

2016-2021 Road Safety Analysis for the Territory of the City of Kraljevo

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Authors:

Dr. Dragoslav KUKIĆ, Director of Research and Development Department, AMSS-Motor Vehicles Center

Jovan DROBNJAK, AMSS-Motor Vehicles Center

Petar KRASIĆ, AMSS-Motor Vehicles Center

Nikolina TASIĆ, AMSS-Motor Vehicles Center

Dragana NOJKOVIĆ, AMSS-Motor Vehicles Center

Miloš TUČIĆ, AMSS-Motor Vehicles Center

Đorđe STANISAVLJEVIĆ, AMSS-Motor Vehicles Center

Dr. Dejan JOVANOVIĆ, AMSS-Motor Vehicles Center

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1 ANALYSIS OF ROAD ACCIDENTS AND THEIR CONSEQUENCES IN THE TERRITORY OF THE CITY OF KRALJEVO

1.1 General analysis of road accident and consequence data for the territory of the City of Kraljevo between 2016 and 2021

The trend analysis of road accidents registered in the territory of the City of Kraljevo was performed for the period from 1997 to 2021. The time period covered by the analysis is twenty-five (25) years. In the observed time period, a total of 20,412 road accidents were registered on the territory of the City of Kraljevo (Chart 1). The number of road accidents in the observed time period has downward trend, with great oscillations in the number of accidents. Observed by years of the covered period, the highest number of road accidents was recorded in 2001, namely 1283 road accidents, while the lowest number of road accidents was recorded in 2020 (426 road accidents). In 1999 and 2000, due to the political situation and the NATO bombing of the Federal Republic of Yugoslavia, a significant decrease in the total number of road accidents was recorded compared to the years before and after (Chart 1). The decrease in road accidents is a direct consequence of the decrease in the standard of living of the population, which also implies reduced motor vehicle use. In 2003, the number of road accidents again decreased as a result of the tightened penalty policy and 7- to 10-fold increase in fines for traffic violations.

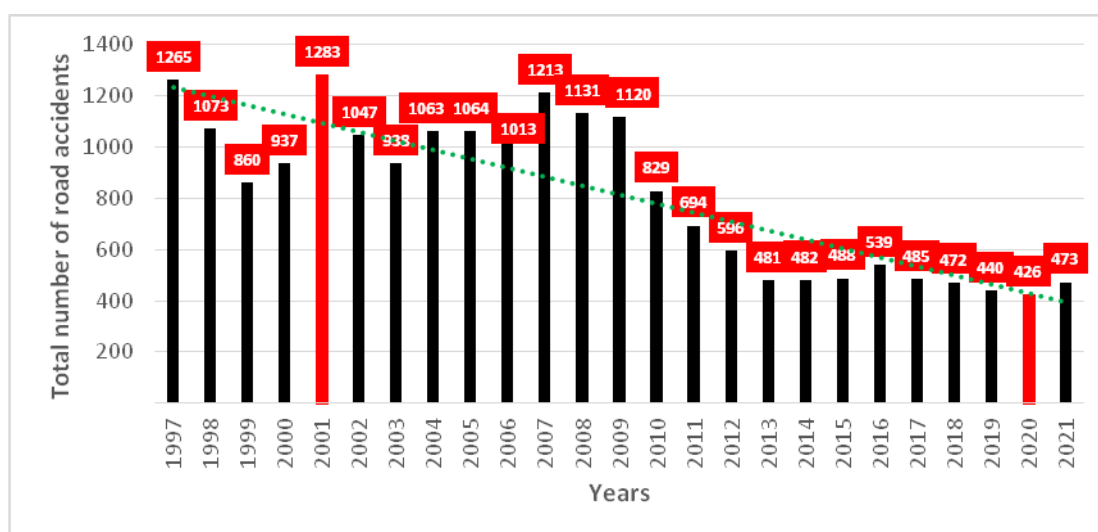


Chart 1. Total number of road accidents, the City of Kraljevo, 1997-2021

On December 10, 2009, the new Road Traffic Safety Law was passed, bringing about a decrease in the number of road accidents in 2010. After the new law adoption, the number of road accidents had been on a steady decline until 2014. In 2014, there was a slight increase in road accidents, after which, from 2016, further decrease in the annual number of road accidents was recorded, reaching the observed period all-time low in 2020. The outbreak of the COVID-19 pandemic in early 2020 was identified as the most significant factor for reduced road accident number, the impact of which was noticeable from March, and pandemic measures in Kraljevo for most of the year included restricted movement, but also the

declaration of a state of emergency and introduction of curfew, which had a direct effect on traffic intensity. Immediately afterward, in 2021, there was a noticeable increase in the total number of road accidents, due to the significantly reduced pandemic impact on traffic intensity, bringing about a significant increase in AADT in 2021 compared to 2020.

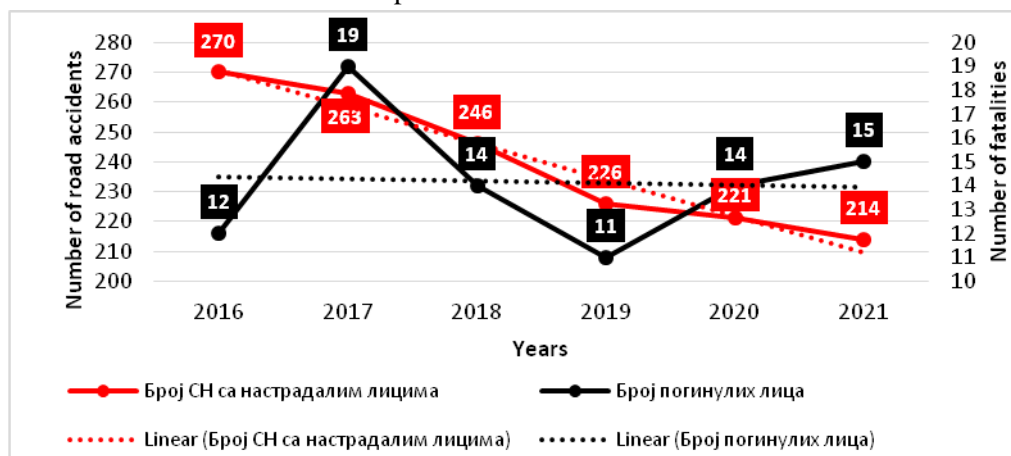


Chart 2. Road accidents with casualties and the number of road fatalities, the City of Kraljevo, 2016-2021

In the past 6 years (2016-2021), a total of **1,440 road accidents with casualties** were recorded in the territory of the City of Kraljevo (Chart 2). The fewest (**214**) and the most (**270**) road accidents with casualties were recorded in 2021 and 2016, respectively. The number of road fatalities in the same period (2016-2021) also had a declining trend. The lowest number of road fatalities was recorded in 2019, when 11 people were killed, while the highest number of road fatalities was in 2017 when 19 people were killed. Since 2019, the number of road accidents with casualties has been on a steady decline, but the reason for concern is the increase in the number of road fatalities in the past two years, which clearly indicates the need to improve the traffic safety system to reduce the frequency of the most severe consequences.

The detailed road accident analysis includes all road accidents registered in the territory of the City of Kraljevo in the period from 2016 to 2021. In the observed period, **a total of 2835 road accidents** were registered in the territory of the City of Kraljevo. The greatest number of registered road accidents resulted in property damages only (**1395 road accidents**), and a slightly lower number of road accidents with injuries were recorded (**1365 road accidents**). When it comes to road accidents with property damages only, it should be noted that there is a number of road accidents with minor property damage (up to RSD 200,000), which are covered by insurance company records and are not included in traffic police records. In the period from 2016 to 2020, **a total of 75 road accidents with fatalities** were registered in the territory of the City of Kraljevo.

The road accident chain index refers to the relative changes (in %) in the number of road accidents in the current year related to the preceding year, i.e., it shows percentage by which the number of road accidents in one year has changed compared to the previous year. By calculating the road accident chain index by type of consequences, it can be concluded that, relative to the previous year, the highest increase in the number of road accidents with fatalities was recorded in 2020 (Table 1). In the case of the number of road accidents with injuries, a steady decrease was recorded in the observed time period, while the highest

increase in the number of road accidents with property damages was recorded in 2021. When it comes to the total number of road accidents, the number of road accidents was on a steady decrease in the observed time period until 2020 only to grow by 11% in 2021 compared to 2020.

Table 1. Road accident chain index, the City of Kraljevo, 2016-2021

Year	RA with fatalities	%	RA with injuries	%	RA with property damages	%	RA total	%
2016	11	/	259	/	269	/	539	/
2017	14	27%	249	-4%	222	-17%	485	-10%
2018	12	-14%	234	-6%	227	2%	473	-3%
2019	10	-17%	216	-8%	214	-5%	440	-7%
2020	13	30%	208	-4%	205	-4%	426	-3%
2021	15	15%	199	-4%	259	26%	473	11%
Total	60		1365		1395		2835	

In the territory of the City of Kraljevo, there were **a total of 2115 road casualties** in the period from 2016 to 2021 (Table 2).

Table 2. Severity of road casualty consequences, the City of Kraljevo, 2016-2021

Year	Fatalities	%	People with severe injuries	%	People with minor injuries	%	Casualties total	%
2016	12	14%	76	18%	309	19%	397	19%
2017	19	22%	75	18%	310	19%	404	19%
2018	14	16%	81	20%	272	17%	367	17%
2019	11	13%	68	16%	246	15%	325	15%
2020	14	16%	62	15%	255	16%	331	16%
2021	15	18%	53	13%	223	14%	291	14%
Total	85	100%	415	100%	1615	100%	2115	100%
%	4%		20%		76%		100%	

The highest share in the total number of casualties is held by people with minor injuries (**76%**), followed by people with severe injuries (**20%**), while fatalities make up **4%** of all casualties. The highest number of road casualties was recorded in 2017. The number of people with severe road accident injuries registered in the territory of the City of Kraljevo in the period from 2016 to 2021 has a downward trend (Chart 3), with the exception of 2018, when there was a significant increase in people with severe injuries. On the other hand, the number of people who suffered minor road accident injuries in this period has a declining trend, with a slight increase in 2020 compared to the previous year in observed period.

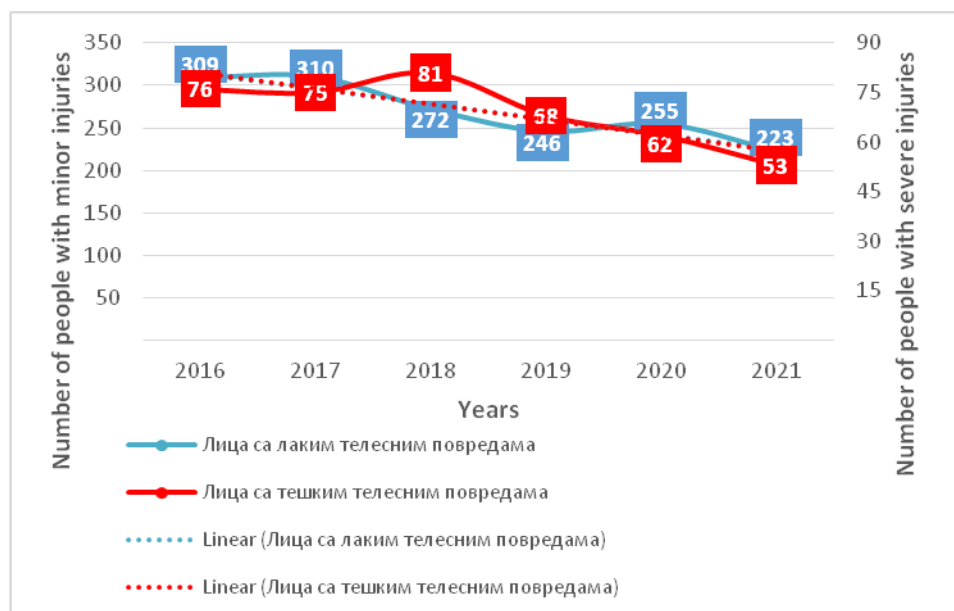


Chart 3. Road accident consequences, the City of Kraljevo, 2016-2021

As of 2016, the road accident characteristics data recording method has changed. The road accident for data recording has been discontinued, and a new category was introduced - road accident type. The "road accident type" category describes each road accident in more detail. Moreover, another category was introduced, "road accident type groups". All types of road accidents are systematized into 5 basic type groups.

The analysis of road accidents with casualties by road accident type groups covers only road accidents with casualties registered from 2016 to 2021. The distribution of road accidents with casualties by road accident type groups shows that the most represented types belong to the group **"no turn RA involving at least two vehicles"**. Types of road accidents from the group **"no turn RA involving at least two vehicles"** account for 27.6% of all road accidents with casualties (Chart 4). This group of types of road accidents with casualties includes road accidents involving at least two vehicles moving in the opposite direction, leading to a head-on collision, rear-end collision, catch-up collision, overtaking collision, side-impact collision, merging collision, and other no turn road accidents involving at least two vehicles, moving in the same or opposite direction. In addition to "no turn RA involving at least two vehicles", a significantly high share (over 20%) is also held by the groups of types of road accidents with casualties **"single vehicle RA"**, **"turn or cross RA involving at least two vehicles"** and **"pedestrian RA"** with 26.9%, 23% and 20.7%, respectively. The more detailed analysis included the above separate groups of road accident types and the share of road accident types and the group of influencing factors within each group was analyzed.

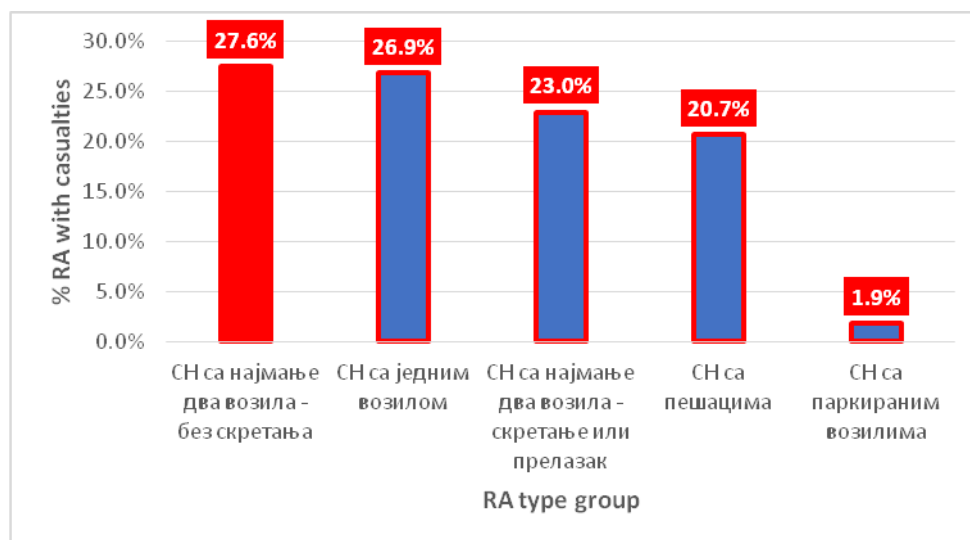


Chart 4. Shares of road accidents with casualties by road accidents type groups, the City of Kraljevo, 2016-2021.

1.2 The City of Kraljevo relative to other local self-government units in the Republic of Serbia

A component of road safety management is situation analysis and monitoring, which implies comparing road safety indicators with those of other local self-government units. For the purposes of road safety analysis on the territory of the City of Kraljevo, the values of relative road safety indicators calculated for the City of Kraljevo were compared with the values calculated for other LSUs in the Republic of Serbia. Drawing on available data, the comparison included 161 local self-government units. The relative road safety indicators used to compare the situation are public and traffic casualty risks. Public risk is defined as the number of fatalities per 10,000 inhabitants, and traffic risk as the number of fatalities per 10,000 registered motor vehicles. The risk calculated from the weighted number of fatalities was used for comparison. In valuing the severity of road accident consequences, the following weighting values were used: 99 for fatalities, 13 for people with severe injuries and 1 for people with minor injuries.

The following charts show the values of weighted public and traffic casualty risk by local self-government units in the Republic of Serbia. Both charts highlight the LSUs of the Raška administrative district, to which the City of Kraljevo belongs. With a weighted public casualty risk of 211 per 10,000 inhabitants, the City of Kraljevo belongs to high risk LSUs (Chart 5).

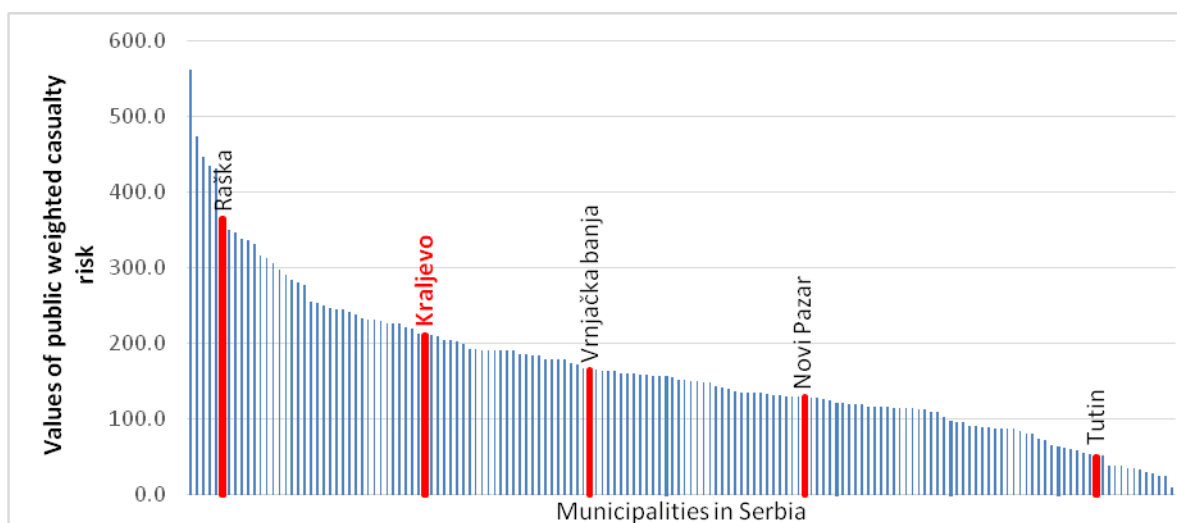


Chart 5. Values of public weighted casualty risk by municipalities in the Republic of Serbia, 2020

According to research conducted for the purposes of developing the 2020 General Urban Plan of the City of Kraljevo, the forecast average daily travel per inhabitant is 2.15 travels. This data indicates that the locals travel, to a certain extent, above the average, observed on a daily basis, with one inhabitant characteristically travelling by the model of going from home to the desired location and back home. Greater exposure to traffic increases the possibility of participating in and being casualty in road accidents, which justifies the high value of the weighted public casualty risk in the territory of the City of Kraljevo.

Observing the values of weighted traffic casualty risk, we conclude that the City of Kraljevo belongs to LSUs with a very high value of this risk (Chart 6). Namely, the value of weighted traffic casualty risk in the territory of the City of Kraljevo is **9964 per 10,000 registered motor vehicles**.

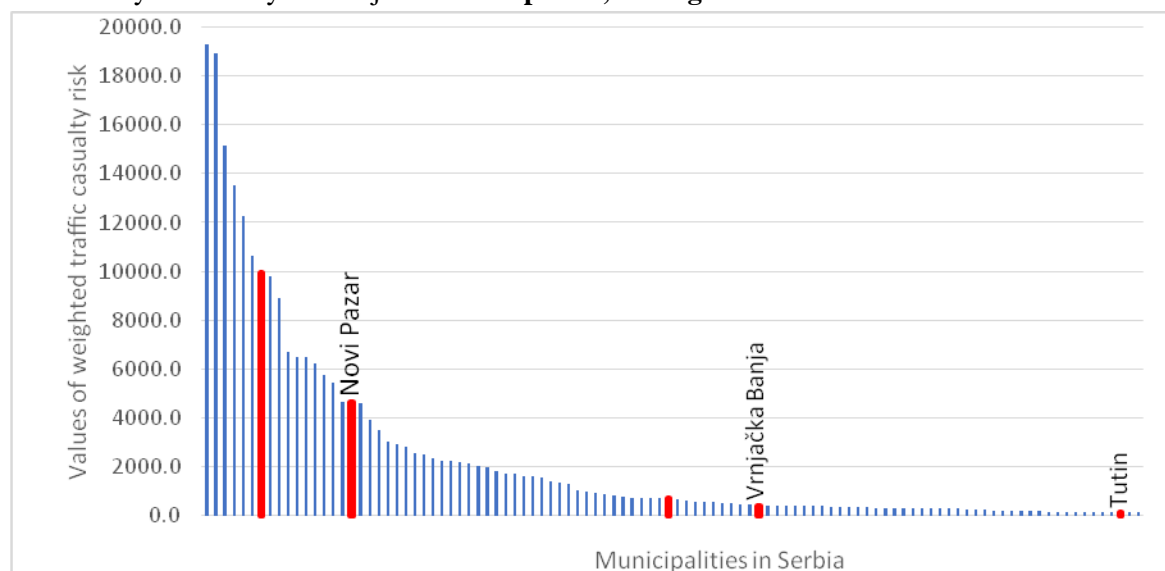


Chart 6. Values of weighted traffic casualty risk by municipalities in the Republic of Serbia, 2020

With a public weighted casualty risk value of **211 per 10,000 inhabitants**, the City of Kraljevo belongs to LSUs with a high value of this risk. Observing the values of weighted traffic casualty risk, we conclude that the City of Kraljevo belongs to very high risk LSUs. Namely, the value of weighted traffic casualty risk in the territory of the City of Kraljevo is **9964 per 10,000 registered motor vehicles**.

1.3 The City of Kraljevo relative to the Republic of Serbia

The road safety analysis for the territory of the City of Kraljevo also includes a comparative analysis of the percentage share of specific road user categories in the total number of fatalities and injured people in the territory of the City of Kraljevo and at the Republic level. The number of fatalities and injured people in the period from 2016 to 2021 was used in the comparative analysis by road accident participant categories.

In the time frame from the beginning of 2016 to the end of 2021 covered by the analysis, in the territory of the City of Kraljevo, the share of child fatalities in total fatalities is lower compared to the Republic level (Chart 7). The analysis included children aged 0 to 14 years. In the territory of the City of Kraljevo, the share of injured children in the total number of injured people is at the Republic level in the observed period and amounts to 7%.

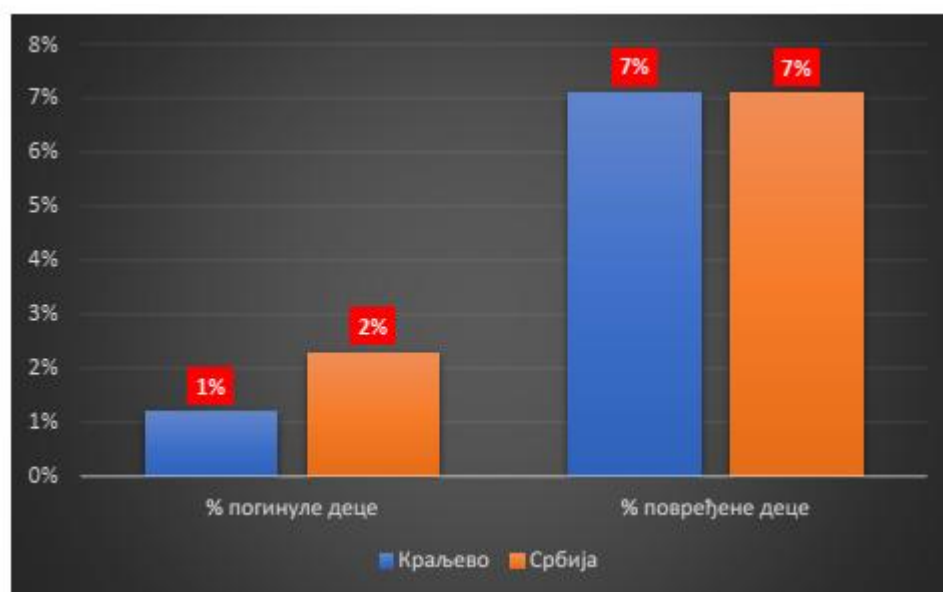


Chart 7. Percentage share of child fatalities and injured children in the total number of fatalities and injured people, the City of Kraljevo and the Republic of Serbia, 2016-2021

Pedestrian fatalities make up 18% of all road fatalities in the territory of the City of Kraljevo. At the Republic level, their share in total fatalities is 26% (Chart 8). The share of injured pedestrians in the total number of injured people in the territory of the City of Kraljevo is 16%, which is above the Republic level (13%). Pedestrians in the territory of the City of Kraljevo are a vulnerable road user category, and it is therefore necessary to take measures to improve their road safety.

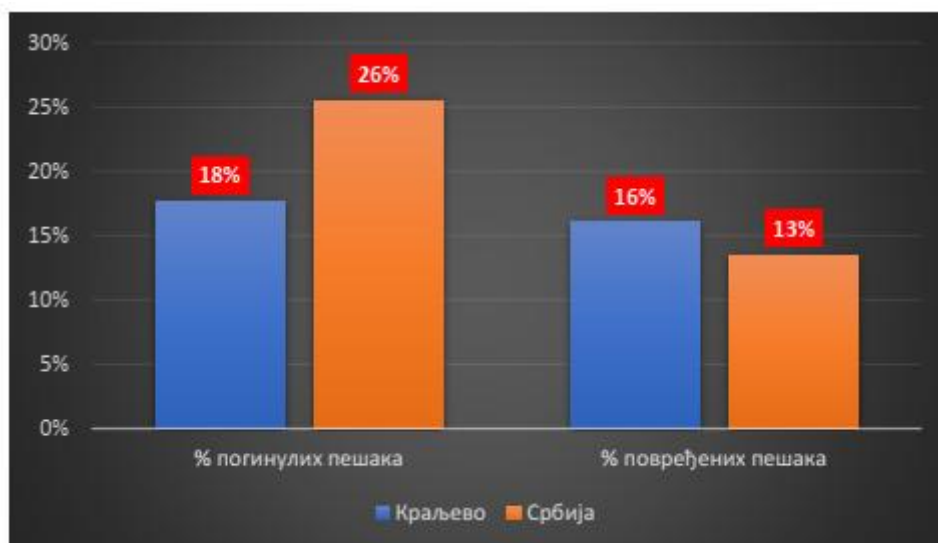


Chart 8. Percentage share pedestrian fatalities and injured pedestrians in the total number of fatalities and injured people, the City of Kraljevo and the Republic of Serbia, 2016-2021

In the time frame covered by the analysis, the share of cyclist fatalities in fatalities in the territory of the City of Kraljevo is above the Republic level and amounts to 12% (Chart 9). The share of injured cyclists total all injured people in the territory of the City of Kraljevo is 10%, which is higher than the Republic level (7%).

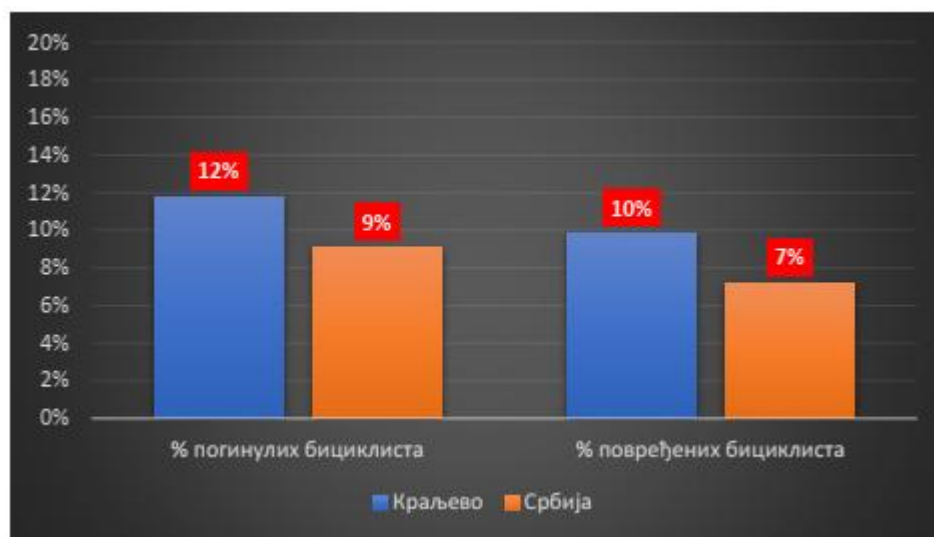


Chart 9. Percentage share of cyclist fatalities and injured cyclists in the total number of fatalities and injured people, the City of Kraljevo and the Republic of Serbia, 2016-2021

Fatalities over the age of 65 account for 32% of all fatalities in the territory of the City of Kraljevo, while this share is lower at the Republic level and amounts to 29% (Chart 10). In the territory of the City of Kraljevo, the share of injured people over the age of 65 in the total number of injured people amounts to 13%, which is above the Republic level (11%).

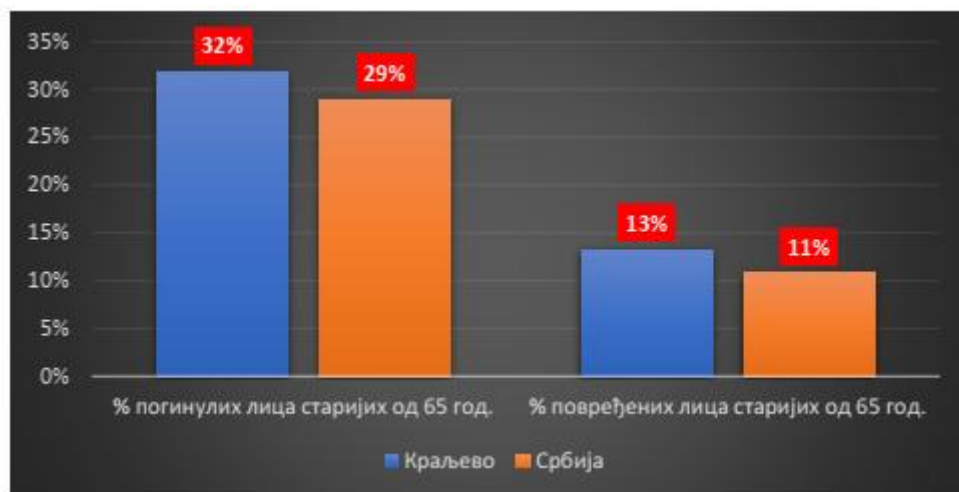


Chart 10. Percentage share of fatalities and injured people over 65 in the total number of fatalities and injured people, the City of Kraljevo and the Republic of Serbia, 2016-2021

When it comes to young people, referring to road users aged 15 to 30, in the territory of the City of Kraljevo, in the observed time frame covered by the analysis, 19% of fatalities were young people, which is at the Republic level (Chart 11). The share of injured young people in total injured people in the territory of the City of Kraljevo is 29%, which is below the Republic level (32%).

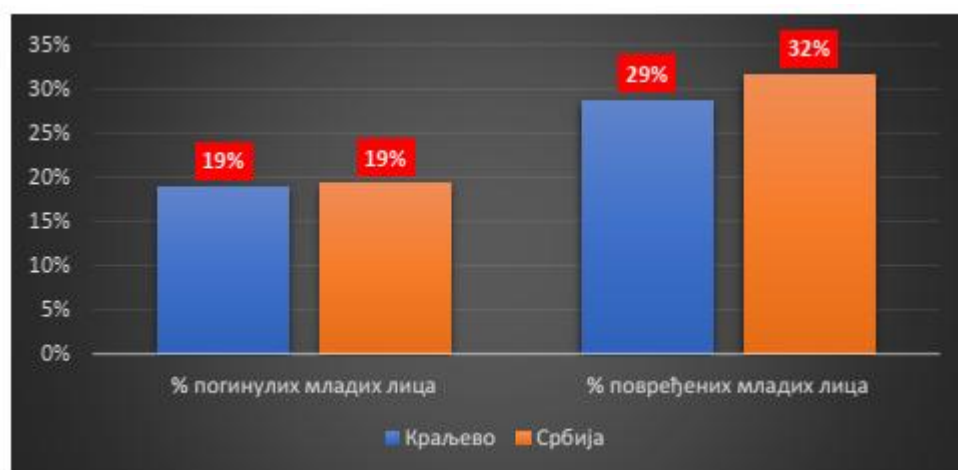


Chart 11. Percentage share of fatalities and injured young people in the total number of fatalities and injured people, the City of Kraljevo and Republic of Serbia, 2016-2021

When it comes to young drivers, referring to drivers aged 15 to 30, in the territory of the City of Kraljevo, in the observed time frame covered by the analysis, 9% of fatalities were young drivers, which is below the Republic level (Chart 12). The share of injured young drivers in total injured people in the territory of the City of Kraljevo is 12%, which is below the Republic level (15%).

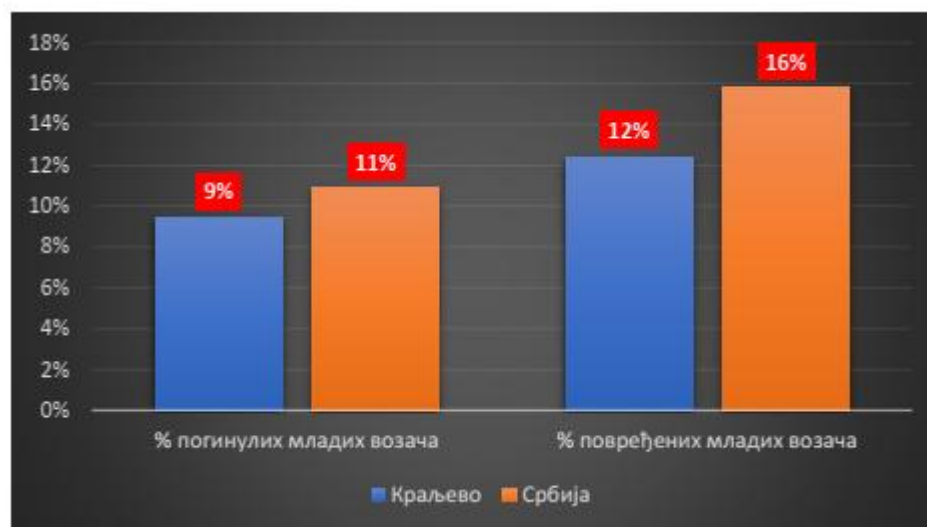


Chart 12. Percentage share of fatalities and injured young drivers in the total number of fatalities and injured people, the City of Kraljevo and Republic of Serbia, 2016-2021

In the territory of the City of Kraljevo, in the observed period, driver and passenger fatalities make up 54% of all road fatalities, which is above the Republic level, where 45% of all road fatalities are drivers and passengers. (Chart 13). When it comes to injured drivers and passengers, their percentage share in the total number of injured people in the territory of the City of Kraljevo is 59%, which is 3% less than the Republic level.

