow a more detailed study of the problem of RTA and ways to solve it.

[4] A/68/970 – Report of the Open Working Group on Sustainable Development Goals. [Electronic resource]: https://digitallibrary.un.org/record/778970/files/A_68_970-EN.pdf. Last accessed 24.10.2022.

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Information about the authors:

Ishkov, Alexander M., *D.Sc. (Eng), Professor, Head of the Department of North-Eastern Federal University named after M. K. Ammosov; Head of the Division of Rhythmology and Ergonomics of Northern Machinery of Yakutia Science Centre of the Siberian Branch of the Russian Academy of Sciences; member of the Yakutia Academy of Sciences, Yakutsk, Russia, ishkovalexander81@gmail.com.*

Ivanova, Anna E., *Senior Lecturer at North-Eastern Federal University named after M. K. Ammosov, Yakutsk, Russia, anyaproh@mail.ru.*

Boyarshinov, Anatoly L., *Ph.D. (Eng), Associate Professor at North-Eastern Federal University named after M. K. Ammosov, Yakutsk, Russia, boyarshinov52@mail.ru.*

Filippova, Nadezhda A., *D.Sc. (Eng), Professor at Moscow Automobile and Highway State Technical University, Moscow, Russia; Professor at North-Eastern Federal University named after M. K. Ammosov, Yakutsk, Russia, umen@bk.ru.*

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