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ANALYSIS OF ROAD TRAFFIC SAFETY THROUGH DIRECT RELATIVE INDICATORS FOR TRAFFIC ACCIDENTS FATALITY: CASE OF REPUBLIC OF MACEDONIA

ABSTRACT

In the absence of a detailed profile and assessment of the road traffic safety situation in the Republic of Macedonia, the paper will show the analysis by calculating and comparing the direct relative indicators for deaths from traffic accidents in relation to the total population (public risk), the total number of vehicles (traffic risk) and the total number of passenger-kilometres (dynamic traffic risk). Their established trends in the period 2005-2014 will also be shown and then compared with the levels in other European countries. Within the risks, there is additionally the risk of suffering that takes into account the consequences of accidents to people (human losses, heavy and light bodily injuries), which will be calculated and analysed for the area covered by the eight Sectors for Internal Affairs (SIA) in the Republic of Macedonia. For this purpose maps of the public risk of suffering from accidents on the roads will be made, which will closely show the traffic safety situation in the country. The diagnosing of the traffic safety situation will contribute to the creation of new measures and activities or improving the existing ones by the competent authorities in order to promote the road traffic safety.

KEY WORDS

public risk; traffic risk; dynamic traffic risk; direct relative indicator; traffic accidents; road traffic safety.

1. INTRODUCTION

The traffic and its functioning belong to a group of activities that in their nature are dangerous – as carriers of the real possibility for causing danger to people's lives or their bodies and property. According to the Organisation for Economic Cooperation and Development (OECD), which uses the data from the World Health Organization [1], each year about 1.3 million people are killed and another 50 million people are injured on roads worldwide. It means that daily around 140,000 people are injured on the roads worldwide, over 3,500 die and 15,000 are disabled for lifetime. This means that the current level of the traffic development penalizes the safety of people participating in it. Beside its general purpose of connecting certain places, especially important is the aspect 'to commute with as few as possible negative effects' [2]. That is why it may be concluded that road traffic safety is one of the most complex problems in the human society and therefore continuous efforts by the authorities and stakeholders are required to reduce the number of accidents and their consequences, and ultimately to improve and enhance an optimal level of road traffic safety.

Road traffic safety [3] can be defined as a state of responsible, conscious and disciplined behaviour of road traffic users without the presence of any danger (or controlling the danger in preset frames) which arises from their participation, with the aim of establishing optimal and normal flow of traffic and also protection of persons and material goods.

The measuring of the traffic safety situation on roads should enable detection, identification, description, definition, analysis and assessment of the safety condition in order to give a forecast for the future. Since there is no special tool, i.e. instrument for measuring traffic safety, as the most suitable are used the statistics and the indicators that can be performed by its help. By analysing the statistics, the coefficients and the indicators of road traffic accidents the main reasons for their occurrence can be differentiated and connected with the movement of population, the size and the development of motor vehicles, the road network, and the national income and so on. Their importance [4] is reflected primarily in the creation of the

so-called proactive approach for continuous improvement of road traffic safety.

Next, the studying and the analysis of the time series of traffic accidents (their trends and movements) combined with the spatial distribution reveal their specific features, characteristics and patterns in the data and bring them in correlation with the number of citizens, the number and the development of vehicles, the road network, and so on. The attitude of the driver population is often mentioned as the most important factor for road traffic accidents. However, it is also the most difficult one to measure.

In a model [5] that was developed by means of stepwise regression analyses and that can be used to explain the differences in road fatalities of individual countries, it was found that the passenger car ownership is a better predictor of fatalities per 100,000 passenger cars than vehicle ownership as a predictor of fatalities per 100,000 vehicles. Many individual infrastructure and socio-economic variables have a significant effect on the fatality rate. National infrastructure, transportation and socio-economic variables from international databases were considered as possible variables. The final model includes passenger car ownership, the Human Development Index, and the percentage of other vehicles as explanatory variables.