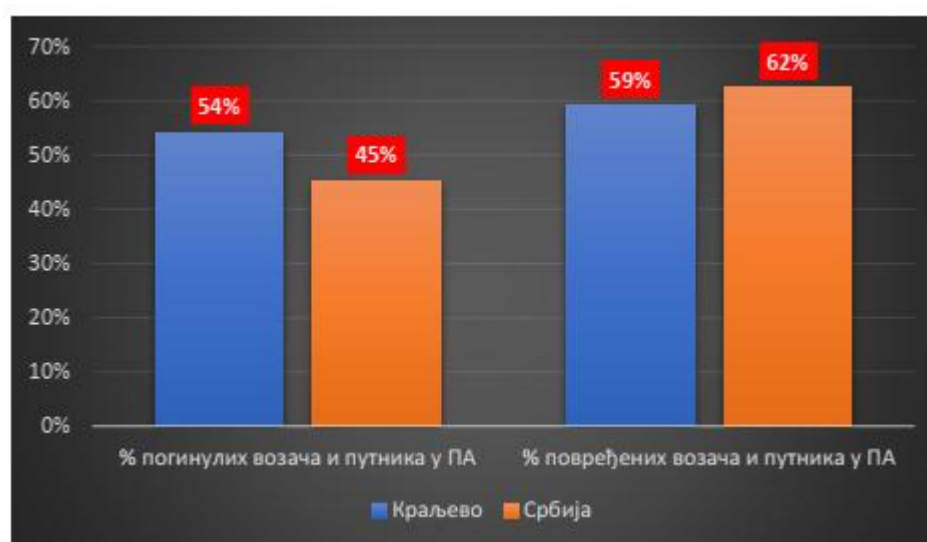


Chart 13. Percentage share of fatalities and injured drivers and passengers in the total number of fatalities and injured people, the City of Kraljevo and the Republic of Serbia, 2016-2021

In the territory of the City of Kraljevo, in the observed period, the percentage of motorized two-wheeler driver fatalities in total fatalities in the territory of the City of Kraljevo is 7%, which is below the

Republic average (Chart 14). Share of injured motorized two-wheeler drivers in the total number of injured people in the territory of the City of Kraljevo is 6%, which is at the Republic level.

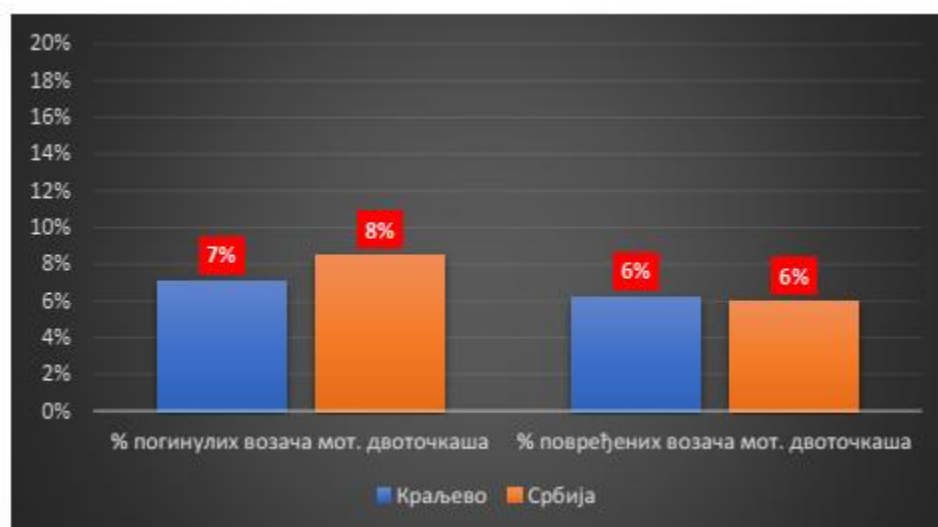


Chart 14. Percentage share of fatalities and injured motorized two-wheeler drivers in the total number of fatalities and injured people, the City of Kraljevo and the Republic of Serbia, 2016-2021

When it comes to fatalities in road accidents involving commercial vehicles, in the territory of the City of Kraljevo, in the observed period, 35% of fatalities are fatalities in road accidents involving commercial vehicles, which is significantly above the Republic level (Chart 15). The share of injured people in road accidents involving commercial vehicles in total injured people in the territory of the City of Kraljevo is 15%, which is below the Republic level (16%).

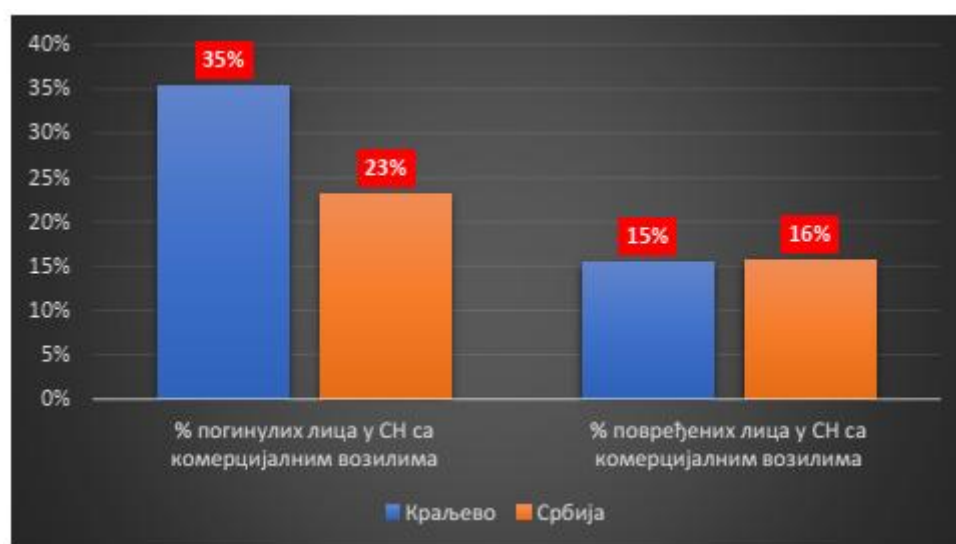


Chart 15. Percentage share of fatalities and injured people in RA involving commercial vehicles in the total number of fatalities and injured people, the City of Kraljevo and the Republic of Serbia, 2016-2021

1.4 Time distribution of road accidents with casualties in the City of Kraljevo between 2016 and 2021

The time distribution of road accidents with casualties by months shows that a greater number of road accidents occur in the second six-month period of the year, namely, 58% of all road accidents with casualties were registered in the period from July to December (Chart 16). Observed by quarters, the most road accidents with casualties were registered in the third quarter, i.e. in the period from July to September, namely, 31% of all road accidents with casualties, which can be correlated with the assumption that in the summer months there is an increase in traffic intensity (greater number of vehicles on the street and road network, greater number of travels), i.e. MADT (monthly average daily traffic) value. The most road accidents were registered in July, with a share of 11% in the total number of road accidents with casualties.

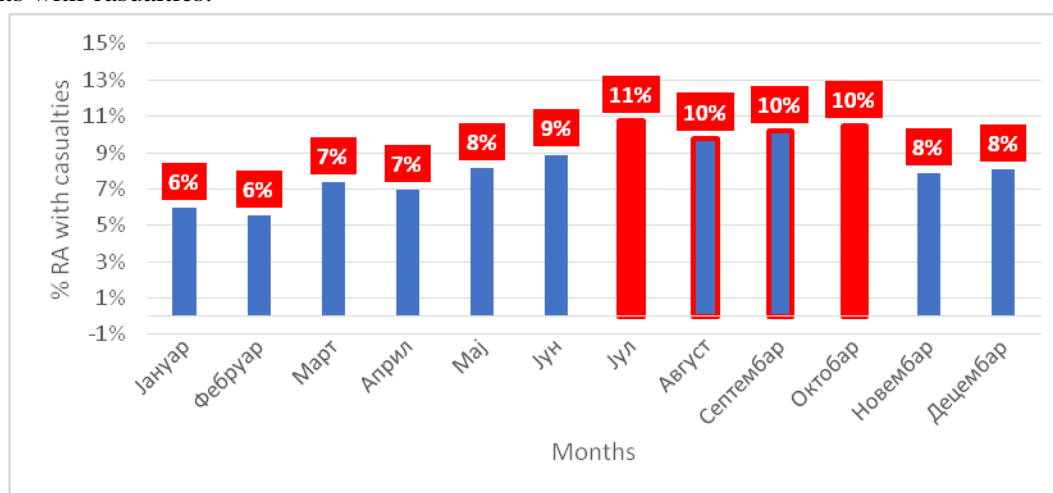


Chart 16. Distribution of road accidents with casualties by months, City of Kraljevo, 2016-2021

The distribution of road accidents with casualties by days of the week shows that the most road accidents were registered on Friday, namely, 17% of all road accidents, which may be a consequence of the expected situation that on Fridays, traffic intensity is higher compared to other days of the week, and therefore, there is a greater number of vehicles participating in traffic, further resulting in an increase in the probability of road accidents with casualties (Chart 17). In the case of other days of the week, the percentage of road accidents with casualties is slightly lower, i.e., there is no significant percentage deviation in any day within the time distribution of road accidents with casualties observed at the week level.

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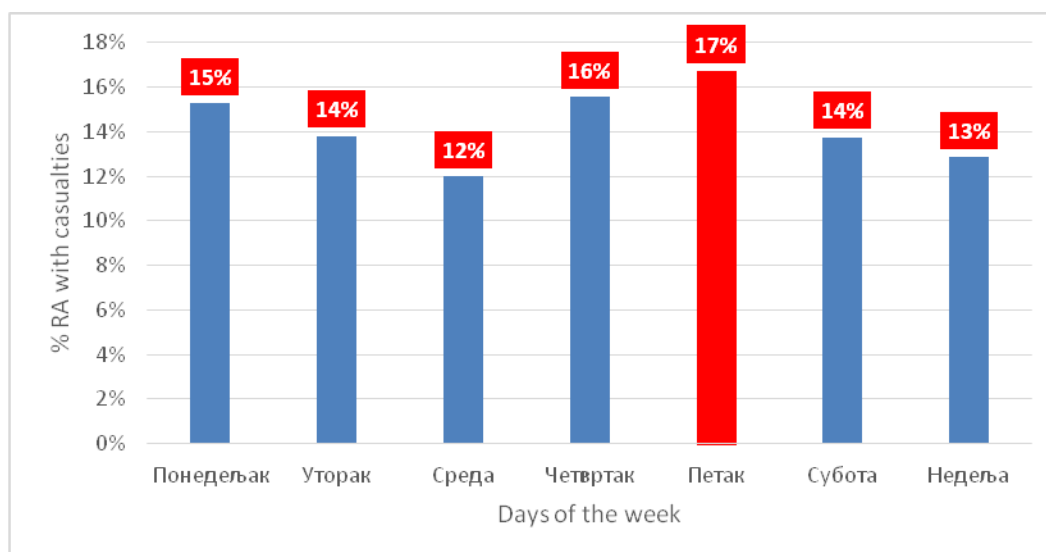


Chart 17. Distribution of road accidents with casualties by days of the week, City of Kraljevo, 2016-2021

From the distribution of road accidents with casualties by the hours of the day, it can be concluded that the afternoon period from 1:00 p.m. to 5:59 p.m. dominated by travel for work (returning home after working hours), is the least safe period during the day in which 37% of the total number of road accidents with casualties were registered between 2016 and 2021. Note that this period is also characteristic for elementary and secondary school students moving outside the school yard, going to school in the second shift or returning home from the first shift (Chart 18).

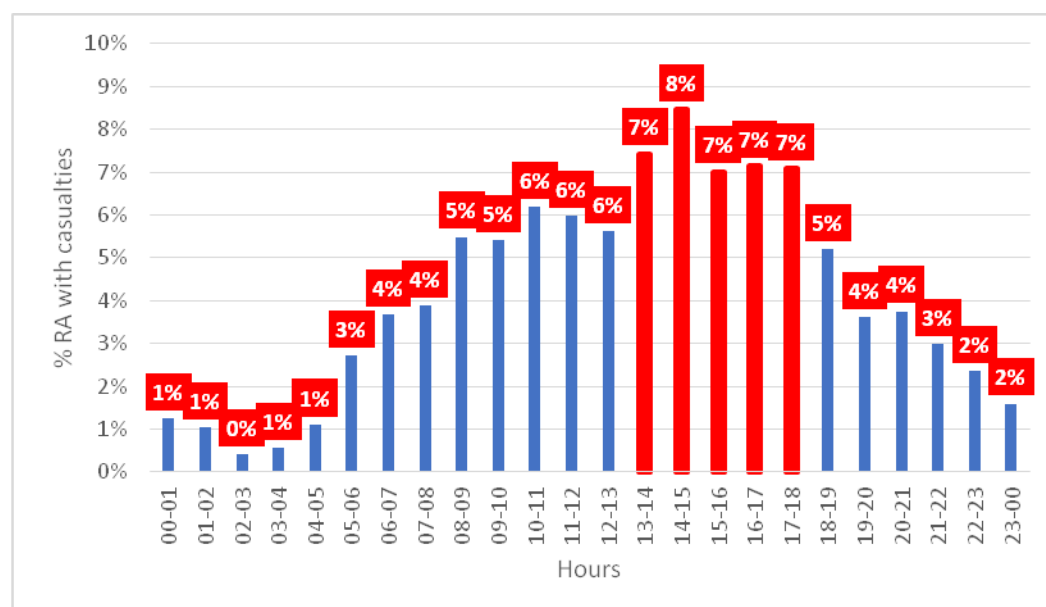


Chart 18. Distribution of road accidents with casualties by hours of the day, City of Kraljevo, 2016-2021

1.5 Distribution of road accidents with casualties and their consequences by gender and age between 2016 and 2021

The distribution of road casualties by gender clearly shows that male casualties hold a significantly higher percentage (**65.2%**) than female casualties (**34.8%**). Men make up almost two-thirds of road casualties, which is in direct correlation with the fact that there is a significantly higher number of registered male drivers, men travel more and more often participate in traffic, but also commit a higher number of traffic violations, which greatly increases the probability of them being road casualties (Chart 19).

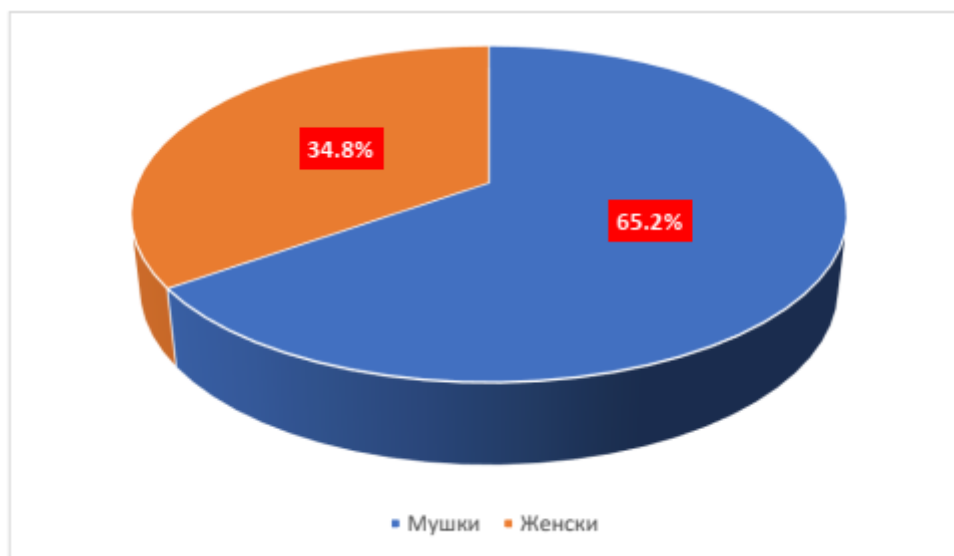


Chart 19. Distribution of road casualties by gender, City of Kraljevo, 2016-2021

By classifying road accidents with casualties to age categories, it can be concluded that the most road accidents with casualties belong to the age category of 46 to 64 years, i.e. make up **28.1%** of all road accidents with casualties, which clearly indicates that this age category is the most vulnerable and that it is necessary to perform a more detailed analysis of road accidents involving inhabitants aged 46 to 64 (Chart 20). The second most represented age category of participants in road accidents with casualties, with a 27.4% share, is from 31 to 45, immediately followed by young people (15-30 years) with a 23.9% share, people aged over 65 with a 14.5% share, while the lowest number of road accidents with casualties belongs to the age category 0 to 14 (children), 6.1%.

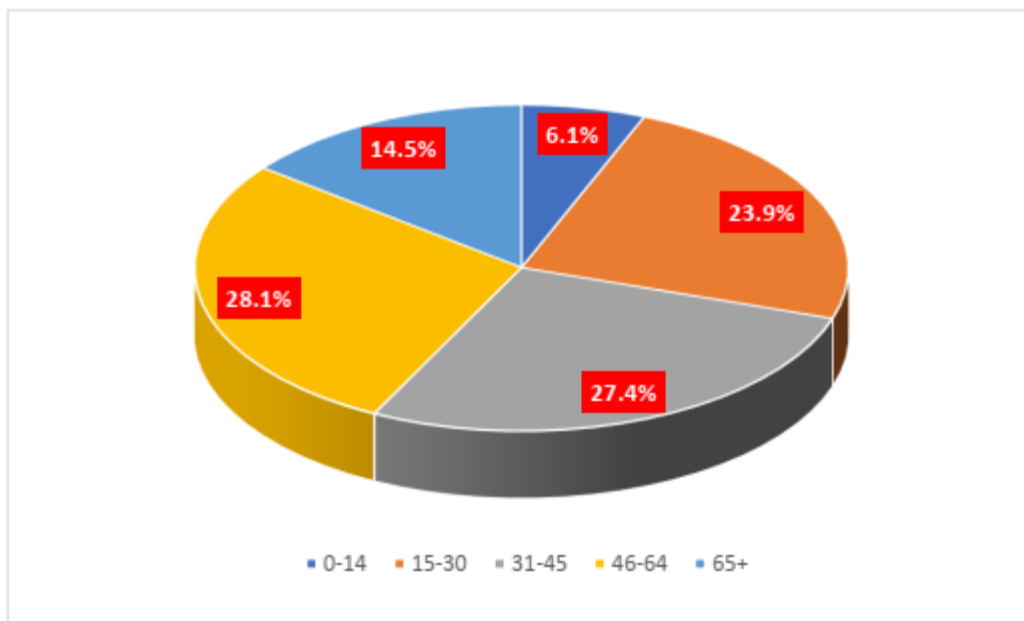


Chart 20. Distribution of road accidents with casualties in road accidents by age categories, City of Kraljevo, 2016-2021

By the type of road accident consequences, the most represented age categories are **46-64** and **65+** years. In the case of people with severe injuries, these were most often people aged **46-64**, and in the case of people with minor injuries, the most represented age category was **15-30** (Chart 21).

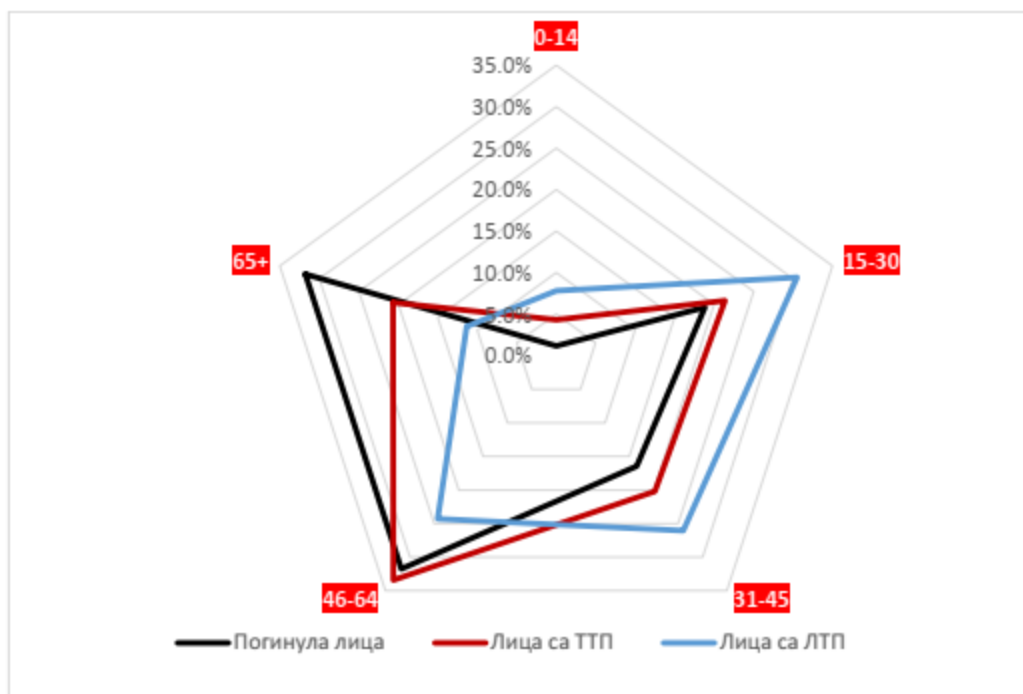


Chart 21. Distribution of road casualties by age categories, City of Kraljevo, 2016-2021

1.6 Distribution of casualties by the nature of participation in traffic between 2016 and 2021

From the distribution of road accident participant casualties by the nature of their road using, it can be concluded that drivers, with a **50.05%** share, participated in the highest percentage of road accidents (Chart 22). Passengers as road accident participants participated with a share of 33.79%, pedestrians make up 16.07% of casualties, while other participant categories account for 0.1% of road casualties.

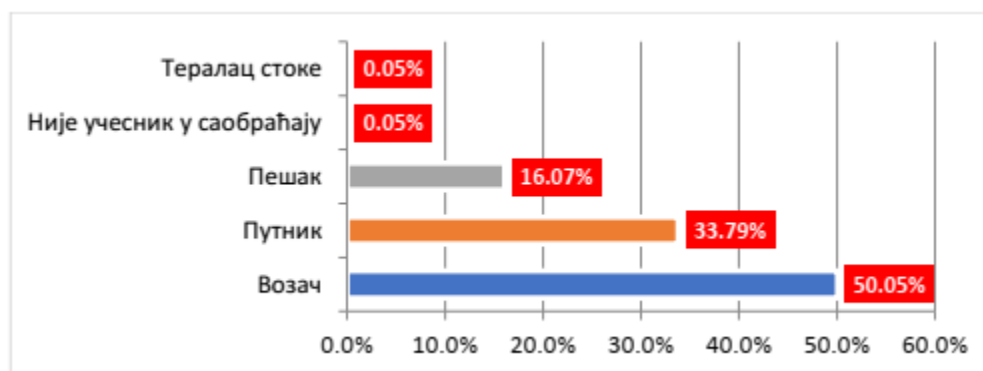


Chart 22. Distribution of participant casualties by the nature of road using, the City of Kraljevo, 2016-2021

The analysis of casualties by categories of vehicles they used when involved in road accident shows that the highest number of victims were in passenger vehicles, with a 71.7% share (Chart 23). These were followed by bicycles, with a 10.5% share, and cargo vehicles and motorcycles with 5.7% and 4.8%, respectively.

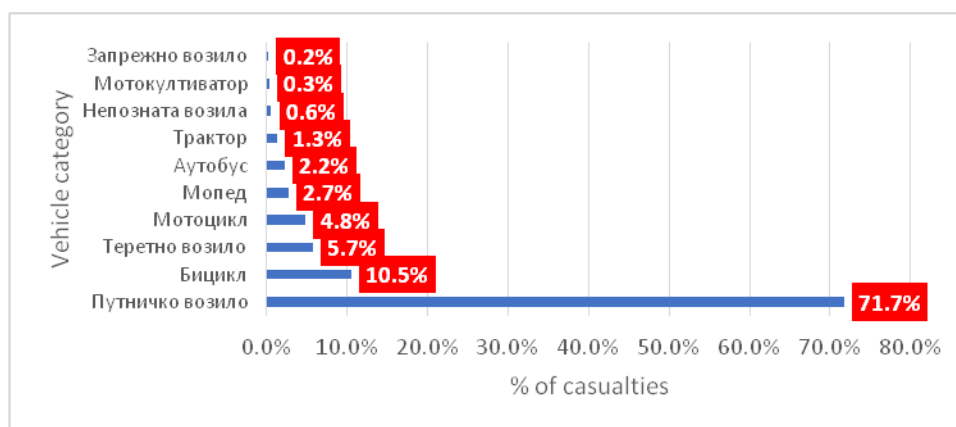


Chart 23. Distribution of casualties by vehicle category, City of Kraljevo, 2016-2021

1.7 Analysis of the types of road accidents that occurred in the City of Kraljevo between 2016 and 2021

Based on the previously analyzed data under 1.1, road accidents with casualties were distributed by road accident type groups. Within this distribution, road accidents belonging to the group **"no turn RA involving at least two vehicles"** were singled out as the most represented, with a share of **27.6%**, followed by road accidents belonging to the groups **"single vehicle RA"**, **"turn or cross RA involving at**

least two vehicles" and **"pedestrian RA"** with percentages of **26.9%**, **23%** and **20.7%**, respectively. Road accidents with casualties belonging to the group **"parked vehicle RA"** hold a share of 1.9%, so they will not be analyzed in detail within this analysis.

The separate road accident type groups are analyzed in detail below by the types of road accidents belonging to them.

1) Analysis of the types of road accidents with casualties belonging to the group "no turn RA involving at least two vehicles"

The types of road accidents from the group **"no turn RA involving at least two vehicles"** account for 27.6% of all road accidents with casualties. This group of types of road accidents with casualties includes road accidents involving at least two vehicles moving in the opposite direction, resulting in a head-on collision. In addition, rear-end collisions, catch-up collisions, overtaking collisions, side-impact collisions, merging collisions, and other no turn road accidents involving at least two vehicles moving in the same or opposite direction are characteristic of this group of road accident types. The following table shows the types of road accidents with casualties within the type group "no turn RA involving at least two vehicles", grouped into 6 subgroups. In the observed period between 2016 and 2021, a total of **370** road accidents with casualties occurred in the City of Kraljevo belonging to the road accident type group "no turn RA involving at least two vehicles", of which **28** were road accidents with fatalities and **342** road accidents with injured people.

Table 3. Road accidents with casualties belonging to the "no turn RA involving at least two vehicles" type group, City of Kraljevo, 2016-2021

RA type	RA fat.	RA inj.	RA cas.
At least two vehicles moving in the same direction – catch-up	1	113	114
At least two vehicles – in opposite directions and no turn – rear-end and other accidents	7	94	101
At least two vehicles - head-on collision	16	66	82
At least two vehicles moving in the same direction – side-impact collision and other	1	35	36
At least two vehicles moving in the same direction – overtaking collision	3	23	26
At least two vehicles moving in the same direction – merging collision	0	11	11
Total	28	342	370

From the data given in the previous table, it can be concluded that road accidents with injuries are most often represented within the road accident type group "no turn RA involving at least two vehicles", when at least two vehicles move in the same direction and cause **catch-up** collisions, which may be the result of insufficient driver alertness and caution, vehicle malfunctioning, but also speeding of the vehicle catching up. Although with road accidents with casualties, the type of road accidents (subgroup) **involving at least**

two vehicles - head-on collisions comes third, it is important to emphasize that for this type of road accidents, a significantly higher number of road accidents with fatalities was recorded than for any other type of road accident belonging to the group "no turn RA involving at least two vehicles". Head-on collisions may be the result of insufficient driver alertness and caution, vehicle malfunctioning, but also insufficient road safety, i.e. roadway damage or insufficient visibility.

For the same time period, from 2016 to 2021, the number of casualties in road accidents belonging to the group of types of road accidents with casualties "no turn RA involving at least two vehicles" in the territory of the City of Kraljevo was analyzed. The analysis found that a total of **658** people were casualties in road accidents belonging to the group "no turn RA involving at least two vehicles", of which **37** people were fatalities, **91** people were severely injured, while **530** people suffered minor injuries (Table 4). The total number of casualties in the City of Kraljevo in the observed period from 2016 to 2021 is **2116**, meaning that the casualties in road accidents belonging to the group "no turn RA involving at least two vehicles" account for **31.1%** of all casualties in the City of Kraljevo in the observed period between 2016 and 2021.

The following table shows casualty consequences by type of road accidents with casualties in the group "no turn RA involving at least two vehicles" which are grouped into 6 subgroups.

Table 4. Casualties in road accidents belonging to the "no turn RA involving at least two vehicles" type group, City of Kraljevo, 2016-2021

RA type	RA fat.	RA inj.	RA cas.
At least two vehicles – head-on collision	24	178	202
At least two vehicles moving in the same direction – catch-up	1	182	183
At least two vehicles – in opposite directions and no turn – rear-end and other accidents	7	165	172
At least two vehicles moving in the same direction – side-impact collision and other	1	50	51
At least two vehicles moving in the same direction – overtaking collision	4	32	36
At least two vehicles moving in the same direction – merging collision	0	14	14
Total	37	621	658

2) Analysis of the types of road accidents with casualties belonging to the group "single vehicle RA"

Types of road accidents from the group "single vehicle RA" make up 26.9% of all road accidents with casualties. This group of types of road accidents with casualties includes left or right side roadway departure and roadway departure at curve, single vehicle rollover, single vehicle road accident caused by obstacles in the roadway involving animals or road works, no roadway obstacle unspecified single vehicle road accident, and intersection or interchange single vehicle road accident. The following table shows the types of road accidents with casualties within the group "single vehicle RA" grouped into 5 subgroups. In

the observed 2016-2021 time frame, a total of **391** road accidents with casualties occurred in the City of Kraljevo belonging to the road accident type group "single vehicle RA", of which **23** were road accidents with fatalities and **368** road accidents with injured people.

Table 5. Road accidents with casualties belonging to the type group "single vehicle RA", City of Kraljevo, 2016-2021

RA type	RA fat.	RA inj.	RA cas.
Left or right side roadway departure and roadway departure at curve	15	226	241
Single vehicle rollover	6	77	83
No roadway obstacle unspecified single vehicle road accident	1	47	48
Single vehicle road accident caused by obstacles in the roadway involving animals or road works	1	11	12
Intersection or interchange single vehicle road accident	0	7	7
Total	23	368	391

From the data shown in the above table, it can be concluded that most often road accidents with casualties within the road accident type group "single vehicle RA" are left or right side roadway departure and roadway departure at curve which can may result from insufficient driver alertness and caution, vehicle malfunction, but also insufficient road safety, i.e. damaged roadway or insufficient visibility in curves. The following most often subgroup of road accidents with casualties within the road accident type group "single vehicle RA" are single vehicle rollovers, which may be a consequence of unfavorable weather conditions on the road, vehicle malfunction, or inadequate driving and inexperienced driver. In the case of the road accident type group "single vehicle RA", **the road and surroundings impact** is expected to the greatest extent, which will be examined within the analysis of influencing factors that contributed to the occurrence of road accidents with casualties belonging to this road accident type group.

In the same period, between 2016 and 2021, in the territory of the City of Kraljevo, the number of casualties in road accidents belonging the group of types of road accidents with casualties "single vehicle RA" was analyzed. The analysis found a total of **551** casualties in road accidents belonging to the group "single vehicle RA", of which **24** were fatalities, **138** people had severe injuries, while **389** people suffered minor injuries (Table 6). The total number of casualties in the City of Kraljevo in the observed time frame between 2016 and 2021 is **2116**, meaning that casualties in road accidents belonging to the group "single vehicle RA" make up 26% of all casualties.

The following table shows casualty consequences by type of road accidents with casualties within the group "single vehicle RA" which are grouped into 5 subgroups.

Table 6. Casualties in road accidents belonging to the type group "single vehicle RA", City of Kraljevo, 2016-2021

RA type	RA fat.	RA inj.	RA cas.
Left or right side roadway departure and roadway departure at	15	358	373

curve			
Single vehicle rollover	6	94	100
No roadway obstacle unspecified single vehicle road accident	1	54	55
Single vehicle road accident caused by obstacles in the roadway involving animals or road works	2	14	16
Intersection or interchange single vehicle road accident	0	7	7
Total	24	527	551

3) Analysis of the types of road accidents with casualties belonging to the group "turn or cross RA involving at least two vehicles"

The types of road accidents from the group "turn or cross RA involving at least two vehicles" account for **23%** of all road accidents with casualties. This group of types of road accidents with casualties includes road accidents involving at least two vehicles moving on the same road in opposite directions, with one vehicle making a U-turn or left turn in front of the other vehicle, and with both vehicles turning onto the same road or opposite roads, at least two vehicles moving on the same road in the same direction with one vehicle making a turn, left turn, right turn or U-turn in front of the other vehicle, at least two vehicles moving on different roads making a left turn and vehicle approaching from the right or left, at least two vehicles moving on the same road in the same direction making a turn, catch-up collision, at least two vehicles moving on different roads while passing the intersection, or one crossing the roadway, with no turn, at least two vehicles moving on different roads making a right turn in front of the vehicle approaching from the left and head-on collision with the vehicle approaching from the right and other accidents involving at least two vehicles moving on different roads or on the same road in the same direction or in opposite directions making a turn.

The following table shows the types of road accidents with casualties within the type group "turn or cross RA involving at least two vehicles" grouped into 7 subgroups. In the observed 2016-2021 period, in the City of Kraljevo, a total of **331** road accidents with casualties belonging to the group "turn or cross RA involving at least two vehicles", took place, of which **8** were road accidents with fatalities and **323** were road accidents with injured people.

Table 7. Road accidents with casualties belonging to the type group "turn or cross RA involving at least two vehicles", City of Kraljevo, 2016-2021

RA type	RA fat.	RA inj.	RA cas.
At least two vehicles moving on the same road in opposite directions, with one vehicle making a U-turn or left turn in front of the other vehicle, and with both vehicles turning onto the same road or opposite roads	2	86	88
At least two vehicles moving on the same road in the same direction with one vehicle making a turn, left turn, right turn or U-turn in front of the other vehicle	2	65	67
At least two vehicles moving on different roads making a left turn	1	56	57

and vehicle approaching from the right or left			
At least two vehicles moving on the same road in the same direction making a turn, catch-up collision	0	41	41
At least two vehicles moving on different roads while passing the intersection, or one crossing the roadway, with no turn	1	33	34
At least two vehicles moving on different roads making a right turn in front of the vehicle approaching from the left and head-on collision with the vehicle approaching from the right	2	20	22
Other accidents involving at least two vehicles moving on different roads or on the same road in the same direction or in opposite directions making a turn	0	22	22
Total	8	323	331

From on the data shown in the table above, it can be concluded that the most common road accidents (subgroup of types) with casualties within the road accident type group "turn or cross RA involving at least two vehicles" are road accidents involving at least two vehicles moving on the same road in opposite directions, with one vehicle making a U-turn or left turn in front of the other vehicle, and with both vehicles turning onto the same road or opposite roads, which can most often be the result of unexpected and careless driver behavior (sudden turns without first activating the turn signals) and insufficient road visibility. A significant number of road accidents with casualties were also recorded within the subgroup of road accidents involving at least two vehicles moving on the same road in the same direction with one vehicle making a turn, left turn, right turn or U-turn in front of the other vehicle.

Within the same period, from 2016 to 2021, in the territory of the City of Kraljevo, the number of casualties in road accidents belonging to the group of types of road accidents with casualties "turn or cross RA involving at least two vehicles" was analyzed. The analysis found there was a total of **530** casualties in road accidents belonging to the group of types of road accidents "turn or cross RA involving at least two vehicles", of which **8** were fatalities, **82** people has severe injuries, while **440** people suffered minor injuries (Table 8). The total number of casualties in the City of Kraljevo in the observed period between 2016 and 2021 is **2116**, meaning that casualties in road accidents belonging to the group of types of road accidents "no turn RA involving at least two vehicles" account for **25%** of all casualties in the City of Kraljevo in the observed period between 2016 and 2021.

The following table shows the consequences of casualties by type of road accident with casualties within the group "Turn or cross RA involving at least two vehicles" grouped into 7 subgroups.

