Road Safety Estimation In Bulgaria From 2010 To 2018

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Abstract: - This paper presents results for the road traffic accident and road safety in Bulgaria from 2010 to 2018. A road safety assessment has been carried out in Bulgaria. The number of vehicles and inhabitants, number of killed, the motorization rate, mortality index, accident rate and road safety index are presented.

Key-Words: - Road safety, Motorization rate, Mortality index, Road safety index.

1 Introduction

Traffic safety is a term that acquires national and supranational significance. Worldwide, the death rate resulting from road accidents is increasing. Problems in the field of road safety are getting worse every day. That`s why millions of people died and were crippled for life as a result of road accidents each year. In order to find an outcome or at least a solution that reduces the number of victims and victims, it is necessary to strengthen international co-operation and constant sharing of good practices and experience [1,4,6].
It is necessary to assess road safety and to analyze the causes of the occurrence of the accidents.

2 Problem Formulation

The aim of this work is to investigate accidents in Bulgaria for the period 2010 - 2018 and then to identify measures to improve road safety. To achieve this goal must take the following action: collecting data on traffic accidents and other information for the period 2010 - 2018, specifying the indicators for evaluation, testing and evaluating the safety of traffic on the specified parameters, analyzing influence of individual factors on accident.

3 Problem Solution

Every year, about 1.2 million people are killed in road accidents worldwide, and about 20 million people are injured. In Fig. 1. data on the number of deaths in road traffic accident per 1 million inhabitants in the Member States of the European Union for 2017 are presented [10,11].

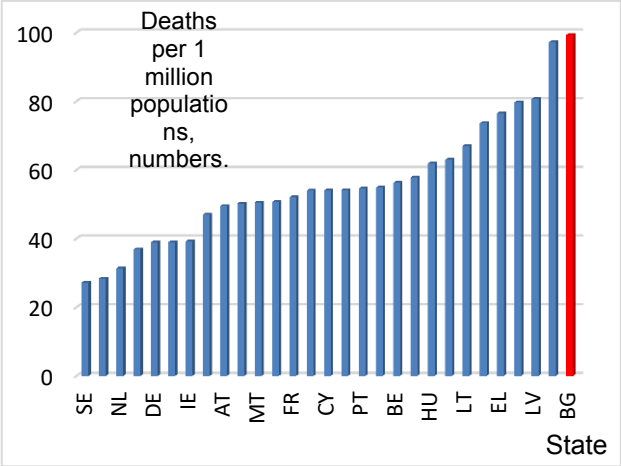

Fig. 1. Number of deaths per 1 million inhabitants

In recent years, Bulgaria has been among the first in Europe in number of people killed in road accidents. In Bulgaria, for the year 2017 (figure 1), 99 per million inhabitants died, according to the report of the Commission for Traffic Safety at the European Union, and in the UK, Malta, Sweden and the Netherlands about 30 perished to 1 million inhabitants. Bulgaria has about three times as many dead people as compared to the leading countries [11].
The comparative analysis of traffic safety is formulated as systematic and complex study, measurement and aggregation of the influence of individual factors on traffic safety in their constantly dynamic development. The comparison gives us the most general idea and the basis for further in-depth research.
In Fig. 2 are presented data on the number of vehicles and the population of Bulgaria for the period from 2010 to 2018 [12].

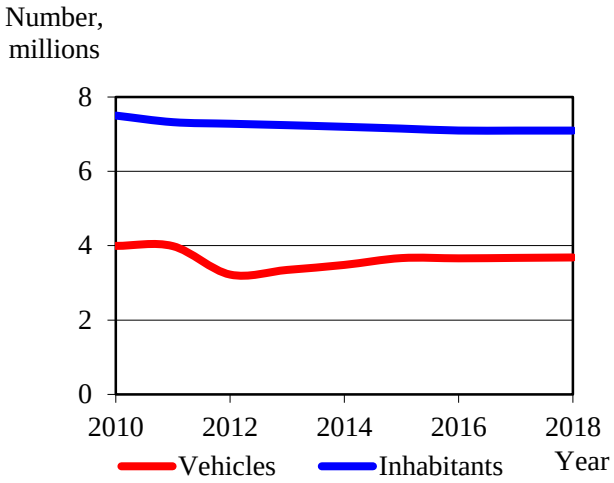

Fig. 2. Trend in number of vehicles and inhabitants, 2010 – 2018

It is clear from the figure that the tendency to keep constant values of the motorization coefficient is outlined. Over the period under review, the population in Bulgaria has decreased by about half a million people.