A study conducted by the University of Michigan [6] made a map of the worldwide public risks, i.e. death (fatality, mortality) rate from traffic crashes (accidents) per 100,000 inhabitants in 193 countries around the world according to the data from the World Health Organization for 2008. The world map of traffic and dynamic traffic risks does not exist, because of the difficulties in collecting data for the number of vehicles and passenger kilometres for all countries in the world. The highest value of public risk was measured in Namibia (45), which means it is the most dangerous country for road traffic users, and the lowest value was measured in the Maldives (2), which means it is the safest country in the world according to this indicator. The world average value of this rate is 18 deaths. According to this World Map, Macedonia is among the countries with lower fatalities caused by traffic accidents (it is ranked 175th with the value of public risk of six).

In the Republic of Macedonia, in order to promote and improve traffic safety on the roads, the Parliament adopted in 2008 the first National Strategy for Improving Traffic Safety on Roads [7], for a period of five years (2009-2014). In 2014 the second National Strategy for Improving Traffic Safety on Roads [8] was adopted for the next five years (2015-2020). The current Strategy is not significantly different from the previous one. Regarding the fact that the main objective of the first Strategy was too ambitious (the number of deaths in road traffic in the Republic of Macedonia until 2014 to be reduced by 50% and 0 (zero) children-victims involved in road traffic), the objective of the second one is a little bit different: the number of fatalities of road accidents should be reduced by 2020 to the average number of fatalities in the EU countries, road traffic deaths amongst young drivers to drop by 30%, of those severely injured by 40% and the number of child fatalities to be reduced to zero. By fulfilling the goal in the next five to six years, the lives of 250-300 citizens would be saved, i.e. there would be fewer road traffic deaths per year.

Although the Republic of Macedonia has adopted the mentioned National strategies, also National Transport Strategy for the period 2007-2017, and has constantly implemented different preventing activities and projects, such as campaigns, multimedia warnings, flyers, brochures etc., it seems that the road traffic safety situation has remained at the same level. Every year (in the last 10 years) there occurred 3,980 traffic accidents, which means that on the average, 11 traffic accidents occurred every day. Every year 157 people were killed as result of traffic accidents, which means that every 56 hours in the country one citizen was killed as result of a traffic accident.

The deeper diagnosing and analyzing of the road traffic safety situation will contribute to identification of the existing problems and the creation of new measures and activities or improving the existing ones by the competent authorities.

2. RESEARCH METHODOLOGY

Traditional road traffic safety monitoring (using direct – absolute and relative indicators) was related exclusively to the national level [9] over the past years. However, in order to improve the level of road traffic safety on the national level, it is of great importance to monitor the key parameters on the local level, too. The question is which direct key indicators give their maximum contribution to the assessment of the road traffic safety situation of an area? Therefore, there is an inclination to establish the overall road safety "index" [10] including indirect and direct indicators, where each of the selected parameters would participate, in the best possible manner, in the forming of the final assessment of the road traffic safety situation.

Unlike the countries that have been managing road safety for a long time (Sweden, Great Britain, the Netherlands), where risk mapping has been adopted as a standard and a very effective tool for monitoring road traffic safety situations, the application of this tool in the Republic of Macedonia is still being developed and about to be established.

For the purposes of this paper, an analysis of the direct relative indicators for the road traffic safety situation in the Republic of Macedonia will be given.

The relative indicators of traffic safety are obtained as a quotient of any of the absolute indicators (the

number of accidents and their consequences), and other important variables (number of inhabitants, number of drivers, number of vehicles, number of kilometres, the length of section of road, number of passenger kilometres, etc). Today, when assessing the state of road traffic safety in an area (country, region), the most used are the public, traffic and dynamic traffic risk [11], which are in direct correlation with the number of fatalities [12]. In road traffic safety, risk is the chance of being involved in a road traffic crash and being killed, injured or suffer material damage. From this it is evident that individual risk is the product of the chance or probability of being involved in a crash and the effect or outcome of that event. The risks in traffic safety area are often expressed in terms of exposure which is a measure of participation in traffic. In doing so, the paper will assess their current situations through the last available data for 2014 and the established trend in the research period (2005-2014) in the Republic of Macedonia and compared also to other countries in Europe.

The data about the numbers of fatalities, road motor vehicles and trailers, passenger kilometres [13] and the citizens [14], will be drawn from the official publications of the State Statistical Office of the Republic of Macedonia. As a serious limitation, because of which imprecise results in the public risk would occur, is the total number of inhabitants of the country. Since the last census in Macedonia in 2002, it was decided in the calculations to use the estimated data on the population in each of the researched years, according to the State Statistical Office.

