



CETRA²⁰¹²

2nd International Conference on Road and Rail Infrastructure
7–9 May 2012, Dubrovnik, Croatia

Road and Rail Infrastructure II

Stjepan Lakušić – EDITOR



Organizer
University of Zagreb
Faculty of Civil Engineering
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THE ANALYSIS OF TRAFFIC ACCIDENTS ON LITHUANIAN STATE ROADS

Stanislav Mamčič, Henrikas Sivilevičius
*Dept of Transport Technological Equipment,
Vilnius Gediminas Technical University, Lithuania*

Abstract

A great number of serious road accidents occur all over the world every year. The problem of road traffic safety is still acute in spite of some progress in this area in recent years. Road traffic accidents depend on the following factors: road traffic volume, road traffic speed, weather conditions, driving experience and driving culture of drivers. All these factors are associated with traffic safety, human lives and health. The main goal of this work is to provide the statistical analysis of traffic accidents and investigate the causes, structure, dynamics and seasonal character of traffic accidents on Lithuanian state roads with various road pavements. The data on traffic accidents, traffic volume, traffic speed, as well as the number of injured and killed people and economic losses caused by traffic accidents on Lithuanian state roads in 2004 – 2011, provided by the Lithuanian Road Administration under the Ministry of Transport and Communications, Lithuanian Department of Statistics, Transport and Road Research Institute and Police Department under the Ministry of Interior are analysed.

*Keywords: road, pavement, traffic accident, traffic volume,
traffic speed, accident rate, dynamics, traffic, traffic safety*

1 Introduction

In many countries of the world, as well as in Lithuania, investigations of road conditions (roughness, noise, etc.) and the influence of various factors (associated with particular seasons, weather conditions, traffic intensity and the technical state) have been conducted. It has been shown that the climate and the increase of traffic can affect not only traffic safety on the road, but comfortability and communication time as well. Road traffic safety depends on many factors, one of which is road surface texture. Large quantities of moving heavy vehicles deform the pavement surface and cause rutting. The climatic winter conditions also make a significant impact on road safety. In winter time, sleet and snow on the road increase the number of traffic accidents up to 50% in the United Kingdom [1]. The analysis of the statistical data on the rate of traffic accidents in Lithuania was also performed [2]. In 2008–2009, the number of traffic accidents registered by the Highway Patrol Police of Lithuania decreased by about 1.3–1.6 times. The collisions of motor vehicles in 2009 make the largest proportion of all traffic accidents (33.4%). In 2009, drivers were the main traffic accident perpetrators (73.6%). Most of traffic accidents, which are recorded in Turkey, include the age group of drivers of 30–39 and 20–29 years, the weekdays from Friday to Sunday and road users without any or only basic education level [3]. High priority is given to the prevention of drunk-driving or driving under the influence of various psychoactive substances. Alcohol is associated with nearly the half of all traffic accident deaths in the city of San Paolo [4]. The odds for involvement in fatal road traffic accidents in Norway for different substances or a combination of