Table 8. Casualties in road accidents belonging to the type group "turn or cross RA involving at least two vehicles", City of Kraljevo, 2016-2021

RA type	RA fat.	RA inj.	RA cas.
At least two vehicles moving on the same road in opposite directions, with one vehicle making a U-turn or left turn in front of the other vehicle, and with both vehicles turning onto the same	2	155	157

road or opposite roads			
At least two vehicles moving on different roads making a left turn and vehicle approaching from the right or left	1	102	103
At least two vehicles moving on the same road in the same direction with one vehicle making a turn, left turn, right turn or U-turn in front of the other vehicle	2	92	94
At least two vehicles moving on the same road in the same direction making a turn, catch-up collision	0	55	55
At least two vehicles moving on different roads while passing the intersection, or one crossing the roadway, with no turn	1	50	51
Other accidents involving at least two vehicles moving on different roads or on the same road in the same direction or in opposite directions making a turn	0	38	38
At least two vehicles moving on different roads making a right turn in front of the vehicle approaching from the left and head-on collision with the vehicle approaching from the right	2	30	32
Total	8	522	530

4) Analysis of the types of road accidents with casualties belonging to the group "pedestrian RA"

Types of road accidents from the group "**pedestrian RA**" account for **20.7%** of all road accidents with casualties. This group of types of road accidents with casualties includes vehicle-pedestrian collisions with pedestrians crossing the roadway outside the intersection and at the intersection with and without vehicle turn, with pedestrians standing on the roadway or moving along the roadway in the vehicle movement direction and opposite to the vehicle movement direction, with pedestrians standing on or moving along the cycle path and sidewalk, and with pedestrians in other situations. The following table shows the types of road accidents with casualties within the "pedestrian RA" type group, grouped into 5 subgroups. In the observed 2016-2021 period, **290** road accidents belonging to the road accident type group "pedestrian RA" occurred in the City of Kraljevo, of which **12** were road accidents with casualties and **278** were road accidents with injured people.

Table 9. Road accidents with casualties belonging to the type group "pedestrian RA", City of Kraljevo, 2016-2021

RA type	RA fat.	RA inj.	RA cas.
Pedestrian crossing from left and right, at the intersection, with and without vehicle turn	3	102	105
Pedestrian crossing from left and right, outside the intersection, without vehicle turn	6	86	92
Pedestrian standing on the roadway or moving along the roadway in the vehicle movement direction and opposite to the vehicle movement direction	2	62	64
Pedestrian standing on or moving along the cycle path and sidewalk	0	15	15

Pedestrian - other situations	1	13	14
Total	12	278	290

From the data shown in the table above, it can be concluded that most common road accidents with casualties in the road accident type group "Pedestrian RA" are those when pedestrians cross the roadway from the left and right, at the intersection, with and without vehicle turn, which may primarily be the result of reckless behavior by both pedestrians and drivers (pedestrians crossing the roadway when not allowed, drivers not stopping in front of a marked pedestrian crossing, inappropriate speed, pedestrians crossing roadway outside marked pedestrian crossing, etc.). These are followed by road accidents involving pedestrians crossing from the left and right, outside the intersection, without vehicle turn, which may be the result of reckless behavior by both pedestrians and drivers, which is also the case with the previously mentioned road accident subgroup, but also the lack of adequate horizontal and vertical signals, as well as road visibility (in this case, these include no marked pedestrian crossing where necessary, pedestrians crossing the roadway outside the pedestrian crossing, inappropriate driver speed in the conditions of reduced road visibility, etc.). These are followed by road accidents with casualties involving a pedestrian standing on the roadway or moving along the roadway in the vehicle moving direction or opposite to the vehicle moving direction, which may be the result of reckless behavior of pedestrian (unexpected and unduly movement along the roadway, stopping on the roadway, etc.), but also the lack of road infrastructure for pedestrian movement, with pedestrians being forced to move on the roadway or along the very edge of the roadway.

Within the same time period, between 2016 and 2021, in the territory of the City of Kraljevo, the number of casualties in road accidents belonging to the group of types of road accidents with casualties "pedestrian RA" was analyzed. The analysis found there were a total of **312** casualties in road accidents belonging to the group "pedestrian RA", of which **12** were fatalities, **91** people suffered severe injuries, while **209** people suffered minor injuries (Table 10). The total number of casualties in the City of Kraljevo in the observed period between 2016 and 2021 is **2116**, meaning that casualties in road accidents belonging to the group "pedestrian RA" account for **14.7%** of all casualties in the City of Kraljevo in the observed time frame from 2016 to 2021.

The following table shows the consequences of casualties by type of road accident with casualties within the group "pedestrian RA" which are grouped into 5 subgroups.

Table 10. Casualties in road accidents belonging to the group "pedestrian RA", City of Kraljevo, 2016-2021

RA type	RA fat.	RA inj.	RA cas.
Pedestrian crossing from left and right, at the intersection, with and without vehicle turn	3	108	111
Pedestrian crossing from left and right, outside the intersection, without vehicle turn	6	88	94
Pedestrian standing on the roadway or moving along the roadway in the vehicle movement direction and opposite to the vehicle movement direction	2	73	75

Pedestrian - other situations	1	15	16
Pedestrian standing on or moving along the cycle path and sidewalk	0	16	16
Total	12	300	312

1.8 Analysis of influencing factors in the occurrence of road accidents in the City of Kraljevo in the period between 2016 and 2021

In order to define what caused a road accident, it is necessary to analyze the influencing factors that contributed to it. This chapter gives a detailed analysis of influencing factors that contributed to the occurrence of road accidents with casualties in the territory of the City of Kraljevo, in the observed time frame between 2016 and 2021.

First the groups of influencing factors that contributed to the greatest extent to the occurrence of road accidents with casualties were analyzed (Chart 24).



Chart 24. Distribution of groups of influencing factors that contributed to the occurrence of road accidents with casualties, City of Kraljevo, 2016-2021

Reckless driver actions is the most represented group of influencing factors that contributed to the occurrence of road accidents with casualties. This is followed by the groups of influencing factors **Driver misactions** and **Driver failure due to poor psychophysical condition, non-alertness, distraction** with a significant percentage.

- **Reckless driver actions**

Group of influencing factors **Reckless driver actions** was observed in **41%** of road accidents with casualties in the territory of the City of Kraljevo, in the observed period from 2016 to 2021.

Within this group, the following influencing factors are defined: failure to yield the right of way defined by an official's sign, traffic signs or traffic rules, crossing an unbroken dividing line on the roadway, failure to stop the vehicle in front of a marked pedestrian crossing, unpermitted direction of movement or turning of vehicle, speeding, speed unadjusted to traffic and road conditions, unsafe distance between vehicles, movement on a surface not intended for the given type of vehicle.

Below is the percentage share of the 5 most frequent influencing factors from this group of influencing factors (Chart 25).



Chart 25. Distribution of the most represented influencing factors belonging to the group "Reckless driver actions", City of Kraljevo, 2016-2021

The most prevalent influencing factor within the group of influencing factors **Reckless driver actions** is **Speed unadjusted to traffic and road conditions**. This influencing factor holds the highest percentage in all three observed segments (RA fat., RA inj. and RA cas.). **Speed unadjusted to traffic and road conditions** is the most frequently recorded influencing factor identified in road accidents with casualties, but the record of this influencing factor should be considered with a certain amount of reservation as identifying its contribution to the occurrence of a road accident is primarily a subjective assessment, and often only an insufficiently justified assumption of the official investigating the road accident with casualties. The essence of the **Speed unadjusted to traffic and road conditions** impact is most often reflected in that the police officer assumes and follows the established practice that the driver did not adjust the speed of movement to the traffic conditions and therefore could not have reacted quickly enough to avoid the road accident with casualties or to mitigate its consequences. For this reason, this influencing factor should not be fully considered, as in most cases, percentage-wise, it has a very small effect on the occurrence of a road accident with casualties, i.e. it does not contribute significantly to the

occurrence of a road accident as much as other influencing factors represented in the case of a specific road accident, which, on the other hand, were not recognized or recorded by the official.

The following influencing factor from this group in terms of percentage share, from the aspect of road accidents with fatalities (SN FAT), is **Crossing over unbroken dividing line**, which occurs in situations of performing overtaking maneuvers that are prohibited on sections with marked unbroken dividing line, leading to head-on collisions with vehicles coming from the opposite direction, which result in the most severe consequences in road accidents. Considering the severeness of possible consequences of a road accident caused by this influencing factor, the penal policy for sanctioning this type of traffic violation is likely not sufficiently strict or constructive to significantly reduce the occurrence of this type of traffic violations first, and then and the very risk of road accidents with casualties.

The influencing factor following the above **Speed unadjusted to traffic and road conditions** influencing factor in terms of percentage share from the aspect of road accidents with injured people (RA INJ) and road accidents with casualties in general (RA CAS) is **Unsafe distance between vehicles**. If the distance between vehicles is smaller than the recommended, expected, or safe distance, the risk of a road accident with casualties is significantly increased, since due to the unsafe distance between vehicles, drivers do not have enough space and time to react to avoid a potential road accident or to mitigate its consequences. In addition to driver failures, there is the possibility of failures on the road itself, such as inadequate speed limits and insufficient road visibility, which may lead drivers, especially young drivers with insufficient driving experience, to a sudden situation in which the distance from another vehicle is not safe enough.

- **Driver misactions**

Group of influencing factors **Driver misactions** was recognized in **31%** of road accidents with casualties in the territory of the City of Kraljevo, in the observed period between 2016 and 2021.

The following influencing factors are defined within this group: wrong assessment of another road user's path or speed, driver's failure to stop at the intersection in front of a marked stop line or a stopped vehicle, incorrect turn or other vehicle maneuver, driver's failure to properly judge the traffic situation, inappropriate (too close) overtaking/passing pedestrians, cyclists or riders, sudden change of direction, loss of vehicle control and vehicle maneuvering at an intersection after successfully stopping before the intersection.

Below is the percentage share of the five most frequent influencing factors from this group of influencing factors (Chart 26).



Chart 26. Distribution of the most represented influencing factors from the group "Driver misaction", City of Kraljevo, 2016-2021

The most represented influencing factor within the group of influencing factors **Driver misaction** is **Driver's failure to properly judge the traffic situation**. This influencing factor takes the highest share percentage in all three observed segments (RA FAT, RA INJ and RA CAS). **Driver's failure to properly judge the traffic situation** is the most frequently recorded influencing factor recognized in road accidents with casualties, and the result of the driver's poor perception of a traffic situation, which further leads to the driver taking inadequate actions (maneuvers) while driving, initially increasing the risk of traffic conflict and road accidents, and in the worst case increasing the risk of road accidents with the most severe consequences. This influencing factor occurs in situations where the driver failed to pay attention to where he was driving or looked but did not see well or misperceived and understood the traffic situation incorrectly, practically failed to observe the specific traffic situation well.

The following influencing factor from this group by percentage share, from the aspect of road accidents with fatalities (RA FAT), is **Wrong assessment of another road user's path or speed**, which occurs in situations of one vehicle merging from one road to the other and during overtaking maneuvers, with the driver performing these maneuvers not having enough space and time to do it safely, which most often leads to road accidents with the most severe consequences. Another characteristic situation when it comes to this influencing factor is a wrong assessment when the vehicle in front starts.

From the aspect of road accidents with injuries (RA INJ) and road accidents with casualties in general (RA CAS), the initially given influencing factor **Driver's failure to properly judge the traffic situation** is followed by the influencing factor **Incorrect turn or other vehicle maneuver**. This influencing factor includes any driver's maneuver that contributed to the occurrence of road accident, such as reversing, turning left/right, U-turn, changing lane, overtaking, passing; wrong vehicle driving, such as, for example

in the middle of the road, moving in the wrong lane while approaching the intersection, moving on bicycle paths or lanes, moving on lanes intended for public transport traffic ("yellow lanes").

- **Driver failure due to poor psychophysical condition, non-alertness, distraction**

The group of influencing factors **Driver failure due to poor psychophysical condition, non-alertness, distraction** was recognized in **10%** of road accidents with casualties in the territory of the City of Kraljevo in the observed period from 2016 to 2021.

The following influencing factors are defined within this group: driver under the influence of alcohol, driver under the influence of drugs or illicit medicines, driver fatigue, failure to use lights at night or in reduced visibility conditions, illness, disability, mental or physical, the existence of distraction phenomena or events outside the vehicle, driver's use of a mobile phone and cyclist's wearing of dark clothing.

Below is the percentage share of the five most frequent influencing factors from this group of influencing factors (Chart 27).



Chart 27. Distribution of the most represented influencing factors belonging to the group "Driver failure due to poor psychophysical condition, non-alertness, distraction", City of Kraljevo, 2016-2021

The most represented influencing factor within the group **Driver failure due to poor psychophysical condition, non-alertness, distraction** is **Driver under the influence of alcohol**. This influencing factor holds the highest percentage share in all three observed segments (RA FAT, RA INJ and RA CAS). **Driver under the influence of alcohol** is the most frequently recorded influencing factor recognized in road accidents with casualties which occurs in situations in which the driver was under the influence of alcohol and behaved in a way that caused a road accident or contributed to the occurrence of a road accident, regardless of whether the driver had an alcohol concentration above or below the legally permitted limit.

The following influencing factors by percentage share from this group from the aspect of road accidents with fatalities (RA FAT) is **Failure to use lights at night or in reduced visibility conditions**, which occurs in situations of poor visibility due to lack of or poor lighting and/or poor visibility conditions as a result of bad weather such as rain or fog; conditions in which cyclists are not illuminated and in which lights on motor vehicles are not turned on (intentionally or unintentionally).

A noticeable percentage share in the occurrence of road accidents with injured people and casualties in general (RA INJ and RA CAS) hold influencing factor **Driver fatigue**, which occurs in situations where the driver is so tired that he/she cannot safely drive the vehicle or observe (perceive) a dangerous situation.

2. SAFETY OF DIFFERENT CATEGORIES OF ROAD USERS IN THE TERRITORY OF THE CITY OF KRALJEVO

As part of the road safety analysis for the City of Kraljevo, different road user categories were recognized and then analyzed in more detail. This aspect of road safety analysis is particularly important for recognizing specific problems to which special attention will be paid by road safety entities in the city. Where working resources (number and type of institutions/organizations, capacities, technical and financial resources) are limited, it is important to organize the method of work and action in the field of road safety according to priorities based on adequately recognized problems. Therefore, this analysis includes the following road user categories:

- 1) Children,
- 2) Young people,
 - 2.1) Young drivers,
- 3) Pedestrians,
- 4) Cyclists,
- 5) Elderly people (people aged over 65),
- 6) Tractor drivers,
- 7) Motorized two-wheelers,
- 8) Commercial vehicles,
- 9) Elderly people (65+), and
- 10) Drivers under the influence of alcohol and psychoactive substances.

The following categories are recognized as particularly vulnerable road user categories:

- 1) Cyclists,
- 2) Drivers and passengers in passenger vehicles, and
- 3) Drivers and passengers in commercial vehicles.

Children

The youngest age category of road users is children (aged 0 to 14). The goal and task of the entire road safety system is to pay special attention to this vulnerable road user category. Given their insufficient

maturity, knowledge and skills, limited psychophysical abilities and inability to perceive traffic risks as adults, children enjoy special protection in traffic. Compared to all other road user categories, the entire traffic system must be subordinated to the safety of children, in both technical and organizational sense.

The road safety of children on the territory of the LSU/city is a priority recognized within the National Road Safety Strategy and is highly acknowledged by the LSUs in the Republic of Serbia. The City of Kraljevo is among the LSUs that pay special attention to children in traffic.

Based on the analysis of data on children casualties in traffic, since 2018 in the territory of the City of Kraljevo, there were no children fatalities (Chart 28). In the observed period, 2017 is the year in which one child lost its life in traffic.

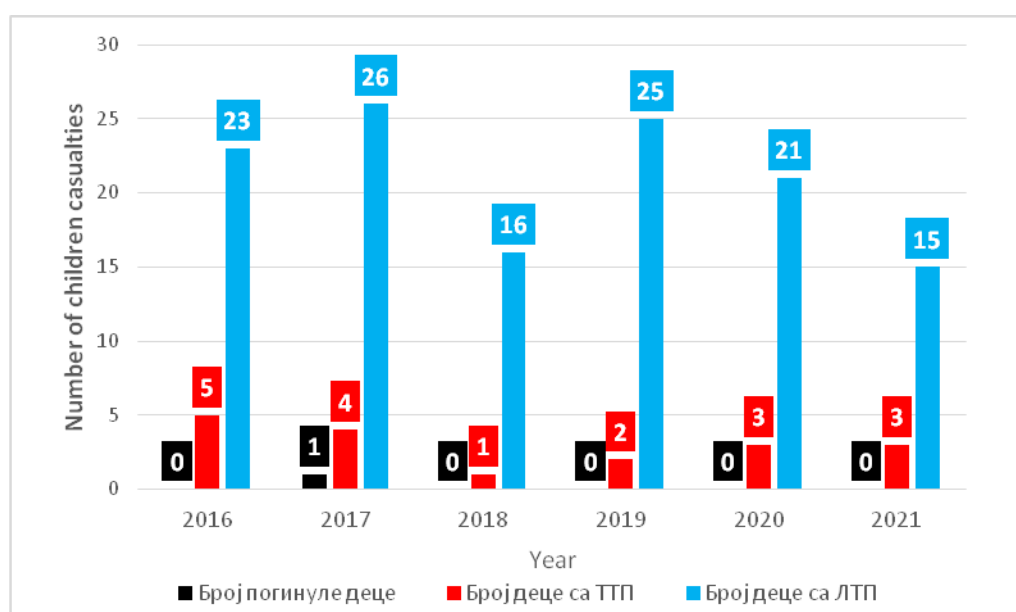


Chart 28. Consequences suffered by children in road accidents, City of Kraljevo, 2016-2021

In Kraljevo, children road casualties were most often passengers (40%), followed by pedestrians (38%) and cyclists (22%). Almost half of children casualties take part in road accidents as passengers accompanied by parents or elderly people. Parents bear the greatest responsibility for the safety of child passengers. Therefore, it is important to initiate a series of activities for improving knowledge and strengthening the awareness of parents of all the elements and factors affecting the road safety of their children. Parents need to be educated about the importance and proper use of children safety systems in the vehicle. When children acquire proper knowledge, attitudes and behavior at the earliest age, they can be expected to exhibit appropriate behavior in traffic later in life.

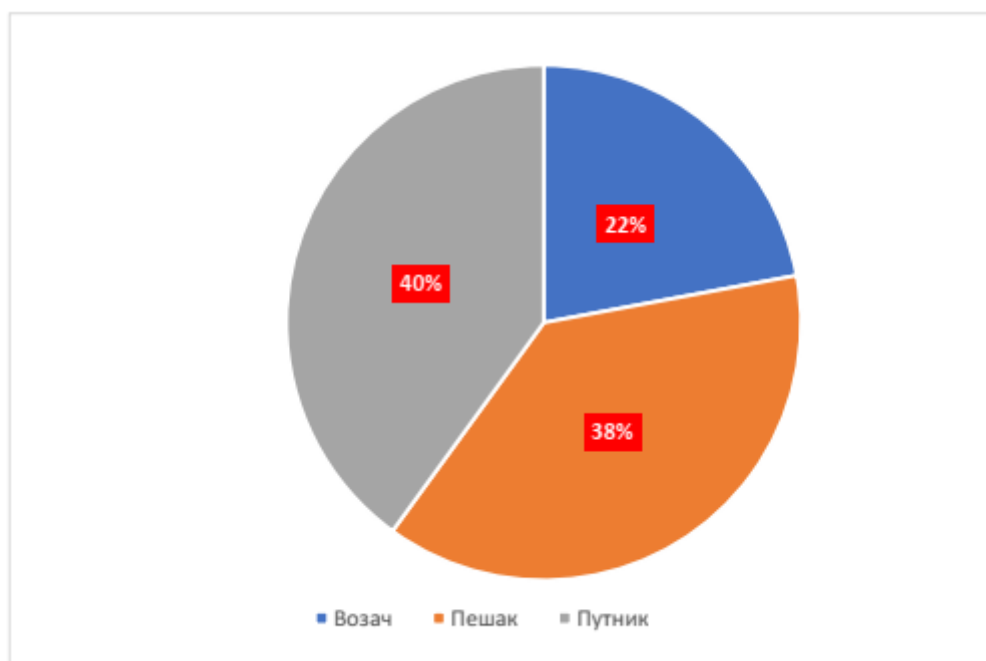


Chart 29. Distribution of children road casualties in Kraljevo by type of road use, 2016 - 2021

The most recorded group of accidents involving children casualties is "pedestrian RA" (Chart 30). Although children casualties were most passengers in a vehicle, almost half of all road accidents involving children casualties belonged to the group "pedestrian RA".

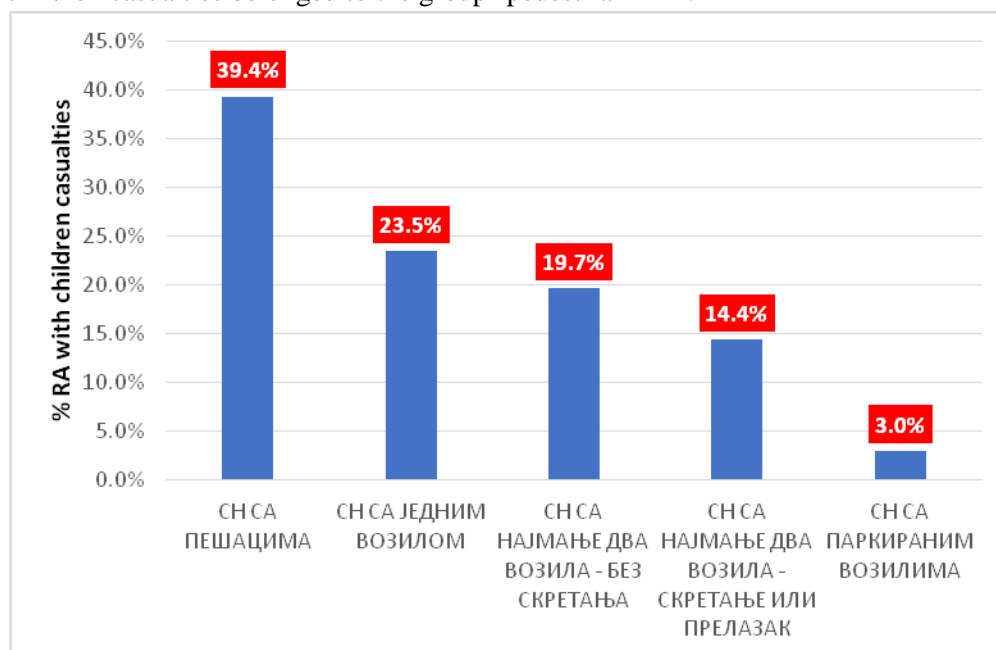


Chart 30. Distribution of road accidents with children casualties by groups of road accident types, 2016 – 2021

The time distribution of road accidents with children casualties by months shows a slightly higher number of registered road accidents in the second half of the year, more precisely in the period from July to December (**55%**). Most road accidents involving children were registered in **September** (13%), which can be related to the change in the level of children's road using (the end of the holidays and the beginning of the school year), i.e. the insufficient preparation of both children and parents and the elderly for more active children's road using (going to school and returning home, movement for the purpose of extracurricular activities, etc.). The distribution of road accidents with children casualties by days of the week shows that the most road accidents were registered on Saturday, namely 20% of all road accidents. Fridays (16% of accidents) and Sundays (16% of accidents) are also among the days with increased number of children road casualties in the territory of the City of Kraljevo.

Spatial distribution of road accidents with children casualties shows that the highest number of these accidents occurred in a settlement (69%), and in low-class streets (29.1%).

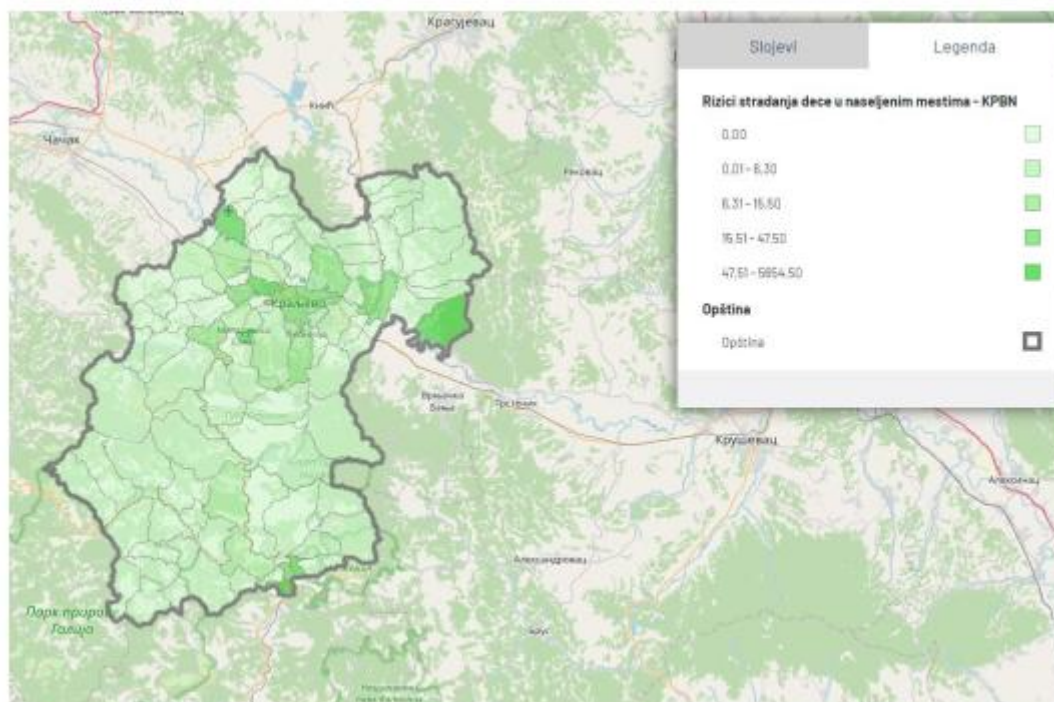
The influencing factor analysis reveals that the most influencing factors that caused road accidents with children casualties in Kraljevo belong to the group "Reckless driver actions" (36.3%). This group of factors includes passing at a traffic light when not allowed, failure to yield the right of way, crossing an unbroken dividing line on the roadway, failure to stop the vehicle in front of a marked pedestrian crossing, unpermitted direction of movement or turning of vehicle, speeding, speed unadjusted to traffic and road conditions, unsafe distance between vehicles, movement on a surface not intended for the given type of vehicle, and cyclist merging the roadway from the sidewalk.

Based on the analysis of the public and collective risk of **children** casualty by settlements of the City of Kraljevo for the period between 2019 and 2021, the following settlements stand out by risk value:

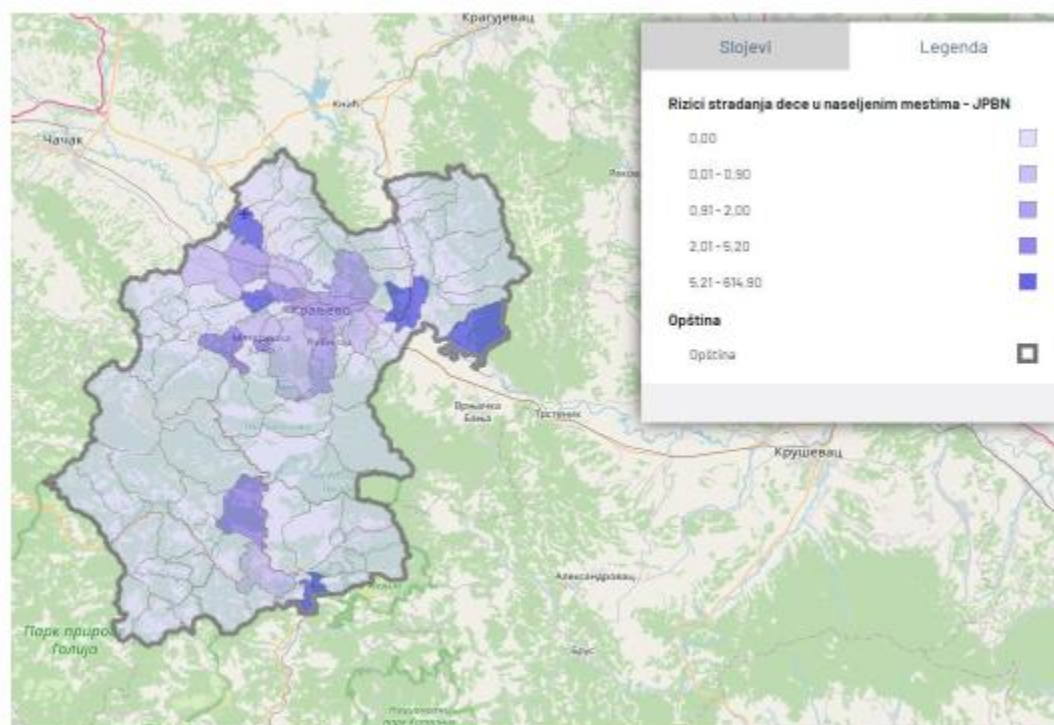
- By collective risk of children casualty, the following settlements stand out: **Obrva (155.8)**, **Mataruška Banja (98.1)** and **Bojanići (84.9)**.
- By public risk of children casualty, the following settlements stand out: **Bojanići (56.3)**, **Obrva (24.5)** and **Stubal (10.9)**.

Below is a graphic representation of the classes of collective and public children casualty risk by settlements of the City of Kraljevo for the observed period between 2019 and 2021.

2016-2021 Road Safety Analysis for the Territory of the City of Kraljevo



Map 1. Collective risk of children casualty in the settlements of the City of Kraljevo, 2019-2021



Map 2. Public risk of children casualty in the settlements of the City of Kraljevo, 2019-2021

Young people

The analysis of young people as road users observed people aged between 15 and 30, which is in accordance with the Law on Youth ("Official Gazette of RS", No. 50/2011). One of the key challenges the City of Kraljevo has faced in the past is work on reducing the number of young road casualties. The implementation of various campaigns and youth education about their road safety could achieve certain effects that were reflected in the statistics of their participation in road accidents. According to the data on young road casualties in Kraljevo in the observed time period, there is a downward trend in the number of young fatalities. In the past period, a total of 16 people aged between 15 and 30 lost their lives in traffic. When it comes to severe injured young people in road accidents, their number fluctuates by years of the observed time period (Chart 31).

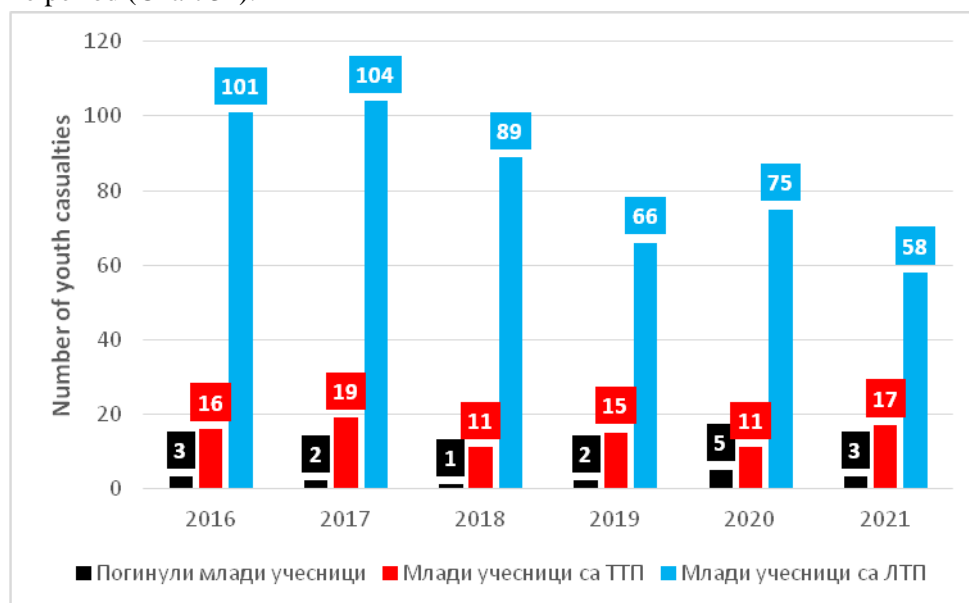


Chart 31. Consequences suffered by youth in road accidents, City of Kraljevo, 2016-2021

In Kraljevo, youth road casualties are most often passengers (47.3%), followed by drivers (43.5%) and pedestrians (9.2%). The fact that almost half of youth road casualties were drivers and that this is the population most represented in traffic calls for a more detailed analysis of this category of road users (Chart 32). The importance of paying attention to this specific category of road users is reflected in the potential for the implementation of various activities aimed at road accident prevention. Unlike children, young people have already acquired attitudes and behavior that can be influenced by various campaigns and education.



Chart 32. Distribution of youth road casualties in Kraljevo by nature of participation, 2016–2021

The most often recorded group of types of accidents involving young people are "single-vehicle accidents" and accounts for 30.9% of the total number of recorded groups of types of accidents (Chart 33). It is important to pay special attention to single-vehicle accidents with youth casualties, either as passengers or drivers. The following groups of accident types involving young people, in order of frequency, include "turn or cross RA involving at least two vehicles" and "no turn RA involving at least two vehicles". Together, these two groups account for more than half of all recorded groups of types of accidents involving young people (55%). The reason for this percentage share of the mentioned groups can be attributed to various influencing factors, primarily driver mistakes (reckless actions), misactions, poor psychophysical condition of road users, effects on road, etc.

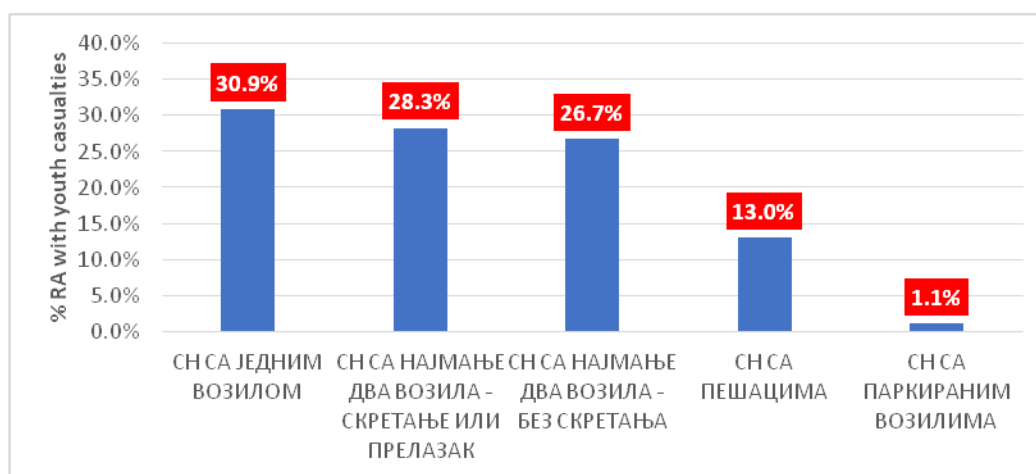


Chart 33. Distribution of road accidents with youth casualties by groups of types of road accidents, 2016 – 2021

Time distribution of road accidents with youth casualties by months shows that a slightly higher number of road accidents was registered in the second half of the year, namely in the period from July to

December (**55%**). The most road accidents involving young people were registered in **July and August** (11% each), which can be related to the intensity of their road using (increased road using in the summer months for traveling, recreation and other purposes). The distribution of road accidents with youth casualties by days of the week shows that the most road accidents were registered on Tuesdays, namely 17% of all road accidents. Friday and Saturday are also the days with increased road youth casualties in the territory of the City of Kraljevo (16%, respectively).

