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INFLUENCE OF LEGISLATION ON ROAD TRAFFIC SAFETY

ABSTRACT

The objective of this paper is to analyse road traffic safety in the Republic of Croatia based on the selected indicators which were used by the legislator in bringing the Law on Road Traffic Safety which has been in force since 28 July 2004, and the achieved effects in reaching the desired safety level in the three-year period from 2005 to 2007. The aim of the research is to establish a prognostic trend of the values of the studied indicators in the time period following the enforcement of new legal regulations. Adequate safety indicator values for the respective period were analyzed using the methods of analysis and synthesis, mathematical statistics as well as trend assessment based on the found mathematical prognostic models. Based on the results of this research it was found that the basic hypothesis according to which the implementation of new legal guidelines had to result in positive change in the condition of road traffic safety, failed to be confirmed. A change in the road traffic safety improvement strategy has been proposed as well as a more significant participation and recognition of the profession and science in this field which is of great significance for the society.

KEY WORDS

influence of legal regulations, road traffic safety, effects and tendencies

1. INTRODUCTION

The state of the road traffic safety system is an essential characteristic of its successful functioning and efficiency. Besides large material damages that occur daily in traffic systems, immeasurable losses arise from sufferings of humans, invalidity, absenteeism because of sick leaves as consequences of road accidents. No doubt, the efficiency of a particular traffic system is also measured with the reached degree, that is, level of traffic flow safety.

1.1 The problem and subject of the paper

With the increase in the standard of living, the number of motorists has been continuously increasing as well as the degree of motorization, traffic density, in other words load on road networks in Croatia. In this intensive and dynamic process of road traffic system development, it is exceptionally significant to attain optimal levels of traffic flow safety.

The problem in this paper consists of the study of influences of legal regulations on the evaluation of the state of safety in the Croatian traffic system, that is, in specific research of the connection between the application of new legal guidelines in the area of road traffic safety and the achieved effects after their application. The object of this paper results from the previous definition of the problem used in order to find out whether the implementation of the new legal guidelines has led to a positive change, that is, an improvement in the safety in the Croatian road traffic system, especially regarding the most significant indicators which are used in practice in the most developed countries in the world.

1.2 Purpose, aim, and contribution of the paper

Complying with the meaning of traffic safety in the traffic system functioning, as well as the contribution of the traffic system to total social and economic development, there is the need for more systematic tracking, study, and improvements of the safety level in the traffic system. One may claim with certainty that the traffic safety issue is becoming a more and more pronounced and significant issue that needs to be addressed primarily by the traffic and transport profession and institutions, as well as everybody else who, directly or indirectly, participates in creating traffic policy. Legal regulations can certainly contribute significantly to road traffic safety. It is, therefore, particu-

larly important to study which changes in traffic safety occur as result of the changes in regulations that regulate the traffic flow within the national traffic system. This paper focuses on the study of the influences of the Law on Road Traffic Safety and the enforcement regulations after its implementation. A short overview of development dynamics of certain road traffic safety elements within a three-year period from 2005 to 2007 is given, and, particularly in the key part of the paper, the values of the chosen representative safety indicators are established. The purpose of this paper is reflected in the analysis of the values of indicators and the reached level of safety, by means of which the value of the efficacy of legal regulations in the area of traffic safety can be assessed. The aim of this paper consists in the identification (positive or negative) of the tendency in order to assess the changes in safety levels in respect to changes in the legislation and its efficiency in road traffic safety on the Croatian roads.

Consequently, the basic hypothesis has been set, according to which, according to past empirical knowledge, it was to be expected that after the application of the new legal guidelines there should have been an improvement in road traffic safety. Beside this basic hypothesis, auxiliary hypotheses have been set which confirm it or deny it, that is, according to which the application of new legal guidelines is followed by an improvement in road traffic safety. Regarding certain representative indicators that are used in this study, the auxiliary hypotheses refer to the establishing of statistically significant tendencies in respect to the following proportions:

1. total number of road traffic incidents and accidents in Croatia in the period from 2005 to 2007,
2. total number of road traffic accidents with fatalities in Croatia in the period from 2005 to 2007,
3. total number of fatalities in road traffic accidents in Croatia in the period from 2005 to 2007,
4. total number of severely injured individuals in road traffic accidents in Croatia in the period from 2005 to 2007,
5. mortality incidence - number of fatalities in road traffic accidents per 100,000 inhabitants in Croatia in the period from 2005 to 2007,
6. intensity of road accidents in Croatia in the period from 2005 to 2007.