In Fig. 3 presents data on the number of crash victims in Bulgaria for the period from 2010 to 2018.

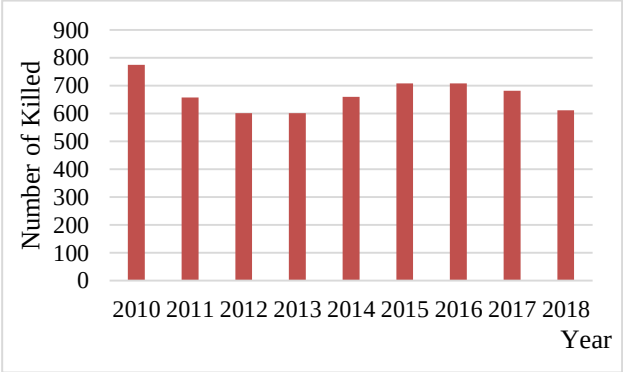

Fig. 3. Trend in road traffic accidents, 2010-2018

In Figure 3 presents data on the number of crash victims in Bulgaria for the period from 2010 to 2018.

Over the last 7 years, the activity of the employees with powers to work under the Road Traffic Law (RTL) aims implementation of the National Strategy for Improvement of Road Safety of the Republic of Bulgaria for the period 2011-2020 (the Strategy) and reduction of traumatism (perished and injured) in road accidents, in order to bring them closer to what they have to achieve. The strategy is formulated in line with the European Union (EU) strategy, with the target of reducing the number of crash victims by 50% by 2020 and 20% of those injured in crashes by 20% compared to the start-up period of 2010. To reach the target, the number of crash victims should not exceed 388 and the 6363 seriously wounded by 2020. After the seventh year of the 10-years period (2011-2020), deaths indicate an increase, taking into account some detention in the last 3 years despite the fact that in 2017 the number of perished is 26 less than those in the previous two years. In 2017, the number of 682 people who died was 178 more than predicted for the same year (504) and 294 more than the end-of-year estimates (388) set in the overall Goal of the Traumatism Reduction Strategy. In the wounded, the comparison is based on mild and severely injured. There is a strong trend towards an increase in the number of mild and seriously injured people, with only a decline in 2017, returning approximately to the 2014 results. In 2017 the number of wounded 8680 people was 1802 more than predictions for the same (6878), and 2317 more than the end-of-term (6363) forecasts set out in the overall goal of the Traumatism Reduction Strategy (fig.4). [13]

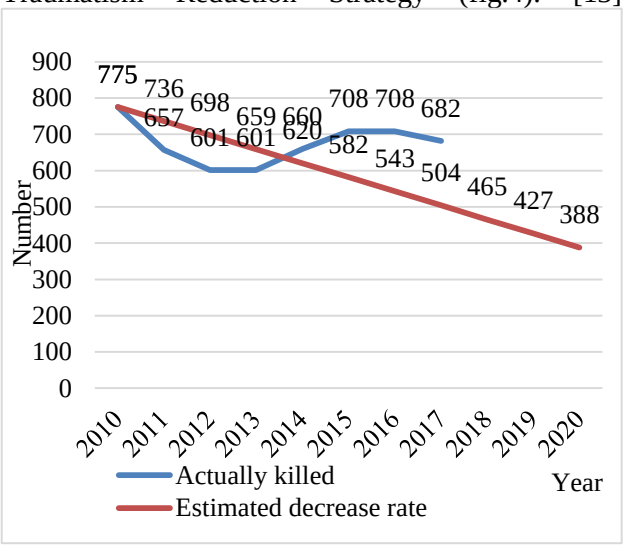

Fig. 4. Trend in traumatism according to estimated – killed, 2010-2020

Total traumatism (crashed and injured in crashes) from 2011 to 2017 is high, taking into account a certain decrease in the last year and returning approximately to the 2014 results. From 2011 to 2016 in the country under the TPPT 3935 people died or an average of 656 per year. Compared to the average for the past period in 2017, the number of perished persons is 1.04 times higher. From 2011 to 2016 the wounded have a total of 52,255 or an average of 8,709 people per year. Compared to the average for the past period in 2017, the number of