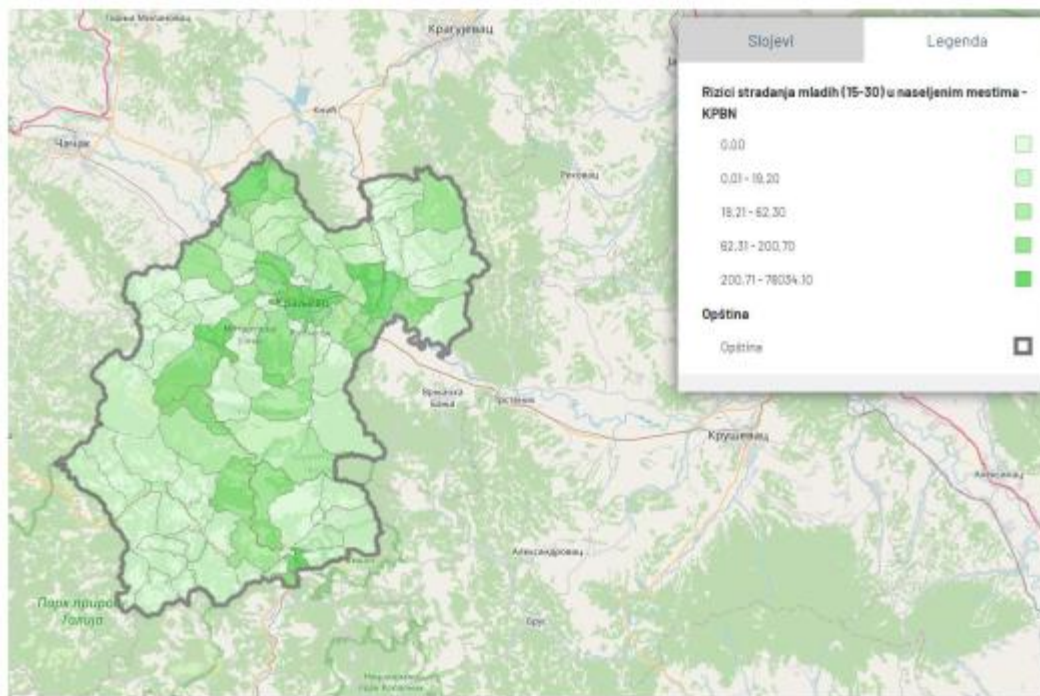
Spatial distribution of road accidents with youth casualties shows that the highest number of these accidents occurred in a settlement (57.8%). However, it is important to note that the highest percentage of accidents involving young people took place on IB-class state roads in the territory of the City of Kraljevo (29.6%).

The influencing factor analysis shows that the most influencing factors causing road accidents with youth casualties in Kraljevo belong to the group "Reckless driver actions" (44.2%). This group of factors includes passing at a traffic light when not allowed, failure to yield the right of way, crossing an unbroken dividing line on the roadway, failure to stop the vehicle in front of a marked pedestrian crossing, unpermitted direction of movement or turning of vehicle, speeding, speed unadjusted to traffic and road conditions, unsafe distance between vehicles, movement on a surface not intended for the given type of vehicle, and cyclist merging the roadway from the sidewalk.

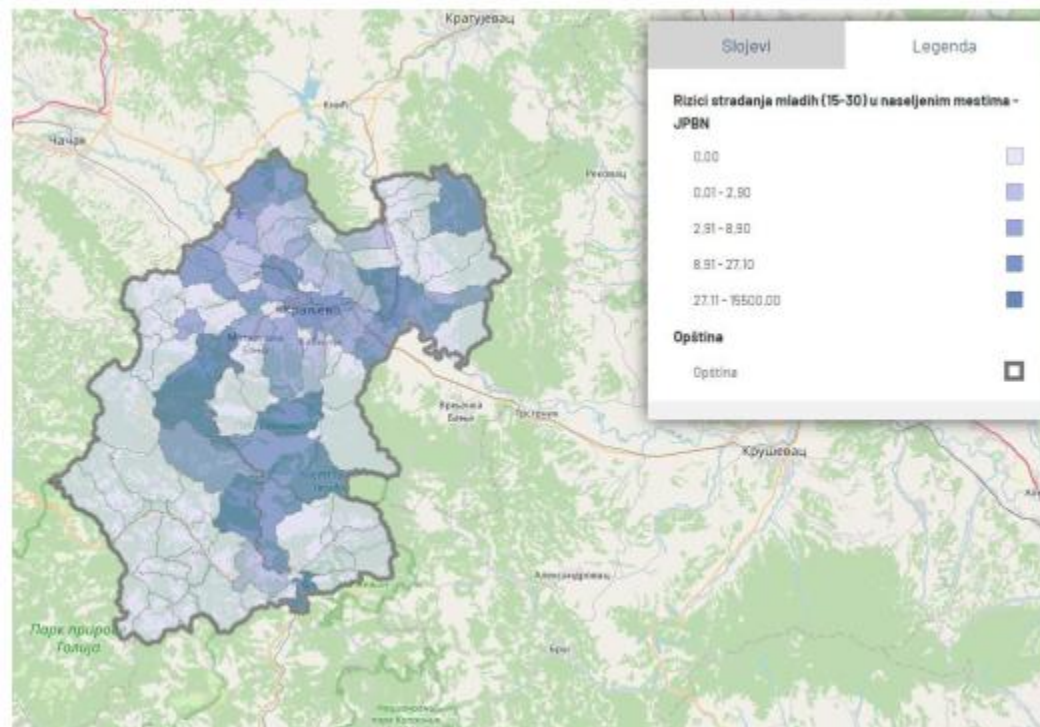
Based on the analysis of the public and collective risk of **youth** casualty by settlements of the City of Kraljevo for the period between 2019 and 2021, the following settlements stand out by risk value:

- By collective risk of youth casualty, the following settlements stand out: **Bare (3102.1), Tavnik (2057.5) and Milavčiči (1067).**
- By public risk of youth casualty, the following settlements stand out: **Bare (717.4), Maglič (441.2) and Milavčiči (332.4)**

Below is a graphic representation of the classes of collective and public youth casualty risk by settlements of the City of Kraljevo for the observed period between 2019 and 2021.



Map 3. Collective risk of youth casualty in the settlements of the City of Kraljevo, 2019-2021



Map 4. Public risk of youth casualty in the settlements of the City of Kraljevo, 2019-2021

Young drivers

When it comes to young drivers, referring to drivers aged 15 to 30 years, a total of 7 people were killed in the observed period. Their number fluctuates by years of the observed period (Chart 34). In 2018 and 2019, there were no young drivers killed in traffic in the territory of the City of Kraljevo, which may indicate the achieved results of various activities aimed at this category of road users. The nature of the achieved effects in the road safety area is such that, unless there are certain additional activities and/or changes in already applied measures and undertaken activities, they lose their significance and the effects dilute. This may be the reason why in 2020 there was an increase in the number of killed and injured young drivers in Kraljevo.

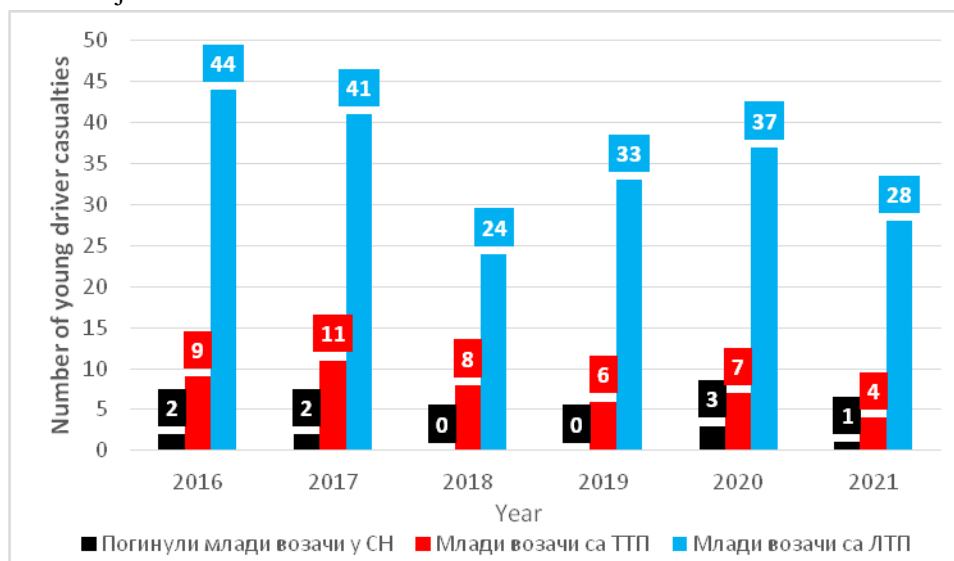


Chart 34. Consequences suffered by young drivers in road accidents, City of Kraljevo, 2016-2021

Observed by vehicle category, more than half of young driver casualties were drivers of a passenger vehicle (66.5%). Then, 11.2% of young driver casualties were cyclists and motorcyclists, and 5% of young driver casualties were drivers of mopeds and trucks. If drivers of mopeds and motorcycles are considered jointly as drivers of motorized two-wheelers, it can be concluded that 16.2% of young driver casualties were driving these categories of vehicles. By the share in accidents, young drivers of this category immediately follow passenger vehicle drivers.

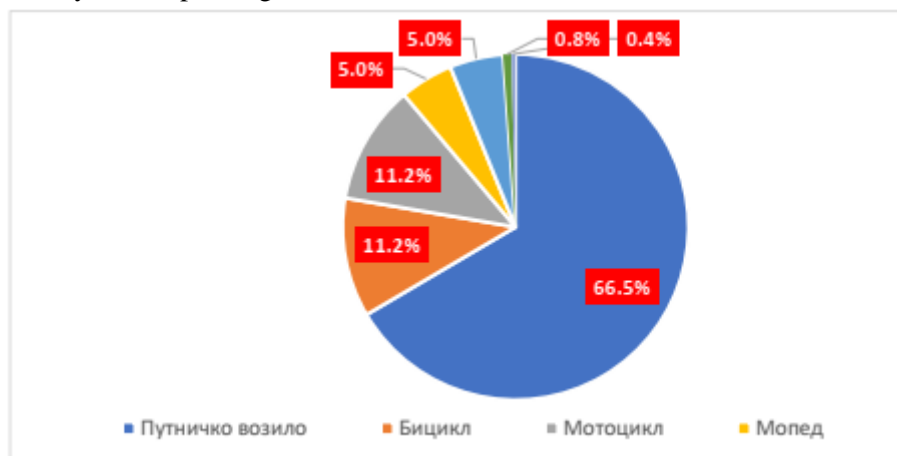


Chart 35. Distribution of young driver road casualties in Kraljevo by the nature of road using, 2016 - 2021

The most often recorded groups of accident types with young driver casualties are "no turn RA involving at least two vehicles" (44.1%), "turn or cross RA involving at least two vehicles" (40.5%) and "single vehicle accident" (38.6%) (Chart 36). A high percentage of accident types belonging to the above groups may call for an action, i.e. the initiation of measures aimed at young drivers in the form of various campaigns, education, safe driving training and general strengthening awareness of road dangers and risks among drivers.



Chart 36. Distribution of road accidents with young driver casualties by groups of types of road accidents, City of Kraljevo, 2016-2021

The time distribution of road accidents involving young driver casualties by months shows a slightly higher number of road accidents (54% of accidents) registered in the second half of the year, namely between July and December. Most road accidents involving young people were registered in **August** (13%), which can be related to the intensity of their road using.

The distribution of road accidents involving young driver casualties by days of the week shows most young driver casualties on Fridays and Saturdays (32% of all accidents). The distribution of road accidents with young driver casualties by hours of the day indicates there were most young driver casualties in the period from 2:00 p.m. to 2:59 p.m. (9%).

Spatial distribution of road accidents with young driver casualties shows that the highest number of these accidents occurred in a settlement (56.2%). However, it is important to point out that the highest percentage of accidents involving young drivers occurred on IB-class state roads in the territory of the City of Kraljevo (25.4%).

The influencing factor analysis reveals that the most influencing factors that caused road accidents with young driver casualties in Kraljevo belong to the group "Reckless driver actions" (44.5%). The following group of influencing factors by share in all road accidents involving young drivers is "Driver misaction" (27.9%).

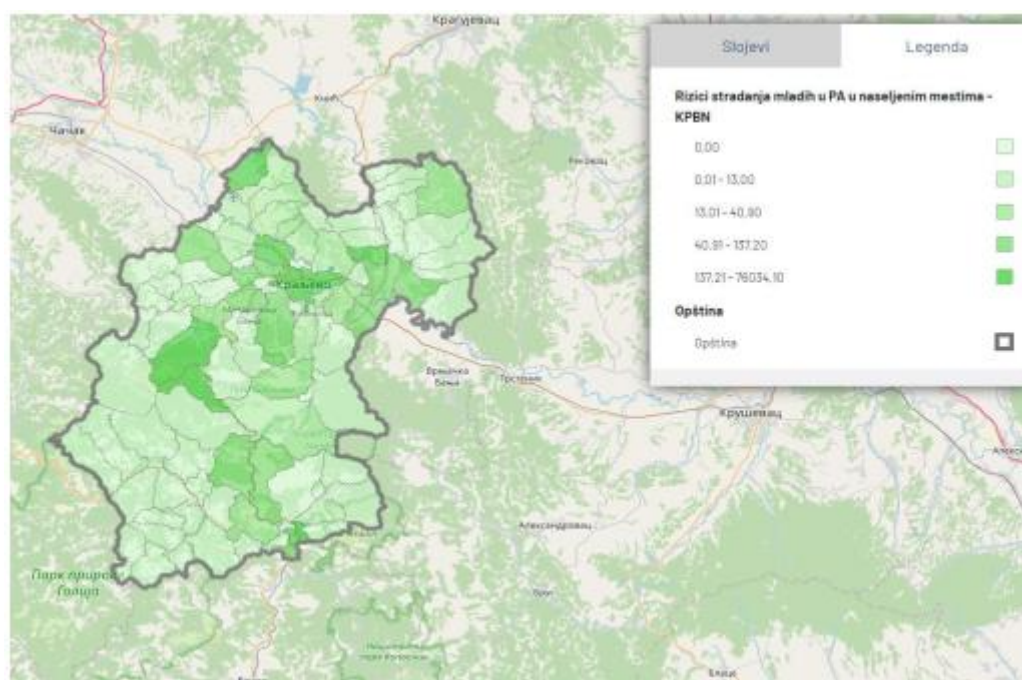
It is important to pay attention to those influencing factors that appear in road accidents involving young drivers, such as passing at a traffic light when not allowed, failure to yield the right of way, crossing an unbroken dividing line on the roadway, failure to stop the vehicle in front of a marked pedestrian

crossing, unpermitted direction of movement or turning of vehicle, speeding, speed unadjusted to traffic and road conditions, unsafe distance between vehicles, movement on a surface not intended for the given type of vehicle, cyclist merging the roadway from the sidewalk, failure to stop at intersection, wrong execution of a turn or other vehicle maneuver, wrong or failure to activate turn signal, inadequate perception of the traffic situation, wrong assessment of the other road user's path or speed, inappropriate overtaking/by-passing, sudden braking, sudden change of direction, etc.

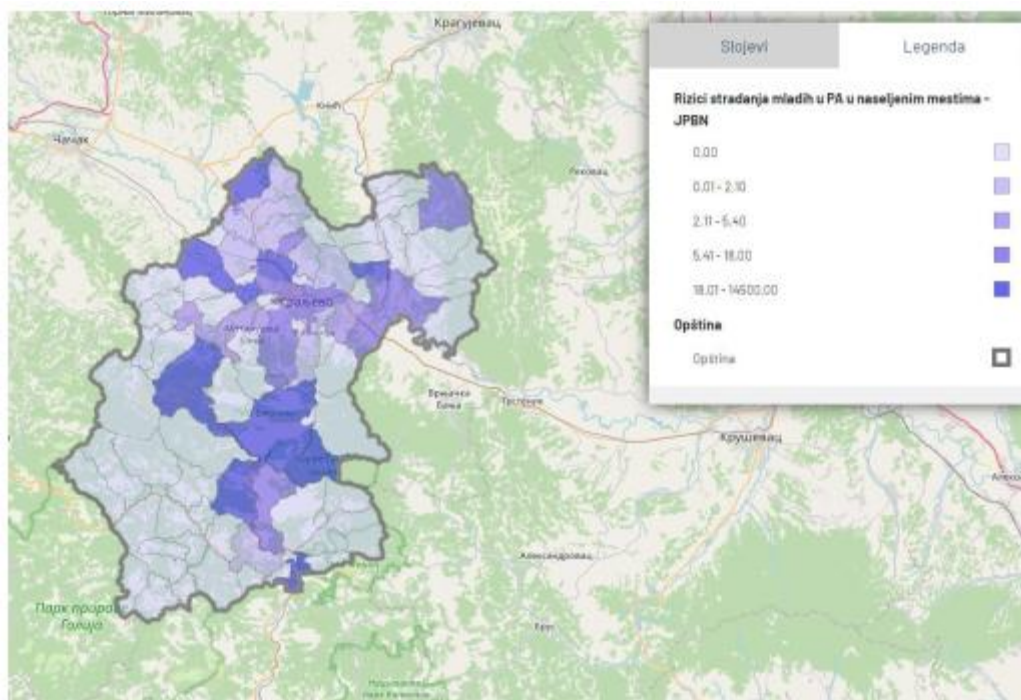
Based on the analysis of the public and collective risk of **passenger car (drivers and passengers) youth** casualty by settlements of the City of Kraljevo for the period between 2019 and 2021, the following settlements stand out by risk value:

- By collective risk of PC youth casualty, the following settlements stand out: **Bare (3102.1), Tavnik (2057.5) and Milavčiči (845.1).**
- By public risk of PC youth casualty, the following settlements stand out: **Bare (717.4), Maglič (441.2) and Milavčiči (263.3)**

Below is a graphic representation of the classes of collective and public PC youth casualty risk by settlements of the City of Kraljevo for the observed period between 2019 and 2021.



Map 5. Collective risk of PC youth casualty in the settlements of the City of Kraljevo, 2019-2021



Map 6. Public risk of PC youth casualty in the settlements of the City of Kraljevo, 2019-2021

Pedestrians

Pedestrians are a vulnerable road user category. In addition to their high degree vulnerability, the lacking or underdeveloped or inadequate pedestrian infrastructure in the settlement also increases their risk of participating in accidents and being casualties. The physical separation of pedestrian and motorized traffic significantly reduces the risk of road accidents involving pedestrians. According to various researches¹, the implementation of a measure such as the construction of a pedestrian path reduces road accidents in the range of 33-44%.

In the observed time period, 15 pedestrians lost their lives in road accidents in Kraljevo, while 97 pedestrians suffered severe injuries, and 228 pedestrians suffered minor injuries (Chart 37).

Note: The fact that **six pedestrians were killed** in 2021 is particularly, with the most prevalent influencing factor for road accidents with pedestrian fatalities is "**Careless pedestrian stepping on the roadway, without first making sure it is safe,**" calls for considering the reasons that led to a significant increase in the number of pedestrians killed in 2021 compared to previous years within the observed time frame.

¹ Jovanov, D., Vollpracht, H., J., Pfeiffer, L. et al. Practical guide for road safety auditors and inspectors, 2008

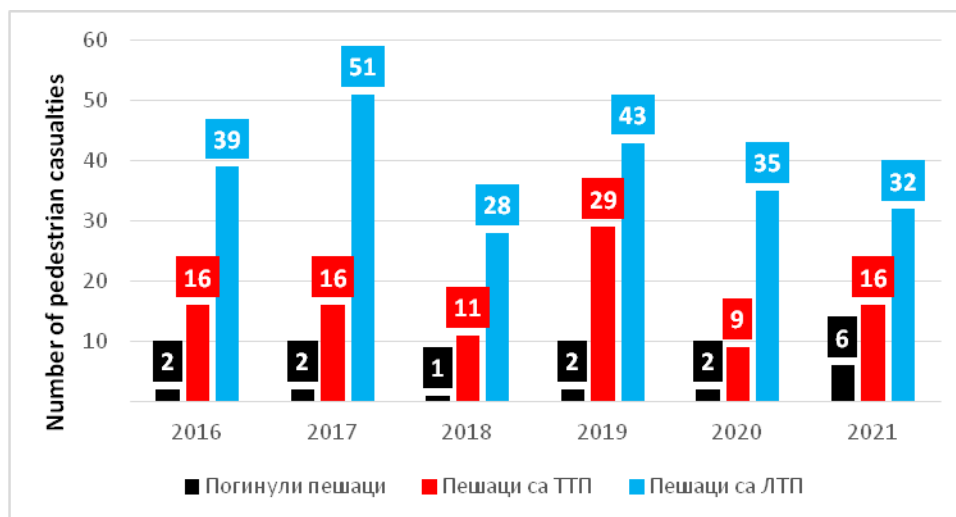


Chart 37. Consequences suffered by pedestrians in road accidents, City of Kraljevo, 2016-2021

The highest percentage of pedestrian road casualties in Kraljevo were over 65 years old (29%), followed by pedestrians aged 46-64 (25%).

Together, these two age categories account for more than half of pedestrian casualties in Kraljevo (Chart 38).

In 2021, there were six pedestrian fatalities, five of which were people over 65 years old. Of the six pedestrian fatalities, four were killed in the central city area, which clearly indicates the increased risk for pedestrians in the City of Kraljevo, especially elderly people who use roads as pedestrians. Therefore, it is necessary to recognize all the existing problems and deficiencies that threaten pedestrian road safety in the territory of the City of Kraljevo.

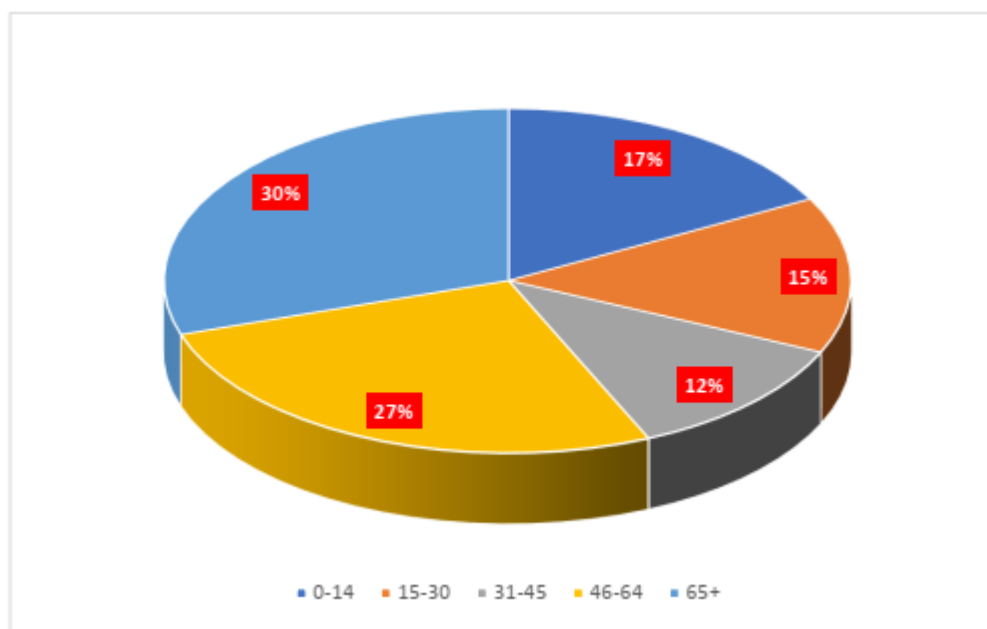


Chart 38. Structure of pedestrian casualties by age categories, City of Kraljevo, 2016-2021

The month in which the highest percentage of pedestrian casualties was recorded in Kraljevo is **September** (13%). The months in which there is a greater number of pedestrian casualties are October (11%) and December (11%). Observed by days of the week, Thursday is the day with the highest risk of pedestrian road casualties, with 19% of pedestrian casualties. High risk days for pedestrian casualties in Kraljevo are Tuesday and Friday.

Distribution of road accidents with pedestrian casualties by hours shows there were most pedestrian casualties in the 10th hour (from 9:00 a.m. to 9:59 a.m), followed by the 9th, 17th and 18th hours. This singles out two characteristic periods during the day with most pedestrian casualties, the first being from 8:00 a.m. to 10:59 a.m. (24.7% of pedestrian casualties), and the second from 4:00 p.m. to 5:59 p.m. (16.7%).

The spatial distribution of road accidents with pedestrian casualties shows that the highest number of these accidents occurred in the settlement (87%). In terms of traffic areas, the highest percentage of pedestrian casualties was in higher class streets (39.5%) and lower class streets (37.2%). There were a total of 76.7% streets in the streets. It is important to note that 6.4% of pedestrian casualties were recorded on sections where the state road passes through the settlement (Chart 39).



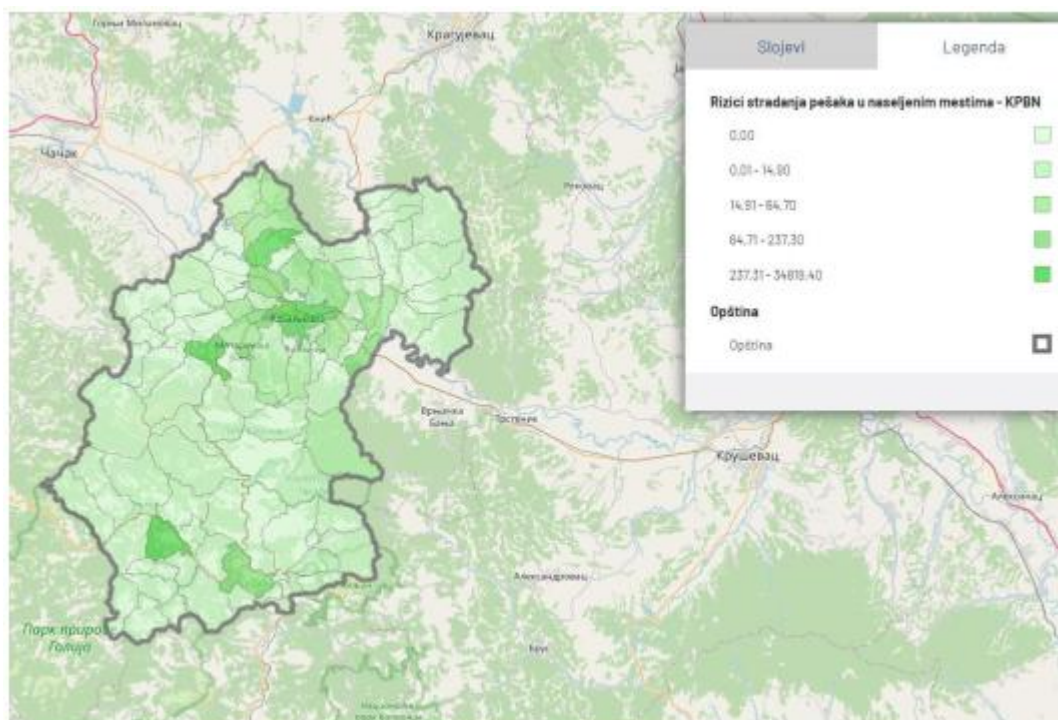
Chart 39. Distribution of road accidents with pedestrian casualties by road/street category, City of Kraljevo, 2016-2021

The influencing factors most often recorded in road accidents with pedestrian casualties belong to the groups "Reckless driver actions" (37.2%) and "Driver misactions" (24.9%). The group of influencing factors "Pedestrian failures" participates with 23.8% in the total distribution of all groups of influencing factors.

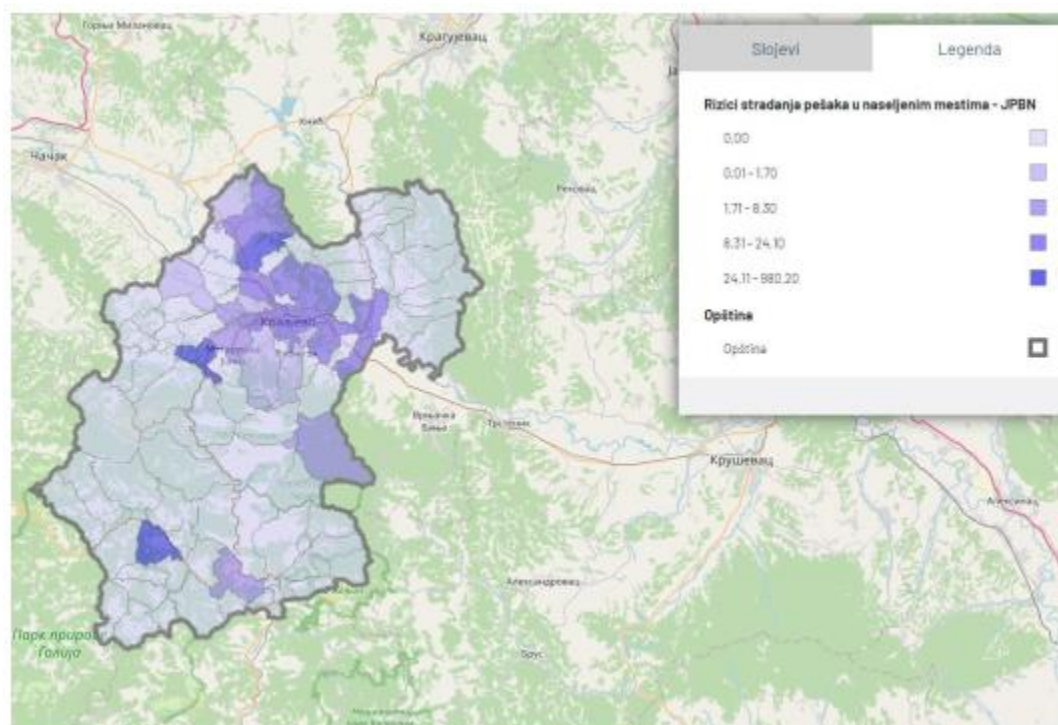
Based on the analysis of the public and collective risk of **pedestrian** casualty by settlements of the City of Kraljevo for the period between 2019 and 2021, the following settlements stand out by risk value:

- By collective risk of pedestrian casualty, the following settlements stand out: **Brezova (1032.5)**, **Progozelica (965.5)** and **Kraljevo (690.9)**
- By public risk of pedestrian casualty, the following settlements stand out: **Brezova (282.9)**, **Progozelica (142.9)** and **Miločaj (97.2)**

Below is a graphic representation of the classes of collective and public pedestrian casualty risk by settlements of the City of Kraljevo for the observed period between 2019 and 2021.



Map 7. Collective risk of pedestrian casualty in the settlements of the City of Kraljevo, 2019-2021



Map 8. Public risk of pedestrian casualty in the settlements of the City of Kraljevo, 2019-2021

Tractor drivers

The basic prerequisite for the safe road using of tractors is their roadworthiness. Technical characteristics of these vehicles such as dimensions, total mass, design speed and others, impose specific requirements for these vehicles in traffic. Some of the requirements relate to proper marking of tractors and agricultural machinery with vehicle marking devices contributing to their visibility in nighttime conditions. The education of tractor drivers on safe road use, proper placing and marking of loads, can also contribute to the improvement of tractor driver road safety.

In the period between 2016 to 2021, there a total of 20 tractor driver road casualties on the territory of the City of Kraljevo (Chart 40). Of these, six were fatalities, five tractor drivers were severe injured, and nine suffered minor injuries.

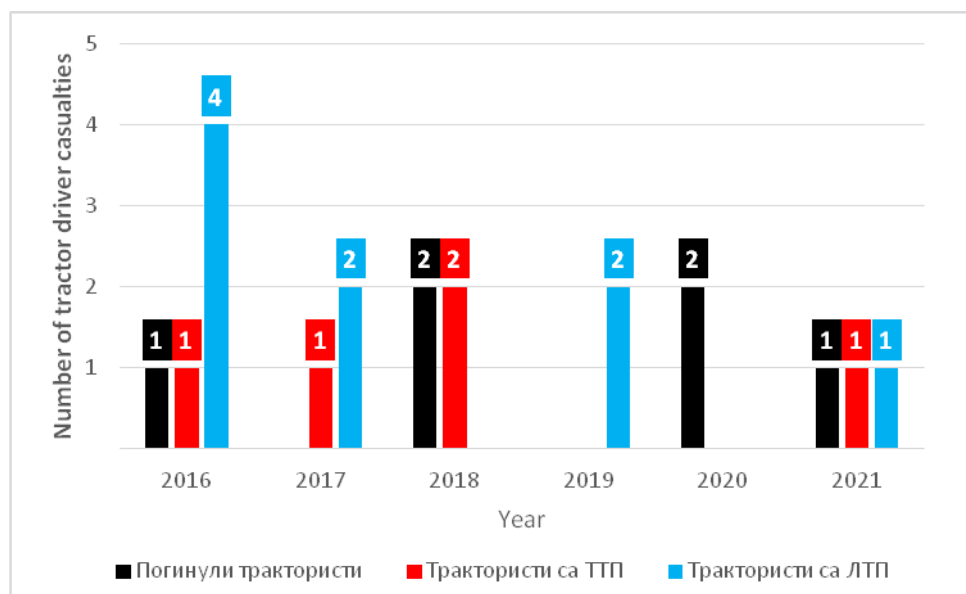


Chart 40. Consequences suffered by tractor drivers in road accidents, City of Kraljevo, 2016-2021

When choosing appropriate countermeasures aimed at improving tractor driver road safety, it is important to consider the age of tractor drivers. Among tractor driver road casualties, the highest percentage (45%) belonged to the age category over 65 (Chart 41). The following age category by percentage share in the number of tractor driver casualties is the 46-64 age category. Together, these two categories account for 75% of all tractor driver casualties in Kraljevo.

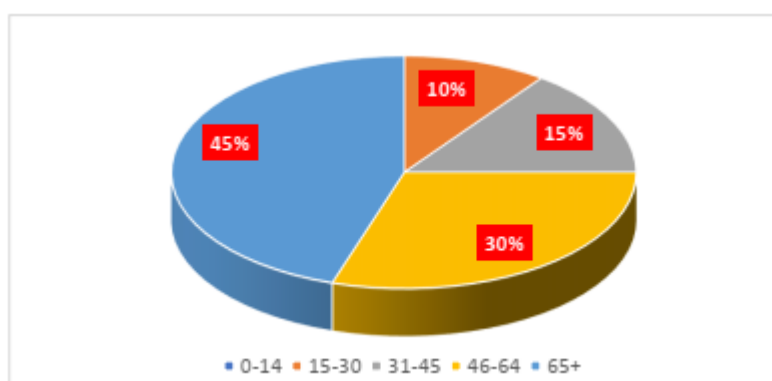


Chart 41. Structure of tractor driver casualties by age category, City of Kraljevo, 2016-2021

August (25% of casualties) and **July** (15% of casualties) are the months with the highest percentage of recorded tractor driver casualties. Generally speaking, over 65% of tractor driver casualties in Kraljevo are recorded in the second year-half. During the months of February, May and December, there were no tractor driver road casualties. Observed by days of the week, Saturday stands out as the day with the most tractor driver casualties, namely 30%. Thursday (25% of casualties) and Friday (15% of casualties) are also among the days with pronounced number of tractor driver casualties.

Distribution of tractor driver casualties by hours shows there were most tractor driver casualties in the period from 3:00 p.m. to 3:59 p.m. During that period, 20% of tractor driver casualties were recorded.

A total of 50% of all accidents with tractor driver casualties belonged to the type group "single vehicle RA" (Chart 42). This means that in half of the accidents, the participant was only one tractor, raising the question about tractor roadworthiness in the territory of the City of Kraljevo, but also tractor drivers ability to safely operate the vehicle.