1.3 Sources and methodologies used in the work

Sources used in order to write this paper are the following:

- Newsletter on road traffic safety, Ministry of the Interior of the Republic of Croatia, Zagreb, 2008;
- Legal regulations in the area of road traffic safety published in Official Gazettes of the Republic of Croatia;

- Final report A6-0225/2005, European Action Program for Road Safety, EU.

The methodology used while working on this paper consists in collecting and analysis of data on available absolute and relative indicators for evaluation and conclusions related to the state of safety of the Croatian road traffic system. The absolute measured values provide a general picture of the vulnerability of people and tangible goods, while relative values enable a more detailed analysis and undertaking of prevention measures.

1.4 Structure of the paper

The introductory section presents the problem and the object of the study, followed by an outline of the purpose, aim, and contribution of the paper. The second chapter brings distinctive general data about the road traffic system, especially with respect to road infrastructure and suprastructure. The third chapter contains a short overview of legislation of Croatian road traffic system. The road traffic safety system condition is analyzed in detail in the fourth chapter of research results, in which a graphic presentation of the development dynamics of certain representative indicators from the area of traffic safety is given for the studied period of time, a suitable mathematical statistical analysis is performed and a possible existence of statistical significances of the tendencies of each indicator is examined. The results of research are explained in the discussion. The conclusion proves the basic set hypothesis based on six set auxiliary hypotheses, and in respect to absolute and relative road traffic safety indicators.

2. DISTINCTIVE GENERAL DATA ABOUT THE ROAD TRAFFIC SYSTEM

The important integral parts of the Croatian road traffic system that have direct or indirect influence on the general state of road traffic safety refer to:

- public roads network,
- registered motor vehicles,
- drivers of motor vehicles.

The data on the previously mentioned values were not taken into consideration in proving the basic hypothesis of this paper.

2.1 Public roads network

The network of classified public roads in the Republic of Croatia of overall length of 29,022 kilometres consists of:

- highways 1,163.00 km*
- state roads 6,751.60 km

Table 1 - Population, drivers, and vehicles in Croatia from 2005 to 2007

Main indicators	Year		
	2005	2006	2007
Population of Croatia	4,442,000	4,442,000	4,441,000
Drivers of motor vehicles	2,052,056	2,085,336	2,131,678
Drivers of motor vehicles per 100,000 inhabitants	46,197	46,946	47,997
Registered motor vehicles on December 31.	1,790,971	1,866,741	1,949,936
Motor vehicles per 100,000 inhabitants	40,319	42,025	43,905
Newly registered vehicles	143,636	157,767	153,548

Source: Newsletter on Road Traffic Safety, Ministry of the Interior of Croatia, Zagreb, 2008

- county roads 10,808.40 km
- local roads 10,279.00 km

* data refer to the state of completeness of highways in 2008

The structural feature of public road network can be seen in the significant increase in the length of the highway network in the observed period from 2005 to 2007.

Since highways, because of their construction and traffic-technical characteristics, represent the safest roads, and at the same time the most attractive roads for drivers, especially for distant (transit) and tourist traffic, it is to be expected that these facts will positively reflect on the overall state of road traffic safety.

2.2 Registered motor vehicles and drivers

In the period from 2005 to 2007, an increase in the total number of registered motor vehicles in Croatia was noted as well as increase in tourist road traffic. At the same time there has been an increase in the total number of drivers of motor vehicles. An analysis of data from Table 1 shows a uniform annual increase of around 2% in the number of drivers and 4% in the number of vehicles.

Data about the average yearly increase of some 148 thousand vehicles indicate the circumstance that in the period from 2005 to 2007 overall 454,951 vehicles were newly registered with mostly new technologi-

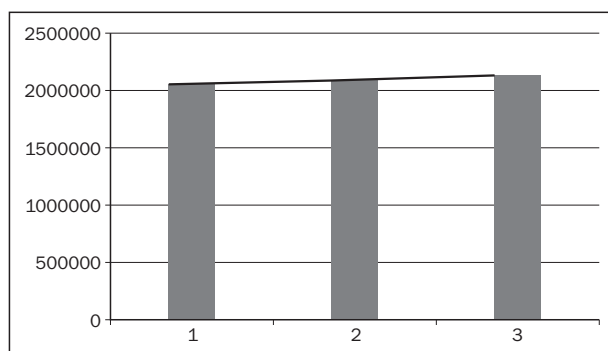


Chart 1 - Total number of drivers of road motor vehicles in Croatia in the period from 2005 to 2007 (x=1 for the year 2005)