wounded is roughly equal to it. The comparison between the mean and the real values generally shows the retention of the traumatism in the last year compared to the 7-year period. Between 2011 and 2017, the actual number of crash victims was the closest to the projected 2014 - 660: 620 (+40), and farthest from it - in 2017 - 682: 504 +178). The actual number of wounded is the closest to the forecast at the beginning of the period - 8303: 7908 (+395) in 2011, and with bigger difference 9374: 7050 (+2324) in the year 2016. In the case of those who died in terms of the difference between real and projected by 2017 the increase from the beginning of the period is twice (2.25), and in the case of the injured the increase from the beginning of the period is almost 5 times (4.56). The observed variation in the total deaths and injuries is an increase of 6 times (6.27) from 2011 to 2017.

There is a tendency to keep a high level of traumatism with a certain decrease, but still - far from the projected number envisaged in the Strategy. The observed dynamics again strongly suggests that a review of priorities and the use of new and flexible methods and ways of working to reduce road traffic injuries is needed at national level. Specific measures and actions need to be identified and planned at the central and territorial level not only by the police authorities with powers to work under the Road Traffic Low [2,7,9].

Serious crashes from 2011 to 2017 (Fig.5) are generally increasing, with a 612-year increase until the year 2016 to an average level of 7012. In 2017, compared with the average, there was a slight decrease with 124 accidents. The tendency is to keep (high) the level of admitted CTFs. Regardless of the reported decrease in the number of people killed in CTIT in 2017, there is no constant value in the period 2011-2017. Those killed in crashes during the 6-year period up to 2016 reached an average of 656 people, the number of victims in the last year being higher. The trend is to keep (high) the level of deaths at CTRT. The trend for the wounded is a retention with a certain decrease in the last year (compared to the previous 2016, when the highest absolute value was recorded for the wounded) at an average increase during the six-year period 2011 to 2016 of 8709 injured. The retention trend is also taken into account in the data on total traumatism (deaths and injuries) during the last 6 years during which the victims of crashes were on average 9365 at 9362 in 2017 [8].

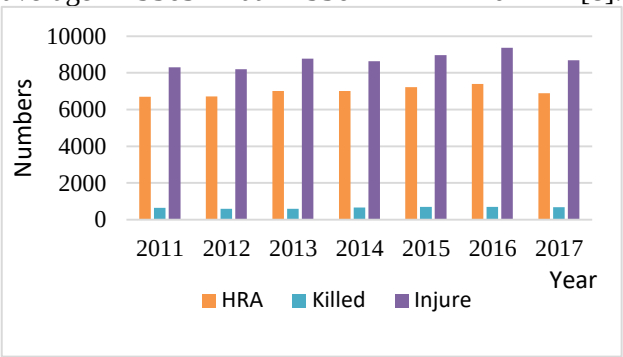

Fig. 5. Trend in heavy road accidents (HRA), 2011 – 2017

In Fig. 6. a distribution of road accidents in the Republic of Bulgaria for 2017 is presented for the main reason in%. There are 6 reasons for the occurrence of the accident in the accident registration card.

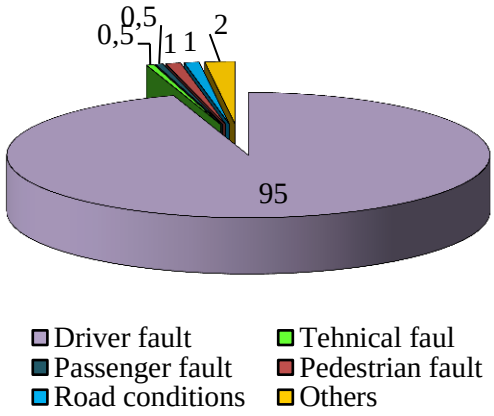

Fig. 6. Distribution road traffic accidents by reason, %

In the distribution of accidents for major reasons, in 2017, the highest share was due to driver violations to which 95% of all 6888 TPPs (2016 - 96% of all 7404 TPPs) and 92% of all 682 perished (2016 - 94% of all 708 perished), followed by crashes due to pedestrian violations and road conditions. The distribution of the number of road accidents caused by a passenger violation and a technical malfunction of the road vehicle (PPS) is almost the same Important to determine the main cause of accidents, have the knowledge and skills of individuals who completed the registration card. For this type of accident, the card must be made within 24 hours. And in this period the the official cause of the accident should be determined by the competent authority [3,5].