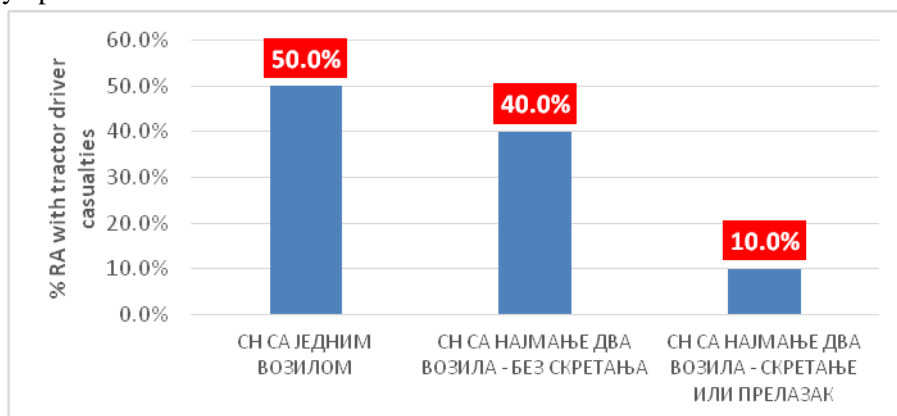


Chart 42. Distribution of road accidents with tractor driver casualties by groups of types of road accidents, 2016-2021

Spatial analysis of road accidents with tractor driver casualties shows the highest percentage of tractor driver road casualties on the local road (45%), closely followed by road accidents with tractor driver casualties on IB-class state roads, namely 41.2% (Chart 43).



Chart 43. Distribution of road accidents with tractor driver casualties by road/street category, City of Kraljevo, 2016-2021

The analysis of influencing factors that contributed to the occurrence of road accidents with tractor driver casualties shows that in the highest number of accidents, influencing factors belonging to the groups "Driver misactions" and "Reckless driver actions" were recognized (Chart 44). In a relatively large number of accidents, influencing factors belonging to the group "Driver failure due to poor psychophysical condition, inattention, distraction" (19.5%) were determined. This group of influencing factors includes factors related to driving under the influence of alcohol, drugs or illicit medicines, driver fatigue, vision problems, the influence of illness or disability, not using lights at night or in conditions of reduced visibility, using mobile phone and other distracting devices, etc.

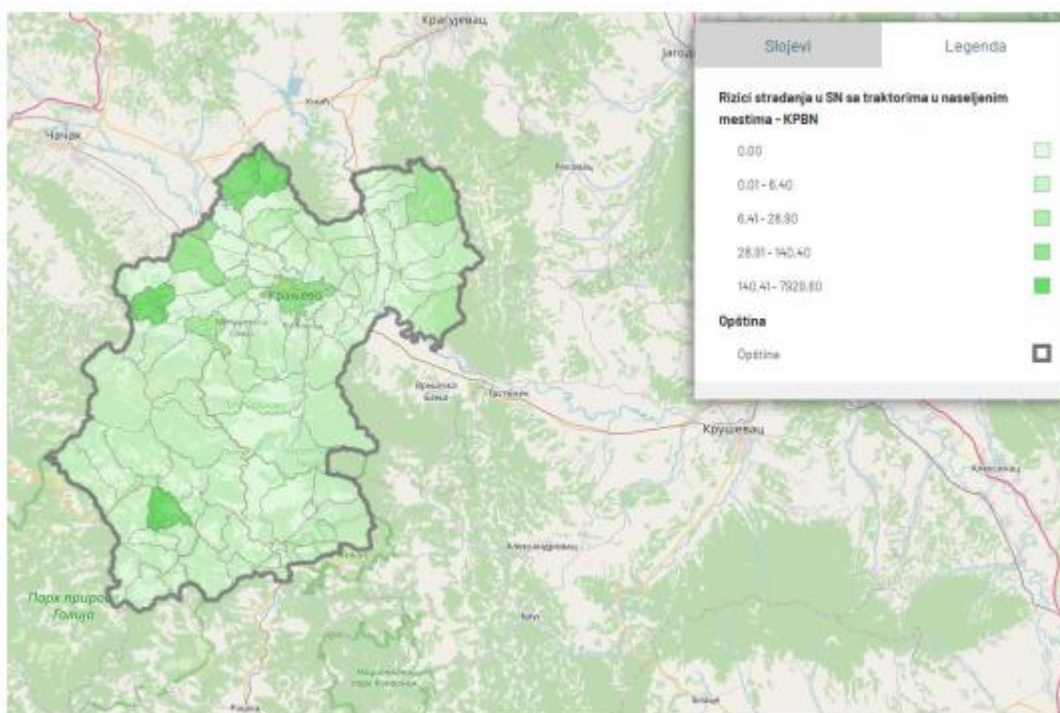


Chart 44. Percentage share of groups of influencing factors in road accidents with tractor driver casualties, City of Kraljevo, 2016-2021

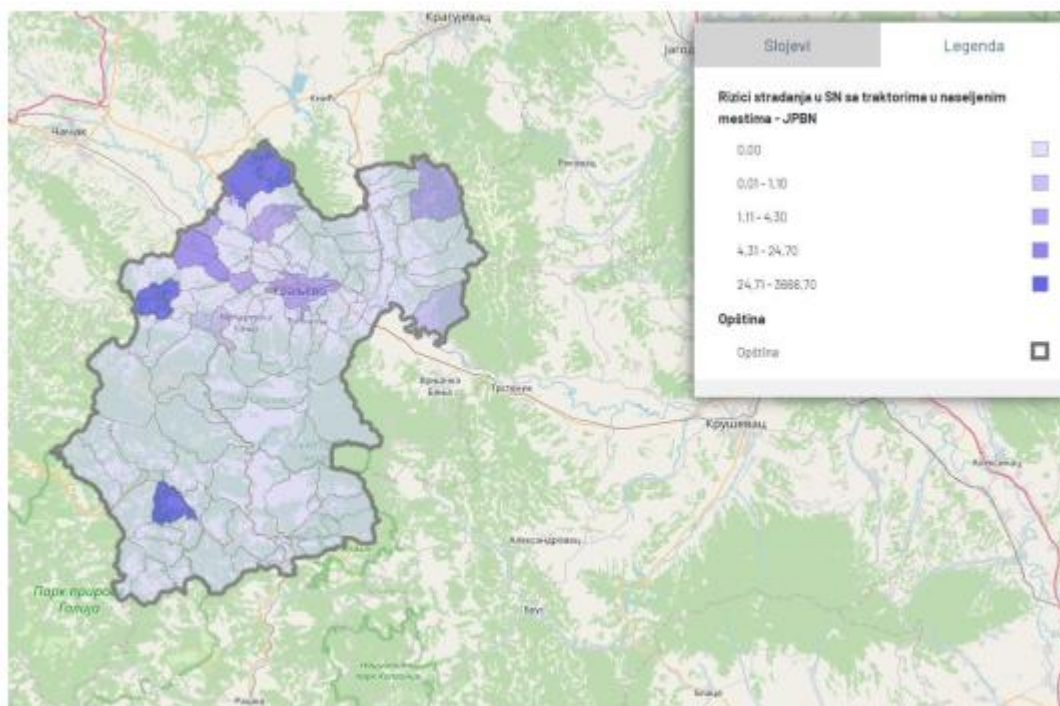
Based on the analysis of the public and collective risk of **casualty in accidents involving tractors** by settlements of the City of Kraljevo for the period between 2019 and 2021, the following settlements stand out by risk value:

- By collective risk of casualty in accidents involving tractors, the following settlements stand out: **Brezova (2064.9), Tavnik (970.5) and Ladevci (479.9)**
- By public risk of casualty in accidents involving tractors, the following settlements stand out: **Brezova (565.7), Ladevci (92.2) and Tavnik (87.1)**

Below is a graphic representation of the classes of collective and public risk of casualty in accidents involving tractors by settlements of the City of Kraljevo for the observed period between 2019 and 2021.



Map 9. Collective risk of casualty in accidents involving tractors in the settlements of the City of Kraljevo, 2019-2021



Map 10. Public risk of casualty in accidents involving tractors in the settlements of the City of Kraljevo, 2019-2021

Elderly (65+)

People over 65 years of age are one of the most vulnerable road user categories. As a consequence of aging, people's psychophysical and perceptual abilities weaken, which directly affects the ability to safely participate in traffic. Therefore, special attention must be paid to elderly road users. When it comes to Kraljevo, 32% of all people killed in road accidents are over 65 years old, which is higher than the national average. The share of injured people over 65 years of age in the total number of people injured in road accidents is 13%, which is higher than the national level (11%).

In the period from 2016 to 2021, there were a total of 296 road casualties over the age of 65 in Kraljevo (Chart 45). Of these, 27 were fatalities, 86 were severely injured, and 183 suffered minor injuries.

It can be noted that since 2019, there has been a downward trend in the number of people aged over 65 with severe injuries from road accidents, but on the other hand, in 2021, the highest number of elderly fatalities was recorded within the observed time period between 2016 and 2021. The increased number of elderly fatalities calls for a for detailed consideration of road safety problems that increase the risk of casualties over 65 years of age.

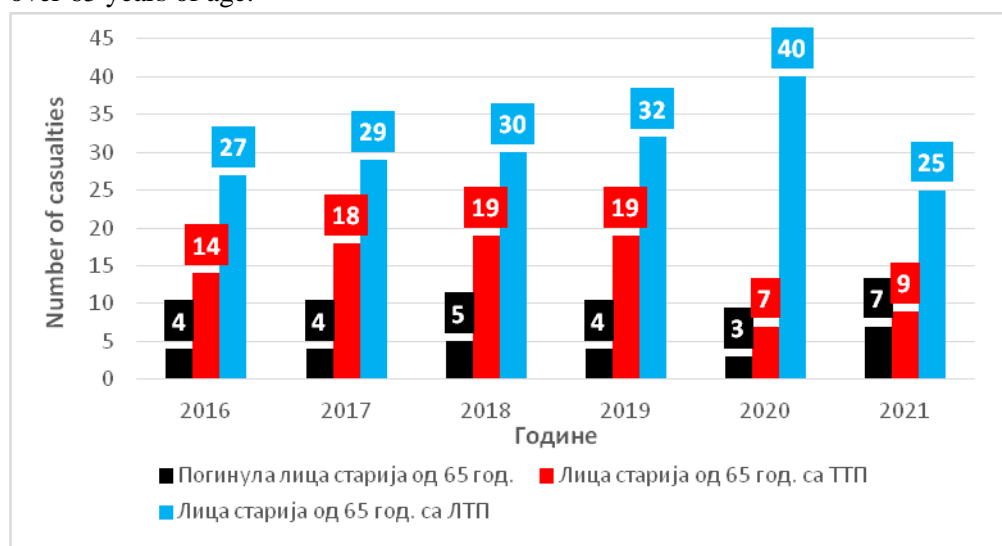


Chart 45. Consequences suffered by people over 65 in road accidents, City of Kraljevo, 2016-2021

Distribution of casualties over 65 years of age, by the nature of participation in road accidents, shows that 48% of people older than 65 were killed as a driver (Chart 46). On the other hand, 34% were killed as pedestrians and 18% as passengers.



Chart 46. Distribution of casualties over 65 years of age by the nature of participation in road accidents, City of Kraljevo, 2016-2021

Observed by vehicle category in which drivers over 65 years of age were road casualties, the highest percentage belonged to the passenger vehicle driver category, namely 58% (Chart 47), followed by cyclists (25%).

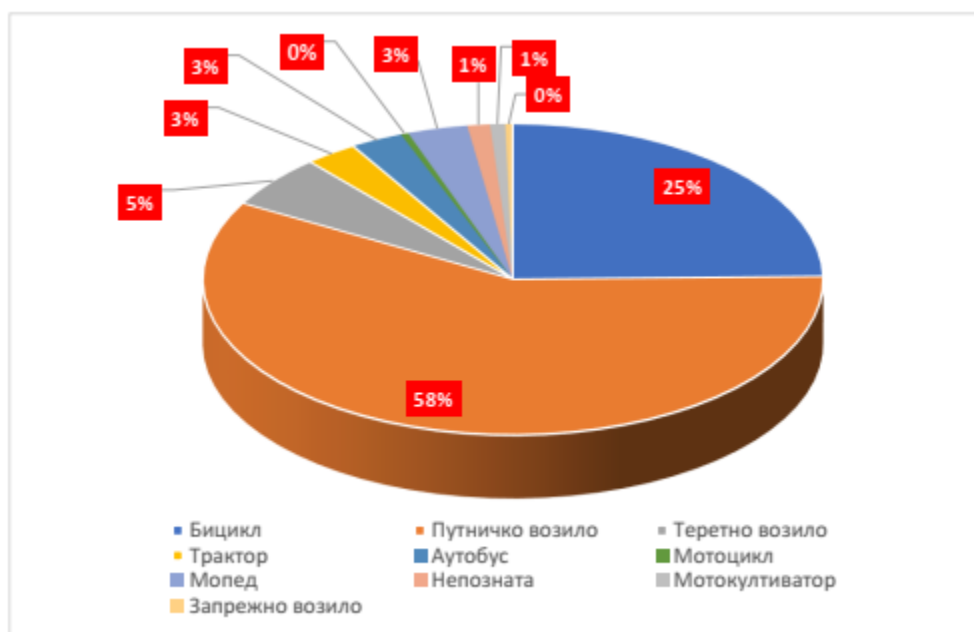


Chart 47. Distribution of road casualties over 65 years old by vehicle category, City of Kraljevo, 2016-2021

The distribution of road accidents with casualties over 65 years old by groups of road accident types is shown in the chart below. The most common types of road accidents in which people over 65 years old were casualties are the types from the "Pedestrian RA" group. Percentage-wise, they account for 34% of all defined types of road accidents with elderly (Chart 48).

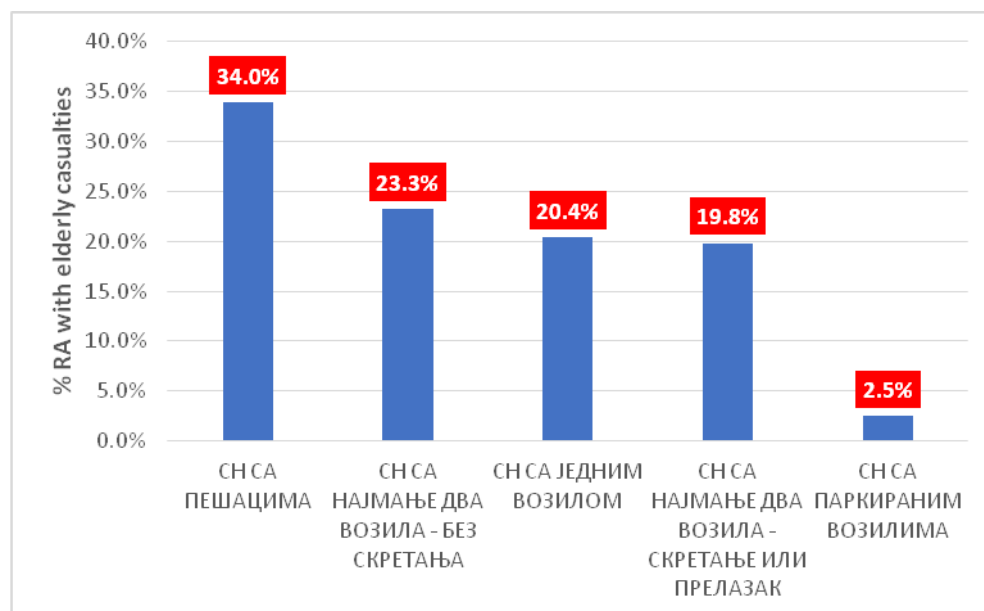


Chart 48. Distribution of road accidents with casualties over 65 by groups of types of road accidents, 2016-2021

The distribution of road accidents with casualties over 65 by months shows that the most accidents with casualties were recorded during October (13%). July, August and September stand out as months with increased number of elderly casualties. Moreover, 48% of the total number of road accidents with casualties over 65 occurred in the observed four months (July - October).

There were most elderly road casualties on Mondays and Fridays (18% each). The time distribution of casualties over 65 shows there were most casualties over 65 in the morning hours (from 6:00 a.m. to 11:59 a.m.). In that time frame, 54% of road casualties were people over 65.

Spatial distribution of casualties over 65 shows that 65.3% of road accidents with casualties over 65 happened in a settlement. By the category of roads/streets on which road accidents with casualties over 65 happened, high- and low-class streets in Kraljevo stand out.

The percentage share of groups of influencing factors in the occurrence of road accidents with elderly casualties in Kraljevo is shown in the following chart. Influencing factors belonging to the groups "Reckless driver actions", "Driver misactions" and "Pedestrian failures" are the most frequently identified factors in accidents with casualties over 65 (Chart 49). They were recognized in 40%, 33.5% and 10.5% of road accidents with casualties over 65, respectively.

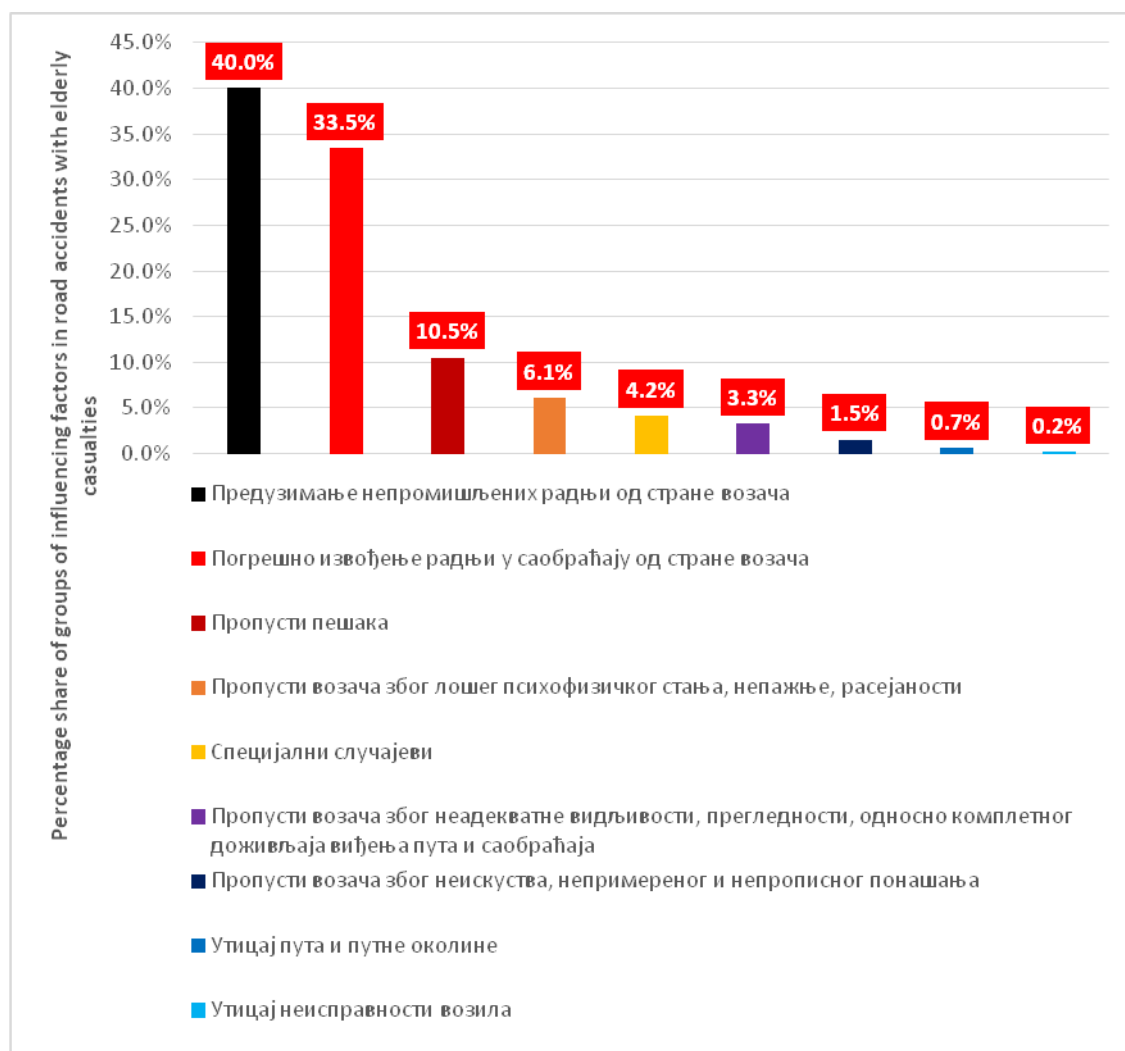
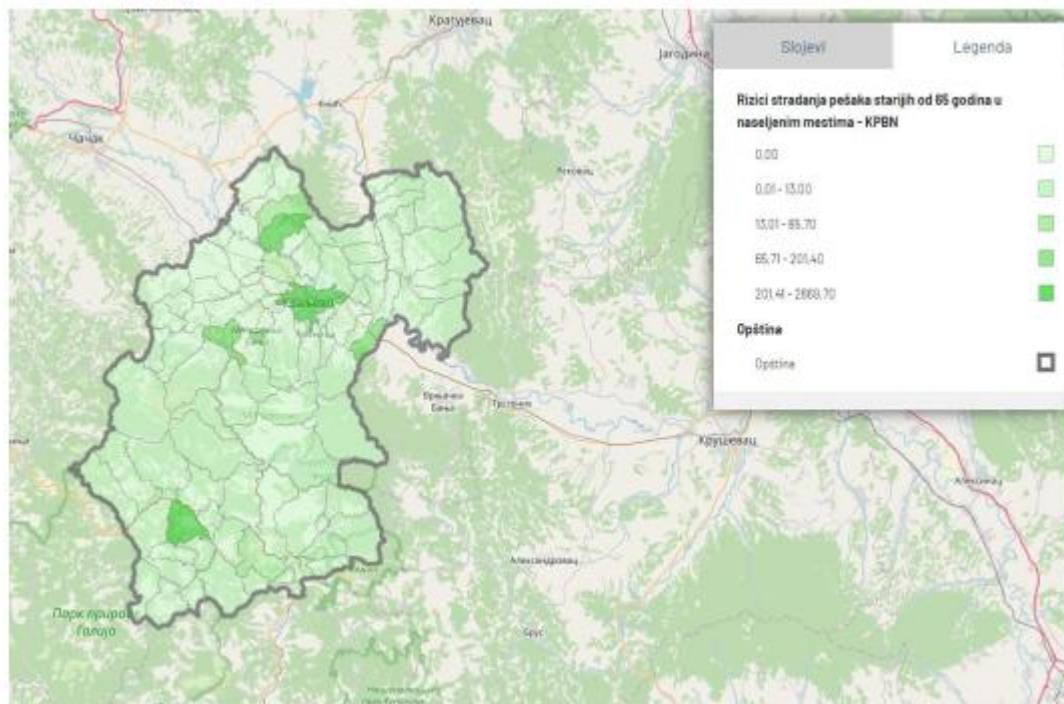


Chart 49. Percentage share of groups of influencing factors causing road accidents with casualties over 65, City of Kraljevo, 2016-2021

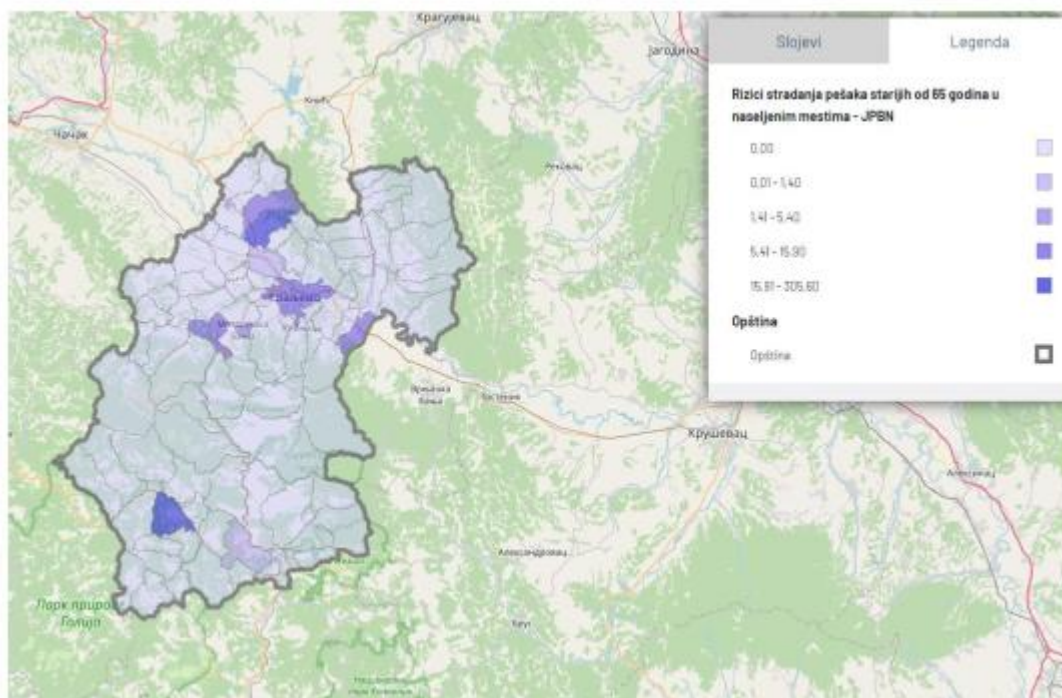
Based on the analysis of the public and collective risk of **elderly pedestrian (pedestrians older than 65) casualty** by settlements of the City of Kraljevo for the period between 2019 and 2021, the following settlements stand out by risk value:

- By collective risk of pedestrian over 65 casualty, the following settlements stand out: **Brezova (1032.5), Kraljevo (428.1) and Miločaj (316.1).**
- By public risk of pedestrian over 65 casualty, the following settlements stand out: **Brezova (282.9), Miločaj (97.2) and Progorelica (14.7)**

Below is a graphic representation of the classes of collective and public risk of pedestrian over 65 casualty by settlements of the City of Kraljevo for the observed period between 2019 and 2021.



Map 11. Collective risk of pedestrian over 65 casualty in the settlements of the City of Kraljevo, 2019-2021



Map 12. Public risk of pedestrian over 65 casualty in the settlements of the City of Kraljevo, 2019-2021

Drivers under the influence of alcohol and psychoactive substances

Driving under the influence of alcohol is one of the leading factors that increase the risk of a road accident. Alcohol, as well as psychoactive substances, reduce all human abilities to operate a motor vehicle. Therefore, special attention in the road safety analysis is paid to the category of drivers under the influence of alcohol and psychoactive substances.

The influencing factor "driver under the influence of alcohol" in road accidents with casualties was recognized in 15% of road accidents that occurred in the territory of the City of Kraljevo, in the period between 2016 and 2021 (Chart 50). In accidents with injured people, the percentage is lower, and amounts to 9%. Considering the above, it can be concluded that alcohol influenced the severity of the consequences of road accidents.

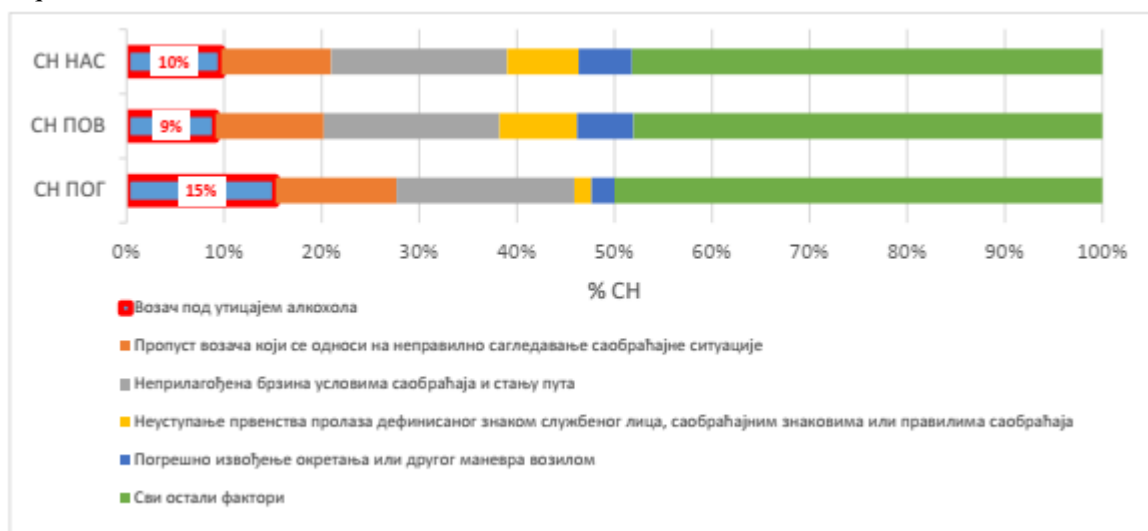


Chart 50. Road accident influencing factors of with "driver under the influence of alcohol" factor highlighted, City of Kraljevo, 2016-2021

In the period from 2016 to 2021, there were six road accidents recorded in Kraljevo with recognized influencing factor "Driver under the influence of drugs or illicit medicines". Considering the effect of these substances on people's cognitive and psychophysical abilities, the risk of road accidents increases significantly when used. If different drugs, psychoactive medicines and/or alcohol are combined, the risk of a road accident is even higher. In order to prevent the use of alcohol, drugs and psychoactive substances in traffic, it is important to implement repressive measures in terms of more frequent targeted controls by the traffic police. These measures are crucial for preventing the increase in the number of road accidents caused by driving under the influence of alcohol/drugs/illicit medicines.

2.1. A special review of vulnerable road user categories in the territory of the City of Kraljevo

High-risk road user categories in the territory of the City of Kraljevo include cyclists, drivers and passengers in passenger and commercial vehicles. These categories were defined based on objective road safety indicators, such as the types and severity of the consequences of road accidents, compared to the average in the Republic of Serbia. Comparison of the values of road casualties by road user categories between the City of Kraljevo and the Republic average is shown in chapter 1.3. of this report.

Cyclists

Tourism is an activity of special importance for the City of Kraljevo. The development of cycling, as an indispensable tourist offer element, also implies the improvement of cyclist safety. This may include the implementation of various measures, whether those aimed at infrastructure (construction of bicycle lanes, bicycle shelters/parking, etc.) or the promotion of cyclist protection (providing protective equipment for cyclists), and the implementation of education for safe road using by cyclists. Cyclists, just like pedestrians, are considered a vulnerable road user category.

Hereinafter, cyclists are understood to mean riders and passengers on bicycles. In the observed time frame, there were a total of 209 cyclist road casualties (Chart 51). Observed by the severity of the consequences, 10 were fatalities, 62 suffered severe injuries and 137 suffered minor injuries. The year in which there were no cyclist fatalities in Kraljevo is 2019. Considering the data on cyclist road casualties, no continuous downward trend in the number of cyclist casualties in the previous five-year period has been established.

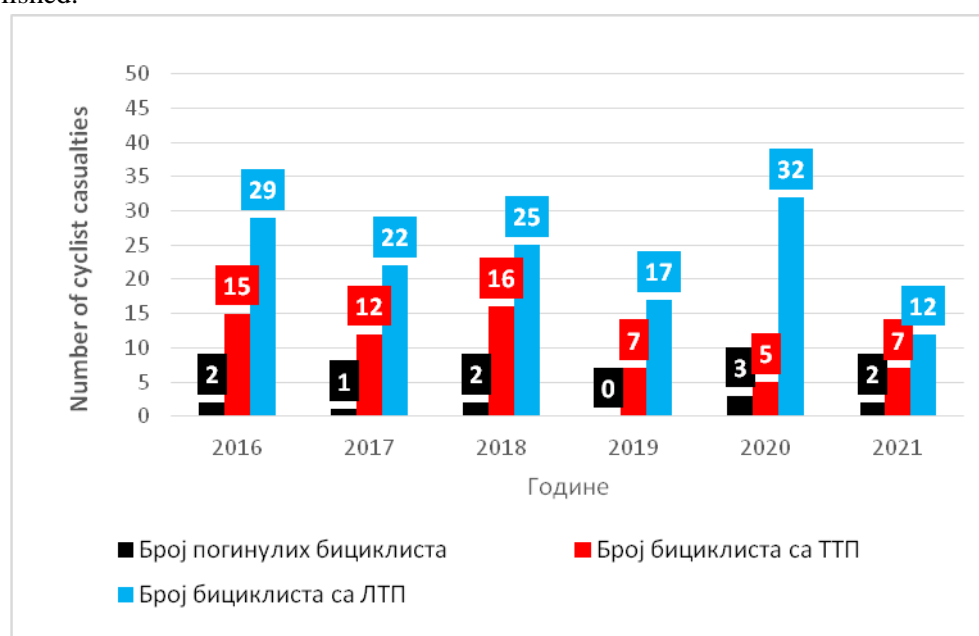


Chart 51. Consequences suffered by cyclists in road accidents, City of Kraljevo, 2016-2021

Observed by age categories, the highest percentage of cyclist road casualties belonged to people over 65 and people aged 46-64 years (30% each). The share of age categories 0-14 years, 15-30 years, and 31-45 years in the number of cyclist casualties is 15%, 14% and 12% respectively.

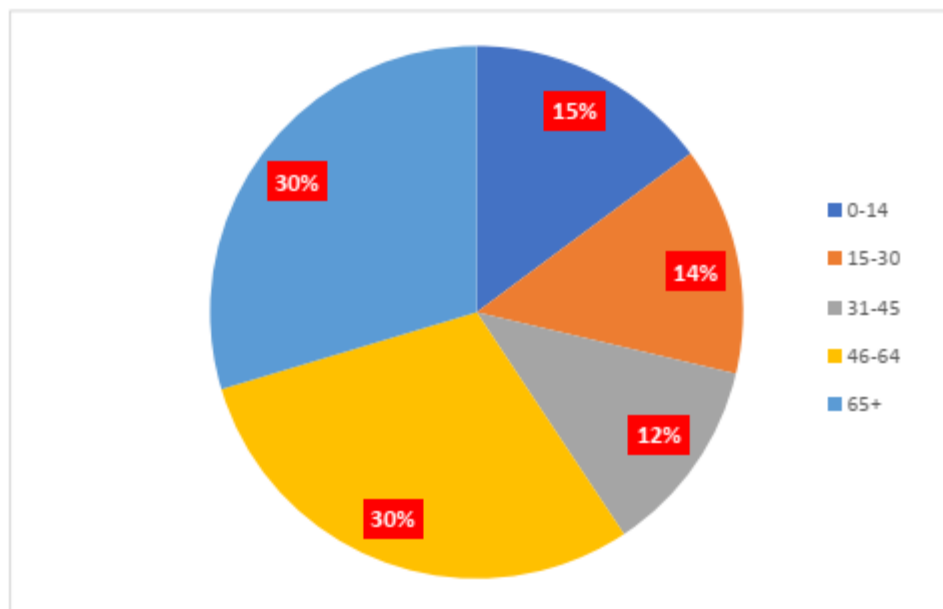


Chart 52. Structure of cyclist casualties by age category, City of Kraljevo, 2016-2021

The most common types of accidents with cyclist casualties in Kraljevo belonged to the "Single vehicle RA" type group. This type of accident group accounts for 37.5% of all accidents with cyclist casualties (Chart 53).



Chart 53. Distribution of road accidents with cyclist casualties by group of types of road accidents, City of Kraljevo, 2016-2021

Time distribution of road accidents with cyclist casualties by months is shown in the following chart. There were most cyclist casualties in Kraljevo in the months of July, August and September (Chart 54), and the least in January and February.