substances were in the increasing order: single drug < multiple drugs < alcohol only < alcohol + drugs. For single substance use: medicinal drug or THC < amphetamine/methamphetamine < alcohol [5]. The influence of road parameters and the surrounding area on the rate of traffic accidents was assessed [6]. Road traffic safety on the main state road network of Latvia was assessed [7]. The methods, based on the accident rate and accident frequency were used. For assessing the traffic conditions on highways [8] traffic safety rate was used, expressing the ratio between the maximum allowed speed and the eventual speed on a given section of the road. Kapski and Leonovich [9] evaluated the accident rates, using the same probability of the intersection accident prediction method. Using the potential danger method [10] made the forecasting of the traffic accidents in the conflict street areas easy. The study performed by Karlaftis and Golias [11] was aimed at determining the effects of road geometry and traffic volumes on rural roadway accident rate. By using a rigorous non-parametric statistical methodology known as hierarchical tree-based regression, the authors concluded that traffic accidents could be influenced by the average daily traffic volume, road width, road stretch servicing and maintenance parameters, as well as the type of road surface friction and pavement type. The number of traffic accidents on gravel roads can be decreased by widening the carriageway, improving the roadside infrastructure (carriageway smoothness and visibility in the overall plan), reducing the number of crossroads [12], increasing the pavement width [13], introducing the criminal responsibility for a dangerous road user's behaviour [14], as well as by using active and passive speed control measures, directing traffic away from residential areas, increasing the number of pedestrians and cyclists, providing the relevant information to the public [15] and using traffic control elements. Unfortunately, many of these measures limit traffic mobility [16]. When a vehicle is moving on an uneven road surface, periodic vehicle wheel discharges due to the vibrations occur, causing a decrease in the grip with the road surface. For this reason, it is suggested to use the accident rate and to measure the road surface roughness for evaluating traffic safety efficiency [17]. The risks of driving on a roadway with the posted speed limit of 50 miles per hour were reviewed [18]. The study allowed the authors to conclude that higher death risks and serious injuries in crashes on 50 mph-roads were associated with teen driver involvement, low restraint use rate, alcohol involvement, single-vehicle fixed object and rollover crashes as a result of speeding or driving too fast for the conditions on gravel two-lane roads. The data on traffic accidents, traffic volume and traffic speed on Lithuanian state roads for the years 2004 – 2010, provided by the Lithuanian Road Administration under the Ministry of Transport and Communications [19], Lithuanian Department of Statistics [20], Transport and road research institute [21] and the Police Department under the Ministry of the Interior [22], were collected and analysed.

2 Evaluating traffic accidents on the Lithuanian state roads

Lithuanian state road network consists of highways (1738.5 km), regional (4939.3 km) and local (14590.6 km) roads in total length of 21268.4 km. The dynamics of Lithuanian state roads' network in the investigated period from 2004 to 2010 remained almost unchanged, except for the local roads because the local gravel roads were paved according to the gravel road paving programme of Lithuania.

For evaluating traffic accidents on Lithuanian state roads, the parameters of the road should be considered, Fig. 1. Most of these interrelated parameters directly affect the number of traffic accidents on the road. Traffic accidents on the road depend on the following factors: road condition, road traffic, vehicle's speed, climatic and weather conditions, driving experience and behaviour of the driver, time of the day and vehicle's condition.

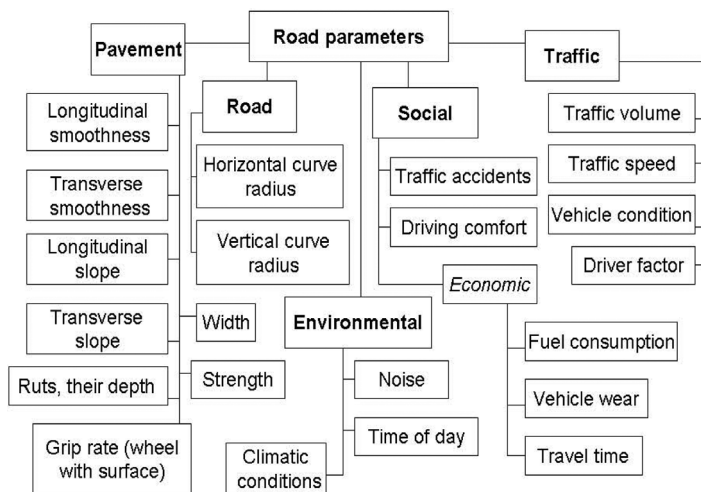


Figure 1 The parameters of the road

The evaluation of traffic accidents in absolute terms is not always correct. To compare the traffic accident rate of various regions or countries with a different traffic volume, traffic speed, the number of vehicles and the population, the relative traffic accident rates, including the number of traffic accidents per 1 million population, the number of traffic accidents per 1000 km of roads and the number of traffic accidents per 1000 vehicles, were used, Fig. 2. The number of victims (injured or killed) in traffic accidents is also taken into account. In general, regional roads with asphalt pavement have the statistically highest traffic accident rate, Fig. 3.