The public risk shows mortality (annual number of deaths) in road traffic accidents per 100,000 inhabitants and it measures the risk of every citizen to die in an accident. Actually, the public risk represents the coefficient of victimization, as one of the indicators for determination of crime intensity and it shows the vulnerability level – the number of fatalities per 100,000 inhabitants. Another name for this indicator is index of threat.

The traffic risk shows mortality (annual number of deaths) in road traffic accidents per 10,000 registered road motor vehicles and trailers and it measures the risk of every citizen to die in an accident. This indicator takes into account the level of motorization in the country for the researched period and it is also called coefficient of density.

The dynamic traffic risk shows mortality (annual number of deaths) in traffic accidents per 100 million passenger kilometres. This indicator is the best measure of the risk of death when travelling by car and the best indicator of road safety. It is also called exposure to hazard.

Additionally, the public and traffic risk of suffering will be shown, that take into account the consequences of accidents to people (human losses, serious and slight bodily injuries). As indicators, they take into account social costs of the consequences of accidents and that number reduced to a single value – slight bodily injury [15].

So, each dead person is considered "equal" to 99 slight bodily injured persons, and each serious bodily injured person is considered "equal" to 13 slight bodily injured persons. By multiplying the number of dead persons with 99 and multiplying the number of serious bodily injured persons with 13, and these values collected together with the number of slightly bodily injured persons, yield the weighted number of casualties. Dividing this number by the number of inhabitants in the analysed area (in this case 8 Sectors for Internal Affairs – SIA, according to Art. 20, Police Act of the Republic of Macedonia) and multiplying by 10,000, we get the measure of relative vulnerability of the population suffering from road traffic accidents or the indicator – weighted public risk of suffering per 10,000 inhabitants. On the other hand, dividing this number by the number of registered motor vehicles and trailers in the analysed area and multiplying by 1,000, we get the measure of relative vulnerability of the population suffering from road traffic accidents or the indicator – weighted traffic risk of suffering per 1,000 vehicles. As long as its value is lower, the traffic safety level of the area is favourable.

The values of these risks of suffering will be shown in the maps, because the risk mapping is one of the most effective tools for determining the actual state of road safety of a particular area, such as sectors for internal affairs. The results obtained using risk mapping are very suitable for the mutual comparison of the level of road safety (risks) per smaller areas in the country. However, in order to make it more realistic, risk mapping will need to be more developed and adapted to the specific features of the observed area.

By displaying the results of these calculations, a solid basis for assessing the traffic safety situation in the Republic of Macedonia will be obtained.

3. RESULTS AND DISCUSSION

Table 1 gives the calculated relative indicators for road traffic safety in the Republic of Macedonia in the period 2005-2014, which were previously mentioned (public, traffic and dynamic traffic risk). From the data, fluctuations of the values of these risks through the years can be noted.

The public risk value was the lowest in 2014 (6.28) and the highest in 2013 (9.58). The average value of traffic risk for the researched period is 7.65, which means that every year in the past decade as a result of traffic accidents about 8 persons per 100,000 inhabitants died in the Republic of Macedonia. Although the numbers of killed persons vary from 130 (in 2014) to 198 persons (in 2013), the coefficient of public risk

Table 1 – Relative indicators for road traffic safety in the Republic of Macedonia in the period 2005-2014

	Deaths	Population	Vehicles and trailers	Passenger kilometres (in millions)	PUBLIC RISK	TRAFFIC RISK	DYNAMIC TRAFFIC RISK
2005	143	2,038,514	288,469	1,087	7.01	4.96	13.16
2006	140	2,041,941	282,285	1,016	6.86	4.96	13.78
2007	173	2,045,177	287,222	1,027	8.46	6.02	16.85
2008	162	2,048,619	308,494	1,239	7.91	5.25	13.08
2009	160	2,052,722	332,365	1,213	7.79	4.81	13.19
2010	162	2,057,284	360,789	1,441	7.87	4.49	11.24
2011	172	2,059,794	364,019	1,640	8.35	4.73	10.49
2012	132	2,062,294	350,762	1,403	6.40	3.76	9.41
2013	198	2,065,769	411,637	1,395	9.58	4.81	14.19
2014	130	2,069,172	437,686	1,208	6.28	2.97	10.76
average	157	2,054,129	342,373	1,267	7.65	4.68	12.39