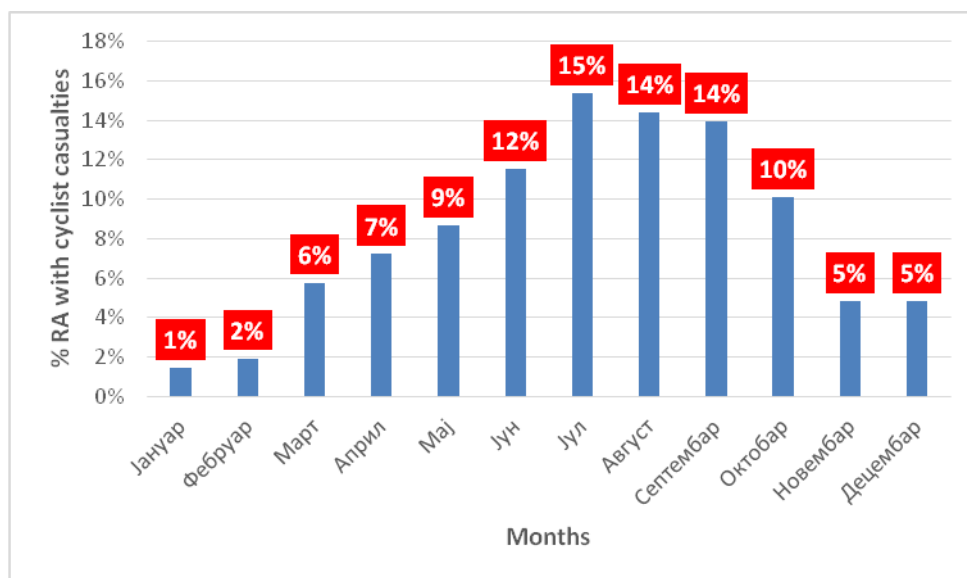


Chart 54. Distribution of road accidents with cyclist casualties by months, the City of Kraljevo, 2016-2021

Observed by days of the week, there were most cyclist casualties on Mondays (17% of accidents), and on Saturdays (16% of accidents). The least road accidents with cyclist casualties (8%) were recorded on Sundays (Chart 55).

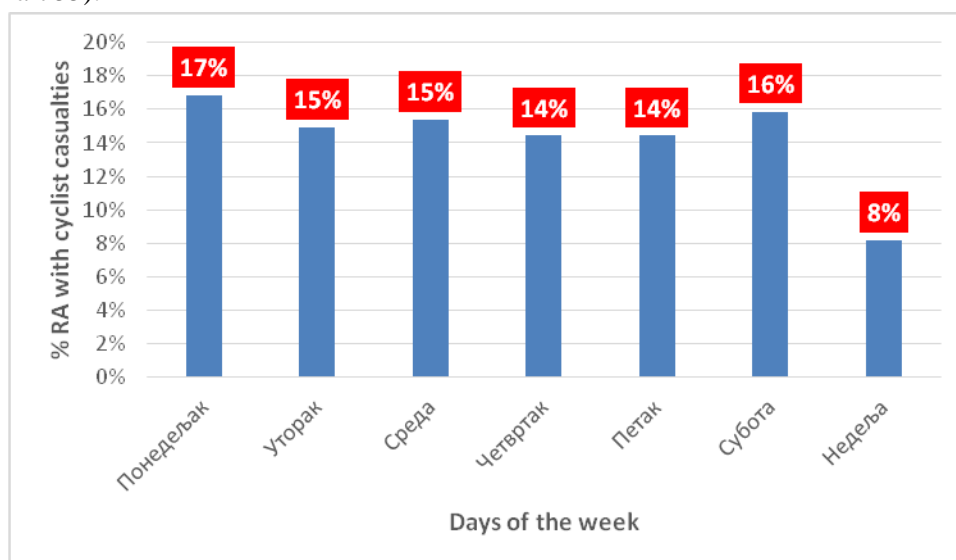


Chart 55. Distribution of road accidents with cyclist casualties by days of the week, City of Kraljevo, 2016-2021

The day periods with pronounced cyclist casualties in Kraljevo were from 8 a.m. to 12 p.m. and from 1 p.m. to 7 p.m. (Chart 56). The hours with the highest percentage of accidents involving cyclist casualties were from 2:00 p.m. to 3:59 p.m. (17%).

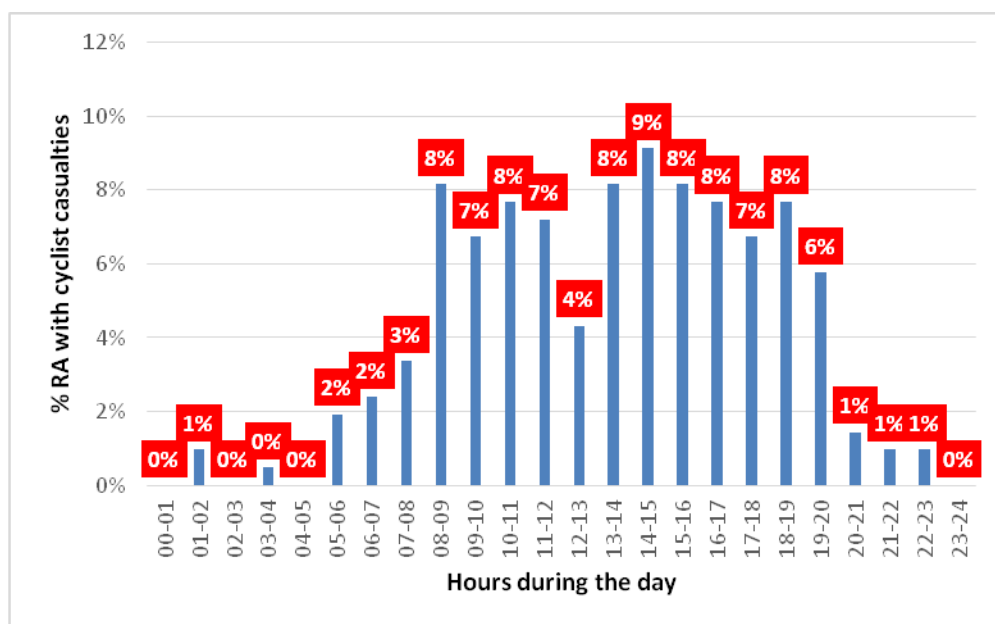


Chart 56. Distribution of road accidents with cyclist casualties by hours, the City of Kraljevo, 2016-2021

Spatial distribution of road accidents with cyclist casualties shows that the highest percentage of these accidents occurred in a settlement (Chart 57), namely 78.4% of accidents.

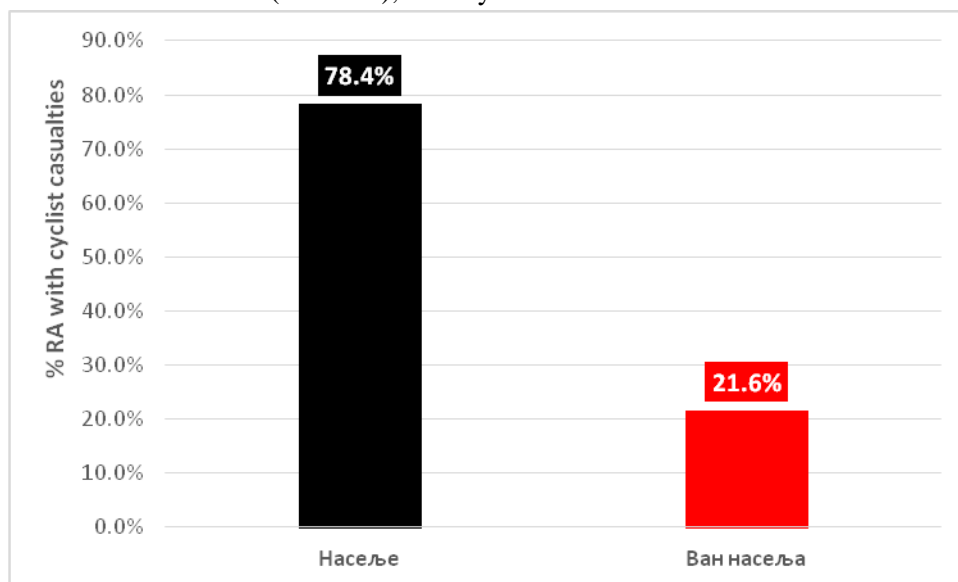


Chart 57. Spatial distribution of road accidents with cyclist casualties (settlement/outside the settlement), City of Kraljevo, 2016-2021

Spatial analysis of road accidents with cyclist casualties by road/street category shows that the highest percentage of these accidents occurred in high- and low-level streets (Chart 58). Collectively, the percentage is 60.5% of all accidents involving cyclist casualties in Kraljevo.

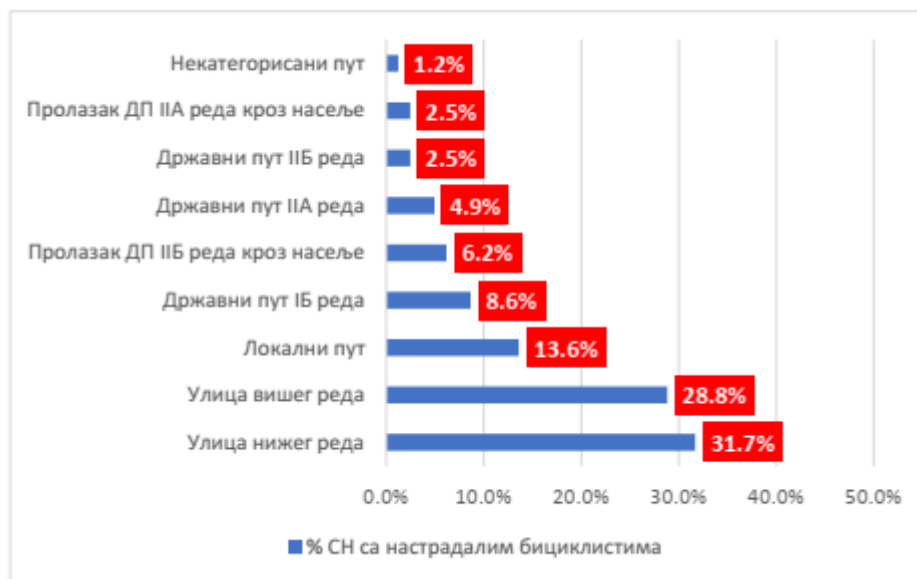


Chart 58. Distribution of road accidents with cyclist casualties by road/street category, City of Kraljevo, 2016-2021

The analysis of influencing factors that were recognized in road accidents with cyclist casualties in Kraljevo shows that the highest percentage of these factors belonged to the group "Reckless driver actions" (Chart 59). The percentage share of this group of influencing factors in the number of accidents with cyclist casualties is 36.2%. The following groups of influencing factors by percentage share are "Driver misactions" (35.5%) and "Driver failure due to poor psychophysical condition, non-alertness, distraction" (11.6%). It is important to note that in accidents with cyclist casualties, the remarkable groups of influencing factors are those which have to do with inadequate driver behavior in traffic - either of the driver of the motor vehicle participating in the accident or the cyclists themselves. Cyclists often use the roadway for moving in traffic, where they are faced with motor vehicles with a significantly greater mass and more power, which makes their vulnerability as a road user category even higher. Possible inadequate signaling of actions in traffic by cyclists or absence of such signals (e.g. change of movement course and direction), insufficient driver attention to (keeping an inadequate following distance, improper passing of cyclists, etc.) could have contributed to the number of road accidents with cyclist casualties in Kraljevo.

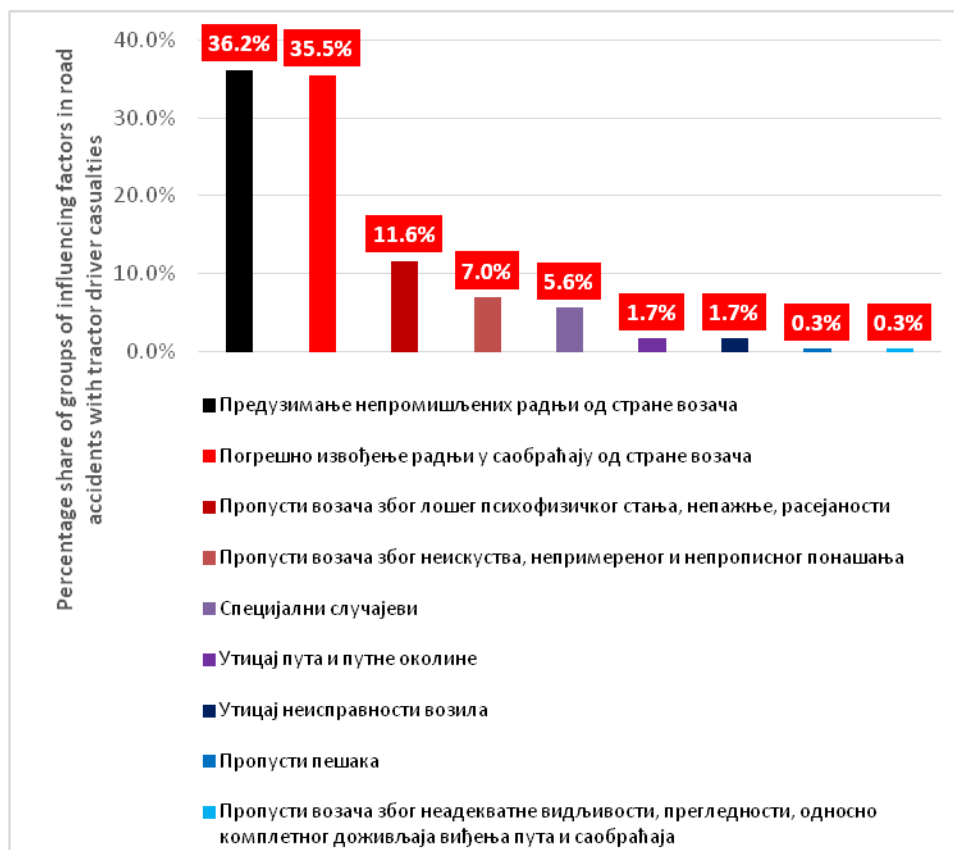


Chart 59. Percentage share of groups of influencing factors in road accidents with tractor driver casualties, City of Kraljevo, 2016-2021

The most represented influencing factor in road accidents with cyclist casualties is "Driver's failure to properly judge the traffic situation" (Chart 60). This influencing factor was identified in 16% of all accidents with cyclist casualties. At the same time, it is important to note that there may be several different influencing factors identified in one road accident. The following influencing factors in order of representation are "Speed unadjusted to road and traffic conditions" (13%), "Loss of control over the vehicle" (9%), "Wrong execution of a turn or other vehicle maneuver" (9%) and "Failure to yield the right of way defined by an official's sign, traffic signs or rules" (8%). Influencing factors cannot fully describe the reasons for a road accident, but are key information that more closely describes the occurrence of a road accident.



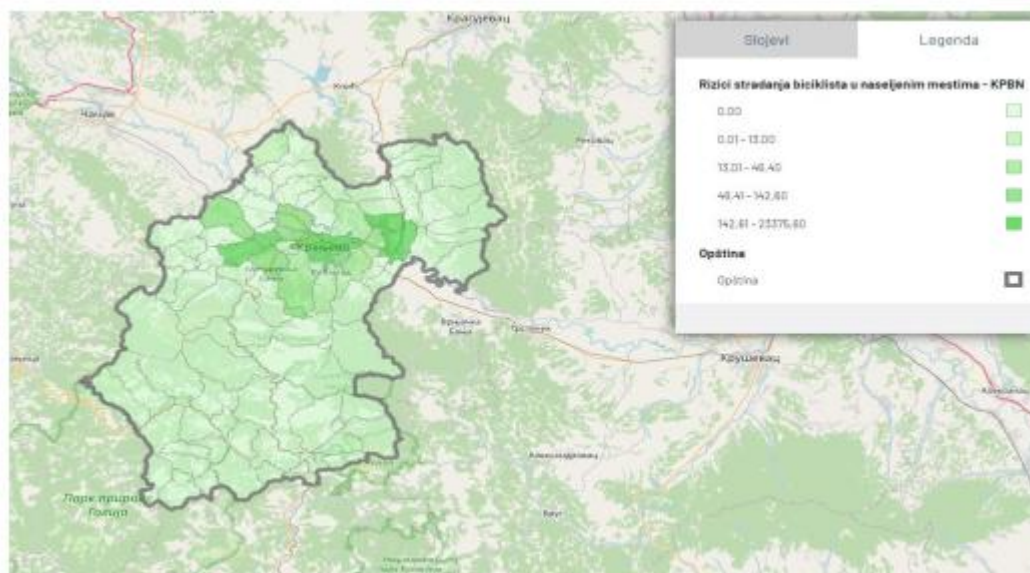
Chart 60. The most prevalent influencing factors in road accidents with cyclist casualties, City of Kraljevo, 2016-2021

Apart from influencing factors "Driver's failure to properly judge the traffic situation" and "Speed unadjusted to road and traffic conditions" (practice of frequent identification to "mask" real influencing factors, etc.), influencing factors such as "Loss of control over the vehicle", "Wrong execution of a turn or other vehicle maneuver" and "Failure to yield the right of way defined by an official's sign, traffic signs or traffic rules" are very often identified in road accidents with cyclist casualties. Measures aimed at improving cyclist road safety can be aimed at preventing accidents in which these influencing factors are recognized. Looking at the spatial distribution of accidents and cross-referencing them with road accident characteristics makes it possible to recognize the possible influence of the road on the occurrence of accidents. Therefore, it is possible to adequately direct activities towards the development and improvement of cycling infrastructure.

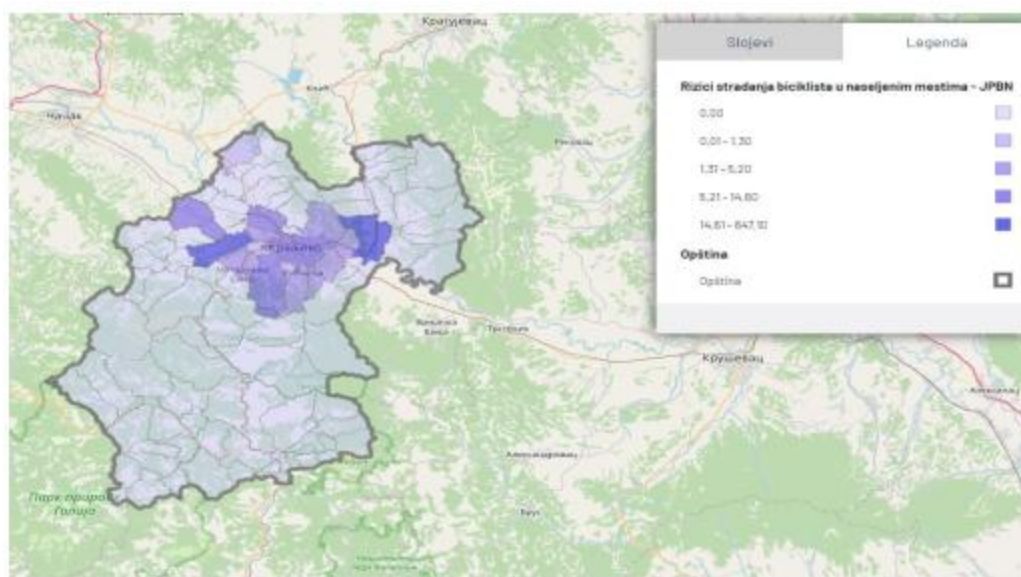
Based on the analysis of the public and collective risk of **cyclist casualty** by settlements of the City of Kraljevo for the period between 2019 and 2021, the following settlements stand out by risk value:

- By collective risk of cyclist casualty, the following settlements stand out: **Milavčiči (845.1)**, **Vrdila (790.1)** and **Vitanovac (285.1)**.
- By public risk of cyclist casualty, the following settlements stand out: **Milavčiči (263.3)**, **Vrdila (116.1)** and **Vitanovac (65)**

Below is a graphic representation of the classes of collective and public risk of cyclist casualty by settlements of the City of Kraljevo for the observed period between 2019 and 2021.



Map 13. Collective risk of cyclist casualty in the settlements of the City of Kraljevo, 2019-2021



Map 14. Public risk of cyclist casualty in the settlements of the City of Kraljevo, 2019-2021

Passenger vehicles

In the period from 2016 to 2021, there a total of 1,290 passenger vehicle road casualties on the territory of the City of Kraljevo (Chart 61). Of these, 48 people lost their lives, 171 people suffered severe injuries, and 1,071 minor injuries. Observed by year, the number of fatalities has a slightly downward trend. The year 2016 stands out as the all-time low in terms of passenger vehicle fatalities in the observed period. In this year, 5 people lost their lives as a driver or passenger in a passenger vehicle. However, in the following year (2017), there was a sudden increase in the number of fatalities, i.e. 14 people lost their lives as drivers or passengers in a passenger vehicle. Later, the number has decreased, but the trend of continuous reduction in the number of passenger vehicle fatalities has not yet been established.

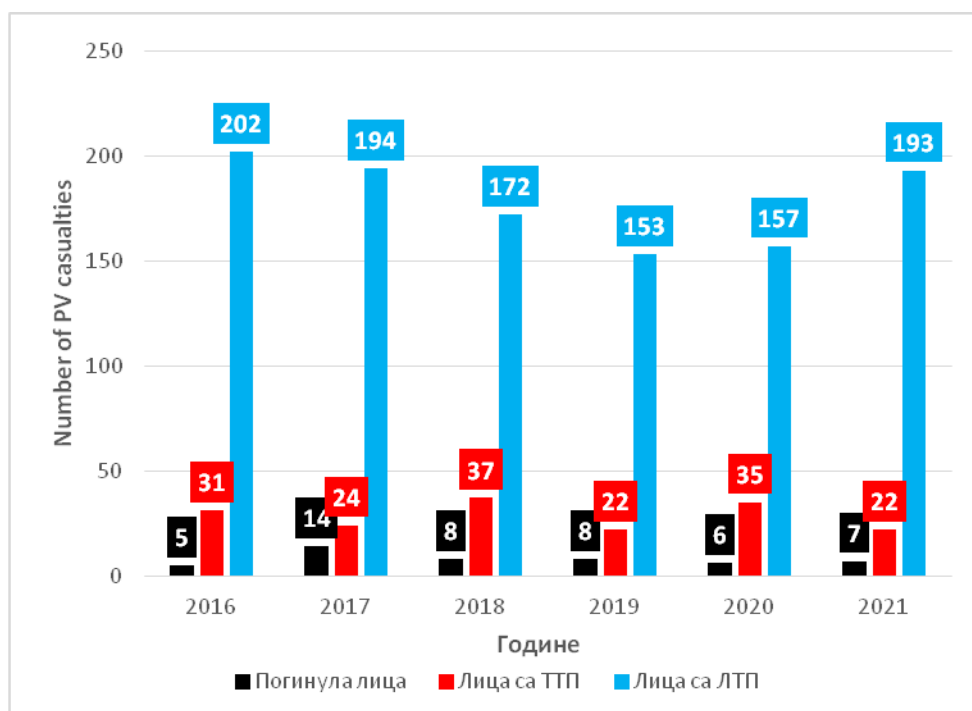


Chart 61. Consequences suffered by people in passenger vehicles in road accidents, City of Kraljevo, 2016-2021

Structure (distribution) of injured people in passenger vehicles by the nature of participation in road accidents shows that more people, 51% to be exact, were killed as drivers, while 49% were killed as passengers of a passenger vehicle (Chart 62).

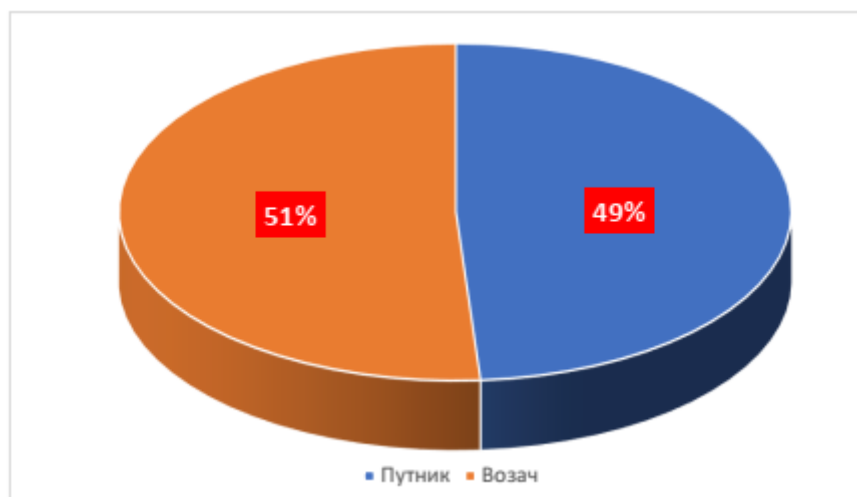


Chart 62. Distribution of passenger vehicle casualties by the nature of participation in road accidents, City of Kraljevo, 2016-2021

If we look at the age categories of passenger vehicle casualties, we see that the highest percentage belonged to the age category of 15 to 30 years (34%). The following category in terms of share in

casualties is the category 31 to 45 years (Chart 63). It can be concluded that young and able-bodied people were most often casualties in passenger vehicles.

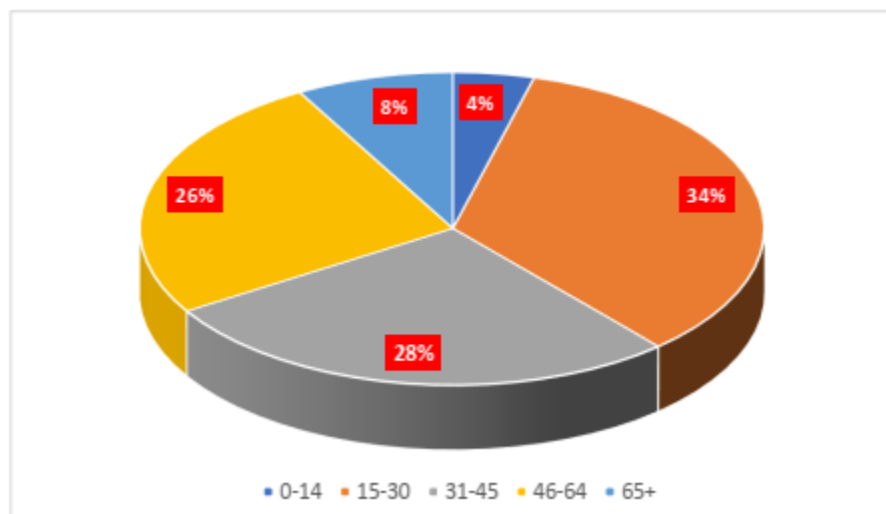


Chart 63. Structure of passenger vehicle casualties by age categories, City of Kraljevo, 2016-2021

The distribution of road accidents with passenger vehicle casualties by groups of types of road accidents shows that the most common types of accidents in which drivers and passengers in passenger vehicles were casualties belonged to the group "No turn RA involving at least two vehicles" (Chart 64).

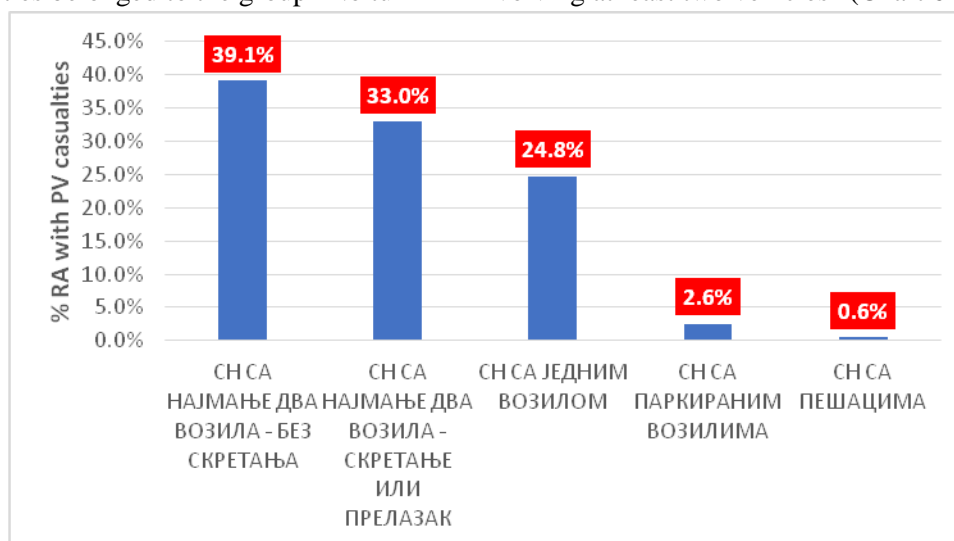


Chart 64. Distribution of road accidents with passenger vehicle driver and passenger casualties by groups of accident types, City of Kraljevo, 2016-2021

The time analysis of road accidents with passenger vehicle casualties by months shows that the most road accidents with casualties were recorded in October, June, July and August, namely 10% of the total number of accidents in each of the mentioned months (Chart 65).

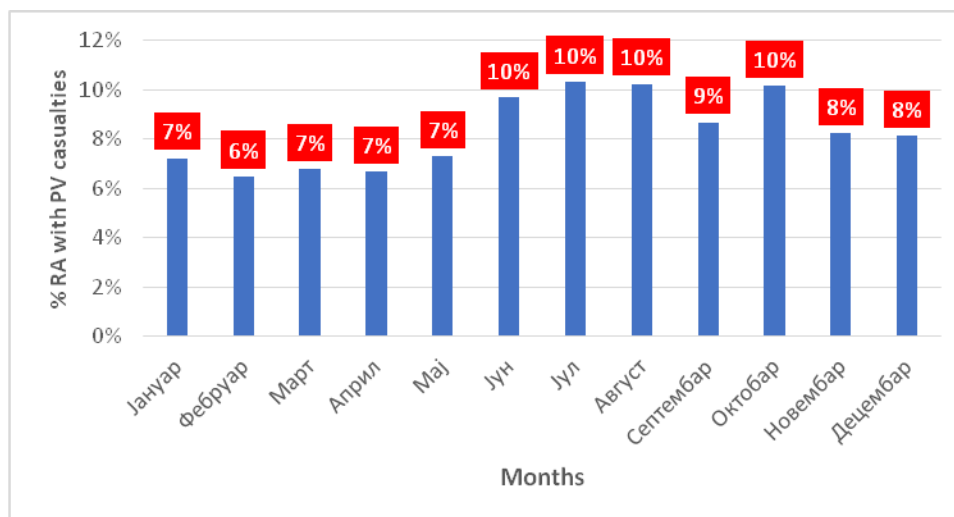


Chart 65. Time distribution of road accidents with passenger vehicle casualties by months, City of Kraljevo, 2016-2021

Saturday stands out as the day when the most accidents with passenger vehicle casualties occur in Kraljevo (Chart 66). Of the total number of accidents with passenger vehicle casualties, 16% occurred on Saturday, 15% occurred on Friday and Sunday, and 14% occurred on Monday and Tuesday. The days of the week when the fewest accidents with passenger vehicle casualties occur are Wednesday (12%) and Thursday (13%).

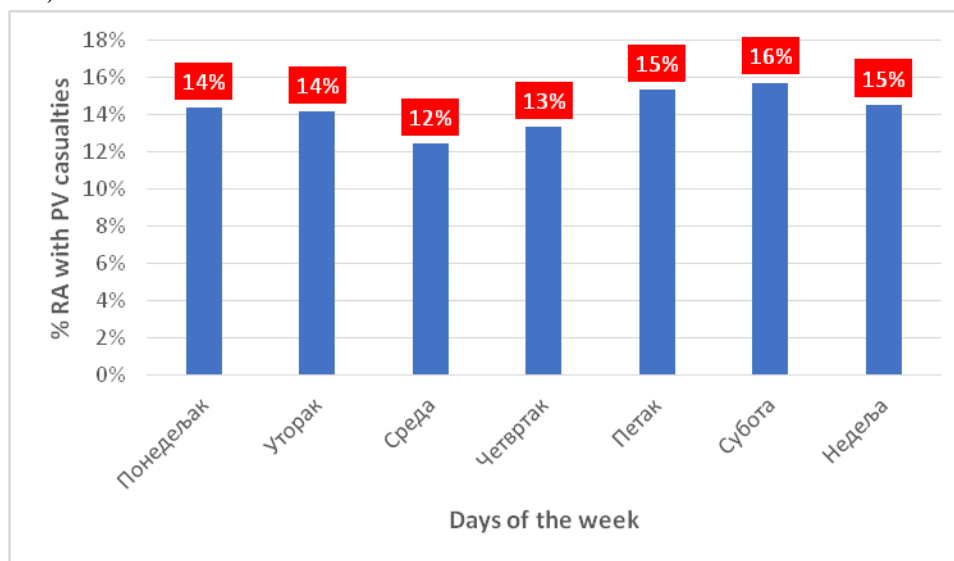


Chart 66. Time distribution of road accidents with passenger vehicle casualties by days of the week, City of Kraljevo, 2016-2021

The distribution of passenger vehicle casualties by hours of the day shows that most road casualties were recorded in the time period from 2:00 p.m. to 2:59 p.m, with 9% of casualties drivers and passengers in passenger vehicles (Chart 67).

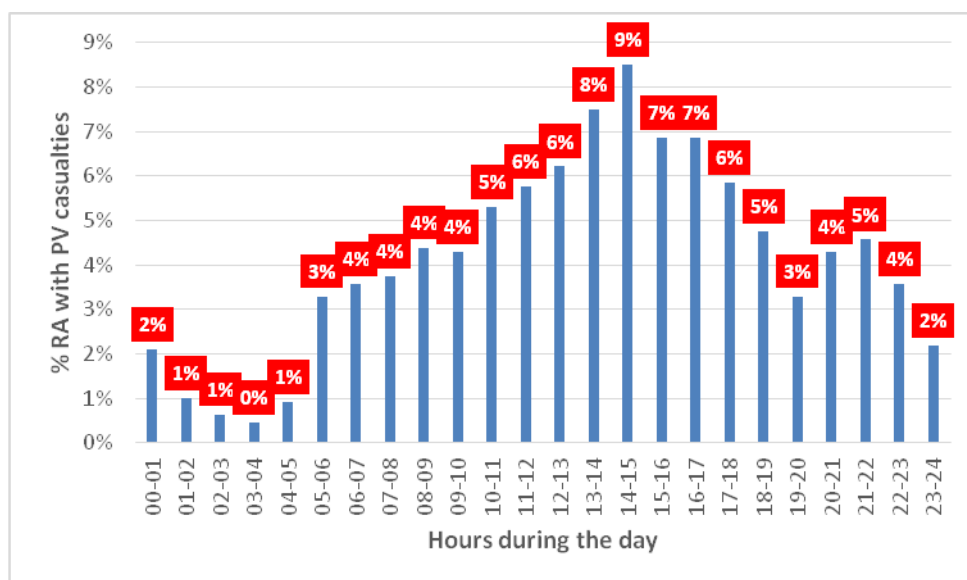


Chart 67. Time distribution of road accidents with passenger vehicle casualties by hours of the day, City of Kraljevo, 2016-2021

Spatial distribution of road accidents with passenger vehicle casualties shows that the highest percentage of those accidents occurred in a settlement (Chart 68), namely 54.8%.

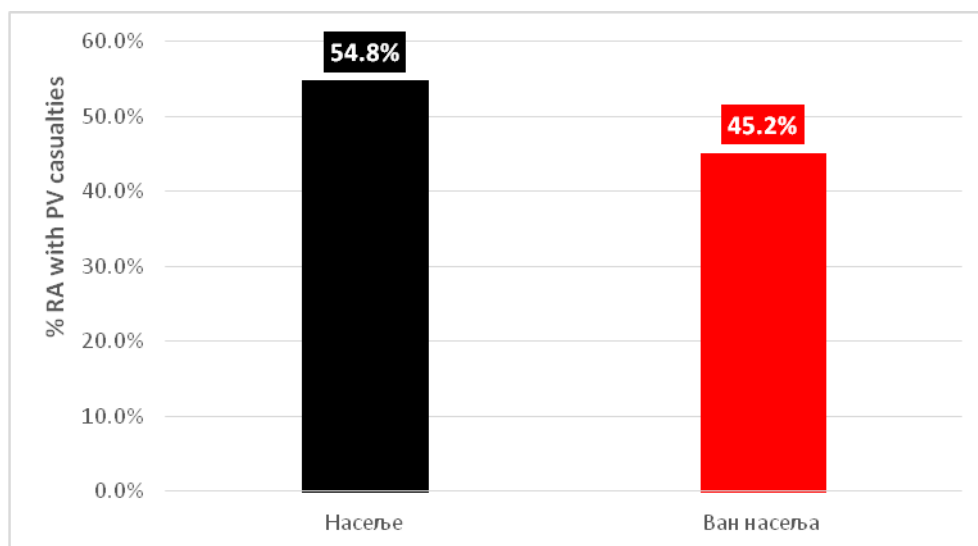


Chart 68. Spatial distribution of road accidents with passenger vehicle casualties (settlement/outside the settlement), City of Kraljevo, 2016-2021

Observed by road/street category, accidents with passenger vehicle casualties most often occurred on IB class state roads and streets (Chart 69). Expressed as a percentage, 37.1% of accidents with passenger vehicle casualties occurred on streets (higher and lower class), while 30.3% of accidents occurred on IB class state road.