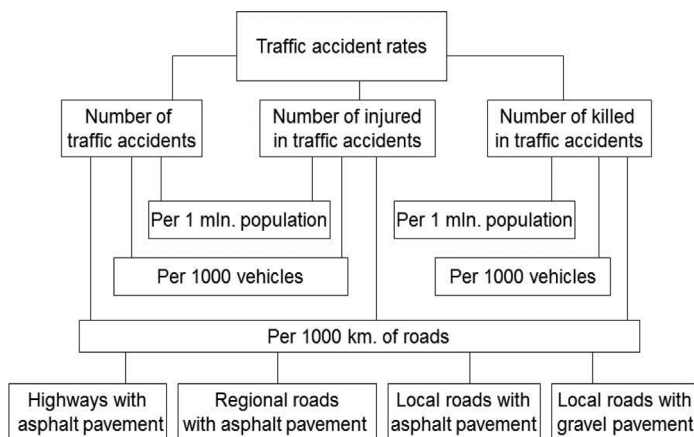


Figure 2 The parameters used in calculating the accident rate on Lithuanian state roads

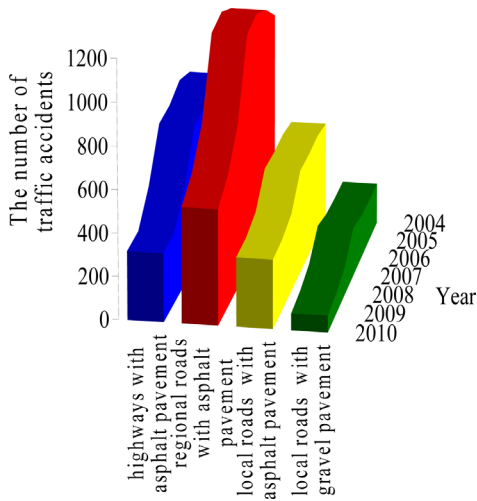


Figure 3 The dynamics of traffic accidents on Lithuanian state roads [22]

Traffic accidents on different roads with different road surface can be compared based on the traffic accident rate, Fig. 4. This universal rate evaluates the number of traffic accidents on the considered road segment, as well as the average annual daily traffic volume and road segment length. Therefore, the considered rate is more useful than the relationship between traffic accidents and traffic volume:

$$TA = \frac{A10^6}{365NLm} \quad (1)$$

where A is the number of traffic accidents on the considered road segment per year, N is the average annual daily traffic volume on the considered road segment (veh./day), L is the length of the considered road segment (km), m is the number of years.

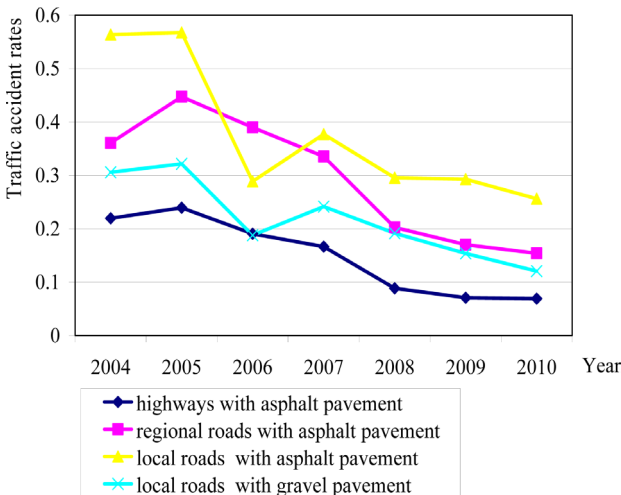


Figure 4 Traffic accident rates

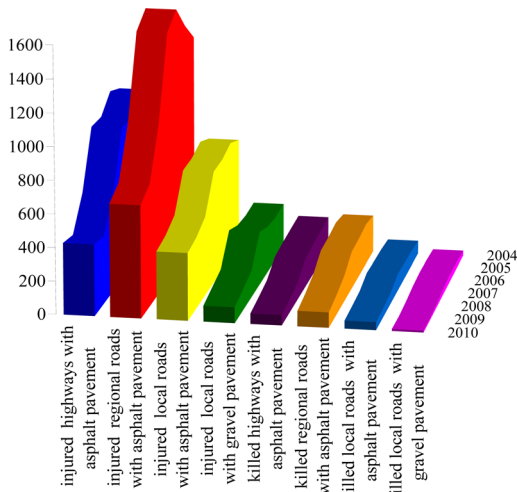


Figure 5 The number of the injured and killed in motor vehicle accidents on Lithuanian state roads [22]

