DANIJELA BARIĆ, Ph.D.
E-mail: danijela.baric@fpz.hr
GORAN ZOVAK, Ph.D.
E-mail: goran.zovak@fpz.hr
MARKO PERIŠA, Ph.D. Candidate
E-mail: marko.perisa@fpz.hr
University of Zagreb,
Faculty of Transport and Traffic Sciences
Vukelićeva 4, 10000 Zagreb, Croatia

Education in Traffic
Preliminary Communication
Accepted: Mar. 13, 2013
Approved: May 23, 2013

EFFECTS OF ECO-DRIVE EDUCATION ON THE REDUCTION OF FUEL CONSUMPTION AND CO_2 EMISSIONS

ABSTRACT

Sustainable mobility is the basic and long-term goal of the traffic policy. Eco-driving represents one of 40 measures that should by 2050 contribute to 60% of traffic-generated emission reduction. The paper presents the significance of educating the drivers about eco-driving as well as eco-drive training with the aim of reducing fuel consumption and CO_2 emission. During research the drivers were tested in three cycles, prior to education, immediately following the education and eco-training and three months after the eco-training. According to the measurement results in this research, after education and the first eco-drive training the fuel consumption as well as CO_2 emission were reduced by about 32%. The analysis of the results shows that driving according to eco rules allows fast and efficient reduction of fuel consumption and CO_2 emissions, which means at the same time also the need to systemically and periodically educate the drivers about the eco-driving at specialized educational centres which is for the moment absent in the Republic of Croatia.

KEY WORDS

eco-driving, fuel consumption, CO_2 emission, sustainable development, education

1. INTRODUCTION

Apart from its positive dimension, traffic has its negative dimension as well. Constant growth of mobility sets the traffic systems under high pressure. This results in the traffic congestion, especially in case of road traffic, which reduces the economic efficiency, increases fuel consumption and pollution. Since today's traffic regime and growth rates are unsustainable, the mobility is threatened by congestions, delays, and pollutions, so that a change is needed that will eventually contribute to sustainable development. The traffic policy has been designed to achieve precisely this. The first White Paper, as the basic European strategy for the sustainable development, suggested some 60 measures oriented to the development of the European traffic system capable of shifting the balance between the transport modes, railway revitalization, promotion of transport on sea and internal waterways and control of the increase in air traffic [1]. The currently valid White Paper has suggested 40 new measures with the aims that by the year 2050 should contribute to a 60% reduction of traffic-generated emissions [2]. By analyzing the research and projects, especially at the European Union level, one may conclude that, apart from other activities, high significance in the frame of sustainable mobility belongs to eco-driving which significantly contributes to environmental protection and reduction of harmful emissions. The education of drivers, especially younger ones, can significantly affect the traffic flow safety, and also it could contribute to environmental protection and reduction of external costs [3, 4]. In order to reduce the negative influence of traffic on the environment, a Program which has significantly influenced the reduction of greenhouse gas emissions of road vehicles of categories N2, N3 and M3 has been successfully implemented in the Republic of Croatia [5].

In the Republic of Croatia the Regulations on the starting and periodical education of drivers has been in force, stipulating the program, performance of the program, conditions and method of testing in order to acquire the initial qualifications and periodical education of drivers of certain categories of road vehicles for the transport of goods and passengers [6]. However, systemic and periodical education at specialized educational centres about eco-driving is still non-existent. Therefore, the purpose of this paper is to indicate the justification of continuous education of drivers about

eco-driving with a long-term objective of sustainable mobility and development, in compliance with the White Paper.

Eco-driving can be characterized as a smarter and more efficient driving style which uses in the best way the benefits of modern technologies in traffic and at the same time increases its safety. The basic objective of eco-driving in relation to conventional method is the reduction of average fuel consumption without reducing the average vehicle speeds, which significantly contributes to the environmental protection and reduction of harmful emissions, and it is in compliance with the objectives for sustainable mobility. In practice, eco-driving is a technique which in practice reduces the fuel consumption and increases the safety, as well as the economy and comfort of driving.

The advantages of eco-driving are multiple, and they refer especially to [7]:

1. Safety
   a. increases safety in road traffic,
   b. improves driving capabilities;
2. Environment
   a. reduces greenhouse emissions (CO_2),
   b. reduces local harmful emissions,
   c. reduces noise;
3. Driving economy
   a. reduces fuel consumption (5-15% in long-term perspective),
   b. reduces the maintenance costs,
   c. reduces the costs due to traffic accidents;
4. Social responsibility
   a. contributes to more responsible driving,
   b. reduces stress during driving,
   c. increases comfort in driving for drivers and passengers.