Chart 69. Spatial distribution of road accidents with passenger vehicle casualties by road/street category, City of Kraljevo, 2016-2021

The spatial distribution of road accidents with passenger vehicle casualties by the type of place (on a road section, street or intersection) is shown in the following Chart (Chart 70).

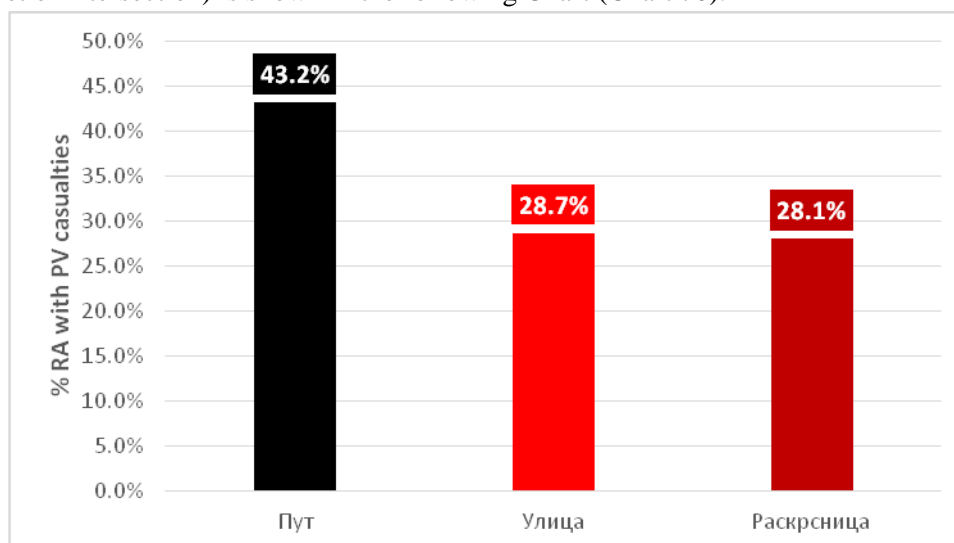


Chart 70. Spatial distribution of road accidents with passenger vehicle casualties by type of place (road/street/intersection), City of Kraljevo, 2016-2021

Among the influencing factors that contributed to road accidents with casualties drivers and passengers in passenger vehicles, the highest percentage belonged to the group of influencing factors "Reckless driver actions" (Chart 71).

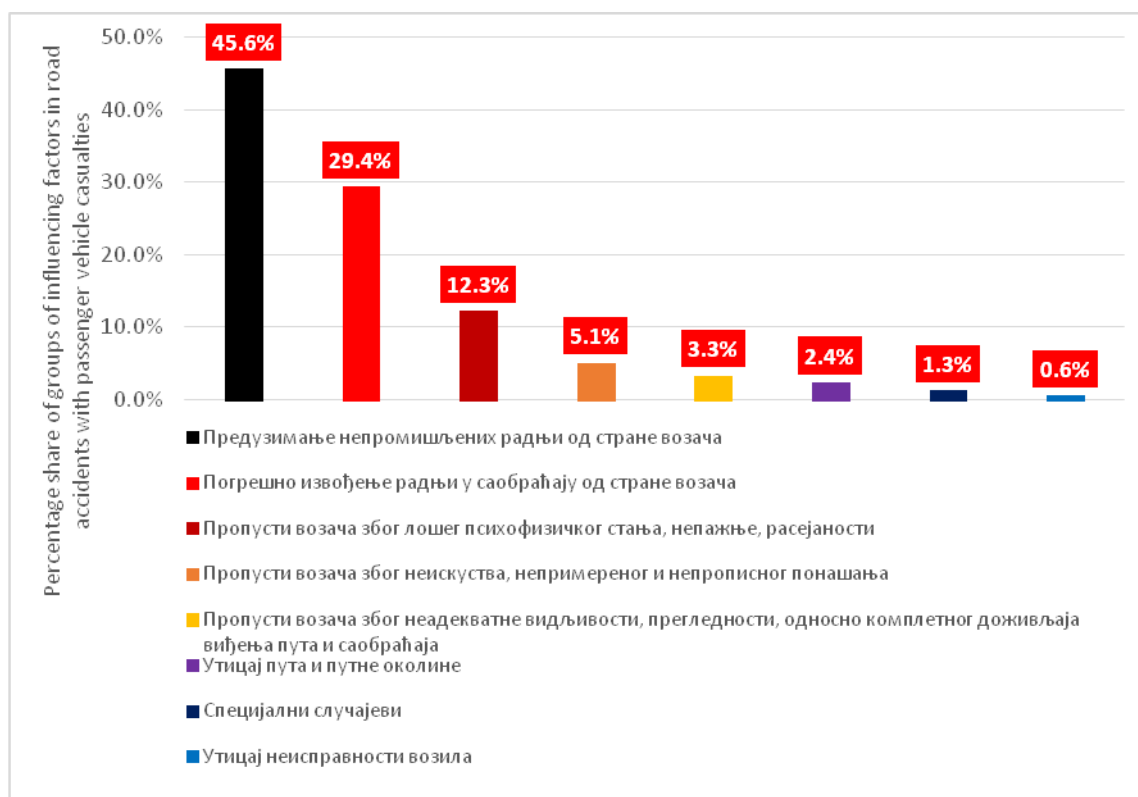


Chart 71. Percentage share of groups of influencing factors in road accidents with passenger vehicle casualties, City of Kraljevo, 2016-2021

The most prevalent recognized influencing factors in accidents with passenger vehicle casualties are "Speed unadjusted to traffic and road conditions" and "Driver's failure to properly judge the traffic situation" (Chart 72). These two influencing factors are recognized in 28% of all accidents with passenger vehicle casualties. The level of identifying the influencing factor related to unadjusted speed very often depends on the level of knowledge of the influencing factor nature by the members of the investigation traffic police. Also, this influencing factor can "mask" some other influencing factors which were not recorded or were recorded as factors related to this influencing factor.

For this reason, the data on the share of improper speed-related influencing factor in road accidents with passenger vehicle casualties should be considered with a reservation. Other influencing factors can provide a clearer picture of the nature of the problem related to the occurrence of accidents with passenger vehicle casualties. For example, failure to yield the right-of-way or wrong assessment of another road user's path may indicate road-related problems. The modern approach to road safety, viewed from the aspect of road infrastructure, requires the application of the **"SELF EXPLAINING ROADS"** concept. It basically draws on human factors (knowledge of nature-related human limitations - cognitive and motor skills, physiological limitations conditioned by various biochemical processes in the human body - disease, sudden stopping of human functions, etc. and adaptation to those limitations).

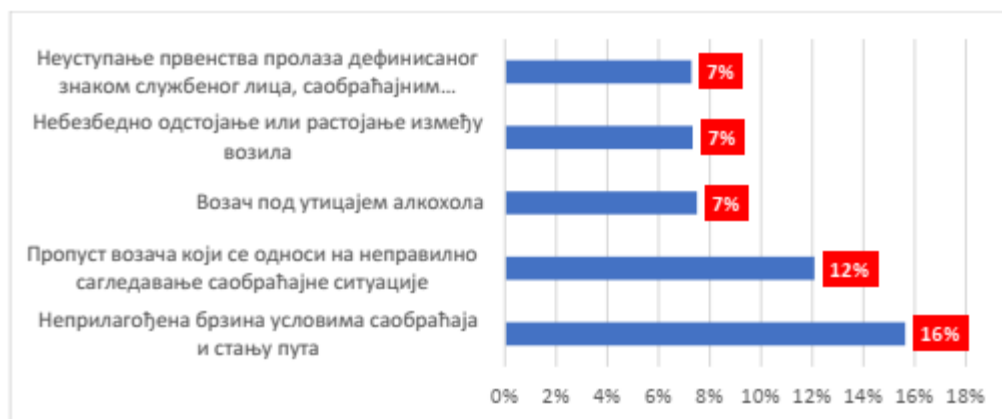


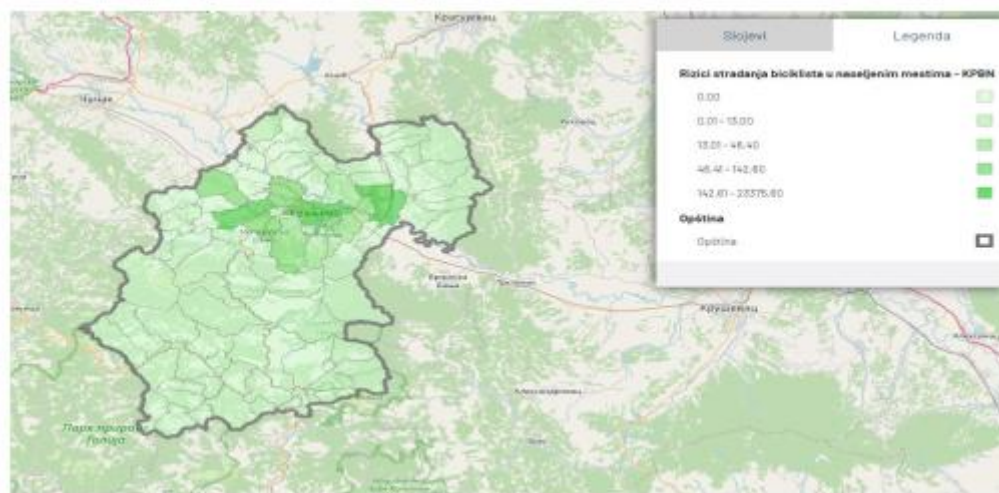
Chart 72. The most prevalent influencing factors in road accidents with passenger vehicle casualties, City of Kraljevo, 2016-2021

Cross-referencing the data on the influencing factors with the spatial analysis of road accidents with passenger vehicle casualties can give a clearer picture of the specific road accident locations, i.e. it facilitates defining adequate measures to improve road safety, especially from the aspect of road infrastructure.

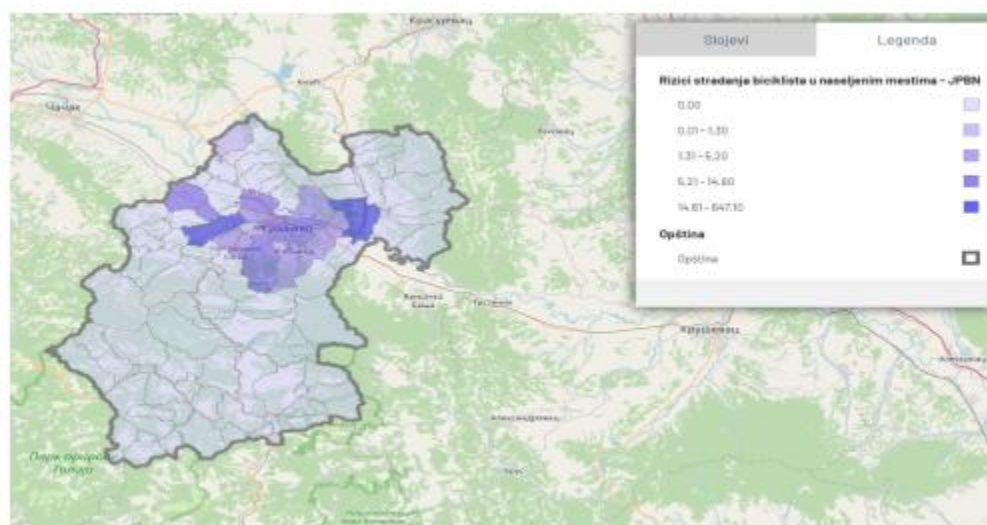
Based on the analysis of the public and collective risk of **passenger vehicle casualty** by settlements of the City of Kraljevo for the period between 2019 and 2021, the following settlements stand out by risk value:

- By collective risk of passenger vehicle casualty, the following settlements stand out: **Milavčiči (845.1)**, **Vrdila (790.1)** and **Vitanovac (285.1)**
- By public risk of passenger vehicle casualty, the following settlements stand out: **Milavčiči (263.3)**, **Vrdila (116.1)** and **Vitanovac (65)**

Below is a graphic representation of the classes of collective and public risk of passenger vehicle casualty by settlements of the City of Kraljevo for the observed period between 2019 and 2021.



Map 15. Collective risk of passenger vehicle casualty in the settlements of the City of Kraljevo, 2019-2021



Map 16. Public risk of passenger vehicle casualty in the settlements of the City of Kraljevo, 2019-2021

Commercial vehicles

One of the tasks of a modern traffic system is to allow smooth performance of social activities and development of economic activities. From a technical and technological aspect, this system must be reliable, unambiguous (uniform), providing an appropriate service quality/level and be safe. Work in the field of road safety is aimed at preventing road accidents while considering all recognized road user categories. Commercial vehicles are recognized as an important factor for the economy and society as a whole. The road user group named as "commercial vehicles" includes cargo vehicles and buses.

There were a total of 433 casualties in road accidents involving commercial vehicles in the period between 2016 and 2021 (Chart 73). Of these, 37 were fatalities, 76 people were severely injured, and 320 suffered minor injuries. In the observed time frame, no significant downward trend in the number of casualties in road accidents involving commercial vehicles was recorded.

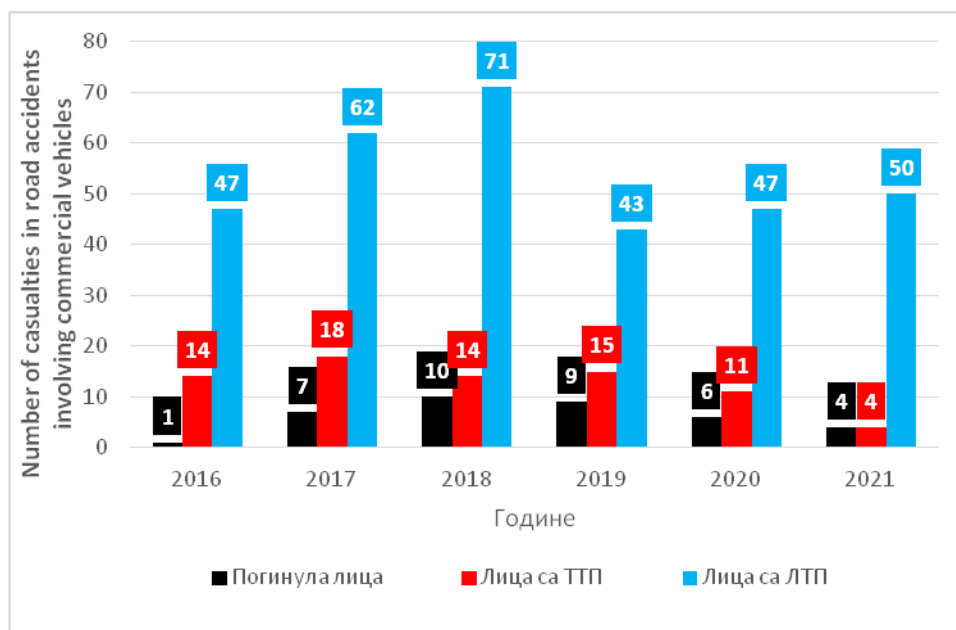


Chart 73. Consequences of road accidents involving commercial vehicles, City of Kraljevo, 2016-2021

The distribution of road accidents involving commercial vehicles with casualties by vehicle category shows that cargo vehicles were involved in 79% of road accidents, while buses were involved in 21% of road accidents (Chart 74).

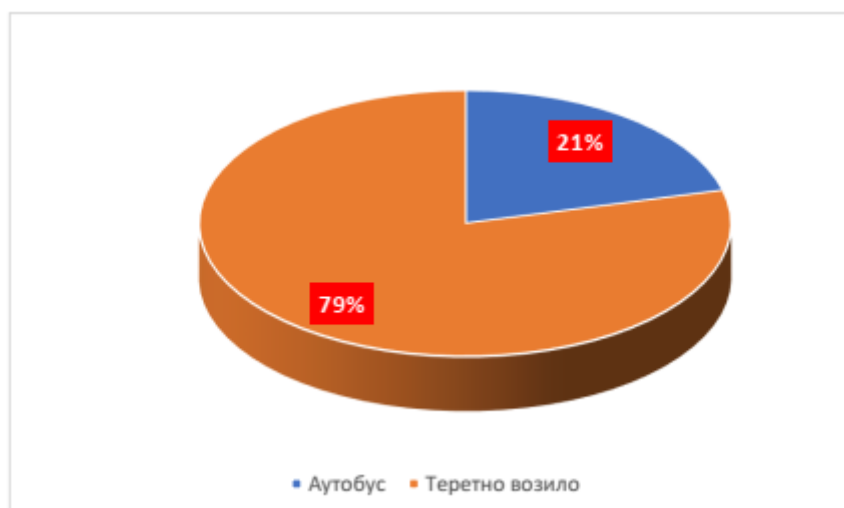


Chart 74. Distribution of commercial vehicles by participation in road accidents with casualties, City of Kraljevo, 2016-2021

The structure of road accidents involving commercial vehicles with casualties shows that the most common types of accidents with casualties belonged to the group "No turn RA involving at least two vehicles" (Chart 75). The share of this type of accident in the total number of accidents with casualties is 53.7%.

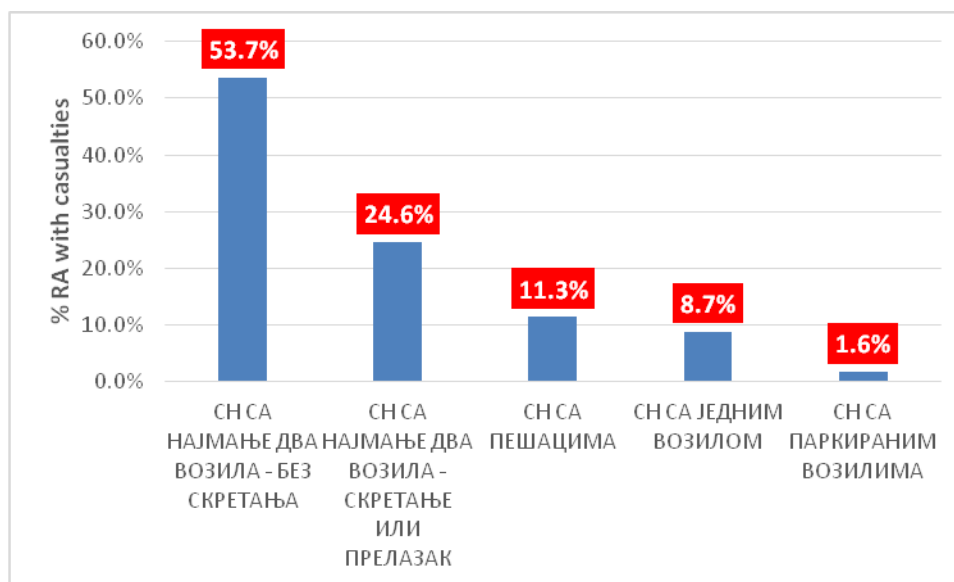


Chart 75. Distribution of road accidents involving commercial vehicles with casualties by groups of types of accidents, City of Kraljevo, 2016-2021

Observed by months, the most road accidents involving commercial vehicles with casualties occurred in the months of June, October and January (Chart 76). Of these, 12% occurred in June, and 11% in January and October each.

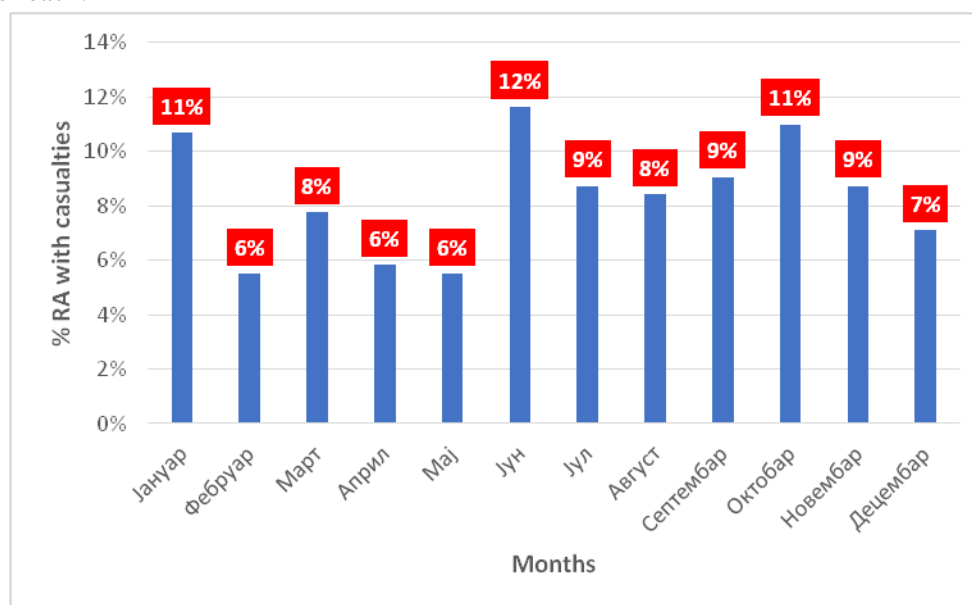


Chart 76. Time distribution of road accidents involving commercial vehicles with casualties by months, City of Kraljevo, 2016-2021

Most accidents involving commercial vehicles with casualties, more precisely 17% of the total number of accidents, occurred on Tuesday, Friday and Saturday (Chart 77).

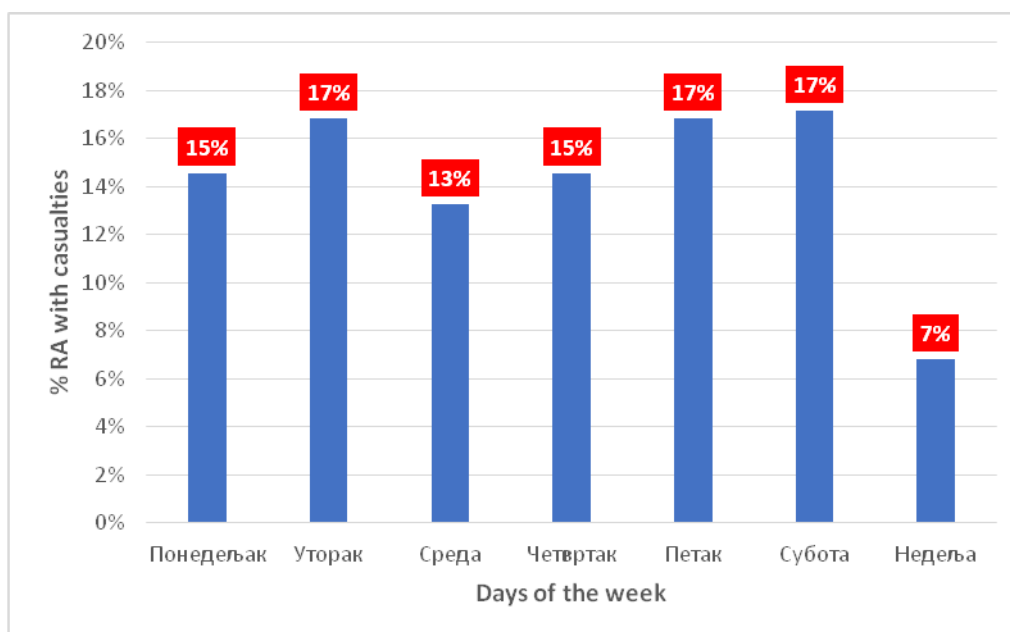


Chart 77. Time distribution of road accidents involving commercial vehicles with casualties by days of the week, City of Kraljevo, 2016-2021

Observed by hours of the day, the most road accidents involving commercial vehicles with casualties occurred in the period from 05:00 a.m. to 05:59 a.m. (Chart 78).

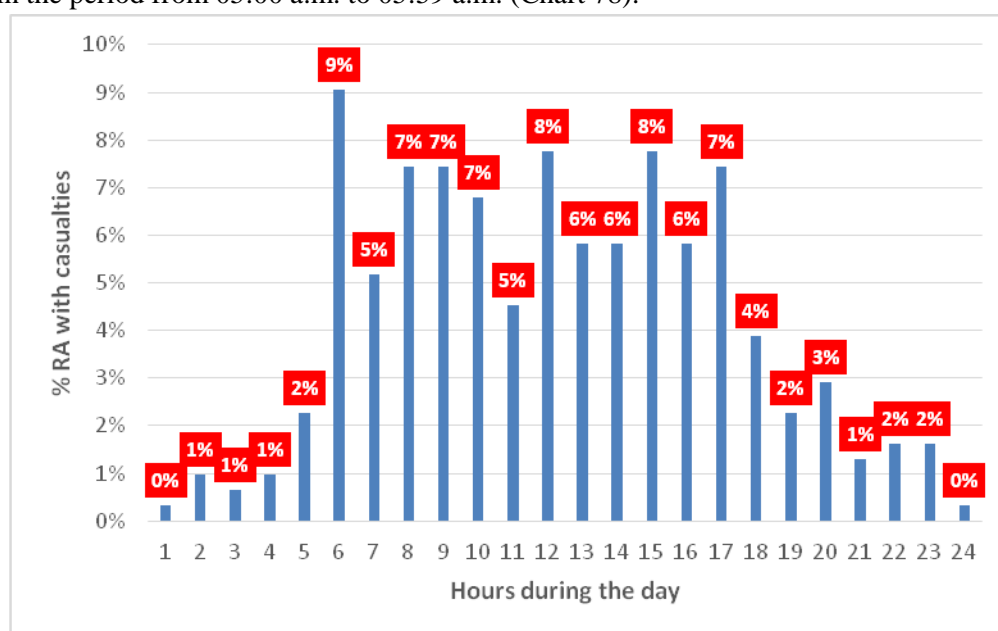


Chart 78. Time distribution of road accidents involving commercial vehicles with casualties by hours of the day, City of Kraljevo, 2016-2021

Spatial distribution of road accidents involving commercial vehicles with casualties shows that most of these accidents, 57.9% to be exact, occurred in a settlement (Chart 79).

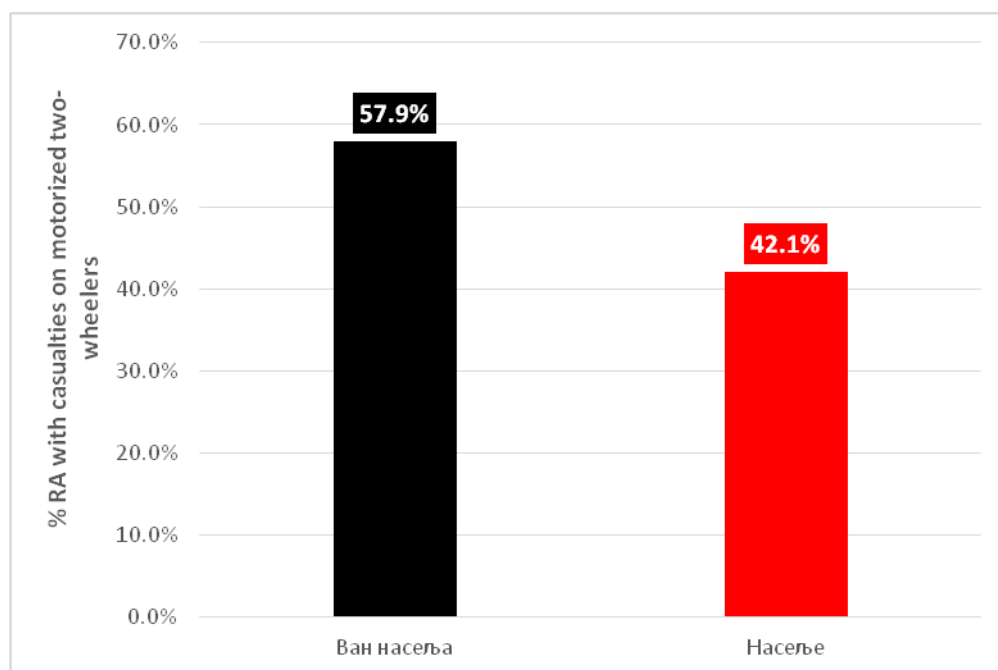


Chart 79. Spatial distribution of road accidents involving commercial vehicles with casualties (settlement/outside the settlement), City of Kraljevo, 2016-2021

Spatial distribution of road accidents involving commercial vehicles with casualties by the type of place (road section, street or intersection) is shown in the following chart (Chart 80).

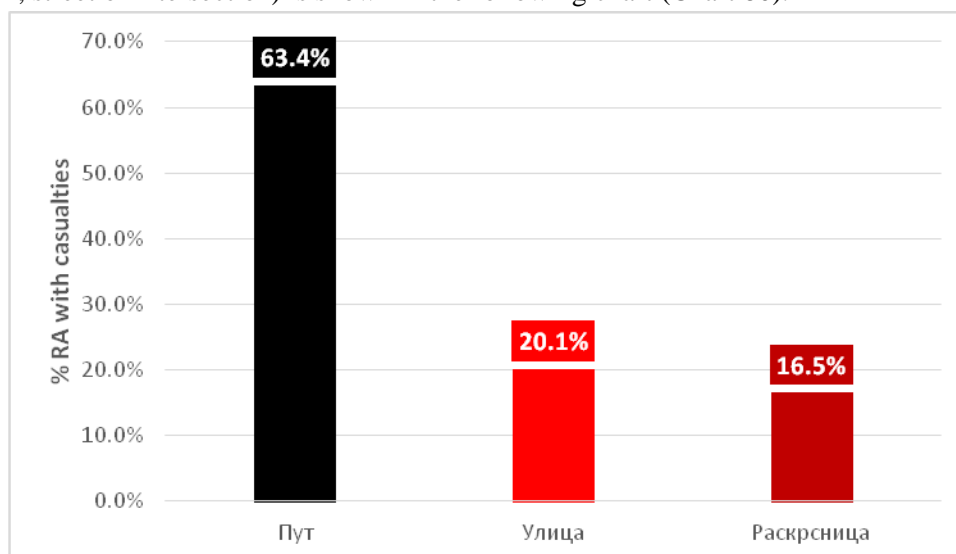


Chart 80. Spatial distribution of road accidents involving commercial vehicles with casualties by type of place, City of Kraljevo, 2016-2021

Observed by road/street category, the most accidents involving commercial vehicles with casualties occurred on the IB-class state road, namely 48.5% (Chart 81).



Chart 81. Spatial distribution of road accidents involving commercial vehicles with casualties by road/street category, City of Kraljevo, 2016-2021

The most represented group of influencing factors in road accidents involving commercial vehicles with casualties is "Reckless driver actions" (Chart 82). The percentage share of this group of influencing factors in accidents involving commercial vehicles with casualties is 48%. The following group of influencing factors by percentage share is "Driver misaction", with 37.5%.

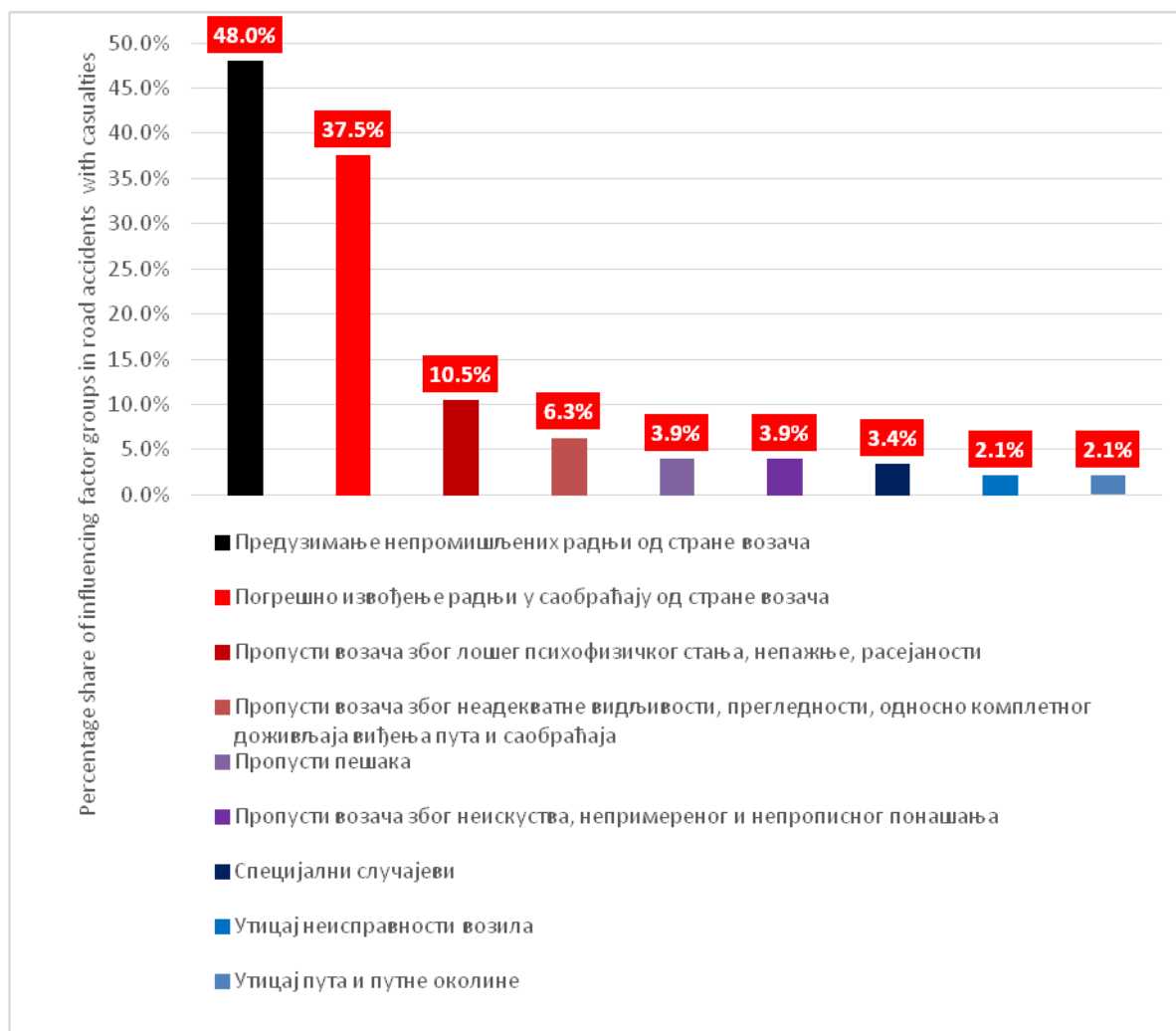


Chart 82. Percentage share of influencing factor groups in the occurrence of road accidents involving commercial vehicles with casualties, City of Kraljevo, 2016-2021

The following factors stand out as the most prevalent influencing factors in road accidents involving commercial vehicles with casualties,: "Driver's failure to properly judge the traffic situation" (21%), "Speed unadjusted for traffic and road conditions" (14%). "Unsafe distance between vehicles" (13%), "Crossing an unbroken dividing line" (10%) and "Wrong execution of a turn or other vehicle maneuver" (7%).