Source: authors' research

varies only from 6.28 to 9.58, which is approximated from 6 to 10 persons per 100,000 inhabitants. The reason for that is because this coefficient depends on the number of population in the country for each year. From the data of deaths, no relevant conclusions here about their increasing or decreasing can be made, because their fluctuations are undefined. In the last three years, one can see the biggest changes in the entire period. Thus, in 2013 and 2014 the number of vehicles is over 400,000, so the only reasonable argument why the number of deaths in 2013 has the highest value (198) is the change of this variable. Because of this situation, in 2013 and 2014 the Police department for traffic safety strengthened the controls on the roads and many multimedia campaigns for increasing the public awareness were undertaken by the National Council for Traffic Safety on the Roads. The result was the lowest number of deaths in 2014 (130).

The coefficient value of the traffic risk was the lowest in 2014 (2.97) and the highest in 2007 (6.02). As can be noted, the number of vehicles over the years has been increasing steadily, and in the last year, that number reached a maximum. On the other side, the number of dead persons through the years has moved in undefined manner. So, by chance in the last year, the number of dead persons is the lowest, and the value of traffic risk in 2014 is the most favourable. The average value of the traffic risk for the researched period is 4.68, which means that every year in the past decade as a result of traffic accidents about 5 people per 10,000 registered road motor vehicles and trailers died in the Republic of Macedonia.

When the traffic risk is analysed, it is necessary to display, analyse and understand the established trend of motorization in the Republic of Macedonia in the last ten years. An important point is that while in March 2010 the new rules for eased import of used vehicles with lower European standards began to be applied, with the measure of the Government adopted in February 2010 which lowered the customs and fiscal duties for imports, the import of such vehicles started to grow. With this measure the Government achieved two important aspects. On the one hand, the social aspect to the citizens was satisfied, so they got a chance to buy a good car for less money, and the environmental aspects were enhanced, because of the fact that, although used, these imported cars polluted the air significantly less compared to those which were driven on the streets across the country. Lately, there are opposite opinions on importers of used cars and the experts about whether and how these "new" vehicles affect the road traffic safety. For some of them, the situation is good, for others it is unfavourable. Importers of used vehicles claim that drivers are safer now because the signalling devices in newer vehicles warn the driver what to do in certain situations when they need to replace some part. However, traffic safety experts suggest that the traffic situation on the automotive market is disastrous, regarding the environment (because many vehicles were imported that are not environmentally friendly, i.e. Euro 1 standard, as the cheapest vehicles), as well as regarding safety (because in our country the habits and the system maintenance are not satisfactory, so we do not replace the old and dilapidated parts by new and original). Macedonia has significantly changed the situation with the age of vehicles, but the road safety situation has remained the same. Although the citizens drive relatively newer cars, the habits for regular maintenance of the vehicles is absent. Another problem is that in our country accidents are registered only numerically, and everything else is secondary. There are no accurate, valid and reliable statistical records of how many accidents are caused due to a technical malfunction of

the vehicle (e.g. bad brakes, tyres, steering problems, etc.).

Figure 1 shows the established trend in the number of road motor vehicles and trailers per 1,000 inhabitants in the Republic of Macedonia in the period 2005-2014. This graph actually shows the level of motorization in the country per 1,000 inhabitants and it confirms the statements above: that the number of road motor vehicles and trailers in recent years, especially after the measure for eased import of used vehicles has been constantly growing and reached its maximum in 2014 (212 vehicles per 1,000 inhabitants). The average of the level of motorization for the researched period is 167 vehicles per 1,000 inhabitants.