Apart from a number of the already mentioned advantages, eco-driving reduces noise pollution, as well as local air pollution. The noise of the engine of one car running at 4,000 rpm is equal to engine noise of 32 cars running at 2,000 rpm. This means that eco-driving reduces one of the basic problems of traffic in urban areas. Safer driving results from the forecasting of traffic situation, maintenance of constant speed, lower driving speeds, fewer overtaking and less aggressiveness in drivers (less stress). In compliance with this, the basic rules of eco-driving have been defined [7]:

1. shift up as early as possible – shift to between 2,000 and 2,500 rpm;
2. maintain a steady speed – drive in highest possible gear at low rpm;
3. anticipate traffic flows – identify on time the traffic situations and consequently adapt the driving;
4. brake on time – when it is necessary to decelerate or stop, brake smoothly by releasing the accelerator pedal on time and by letting the engine in gear;
5. check tyre pressures frequently - 25% lower pressure than the nominal one in pneumatics increases the roll friction by 10%, including the fuel consumption by 2%;
6. remove unnecessary load from the vehicle – every 10 kg of additional mass cause additional consumption of 0.1 litre of fuel per 100 kilometres (100 kg of additional mass causes consumption of 1 litre of fuel per 100 kilometres).

2. PREVIOUS RESEARCH

Eco-driving programs have been implemented in numerous countries and they have proven extremely efficient both from the ecological and from the financial aspect. The examples of implemented programs of eco-driving are numerous, as well as the achieved results (*Figure 1*) [8]. The efficiency of eco-driving in order to reduce CO_2 emissions cannot be obtained in a simple percentage amount based on universal methodology. It is, therefore, necessary to determine an approximate amount based on the results of a number of studies recognizing the practical experiences and scientific research.

Table 1 shows the range of savings in fuel consumption obtained from the research done in 25 studies. Depending on the type of vehicle the savings in fuel consumption can be even up to 30%. Thus, for instance, eleven months after having carried out the eco-driving education in the German company Hamburger Wasserwerke, the fuel consumption was reduced by 5.8%, and this method of driving had impact on the reduction in the number of traffic accidents and the related costs by more than 25%. The results of the carried out eco-driving program in the Netherlands have indicated savings of about 5 euro per ton of CO_2 emission in the time period of 10 years. The eco-driving program has been implemented in Switzerland as well on a sample of 350 car service drivers, who after eco-driving education reduced fuel consumption by 6.1%, thus realizing 22% more kilometres and the total number of traffic accidents was reduced by 35% [9].

There are various approaches to eco-driving method training which are mainly based on the theoretical education and practical training in a vehicle. *Table 2* describes three different approaches to eco-driving education. The first two methods include one-day education with theoretical teaching and practical training in the vehicle. In the first method of education the drivers with eco-training (with at least one year experience) have been compared to novice drivers without eco-training. Another way of education includes drivers with eco-drive training (tested drivers have at least six months of experience) and the drivers without any eco-training. The third comparison represents the comparison of novice drivers with passed eco-training and novice drivers who had no such eco-training. The education includes 2x2 hours of theoretical part and