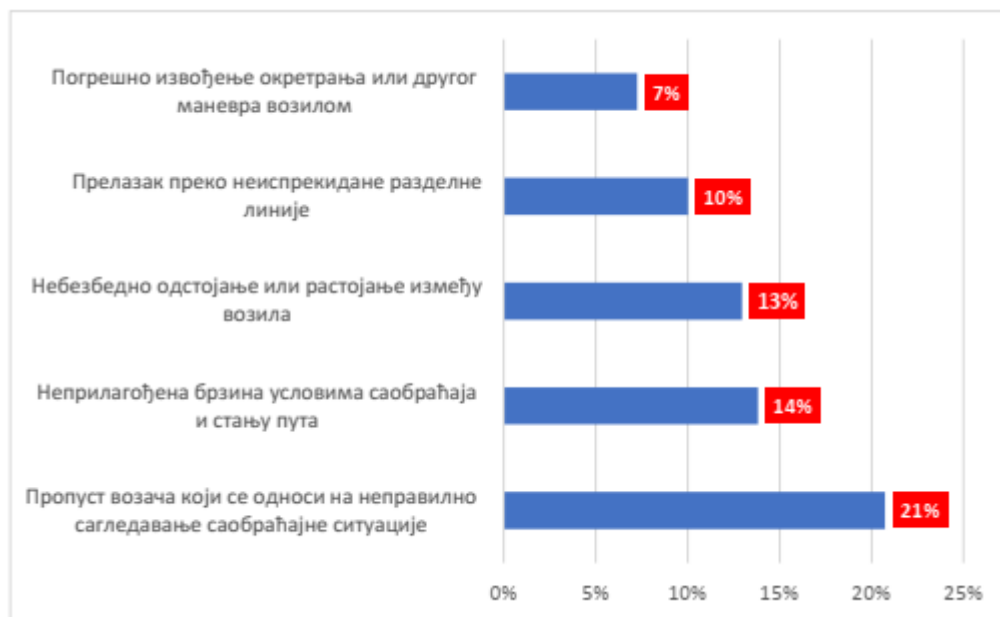


Chart 83. The most prevalent influencing factors in road accidents involving commercial vehicles with casualties, City of Kraljevo, 2016-2021

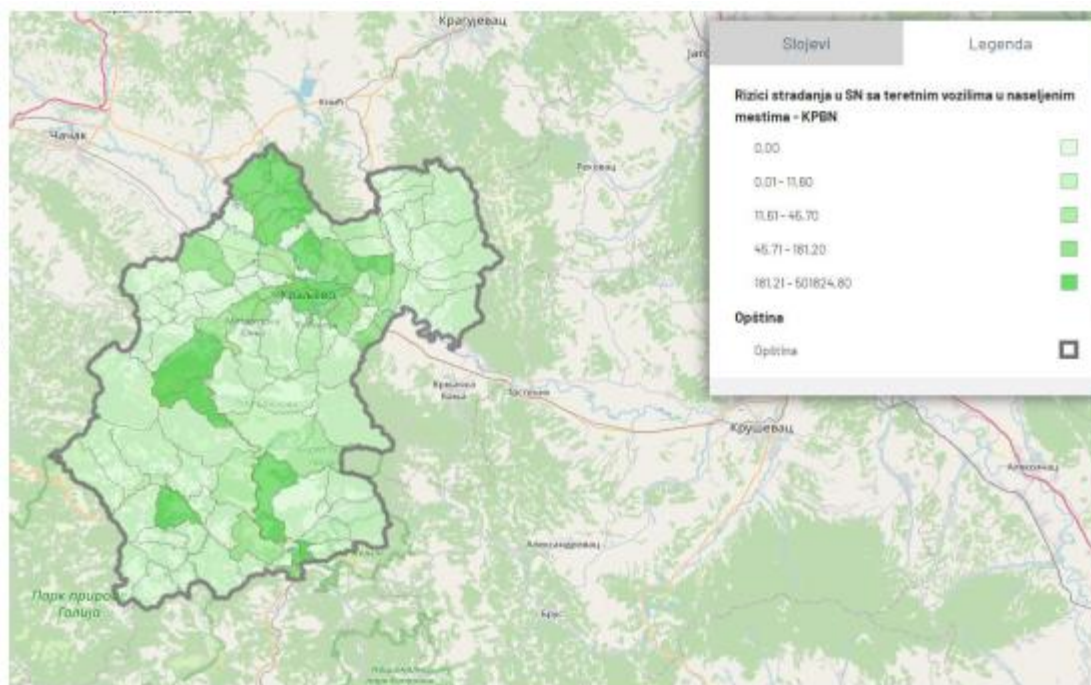
The character, that is, the specificity of the most frequently identified influencing factors speaks of the type and magnitude of the existing problem in terms of commercial vehicle road safety in Kraljevo. For example, the relatively frequent identification of influencing factors related to actions such as keeping an unsafe distance between vehicles, crossing an unbroken dividing line, and wrong execution of turns and other maneuvers, may indicate the need for additional education of commercial vehicle drivers on various aspects of safe road using (driving mode, behavior in various critical situations, the impact of fatigue on the driver, etc.).

Based on the analysis of the public and collective risk of **casualty in road accidents involving commercial vehicles** by settlements of the City of Kraljevo for the period between 2019 and 2021, the following settlements stand out by risk value:

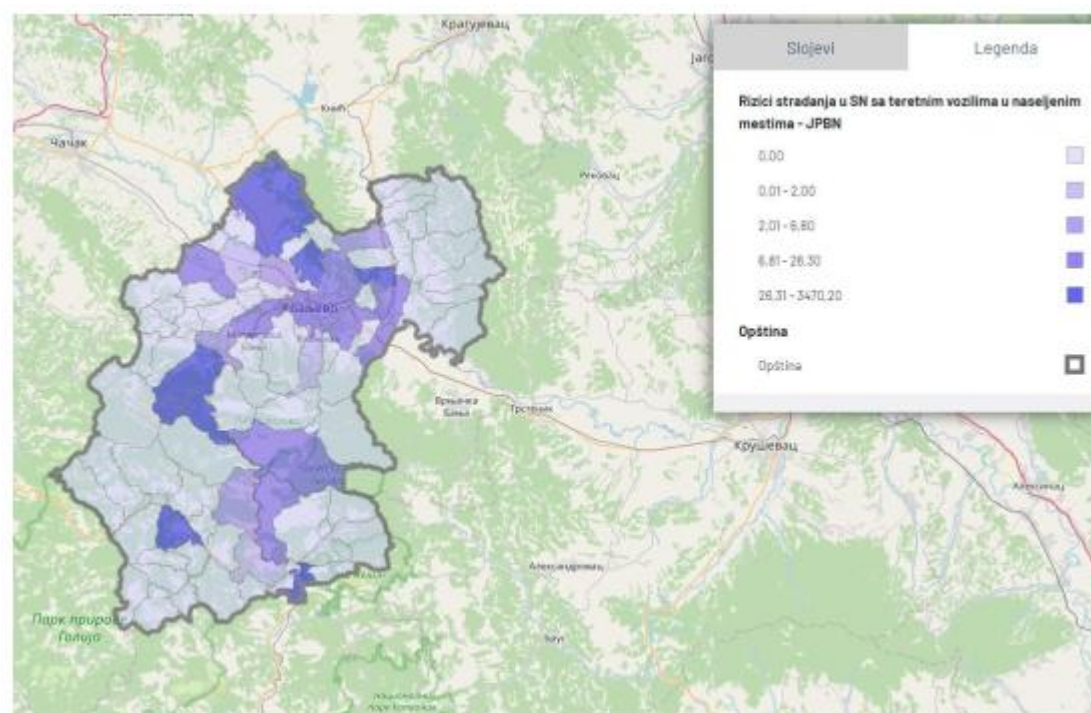
- By collective risk of casualty in road accidents involving commercial vehicles, the following settlements stand out: **Bare (3164.8), Tavnik (2086.6) and Milavčiči (1801.1).**
- By public risk of casualty in road accidents involving commercial vehicles, the following settlements stand out: **Maglič (852.9), Bare (731.9) and Milavčiči (561.2)**

Below is a graphic representation of the classes of collective and public risk of casualty in road accidents involving commercial vehicles by settlements of the City of Kraljevo for the observed period between 2019 and 2021.

2016-2021 Road Safety Analysis for the Territory of the City of Kraljevo



Map 17. Collective risk of casualty in road accidents involving commercial vehicles in the settlements of the City of Kraljevo, 2019-2021



Map 18. Public risk of casualty in road accidents involving commercial vehicles in the settlements of the City of Kraljevo, 2019-2021

3. SPATIAL ANALYSIS OF ROAD ACCIDENTS IN THE TERRITORY OF THE CITY OF KRALJEVO

Spatial analysis of road accidents for the territory of the City of Kraljevo was done for a five-year period, between 2016 and 2021. The distribution of road accidents with casualties was analyzed for the severity of the consequences, depending on whether the road accident occurred in the settlement or outside the settlement, for road category, routes and type of place on the road network. In analyzing the spatial distribution by road category and routes, only data on road accidents with casualties for which this data was recorded were allowed for. In accordance with the number of road accidents with casualties for which this data was known, the distribution of road accidents by road category and routes and type of place on the road network was calculated.

From the analysis of the spatial distribution of road accidents with casualties, it was concluded that the frequency of road accidents with casualties in the settlement is **63%** to the total number of road accidents with casualties in the territory of the City of Kraljevo, while outside the settlement frequency is 37% (Chart 84).

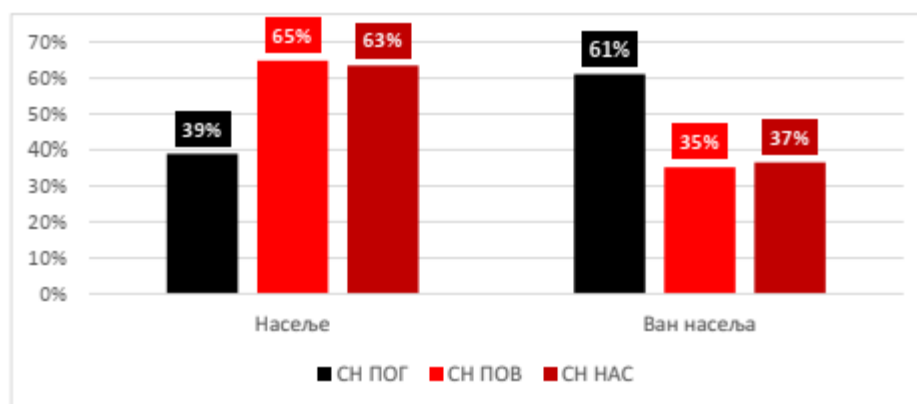


Chart 84. Distribution of the locations of road accidents with casualties relative to settlement/outside the settlement data, City of Kraljevo, 2016-2021

A higher percentage of road accidents with casualties in the settlement is expected due to higher traffic density, the number of conflicts and travels taking place in the settlement, reflecting in road accidents with casualties. On the other hand, the higher percentage of road accidents with casualties outside the settlements is related to the fact that the consequences of road accidents with casualties on state roads outside the settlements are significantly more severe compared to road accidents in settlement due to the higher permitted speed.

In the continuation of the analysis of the spatial distribution of road accidents with casualties in the territory of the City of Kraljevo for the period from 2016 to 2021, the percentage share of road accidents relative to the road category was recorded. The most frequent road accidents with casualties occur on lower and higher class streets, with a total percentage share of **59.6%** (Chart 85). In the case of other road categories, the percentage of road accidents with casualties is significantly lower compared to the above road categories, which is in line with the previously found spatial distribution with the highest percentage of road accidents with casualties in the settlement where the streets are built.



Chart 85. Distribution of locations of road accidents with casualties relative to road category, City of Kraljevo, 2016-2021

The following table provides data on road accidents with casualties that occurred in the period from 2016 to 2021 in the territory of the City of Kraljevo and their distribution by state road sections. It can be seen from the table that the greatest number of road accidents with fatalities (13) occurred on the Mrčajevci - Kraljevo section, which belongs to IB-class state road no. 22, while the most road accidents with injured people (87) took place on the Kraljevo (Beranovac) - Mataruška banja section belonging to IIB-class state road no. 410 and (82) on the Mataruška banja - Ušće section, which belongs to IB-class state road no. 22. These sections on IB-class state road no. 22 also stand out by the total number road accidents with casualties.

Some other state road sections standing out by the number of road accidents with casualties include Kraljevo (Beranovac) - Mataruška banja (88 RA CAS), Ratina - Kraljevo (Beranovac) (55 RA CAS) and Kraljevo (Jaručjak) - Mataruška banja (49 RA CAS).

Table 11. Distribution of road accidents with casualties by SR sections, City of Kraljevo, 2016-2021

Section	RA FAT	RA INJ	RA CAS
Mrčajevci - Kraljevo	13	83	96
Mataruška banja - Ušće	8	82	90
Kraljevo (Beranovac) - Mataruška banja	1	87	88
Ratina - Kraljevo (Beranovac)	4	51	55
Kraljevo (Jaručjak) - Mataruška banja	0	49	49
Drakčići - Kraljevo (Jaručjak)	2	30	32
Ravni Gaj - Vitanovac	0	32	32
Ratina - Kraljevo (Kamidžora)	0	28	28
Vitanovac - Kraljevo (Kamidžora)	5	22	27
Kraljevo (Beranovac) - Goč (Gokčanica)	2	23	25

Ušće - Bare	0	15	15
Kaona (Gornji Dubac) - Drakčići	0	14	14
Kraljevo - Kraljevo (Jarčujak)	0	9	9
Goč (Gokčanica) - Bare	0	1	1
Total	35	526	561

Note: In the City of Kraljevo, as many as 61% of road accidents with casualties occur on the road network outside the settlement. Considering that roads, and especially outside settlement roads, often do not fully meet all the necessary road safety standards (e.g. expressed mixed road function), it is assumed there is a high probability that ROAD IMPACT on the occurrence of road accidents with casualties is significantly higher, i.e. more frequent in compared to that registered by officials who investigated road accidents with casualties in the territory of the City of Kraljevo in the observed period from 2016 to 2021.

Below is a spatial analysis of road accidents with casualties relative to the type of place on the road network of the City of Kraljevo. The analysis found that the highest percentage of road accidents with casualties were located on roads (44.5%), followed by streets (30.1%) and intersections (25.3%). When it comes to the percentage of road accidents with casualties, the distribution is almost identical to that of road accidents with casualties (Chart 86). In the case of road accidents with casualties, roads, primarily roads outside settlements, stand out as the type of place with the highest percentage of road accidents with casualties (71%), which is expected, given that the consequences of road accidents with casualties on roads outside settlements are significantly more severe compared to road accidents on settlement streets or intersections due to the higher permitted speed. In the case of road accidents with casualties that occurred on a street or intersection, the percentage share is significantly lower, **16%** and **13%**, respectively.

In the observed time period between 2016 and 2021, a total of 17 road accidents with casualties were recorded on the local road and street network in the territory of the City of Kraljevo.

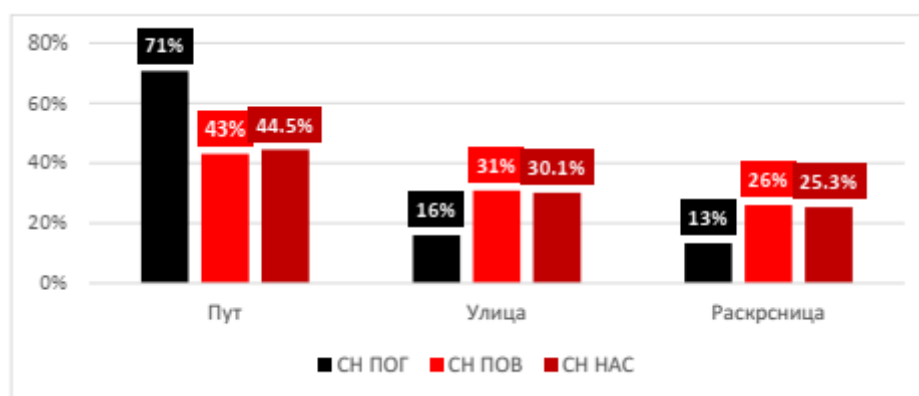
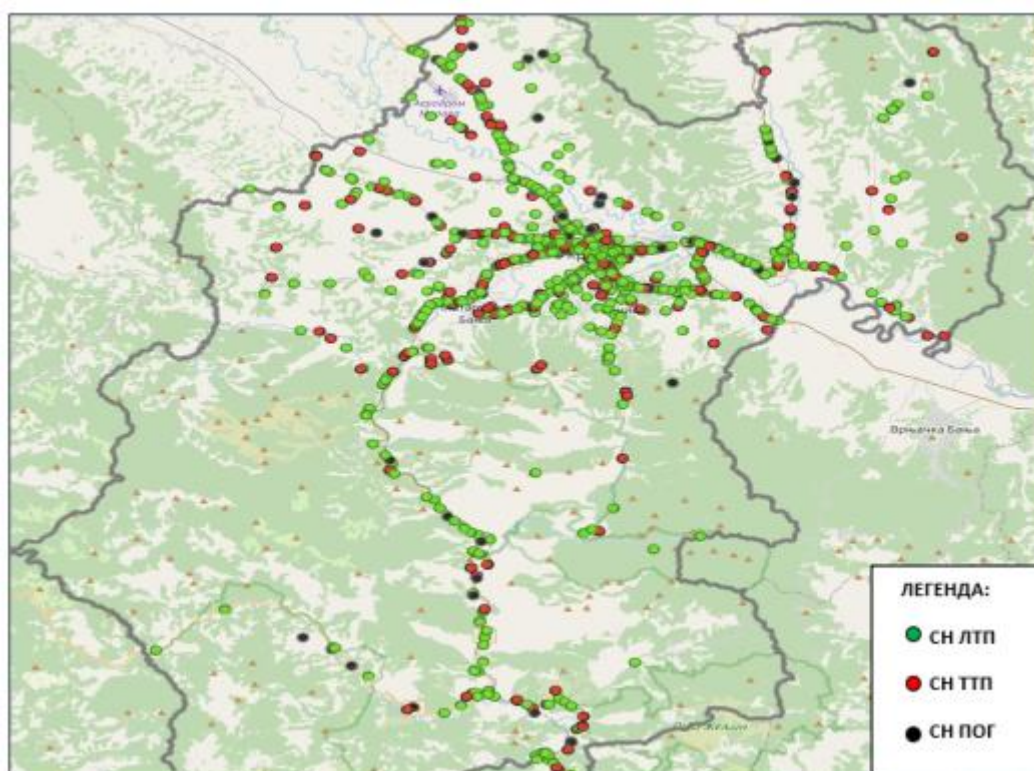


Chart 86. Distribution of locations of road accidents with casualties relative to the type of place on the road network, City of Kraljevo, 2016-2021

A broader view of the spatial distribution of road accidents with casualties in the territory of the City of Kraljevo, in the period from 2016 to 2021, is given in the figure below.



Map 19. Spatial distribution of road accidents with casualties, City of Kraljevo, 2016-2021

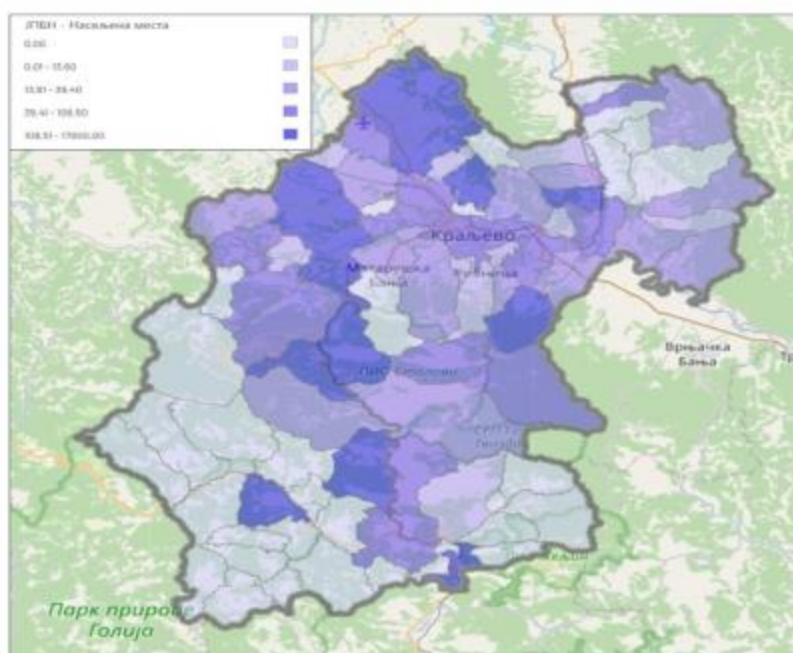
The territory of the City of Kraljevo comprises 92 settlements. Risk analysis by settlements can show which settlements stand out by risk values, which can further be used for a more detailed determination of the road safety problem. Below is a graphic representation of the value of the public (PRSI) and collective (CRSI) casualty risk by settlements in the City of Kraljevo.

Public risk is a relative (final) road safety indicator. It represents the number of road fatalities usually per 100,000 inhabitants in the observed area (variations are possible depending on the size of the observed territory). Collective risk is also a relative (final) road safety indicator that is most often used to calculate and analyze risks on roads and road sections.

Based on the value of the public risk of casualties, i.e. the value of the public weighted number of casualties, the settlements in Kraljevo were ranked.

By PRSI values, the following settlements stand out: **Polumir** (1074.2)², **Bojanići** (971.8), **Bare** (884.1), **Maglič** (882.4), **Brezova** (851.4) and **Zamčanje** (750), as settlements with a high value of public risk of road casualties (Map 20).

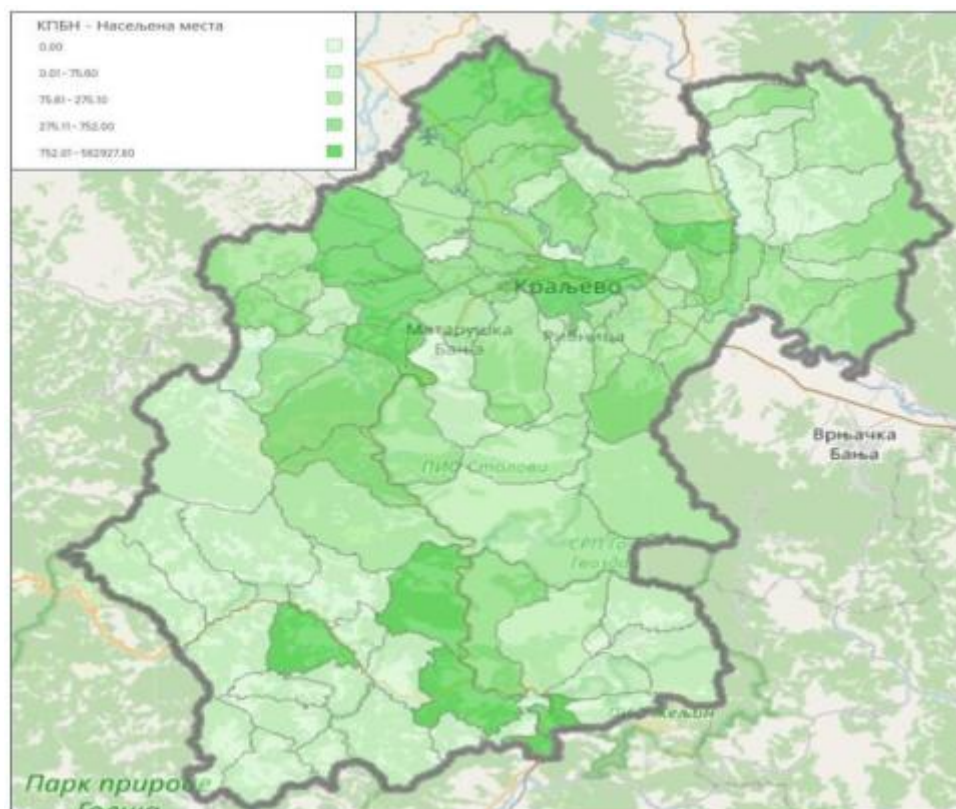
² The values of public risk relative to the number of inhabitants are shown in parentheses, which were obtained from the weighted number of casualties in the territory of the observed settlement - PRSI in the City of Kraljevo.



Map 20. Public casualty risk (PRSI) by settlements in the territory of the City of Kraljevo, 2021

By CRSI values, the following settlements stand out: **Tavnik** (4435.3)³, **Bare** (3822.8), **Brezova** (3107.8), **Milavčevići** (2868.1), but also the settlements of **Kraljevo** (1477.2) and **Bojanići** (1465.1). The collective casualty risk by populated areas is shown on the following map.

³ The values of the collective risk relative to the length of the road network are shown in parentheses, which were obtained from the weighted number of casualties in the territory of the observed settlement - CRSI in the City of Kraljevo.

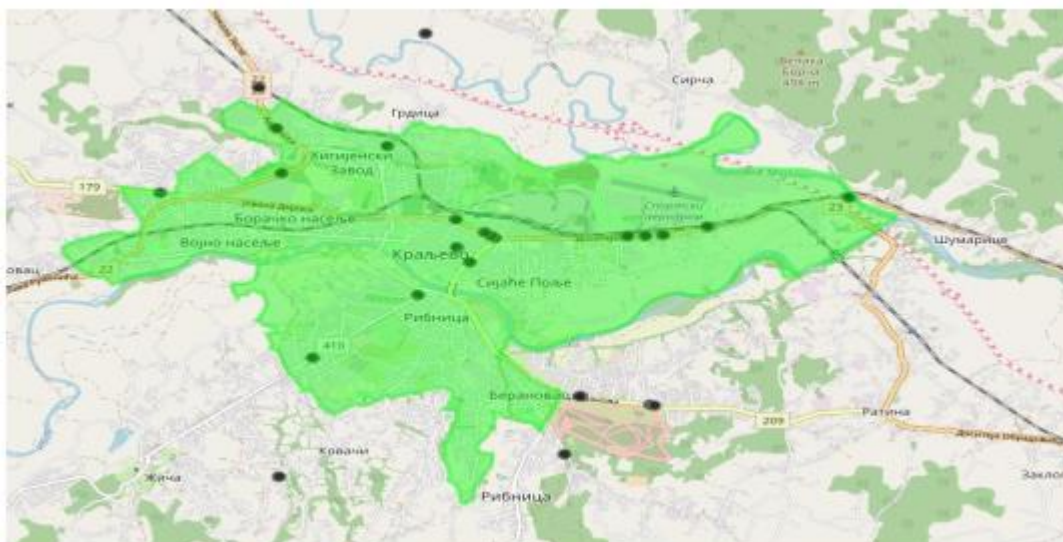


Map 21. Collective casualty risk (CRSI) by settlements in the territory of the City of Kraljevo, 2021

Settlements where a high value was recorded for both observed risks are **Bojanići, Bare** and **Brezova**.

Considering the severity of the consequences, special consideration is attributed to road accidents with **fatalities** that occurred in the observed 2016-2021 period in the central urban area of the City of Kraljevo.

The figure below shows a closer view of the spatial distribution of road accidents with fatalities in the city center of Kraljevo in the observed time period between 2016 and 2021.



Map 22. Spatial distribution of road accidents with fatalities in the city center of Kraljevo, 2016-2021, a closer view

In the observed time period, in the central settlement of the City of Kraljevo, there were a total of **17** road accidents with fatalities. **Four** road accidents with fatalities were recorded on the local street network, while **13** road accidents with fatalities were recorded on state roads passing through the central urban area.

In addition, **four** road accidents with fatalities were recorded in a specific place, one in a **curve**, one on a **bridge** and two at a **pedestrian crossing**, both of which occurred on the local street network, which is a special indicator of the vulnerability of pedestrians as road users in the city center of Kraljevo.

Out of a total of **17** road accidents with fatalities recorded in the central urban settlement of the City of Kraljevo, in the observed 2016-2021 period, as many as **9** road accidents belong to the road accident type group "**PEDESTRIAN RA**". The most frequent types of road accidents within this group are **Pedestrian crossing on the left, outside the intersection, without vehicle turning** and **Pedestrian crossing on the left, at the intersection, without vehicle turning**.

The most common influencing factor recognized in road accidents with fatalities in the central urban area of the City of Kraljevo in the 2016 -2021 period is **Careless pedestrian stepping on the roadway, without first making sure it is safe**. Given that pedestrians are prone to carelessly stepping the roadway and making other mistakes, it is necessary to intensify the work on increasing pedestrian awareness to neutralize bad habits and thereby improve the safety of road using.

4. FINAL CONSIDERATIONS

- In the past 6 years (2016-2021), a total of **1440 road accidents with casualties** were registered in the territory of the City of Kraljevo (Chart 2). The fewest road accidents with casualties (**214**) were registered in 2021, and the most in 2016 (**270**). The number of road fatalities registered in

the same period (2016-2021) also has a downward trend. The lowest number of road fatalities was recorded in 2019, when **11** people were killed, while the highest number of people were killed in 2017, namely **19** people. In the observed time frame, **a total of 2835 road accidents** were registered in the territory of the City of Kraljevo. The greatest number of registered road accidents resulted in property damages (**1395 road accidents**), and a slightly lower number of road accidents with injured people were recorded (**1365 road accidents**). When it comes to road accidents with property damages only, it should be noted that there is a certain number of road accidents with minor property damages (up to RSD 200,000) which are covered by the records of insurance companies and are not included in the traffic police records. In the period from 2016 to 2021, in the territory of the City of Kraljevo, **a total of 75 road accidents with fatalities** were registered.

- The highest share in the total number of casualties is made up of people with minor injuries (**76%**), followed by people with severe injuries (**20%**), while fatalities account for 4% of casualties. The highest number of road casualties was recorded in 2017.
- With a weighted public casualty risk value of **211 per 10,000 inhabitants**, the City of Kraljevo belongs to high-risk LSUs. From the values of weighted traffic casualty risk, it can be concluded that the City of Kraljevo belongs to very high-risk LSUs. More precisely, the value of weighted traffic casualty risk in the territory of the City of Kraljevo is **9964 per 10,000 registered motor vehicles**.
- By the distribution of road accidents with casualties by age categories, it can be concluded that the most road accidents with casualties belong to the age category of 46 to 64 years, i.e. **28.1%** of all road accidents with casualties, which clearly indicates that this age category is the most vulnerable.
- By the type of consequences of road accidents, the most represented age categories are **46-64** and **65+** years. In the case of people with severe physical injuries, these were most often people aged **46-64**, and in the case of people with minor physical injuries, the most represented age category was **15-30** years.
- The distribution of casualties participants in road accident by the nature of their road using led to the conclusion that drivers, with a **50.05%** share, participated in road accidents in the highest percentage. Passengers as participants in road accidents participated with a share of 33.79% in the distribution of casualties, pedestrians make up 16.07% of casualties, while other road user categories account for 0.1% of road casualties. The analysis of casualties by categories of vehicles in which they participated in road accidents shows that the highest number of casualties were in passenger vehicles, with a **71.7%** share. The following most represented category are bicycles with a percentage of **10.5%**, followed by cargo vehicles and motorcycles with a percentage of **5.7%** and **4.8%**, respectively.
- Within this distribution, road accidents belonging to the group **"No turn RA involving at least two vehicles"** were singled out as the most represented, with a percentage share of **27.6%**, and road accidents belonging to the groups **"Single vehicle RA"**, **"Turn or cross RA involving at least two vehicles"** and **"Pedestrian RA"** with a percentage share of **26.9%**, **23%** and **20.7%**, respectively.
- **Reckless driver actions** is the most represented group of influencing factors that contributed to road accidents with casualties. The following group by percentage share is **Driver misactions**,

and the group of influencing factors **Driver's failure due to poor psychophysical condition, non-alertness, distraction** also holds a significant percentage.

- As part of the road safety analysis, different categories of road users were considered among which vulnerable categories were recognized and paid additional attention in the analysis. The road safety of children, young people, young drivers, pedestrians, tractor drivers, people aged over 65 was analyzed. Drivers under the influence of alcohol and psychoactive substances were specifically considered, taking into account the magnitude and nature of the problem, which is related to the influence of alcohol on the occurrence of road accidents. The following categories were recognized as particularly vulnerable road user categories: **cyclists, drivers and passengers in passenger vehicles, drivers and passengers in commercial vehicles**.
- In the observed time frame, there were a total of **209** cyclist road casualties. Observed by the severity of the consequences, **10** cyclists were killed, **62** suffered severe injuries, and **137** minor injuries. In the past period, no continuous decreasing trend in the number of cyclist casualties was established. Cyclists aged 46-64 and older than 65 were most often casualties. The most common group of road accident types with cyclist casualties is "**single-vehicle accident**". Observed by months, July, August and September stand out as the months with most often accidents involving cyclists. **Monday** is singled out as the day of the week when most accidents involving cyclists occur, and by time distribution, the 15th and 16th hours are singled out (from 2:00 p.m. to 3:59 p.m.). Cyclists were the most frequently casualties in accidents that occurred on the streets, and the most prevalent influencing factors in accidents were related to wrong judgment of the traffic situation, inappropriate speed, loss of control over the vehicle, etc.
- There were a total of **1,290** passenger vehicle casualties in road accidents on the territory of the City of Kraljevo. Of these, **48** people lost their lives, **171** people suffered severe injuries, and **1,071** suffered minor injuries. There is no established trend of continuous reduction in the number of people killed in passenger vehicles. Observed by nature of participation in road accidents, **51%** of casualties were drivers, and **49%** passengers in a passenger vehicle. The most common group of accidents with passenger vehicle casualties is "**No turn RA involving at least two vehicles**". The time distribution of road accidents with passenger vehicle casualties by months shows that the highest percentage of accidents occurred in the months of July, August and October (10% each). **Saturday** stands out as a day of the week by the number of accidents. Drivers and passengers in passenger vehicles were most often casualties during the 15th hour (from 2:00 p.m. to 2:59 p.m.). Spatial analysis of road accidents shows that **37.1%** of accidents with passenger vehicle casualties occurred on streets (higher and lower class), while **30.3%** of accidents occurred on IB-class state road. The factors "Speed unadjusted for traffic and road conditions" and "Driver's failure to properly judge the traffic situation" were recognized as the most prevalent influencing factors in accidents with passenger vehicle casualties.
- There were a total of **433** casualties in road accidents involving commercial vehicles in the period from 2016 to 2021. Of these, **37** were fatalities, **76** people were severely injured, and **320** people had minor injuries. The decreasing trend in the number of casualties in accidents involving commercial vehicles in the 2016-2021 period has not been established. Cargo vehicles were involved in **79%** of road accidents with commercial vehicles, while buses were involved in **21%** of road accidents. The most common types of accidents with casualties belonged to the group "**No turn RA involving at least two vehicles**". Most road accidents involving commercial

vehicles with casualties occurred in October, January and June. Observed by days of the week, Tuesday, Friday and Saturday stand out as the days with most frequent accidents involving commercial vehicles with casualties. Hourly distribution of road accidents with casualties shows that the highest number of accidents involving commercial vehicles occurred during the **6th hour** (from 05:00 a.m. to 05:59 a.m.). Observed by road/street category, the most accidents involving commercial vehicles with casualties took place on IB-class state road. The most represented influencing factor in road accidents involving commercial vehicles with casualties is "Driver's failure to properly judge the traffic situation".

- Considering that roads, and especially outside settlement roads, often do not fully meet all the necessary road safety standards (e.g. expressed mixed road function), it is assumed there is a high probability that ROAD IMPACT on the occurrence of road accidents with casualties is significantly higher, i.e. more frequent in compared to that registered by officials who investigated road accidents with casualties in the territory of the City of Kraljevo in the observed period from 2016 to 2021.