It follows from the conclusion that specified in the registration card cause of the accident is not always true. Therefore, the statistics data should be considered carefully.

The severity of the consequences of accidents can be presented to the relative index severity coefficient [1, 4]:

$$C_S = \frac{F + I}{A} \quad (1)$$

where F is fatalities in road accidents;

I – injured in road accidents;

A – is the number of road accidents in the country.

The indicator "mortality coefficient" can be calculated as a probability for death in road accidents:

$$C_M = \frac{F}{F + I} \quad (2)$$

Fig. 7 and 8 are presented data on rates of mortality and severity depending on the cause of the accident.

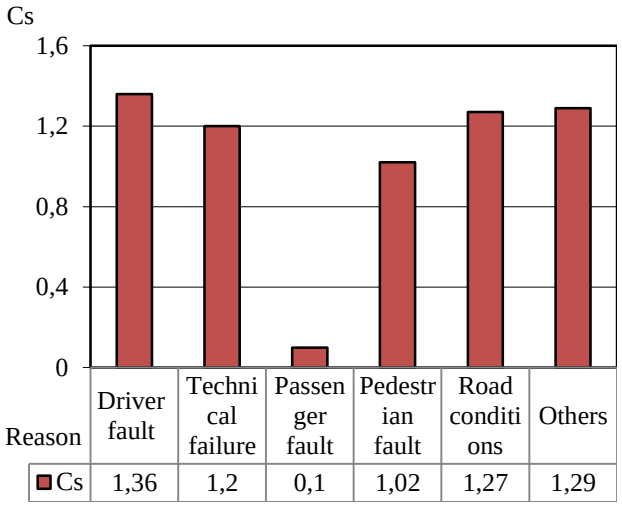

Fig. 7. Severity coefficient in road traffic accidents

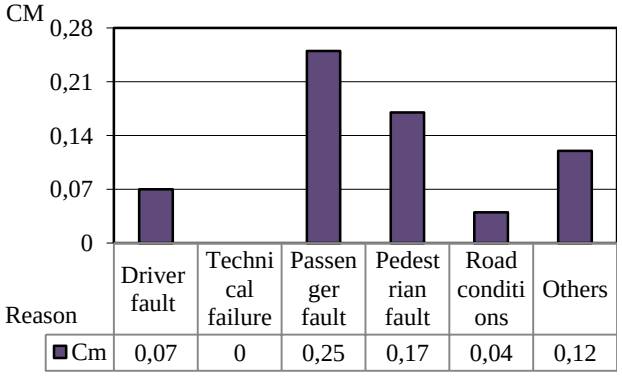

Fig. 8. Mortality coefficient in road traffic accidents

The highest (Fig. 7) is the severity of consequences for reasons due to driver's reason - 1.36. The severity of the consequences of road traffic crashes is third - 1.27. Except for the other reasons, which are generally unknown, the highest (Figure 8) is the mortality rate for the crash with a traveler - 0.25 followed by the pedestrian - 0.17. This value can be explained by the pedestrian's lack of protection, while in the case of a crash due to a technical malfunction the explanation is that they happen at higher speeds and more people die[11].

Objective assessment can be made using the following mathematical expression [1, 2, 4]:

$$SI = \sqrt{MR^2 + AR^2 + MI^2} \quad (3)$$

where MR is a relationship between number of vehicles and the population, known as "Motorization rate";

AR – is a relationship between road traffic accidents and number of vehicles, known as "Accident rate";

MI – is a relationship between fatalities and injured persons in road traffic accidents, known as "Mortality index".

To received a balanced estimation the predominate partial estimations must be from zero to one. By this way they received equal appearance in the integral estimation when compare countries.