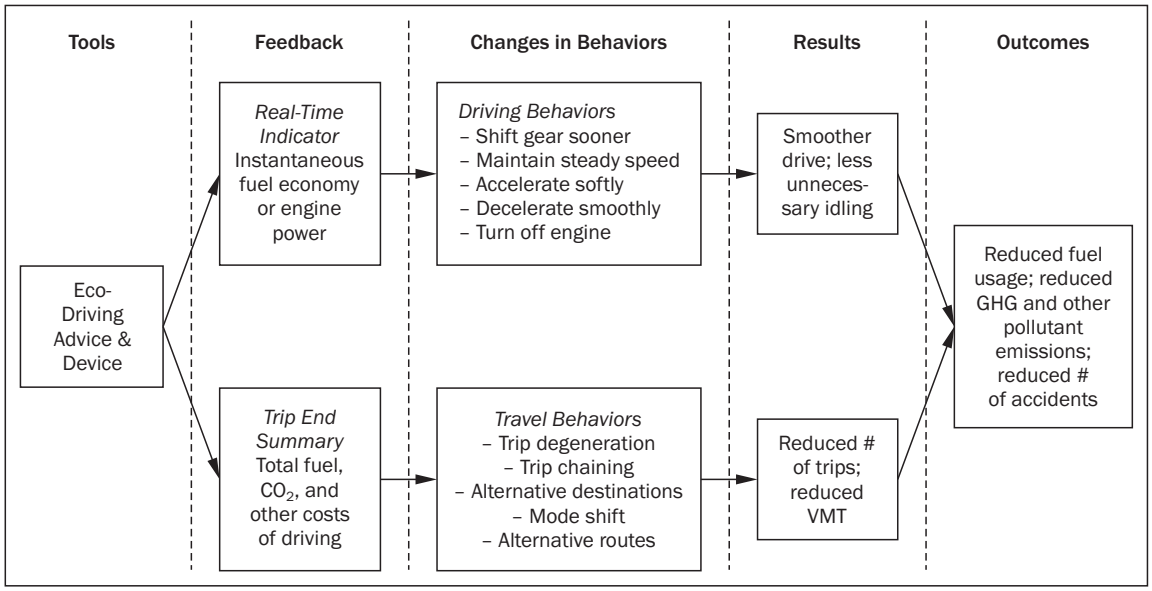

Figure 1 – Reduction of fuel consumption and greenhouse gas emissions as result of eco-driving

Source: Co Eco-Driving: Pilot Evaluation of Driving Behavior Changes among U.S. Drivers, University of California Transportation Center UCTC-FR-2010-20, August 2010, p. 4

Table 1 – Savings in fuel consumption obtained in the major eco-driving studies

Study/project	Savings in fuel consumption
Barth and Boriboonsomsin (2009)	10–20%
TNO (2006)	7% (for petrol), 8% to 10% (for diesel)
Fiat eco:Drive	6% (top 10% of participants saved 16% or more)
ECMT/IEA (2005)	5% (for OECD regions, based on literature review)
Wåhlberg (2007)	2%
Zarkadoula et al. (2007)	4.35%
Beusen et al. (2009)	From 12% savings to a 3% worsening
Rowson and Young (2011)	20% (peak savings of 45%)
Greene (1985)	10% or more
Mississippi State Energy Ofice	10–15%
Caltrans	15%
Maryland High School driver education	10%
WBCSD – VW and Naturschutzbund Deutschland	13% (peak savings of 25%)
Mele (2008)	35%
Bragg/FuelClinic.com (2009)	5.23%
Beusen and Denys (2008)	From 7.3% savings to 1.7% worsening
Taniguchi (2007)	20%
Onoda (2009)	5–15%
Saynor (Ford Motor Company) (2008)	24%
Henning (Ford of Europe) (2008)	20.65– 26.1%
Quality Alliance Eco-Drive	11.7–21%
SAFED, DfT	2–12%
Driving Standards Agency, UK	8.5%
Hamburger Wasserwerke, Germany	5.8%
Dutch Consumer Organisation	7%

Source: Wengraf I.: Easy on The Gas, The effeciteveness of ecodriving, RAC Foundation, London, 2012, pp.16-17 [11]

practical explanation in a vehicle. It should be noted that there have been no significant differences in fuel consumption [10].

In order to popularize eco-driving, as one of the most acceptable measure to implement energy efficiency policy in traffic, as part of the program Intelligent Energy in Europe – IEE, the ECOWILL project has been started – mass implementation of the eco-driving standard into the educational program of driver candidates and implementation of the campaign among licensed drivers (Eco-driving – Widespread Implementation for Learners and Licensed Drivers). This project is an extension of the previous European projects such as TREATISE, FLEAT, and finally the ECODRIVEN Project. The aim of the ECOWILL project is to increase the number of Ecodriving training programmes in Europe to contribute to the reduction of emissions of greenhouse gases and other harmful gases, as contribution to fulfilling the obligations of the national and EU governments according to the Kyoto Protocol, through widespread implementation of a standardized eco-driving school in the program of training candidate drivers, as well as the implementation of short, so-called "snack" trainings for the already licensed drivers. Between 2010 and 2013, ECOWILL intends to conduct Ecodriving training programmes for licensed drivers in 13 European countries including Croatia. In Croatia since 2010 the ECOWILL project has been successfully carried out especially in the education of eco-driving for B category of motor vehicles. The project in general will develop the standardized applications of eco-driving that will be implemented in the commercial curricula of all the driving schools in Europe both in the training and in the testing part.