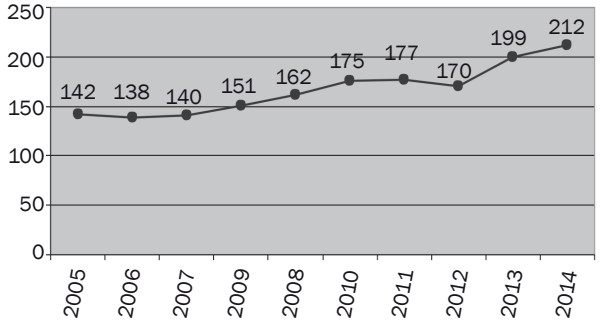

Figure 1 – Level of motorisation in the Republic of Macedonia in the period 2005-2014 (number of vehicles per 1,000 inhabitants)

The coefficient of the dynamic traffic risk was the lowest in 2012 (9.41), and the highest in 2007 (16.85). The average dynamic traffic risk for the researched ten-year period is 12.39, which means that on the average each year over the past decade as a result of traffic accidents 12 persons died per every 100,000,000 spent passenger kilometres by vehicle in the Republic of Macedonia.

From the data presented in *Table 2* it can be concluded that at the significance level of 0.01 there is a clear link between the traffic and dynamic traffic risk, as indicated by the value of the Pearson correlation coefficient of 0.802. If applied, the Gareth rule for the significance of the degree of correlation that means that there is a strong connection between the public and the traffic risk i.e. a strong connection because of which the change in the traffic risk causes the change in the same direction in the dynamic traffic risk and vice versa. So, the degree of intensity of the relation between these two risks that take into consideration the death caused by traffic accidents in terms of vehicles and passenger kilometres, is particularly pronounced and statistically highly significant (substantial, characteristic). The determination of the magnitude of the dynamic traffic and traffic risk and vice versa is 0.644, which means that these two risks influence one another with 64.4%, i.e. more than half of the variance of public risk is explained by the traffic risk and vice versa. The coefficient of alienation, i.e. unexplained variation of these risks is 35.6% and it is explained by and depends on some other factors.

Table 2 – Correlation matrix of direct relative indicators for road traffic safety in the Republic of Macedonia for the period 2005-2014

		Public risk	Traffic risk	Dynamic traffic risk
Public risk	Pearson Correlation	1	.602	.505
	Sig. (2-tailed)		.065	.137
	N	10	10	10
Traffic risk	Pearson Correlation	.602	1	.802**
	Sig. (2-tailed)	.065		.005
	N	10	10	10
Dynamic traffic risk	Pearson Correlation	.505	.802**	1
	Sig. (2-tailed)	.137	.005	
	N	10	10	10

So, basically, the public and traffic risk are risks of suffering and they are calculated as the ratio of consequences of accidents with the number of population or number of motor vehicles and trailers. Here the number of fatalities is taken as the most drastic sample of the consequences. However, at the level of eight SIAs, since these are small numbers, their comparison is considered sufficiently representative. When there is a sample of less than 30 (except in SIA Skopje in all other SIA the number of dead people is less than 30), it is very controversial for statistical analysis and performing specific and substantiated conclusions. For this purpose, an indicator should be used that takes into account other effects (serious and slight bodily injured persons). These numbers are significantly larger, and thus compensate for the impact of random variations that exist in the case of using only the number of fatalities. These indicators are the public and traffic risk of suffering.

Regarding the public risk of suffering on all roads in SIA in 2014 (according to the map shown in *Figure 2*), it can be found that the situation is favourable, because six sectors have reached very low level of this risk (SIA Tetovo – 99.27, SIA Strumica – 121.97, SIA Kumanovo – 141.0, SIA Ohrid – 144.21, SIA Skopje – 146.25 and SIA Shtip – 150.36) and two sectors have reached low level of this risk (SIA Veles – 168.05 and SIA Bitola – 192.71). All sectors regarding the previous year made progress in reducing the value of this indicator.