Source: Table 1

cal and safety parameters which should certainly have to contribute to a decrease in the intensity of road accident consequences, that is, the number of fatalities and severely injured persons.

$$y = 2E+06e^{0.019x} \tag{1}$$

$$R^2 = 0.99 \tag{2}$$

Chart 1 shows a permanent increase of the total number of drivers of motor vehicles in Croatia, alongside a statistically significant tendency $R^2 > 0.99$.

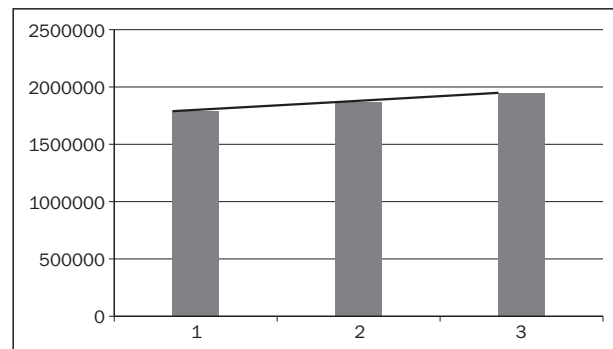


Chart 2 - Total number of registered motor vehicles in Croatia in the period from 2005 to 2007 (x=1 for the year 2005)

Source: Table 1

$$y = 2E+06e^{0.0425x} \tag{3}$$

$$R^2 = 0.99 \tag{4}$$

Chart 2 shows a permanent increase in the total number of registered motor vehicles, alongside a statistically significant tendency $R^2 > 0.90$.

3. OVERVIEW OF ROAD TRAFFIC LEGISLATION

The area of road traffic safety is organized with a series of legal and sublegal acts as well as platforms that comprise a legislative framework for the realization of the main goal regarding a decrease in the human suffering in road traffic, that is, an increase in road traffic safety. The legal act in Croatia which organizes the basic principles of correlations and behaviours of participants and other subjects in traffic

and basic conditions which roads should meet regarding the traffic safety, organize road traffic rules, traffic signage system and signs provided by authorized individuals, duties in case of road accidents, training of driving candidates, taking driving exams and conditions for the acquire the right to operate vehicles, tow of vehicles, instruments and equipment which vehicles should have, dimensions, total mass and axial load of vehicles, technical inspection of vehicles, conditions which vehicles must meet in traffic, are introduced by the Law on Road Traffic Safety. Regarding the problem and object of research, the focus is on the Law on Road Traffic Safety (National Gazette No. 105/04), which came into force on 20 August 2004, and whose effects on the improvement of road traffic safety should be researched. Further relevant legal act for road traffic safety is the Law on Public Roads (National Gazette No. 180/2004), which defines the legal status of public roads, planning, building and reconstruction of public roads maintenance, measures for the protection of public roads and the traffic on them, concessions, management, financing and surveillance of public roads. Based on the previous two basic Laws a series of sublegal acts was brought (Book of regulations).

Considering the problem area and the condition of road traffic safety, as well as the achieved results in reducing the number and consequences of road accidents, the Croatian Government concluded that Croatia, as a tourist country in the process of joining the European Union has to accept and adopt the standards, directives and guidelines of EU which oblige the members to increase road traffic safety. For this purpose, the Croatian Government brought in 1994 the National Curriculum on Road Traffic Safety that, in its third version, is currently the actual strategic platform for the period 2006-2010.

The program establishes the quantitative and qualitative aims consistent with the aims of the European Union included in the European Action Program for Road Safety (to cut the number of fatalities of road accidents in the EU by the year 2010 by half - the shared responsibility (2004/2162 (INI)). The National Curriculum on Road Traffic Safety of Croatia for the period 2006-2010 was published in the National Gazette RH No. 24/2006. The quantitative aims consistent with the aims of EU refer to the need to reduce the number of fatalities in road traffic within the program period from 608 fatalities in 2004 to 440 in 2010. The qualitative aims refer to an increase in traffic culture and education of the population as well as reduction of all kinds of traffic lack of discipline, that is, an increase in the awareness and liabilities of drivers regarding respect of traffic regulations. The Curriculum also establishes activities and their carriers, the way of executing these measures and monitoring of results, that is, evaluating the curriculum.