Motorization rate is calculate by:

$$MR = V/P, \quad (4)$$

where V is the total number of vehicles (mopeds, motorcycles, cars, trucks and buses) at the end of the year;

P – population at the end of that period.

Accident rate can be calculate by the following equation:

$$AR = A/V.10^{-2}, \quad (5)$$

where A is the number of road traffic accidents in the country, officially registered for the period.

The mortality index in road traffic accidents can be calculate by the following equation:

$$MI = 10F/(F + I), \quad (6)$$

where F is a fatalities in road traffic accidents;

I – injured persons.

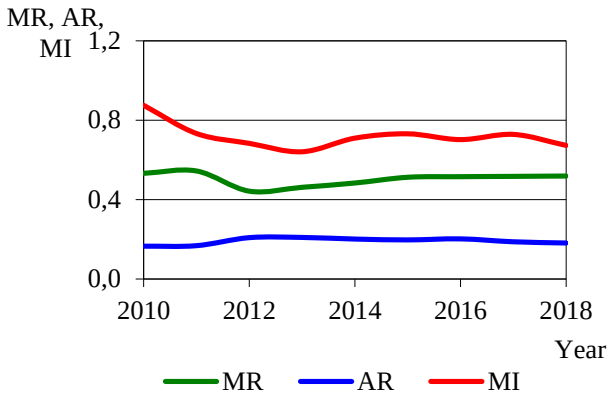

Fig. 9. Motorization rate, Accident rate and Mortality index, 2010-2018

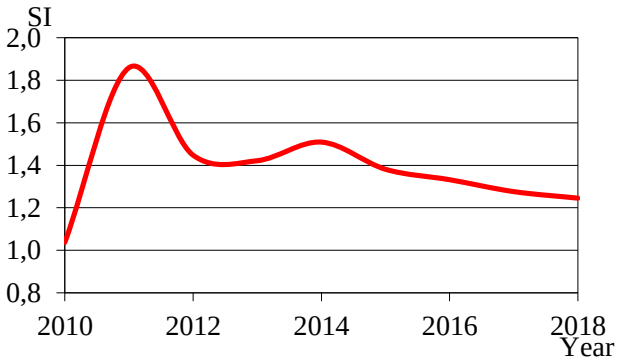

Fig. 10. Road safety index, 2010-2018

From the values for private indicators it is established that the rate of motorization MR is relatively constant, and for the last three years of the period under review, the coefficient is equal.

The active safety indicator influenced by the number of traffic accidents has variable values over the years. The highest value this coefficient has in 2012 and 2013 - 0.21. The most favorable value has this indicator in 2010 and 2011 - 0.17.

The private mortality rate for crashes has a relatively steady downward trend over the whole period - from 0.88 in 2010 to 0.67 in 2018.

The overall traffic safety assessment coefficient for the whole period also has a steady downward trend. In 2010, this ratio had the highest value - 1.04, and the lowest in 2013 - 0.82, and in 2018 the coefficient was 0.87.

4 Conclusion

As a result of the analysis of car accident and road safety in Bulgaria from 2010 to 2018, the following conclusions can be drawn:

Most people who died in the crash occurred in 2010 - 775 people. The smallest is the number of people killed in 2018 - 611 people. With the exception of the period 2013-2016, there is a steady trend towards reducing the number of crash victims, with a 21% reduction over the period under review.

The largest share is the driver fault for the occurrence of crashes. It is significant the low share of bad road conditions as a reason for accidents (1%) and technical failure of vehicles (0.5%). The reason for the occurrence of the accident in the registration card is not always true. For this reason, statistics on this need to be carefully considered.

The severity of consequences is the highest due to unsatisfactory road conditions - 1.27, followed by a crash due to a technical failure - 1.2. Except for the other reasons, which are generally unknown, the highest mortality rate for passenger crashes - 0.25 followed by pedestrian fault - 0.17.

From the data on the number of vehicles and the population of Bulgaria for the period under review, there are clearly outlined the tendencies for retaining the staging values of the motorization coefficient. For this period the population in Bulgaria has decreased by about half a million people.

The overall road safety assessment coefficient for the whole period has a steady downward trend.

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