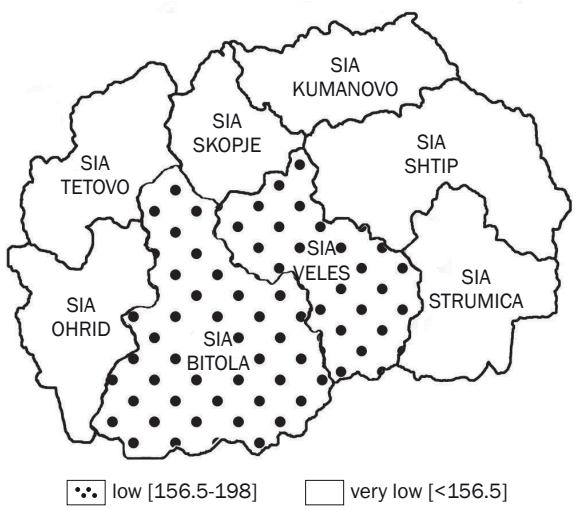

Figure 2 – Map of public risk of suffering on all roads in the SIA in 2014

Regarding the traffic risk of suffering on all roads in SIA in 2014 (according to the map shown in *Figure 3*), which takes into account the number of fatalities compared to 1,000 registered road motor vehicles and trailers, it can be found that the situation is particularly serious and worrying. One of the sectors has a very high traffic risk of suffering (SIA Bitola – 89.82), three have a high traffic risk of suffering (SIA Veles – 88.04, SIA Kumanovo – 81.21 and SIA Shtip – 78.20), two have high levels of traffic risk of suffering (SIA Ohrid – 73.63 and SIA Tetovo 65.41) and two have favourable, i.e. low traffic risk of suffering (SIA Strumica – 58.79 and SIA Skopje – 54.34). As for comfort, all sectors, in the previous year (2013) achieved minimal progress in reducing the value of this indicator, but not sufficiently because they still have high levels of risk.

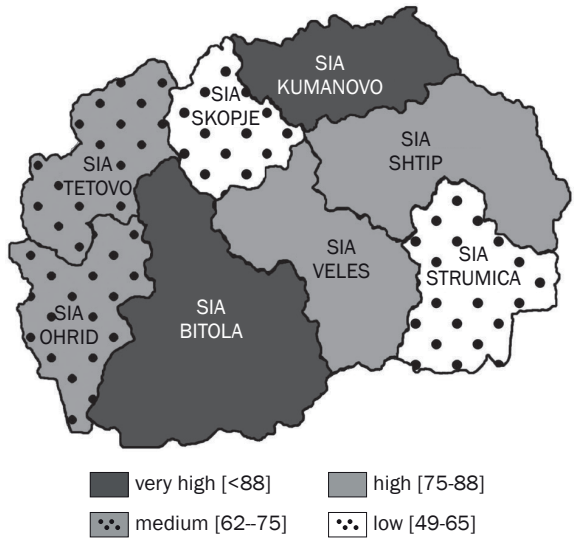

Figure 3 – Map of traffic risk of suffering on all roads in the SIA in 2014

For the purposes of establishing the position of the Republic of Macedonia compared to the European countries, the public risk has been considered – the established trend in the European countries [16] in the period 2003-2012. The data show the trend of standardized mortality rate per 100,000 inhabitants as a result of traffic accidents in the European countries. Death rate of the population adjusted to a standard age distribution. As most causes of death vary significantly with people's age and gender, the use of standardized death rates improves comparability over time and between countries, as they aim at measuring death rates independently of different age structures of populations. The standardized death rates used for the European countries are calculated on the basis of a standard European population.

If we compare the data on public risk relating to the Republic of Macedonia from Eurostat, with the data from *Table 1*, it will be noted that while referring to the same indicator, however, they have different values. Although the methodology for calculating the public risk is simple and unique, it remains unclear how Eurostat calculated this risk and based on which data for dead people and total population of the country.

The average value of the public risk in the Republic of Macedonia, if calculated according to Eurostat data, amounts to 7.7, which means that as a result of traffic accidents in the country 8 persons per 100,000 inhabitants were killed. Only 11 European countries (Denmark, Germany, Ireland, France, Luxembourg, Malta, the Netherlands, Sweden, the United Kingdom, Norway, and Switzerland) have lower values of public risk compared to Macedonia, and not a single of them is from the Macedonian neighbourhood or on the Balkan Peninsula. So, the average value of public risk in Macedonia is lower than the public risk of Bulgaria (which is 11.7), Slovenia (which is 12.1), Croatia (which is 14.0), and Greece (which is 14.4).