4. RESULTS OF RESEARCH

A graphic presentation is given hereafter and a more detailed mathematical statistical analysis of the absolute and relative representative indicators of road traffic safety is performed. A prognostic tendency model of development dynamics of individual indicators has been obtained using the computer program «Microsoft Excel», and determined by the equation and determination coefficient R^2 , and its graph is presented in the chart. The determination coefficient R^2 measures the intensity of connection of the observed variable in the mathematical model and the time. If the connection is functional, then the value of determination coefficient $R^2 = 1$, and the closer R^2 to this value, the connection becomes stronger [1]. When the value of determination coefficient R^2 is greater than 0.90 the conclusion is that the established mathematical model of the prognostic trend of the studied variable is statistically significant [2].

$$y = 56332e^{0.024x} \quad (5)$$

$$R^2 = 0.79 \quad (6)$$

According to data from Chart 3, in the period from 2005 to 2007, a permanent increase in the total number of traffic incidents and accidents can be noted, which, nevertheless, is not statistically significant (confidence level $p > 0.05$, with the value of determination coefficient $R^2 > 0.90$).

$$y = 532.2x^{0.033} \quad (7)$$

$$R^2 = 0.77 \quad (8)$$

According to data from Chart 4, in the period from 2005 to 2007, a permanent increase in the total number of road accidents with fatalities can be noted.

$$y = 20.51 \ln(x) + 597.7 \quad (9)$$

$$R^2 = 0.98 \quad (10)$$

According to data from Chart 5, it may be claimed that there is permanent statistically significant tendency (confidence level $p > 0.05$, with the value of determination coefficient $R^2 > 0.90$) of an increase in the total number of fatalities in road accidents.

$$y = 1475x + 16041 \quad (11)$$

$$R^2 = 0.98 \quad (12)$$

According to data from Chart 6, in the period from 2005 to 2007, one may claim that there is a permanent statistically significant tendency (confidence level $p > 0.05$, with the value of determination coefficient $R^2 > 0.90$) of the constant increase in the total number of severely injured persons in road accidents.

$$y = 0.468 \ln(x) + 13.42 \quad (13)$$

$$R^2 = 0.97 \quad (14)$$

According to data from Chart 7, in the period from 2005 to 2007, one may claim that there exists a per-

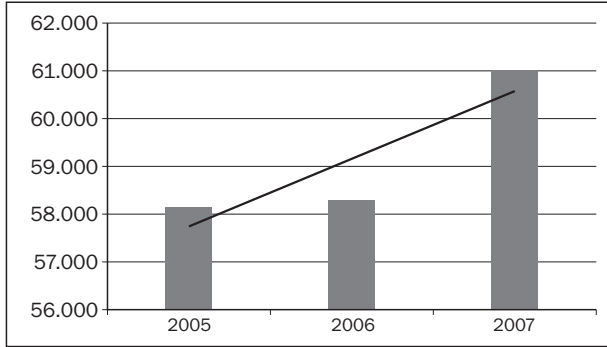


Chart 3 - Total number of road traffic incidents and accidents in Croatia in the period from 2005 to 2007 (x=1 for the year 2005)

Source: Newsletter on Road Traffic Safety, Ministry of the Interior of Croatia, Zagreb, 2008

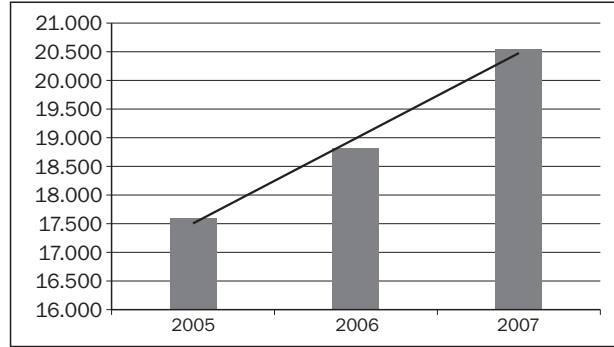


Chart 6 - Total number of severely injured individuals in road accidents in Croatia in the period from 2005 to 2007 (x=1 for the year 2005)