3. METHODOLOGY

Based on international experiences and results of research of numerous studies, there is a whole series of key methods of stimulating eco-driving that have been divided into four basic categories [11]:

- information campaigns;
- driver training;
- in-vehicle technology; and
- gamification: the use of competitions and learning with a social dimension.

The research carried out in the Republic of Croatia included all four mentioned categories. In the initial phase the drivers had one-day theoretical education, and then practical training onboard a vehicle. The theoretical education of drivers and the practical driving were organized in cooperation between the Faculty of Transport and Traffic Sciences in Zagreb and ORYX Centre for safe driving in Mićevec. In testing eco-driving the driving method of each driver was analyzed, as well as the fuel consumption. The indicated parameters were measured in case of every driver three times:

- before ECO-drive training (drive 1);
- after ECO-drive training (drive 2);
- three months after having passed the training (drive 3).

Table 2 – Summary of results obtained by studying the influence of different ECO drive educations on reduction in fuel consumption

PROCEDURE AND METHODS			
Type of training	One-day training. Theoretical explanation of factors affecting fuel consumption. Practical training with vehicle in real conditions.	One-day training. Theoretical explanation of factors affecting fuel consumption. Practical training with vehicle in real conditions.	Theoretical explanation of eco-driving 2x2 hours. Theoretical explanation of principles in the vehicle.
Data obtained on / from	Simulator	Vehicle	Simulator
Attendees of eco-education program, number of attendees n	Drivers with ECO-drive education and with 1-2 years of practical experience in driving, n=20	Drivers who completed ECO-drive education (tested drivers completed the training approx. 6 months to 4 years prior to testing), n=75	Novice drivers with ECO-drive training, n=19
Group for comparison, number of attendees n	Novice drivers without ECO-drive training, n=22	Random selection of drivers without ECO training, n=75	Novice drivers without ECO-drive course, n=18
RESULTS			
Mid-/long-term effects	Consumption: drivers with ECO-drive training: 12% lower consumption after 8 months, 21% lower consumption after 17 months in comparison to new drivers without ECO-drive training	Consumption: Drivers with ECO-Drive training: 12% lower consumption compared to drivers without ECO-drive training	Consumption: No significant difference between novice drivers with and without ECO-drive training

Source: Summary of Eco-Drive Training Courses, Quality Alliance Eco-Drive and the Swiss Federal Office of Energy (BFE), 2004

4. DESCRIPTION OF ECO-DRIVE TESTING

4.1 Test vehicle

For eco-drive test, the testing and measuring of the defined indicators was performed on the light commercial vehicle MAN 10.180.

4.2 Measurement system

The measurement was carried out by means of the Key Driving Training System (KDTS) which allows objective measurements and analysis of the driver's behaviour during the driving and its influence on the fuel consumption and CO_2 emission (*Figure 2*). KDTS is connected to the vehicle electronics by means of an FMS interface. The following indicators have been measured: fuel consumption, current vehicle speed, current gear, current number of RPMs, number of pressing the brake pedal, as well as all the other relevant parameters that affect fuel consumption [12].

4.3 Test route

Test route was in the urban area (city of Zagreb). Every time the vehicle travelled the same route in the urban area of 26 km (*Figure 3*), in order to avoid deviations in consumptions due to different travelling distances. Likewise, all the parameters that affect fuel consumption were approximately the same in case of every measurement (load, pressure in pneumatics, etc.).

All studies were carried out under the same conditions, i.e. during all the three measurements the drivers used the same vehicle, with approximately the same quantity of fuel in the tank, travelled the same distance, and transported the same load mass, i.e. the total mass of the vehicle did not change. To ensure approximately similar traffic conditions for all the tests, the test drives were always made on Thursday morning at 10:30 after the peak hour. The first test after training was made on 14th of June 2012 and the second one on 13th of September 2012.

Figure 2 – Key Driving Training System (real time)

4.4 Measurement results

The measurement results and the analysis of the results of testing (fuel consumption and other parameters) before training, after training and three months after training are presented in Tables 3 and 4 [13].