The Macedonian public risk compared to public risk of the EU (28 countries) is on the average higher by 0.9 within the analysed ten-year period. There is constant reduction of public risk in the EU from 11.4 (in 2003) to 6.3 (in 2012), that indicates continued taking of preventive measures to promote road traffic safety situation throughout the EU. With the values of public risk of Macedonia, this is not the case. There are notable alternating decreases and increases in the public risk, which would mean that there is lack of consistent policies and the main aim that is followed by all measures and actions taken for improving road traffic safety.

In terms of reducing public risk, it can be concluded that Lithuania, Latvia, Cyprus and Portugal maintained its reduction from 2003 to 2012, and for the ten-year period they managed to reduce its values. Macedonia and Malta have the lowest rate of reduction.

We have overviewed the established trend in some countries of the world in the period 2004-2013 through the statistical database of the UNECE, United Nations Economic Commission for Europe [17]. If we compare the data for the Republic of Macedonia with those from *Table 1*, there are huge differences, primarily because UNECE calculates this risk per 100,000 passenger cars and in *Table 1* it is calculated per 10,000 road motor vehicles and trailers. Another difference is that UNECE has calculated this risk in terms of passenger cars only. However, within the total number of vehicles in the Republic of Macedonia, passenger cars account for the highest percentage (84.87% in 2014) . Therefore, the total number of vehicles, other than passenger cars, includes other types of vehicles that drive on the roads and which are equally responsible for road traffic safety, traffic accidents and mortality. Therefore, for better and more comprehensive visibility of the traffic safety level, in the future, calculations of traffic risk should be made on the total number of road motor vehicles and trailers, as in *Table 1*.

The average traffic risk for Macedonia, calculated on the basis of UNECE data, has been estimated at 57, which means that as the result of traffic accidents in the country 57 people per 100,000 passenger cars were killed each year. The level of this indicator is particularly worrying, even more so considering the fact that Macedonia is almost at the bottom of this table. Worse values of this indicator have Albania, Moldova, Romania, Russian Federation, Turkey and Ukraine. All other European countries, including neighbouring ones (except Albania) have more favourable values in terms of this indicator. Top-ranked are Liechtenstein, Malta, Iceland, the Netherlands, Sweden, Switzerland, Norway, the United Kingdom, and Germany.

In terms of reducing the traffic risk from the initial (baseline) year to the last year within the analysed period (2004-2013), it can be concluded that the greatest reduction has been achieved by the Russian Federation, Ukraine, Moldova, Latvia, Lithuania and Turkey.

4. CONCLUSION

As final observations based on the results obtained by the calculations in the research the following conclusions can be highlighted:

- On the average, every year in the past decade as a result of traffic accidents 8 persons per 100,000 inhabitants and 5 persons per 10,000 registered road motor vehicles and trailers died in the Republic of Macedonia.
- The level of motorisation in the Republic of Macedonia in the last ten years has increased steadily, especially after the Government measure for easier import of used vehicles from 2010.
- The coefficient of the public risk had the lowest value in 2014 (6.28) and the highest value in 2013 (9.58).
- The situation with the public risk of suffering on all roads in SIA for 2014 is particularly advantageous because six sectors have a very low level of public risk of suffering, and two of them have a low level of public risk of suffering.
- The situation with the traffic risk of suffering on all roads in SIA for 2014 is particularly serious and worrying because the two sectors are placed in groups with very high, high, medium and low levels of risk.
- Only 11 European countries (Denmark, Germany, Ireland, France, Luxembourg, Malta, the Netherlands, Sweden, the United Kingdom, Norway, and Switzerland) have lower value of public risk than Macedonia, and none of them is in Macedonian neighbourhood or on the Balkan Peninsula.
- The average public risk in Macedonia is lower than the average public risk in Bulgaria, Slovenia, Greece and Croatia.
- The dynamics of the public risk of Macedonia shows noticeable alternating decreases and increases, which would mean that there is lack of consistent policies and the main objective followed by all measures and actions taken to improve road traffic safety.
- According to the average traffic risk calculated by the UNECE, Macedonia is ranked nearly at the bottom of the table.
- According to the World Map of deaths in traffic accidents, Macedonia is among the countries with lower fatality from traffic accidents (at 175th place).