Source: Newsletter on Road Traffic Safety, Ministry of the Interior of Croatia, Zagreb, 2008

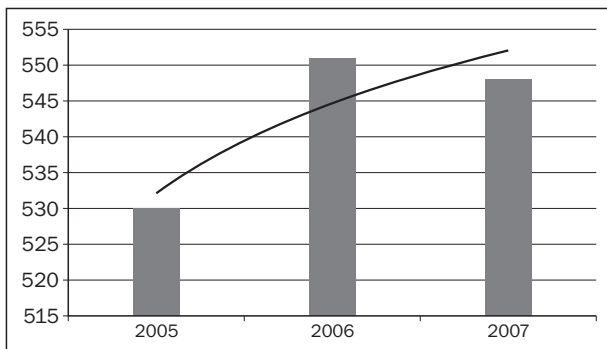


Chart 4 - Total number of road accidents with fatalities in Croatia in the period from 2005 to 2007 (x=1 for the year 2005)

Source: Newsletter on Road Traffic Safety, Ministry of the Interior of Croatia, Zagreb, 2008

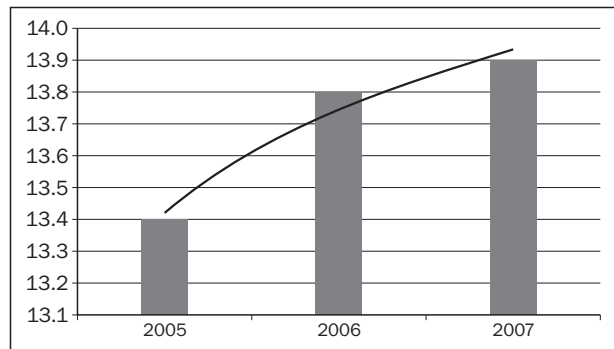


Chart 7 - Mortality incidence – the number of fatalities in road traffic accidents per 100,000 inhabitants in Croatia in the period from 2005 to 2007 (x=1 for the year 2005)

Source: Newsletter on Road Traffic Safety, Ministry of the Interior of Croatia, Zagreb, 2008

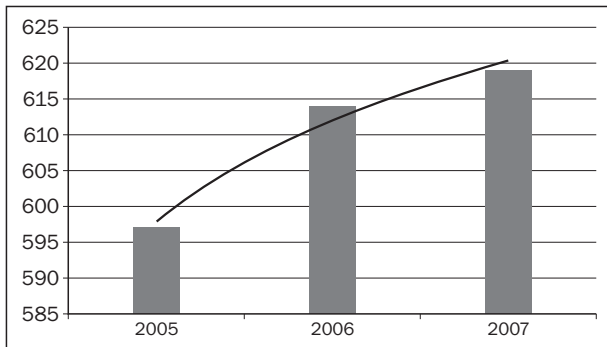


Chart 5 - Total number fatalities in road accidents in Croatia in the period from 2005 to 2007 (x=1 for the year 2005)

Source: Newsletter on Road Traffic Safety, Ministry of the Interior of Croatia, Zagreb, 2008

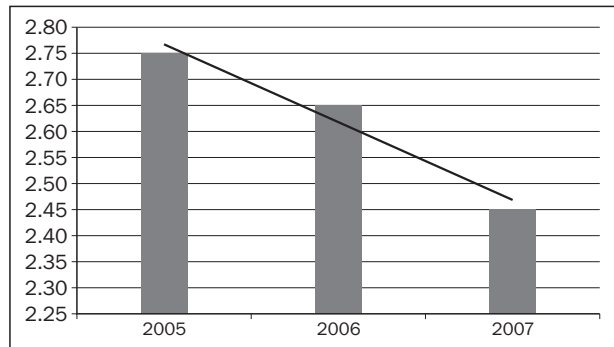


Chart 8 - The intensity of road traffic accidents in Croatia in the period from 2005 to 2007 (x=1 for the year 2005)

Source: Newsletter on Road Traffic Safety, Ministry of the Interior of Croatia, Zagreb, 2008

manent statistically significant tendency (confidence level $p > 0.05$, with the value of determination coefficient $R^2 > 0.90$) of the constant increase in the total number of fatalities per 100,000 inhabitants in road traffic accidents.

$$y = -0.15x + 2.866 \quad (15)$$

$$R^2 = 0.96 \quad (16)$$

According to data from Chart 8, in the period from 2005 to 2007, it is possible to state that there exists a permanent statistically significant tendency (confidence level $p > 0.05$ with the value of determination coefficient $R^2 > 0.90$) of a reduction in the intensity of road accidents (as result of relation of the number of fatalities and the injured persons) in road traffic accidents. However, although a tendency of decrease was

noted in the period from 2005 to 2007, the intensity of road accident consequences in road traffic has remained at the same level as in 2004, when the new Law on road traffic safety was brought.