4.5 Economic justification of eco-driving

Past research has shown that in comparison with other traffic measures, eco-driving brings very fast, efficient eco-savings which at the same time results also in the saving of costs for the society as a whole. According to the measurement results in this research, after education and the first eco-drive training the fuel

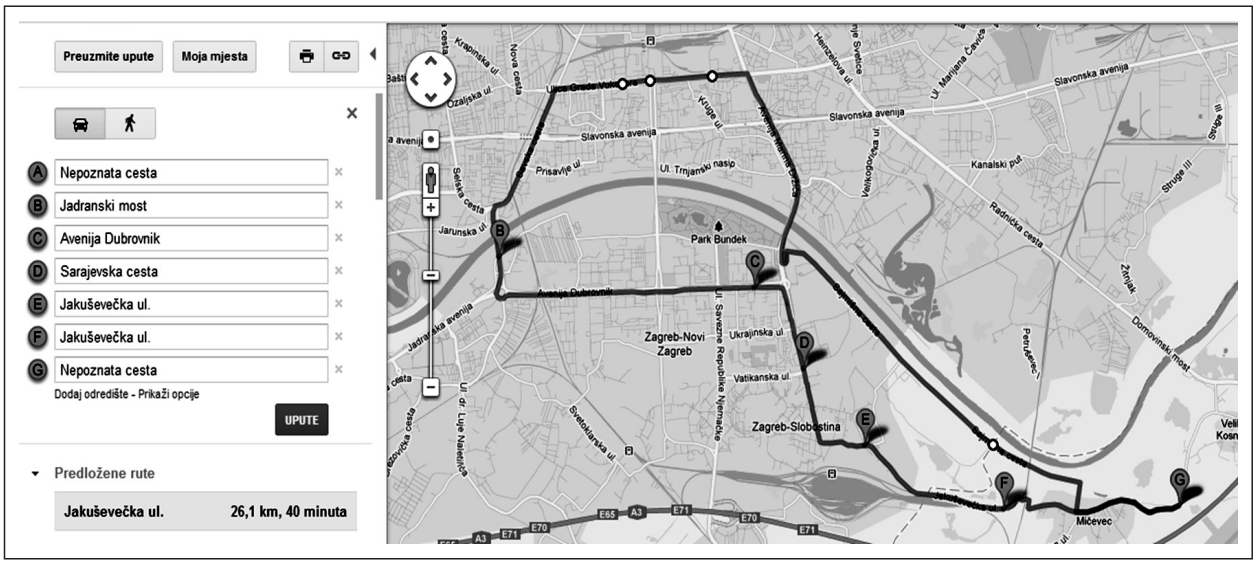

Figure 3 – Testing route

Table 3 – Measuring of drivers A before training, after training, and three months after training

Parameter	Unit	DRIVE 1	DRIVE 2	DRIVE 3	Difference V2-V1	[%]	Difference V3-V2	[%]
Total time	mm:ss	0:41:23	0:42:11	0:43:10	0:00:48	1.93	0:00:59	2.33
Total distance	[km]	25.71	25.77	25.68	0.06	0.23	-0.09	-0.35
Average speed	[km/h]	37.27	36.66	35.70	-0.61	-1.64	-0.96	-2.62
Fuel consumption - stationary	[l]	0.09	0.07	0.11	-0.02	-22.22	0.04	57.14
Fuel consumption - on the move	[l]	5.29	3.58	3.48	-1.71	-32.33	-0.10	-2.79
Total fuel consumed	[l]	5.37	3.65	3.60	-1.72	-32.03	-0.05	-1.37
Average fuel consumption	[l/100km]	20.90	14.20	14.00	-6.70	-32.06	-0.20	-1.41
Average CO_2 emission	[kg/100km]	55.60	37.70	37.30	-17.90	-32.19	-0.40	-1.06

Table 4 – Analysis of measurement results of the tested driver before training, after training, and three months after training

Parameter	Unit	DRIVE 1	DRIVE 2	DRIVE 3	Difference V2-V1	[%]	Difference V3-V2	[%]
Average position of gas pedal	[%]	36	28	28	-8	-22.22	0	0.00
Maximum position of gas pedal	[%]	89	90	91	1	1.12	1	1.11
Moving time – driving without throttle	[mm:ss]	6:20	11:10	10:18	4:50	76.32	-0:52	-7.76
Time – usage of brakes	[mm:ss]	7:01	3:59	2:58	-3:02	-43.23	-1:01	-25.52
Total distance – driving without throttle	[km]	4.06	7.32	6.62	3.26	80.30	-0.7	-9.56
Total distance – usage of brakes	[km]	2.81	1.22	1.25	-1.59	-56.58	0.03	2.46
Number of braking	#	69	45	46	-24	-34.78	1	2.22
Number of stopping	#	9	8	8	-1	-11.11	0	0.00
Time of idling	[mm:ss]	3:44	3:20	4:57	0:24	10.71	1:37	48.50
Number of shifting gears	#	238	274	261	36	15.13	-13	-4.74

consumption as well as CO_2 emissions were reduced by about 32%.