The dynamics of the injured and killed in motor vehicle accidents on Lithuanian state roads is presented in Figure 5. It can be seen that the number of the injured and killed in motor vehicle accidents on Lithuanian state roads has been decreasing since 2008 and has reached the lowest values in 2010. Road traffic accidents classified according to the nature of the event are shown in Figure 6.

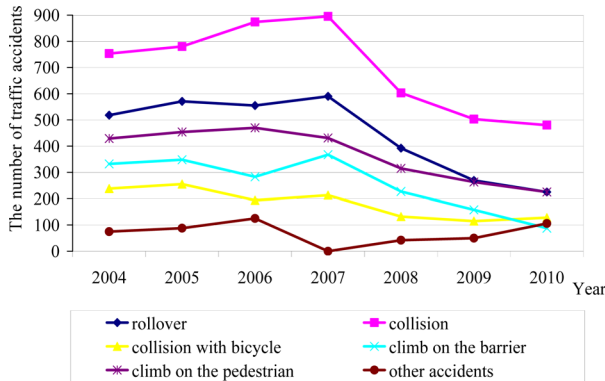


Figure 6 The types of traffic accidents on Lithuanian state roads [22]

Road traffic accidents, depending on the nature of the event, are calculated by summing up the annual values:

$$TA_{iY} = \sum_{M=1}^{12} TA_{iM} \quad (2)$$

where TA_{iY} is the number of traffic accidents of a particular type per year, TA_{iM} is the number of traffic accidents of a particular type per month.

The distribution of traffic accidents by months is calculated by summing up all types of traffic accidents for a particular month:

$$TA_M = \sum_{i=1}^7 TA_{iM} \quad (3)$$

where TA_M is the number of traffic accidents per month, Fig. 7. By summing up traffic accidents in a particular year according to their type, we obtain the total annual number of traffic accidents:

$$TA_Y = \sum_{i=1}^7 TA_{iY} \quad (4)$$

where TA_Y is the rate of traffic accidents.

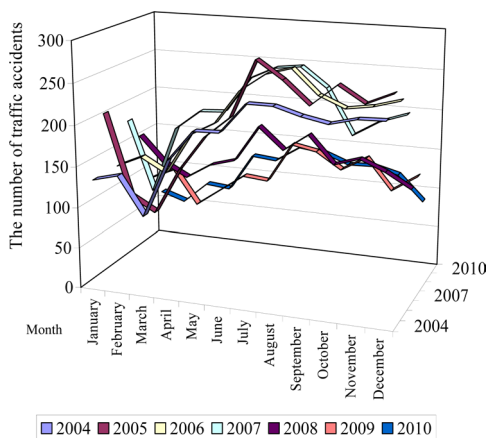


Figure 7 Traffic accidents on Lithuanian state roads by the months of the year [22]

The analysis of traffic accidents on local roads with gravel pavement shows that the decrease of the permitted maximum speed from 90 km/h to 70 km/h in 2007 [23] has not led to the decrease of traffic accidents. However, to prove this, a more extensive study is required. Further research is needed to assess the influence of the economic crisis that began in 2008 and is continuing now, as well as the effects of traffic volume and surface roughness on the rate of traffic accidents.

Conclusions

- 1 Traffic accidents on the road depend on a particular season. Traffic accident rate increases from April to November because of the increased traffic volume due to better traffic conditions, with the peaks in July. It decreases in December – March because of the lower traffic intensity due to the worsening of traffic conditions and safer road user's behaviour.
- 2 The number of traffic accidents on Lithuanian roads, as well as traffic volume, decreased considerably in 2008 and 2009.

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