5. DISCUSSION

On the basis of the conducted analysis on the state of road traffic safety for the studied period it can be affirmed with certainty that in spite of the expectations regarding effects of bringing the new 2004 Law on Road Traffic Safety, there has been no increase in road traffic safety. On the contrary, in spite of legal introduction of substantially more severe penalties, zero tolerance on alcohol, driving during day with short lights turned on, prohibition of mobile phone usage while driving, limitations for new drivers like implementation of measures and activities from the National Curriculum of road traffic safety in Croatia, positive results failed to be achieved in realizing the quantitative aims.

Contrary to the final goal, namely, established by the National Curriculum, of 10 fatalities per 100,000 inhabitants in 2010, that is, 12.5 fatalities in 2006, 11.9 fatalities in 2007, and 11.3 fatalities in 2008, considerable deviations in the negative sense has been noted. In 2006 there were 13.8 fatalities per 100,000 inhabitants, 13.9 fatalities per 100,000 inhabitants in 2007, and in first eight months of 2008 there were more than 14 fatalities per 100,000 inhabitants.

6. CONCLUSION

According to the past trends and effects in bringing the regulations in the field of safety, the new Law on Road Traffic Safety adopted in 2004, was supposed to guarantee efficiency and direct influence on reducing the traffic accidents and the range of suffering of all road traffic participants, but this failed to be fulfilled. The basic hypothesis, according to which the application of new legal guidelines should have resulted in positive changes of road traffic safety, failed to be confirmed. Out of six set auxiliary hypotheses, only the one that refers to the intensity of road accidents confirms a positive statistically significant tendency, while the remaining five hypotheses suggest the opposite, that is, negative effect in respect to the set goals. Consequently, it is necessary to change the approach to the scope of activities and to define the revised and new strategies of raising the road traffic safety. In the making of the new strategy to increase road traffic safety and realization of quantitative aims, it is necessary to actively include the traffic profession, scientific and academic, research and professional institutions and institutions from the area of traffic and transport respecting the programs and positive experiences of

the European Union countries. The paper should also provide incentive to further scientific research in the field of traffic safety establishing the correlation in the increase of the number of vehicles, number of drivers and road infrastructure.

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SAŽETAK

UTJECAJ ZAKONSKIH PROPISA NA STANJE SIGURNOSTI CESTOVNOGA PROMETA

Svrha ovoga rada je analiza stanja sigurnosti cestovnoga prometnog sustava Republike Hrvatske temeljem odabranih pokazatelja koji su služili zakonodavcu prilikom donošenja Zakona o sigurnosti cestovnoga prometa koji je u primjeni od 28. srpnja 2004., te postignutim efektima u postizanju željene razine sigurnosti razdoblju u narednom trogodišnjem razdoblju od 2005. do 2007. godine. Cilj istraživanja sastoji se u ustanovljavanju prognostičkoga trenda vrijednosti izučavanih pokazatelja u vremenskom razdoblju nakon stupanja na snagu novih zakonskih propisa. Izvršena je analiza odgovarajućih vrijednosti pokazatelja sigurnosti za predmetno razdoblje, korištenjem metoda analize i sinteze, matematičke statistike kao i procjene trendova temeljem ustanovljenih matematičkih prognostičkih modela. Na temelju rezultata ovoga istraživanja dolazi se do spoznaje da temeljna hipoteza prema kojoj je nakon primjene novih zakonskih odrednica trebalo doći do pozitivne promjene stanja sigurnosti cestovnoga prometa, nije potvrđena. Predlaže se izmjena strategije poboljšanja sigurnosti cestovnoga prometa kao i značajnije uključivanje te uvažavanje struke i znanosti u ovome za društvo značajnome području.

KLJUČNE RIJEČI

utjecaj zakonskih propisa, sigurnost cestovnog prometa, efekti i trendovi

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