The problems regarding the safety of persons and property in road traffic largely need to be actualized in the scientific and wider public, because of the social-economic damages which arise from them. More obvious is the need for taking concrete measures through the adoption of programs and strategies for managing road traffic safety. That means that a wider social action is needed in which there is involvement and mutual cooperation, coordination and responsibility of more social entities, authorities, agencies and institutions. Many traffic offenses and accidents, namely, would not occur if the traffic participants were more responsible.

For further improvement of traffic safety continuous strengthening and promotion of the partnership between public, private, governmental and NGO sector is needed. Traffic safety should be political priority. It has to appoint a lead agency for road traffic safety, to provide funds and the required accountability. The prevention of the social negative phenomena is the best policy trend in the society because it is more rational to prevent than to cure. In general, the measures and

actions should be focused and intensified in the following contents:

1) Prevention of traffic delinquency as a negative phenomenon of social indiscipline in traffic, with specific means of prevention and repression, and
2) traffic accidents prevention, as a general policy of maintaining traffic safety – security in various ways.

The obtained research results and risk maps presented in this paper may be used by traffic police units for planning effective preventive and repressive measures, with the aim of improving road traffic safety in the whole country. They will help them to observe road traffic safety related problems, identify which local communities and in whose jurisdictions (which police stations) are (un)safe, but also encourage them to compete mutually in order to raise the level of road traffic safety. It is of utmost significance to further improve the risk mapping methodology and adopt it in order to make periodical risk maps in the future (monthly, quarterly, half a year, per year), and on all levels (territory of the police station, of the sector for internal affairs, of the country), on a regular (traditional) basis.

In order to further develop road safety assessment using direct relative road safety indicators, it will be necessary in the future to:

- make a deeper analysis of the impact of a specific indicator on the road safety situation;
- define the potential and willingness for road safety improvement depending on indicators, by applying techniques which will support the decision-making process;
- define for each sector for internal affairs the potential for road safety improvement, depending on indicators;
- draw up an action plan to pursue the improvement of the road safety situation, by acting on indicators which have the greatest potential for road safety improvement.

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АНАЛИЗА НА БЕЗБЕДНОСТА ВО ПАТНИОТ СООБРАЌАЈ ПРЕКУ ДИРЕКТНИТЕ РЕЛАТИВНИ ПОКАЗАТЕЛИ ЗА СМРТНОСТА ОД СООБРАЌАЈНИТЕ НЕСРЕЌИ: СЛУЧАЈ НА РЕПУБЛИКА МАКЕДОНИЈА

АПСТРАКТ

Во недостиг на детален профил и оценка за состојбата со безбедноста во патниот сообраќај во Република Македонија, трудот ќе прикаже анализа преку пресметка и споредба на директните релативни показатели за смртноста од сообраќајните несреќи во однос на вкупниот број на население (јавниот ризик), вкупниот број на возила (сообраќајниот ризик) и вкупниот број на поминати патнички километри (динамички сообраќаен ризик). Притоа, ќе бидат прикажани нивните воспоставени трендови во периодот 2005-2014 година, а потоа и компарирани со нивните нивоа во другите европски држави. Во рамките на ризиците, дополнително, се појавува и ризикот на страдање кој ги зема во обзир последиците од сообраќајните несреќи врз луѓето (човечки загуби, тешки и лесни телесни повреди), кои ќе бидат пресметани и анализирани за подрачјата кои ги покриваат осумте сектори за внатрешни работи (СВР) во Република Македонија. За таа цел ќе бидат изработени мапи на јавниот ризик на страдање од сообраќајните несреќи низ патиштата во Република Македонија, кои поблиску ќе ја прикажат сообраќајно-безбедносната состојба во државата. Дијагностицирањето на сообраќајно-безбедносната состојба во државата ќе придонесе за креирање на нови мерки и активности или подобрување на постојните од страна на надлежните органи заради унапредување на безбедноста во патниот сообраќај.

КЛУЧНИ ЗБОРОВИ

јавен ризик; сообраќаен ризик; динамички сообраќаен ризик, директен релативен показател; сообраќајни несреќи; безбедност во патниот сообраќај;

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