In accordance with the obtained measurement results a simulation of savings has been carried out for one vehicle and for a fleet of 1,500 vehicles which account for about 10% of the licensed commercial road vehicles in the Republic of Croatia [14]. Research has shown that drivers can adjust their driving behaviours accordingly to save fuel and reduce CO_2. Therefore, the parameters which are significant to calculate the savings in reducing fuel consumption and CO_2 emissions are selected (*Table 5*). The simulation of savings is shown in *Table 6*.

Table 5 – Input parameters to simulate savings

Input parameter	Value
Total number of vehicles in the fleet	1,500
Fuel consumption per 100km	20 [l]
Number of travelled km per year	100,000 [km]
Price of one litre of fuel	1.40 [euro]
Average cost of damages / vehicle / year	750 [euro]
Savings in cost of damage after training	14 [%]

5. DISCUSSION OF RESULTS

Within this study, several results have been achieved. After ECO-drive training a reduction in the total fuel consumption was achieved, and the elements affecting reduction include:

- driving at lower RPMs,
- less frequent usage of brakes (engine braking),
- longer travelled distance without using the accelerator,
- use of cruise control,
- shifting to higher gear as soon as possible.

The comparison of the obtained results of the carried out study of driving before training, driving after training and driving three months after the training show significant improvements. Thus, for instance, the use of brakes was reduced, so that the number of braking in driving was reduced after the training by about 41%, and the result of a lower number of braking is the reduction of the number of travelled kilometres during braking by about 62%. After the performed training and application of the acquired knowledge, the tests have shown that the tested driver, during the

Table 6 – Results of saving calculations (financial effects of eco-training)

Parameter	1 vehicle		Fleet	
	1 year	Cumulative 5 years	1 year	Cumulative 5 years
Energy costs/year [€]	28,000	2,800,000	42,000,000	210,000,000
Savings in fuel consumption/vehicle/year [€]	1,400	1,400	1,400	1,400
Savings in fuel consumption/year (fleet) [€]	1,400	7,000	2,100,000	10,500,000
CO2 savings for fleet [kg]	3,612	18,060	5,418,000	27,090,000
Annual cost of damages [€]	750	3,750	1,125,000	5,625,000
Savings in cost of damages/vehicle [€]	105	105	105	105
Annual savings in cost of damages (fleet) [€]	105	525	157,500	787,500
Savings after training/vehicle/year [€]	1,505	1,505	1,505	1,505
Annual savings after training (fleet) [€]	1,505	7,525	2,257,500	11,287,500

total testing time of about 42 minutes, time of driving without the use of accelerator before the training amounted to 6:20 min., and after training to 11:10 minutes and the travelled distance without the use of accelerator increased from 4.06km to 7.32km i.e. by 80%. The number of gear shifting to higher gears during driving after training increased by about 19% in comparison with the number of gear shifting before the carried out training. The average fuel consumption of the tested driver on the given route before training amounted to 20.9 l/100km, and after training 14.2 l/100km which means that the average fuel consumption on the same route under approximately the same conditions was reduced by 32.27%. Consequently, the average CO_2 emission in tested drivers was reduced by about 32% in relation to the emission before the training. The measuring of fuel consumption three months after, in case of the tested drivers proved that there are no major deviations in fuel consumption in comparison to the measurement immediately after the training. It should be mentioned that the average speed of vehicles during the testing before the training and testing after the training remained almost unchanged (about 1% difference). In comparison with results of savings in fuel consumption obtained in the analyzed eco-driving studies (*Table 1*) it can be conclude that these approach is justified and successful. All the analyzed parameters undoubtedly indicate the earlier set postulates of eco-driving, i.e. defined elements.

6. CONCLUSION

The mere replacement of the fleet by vehicles of more advanced technology does not bring optimal improvement regarding pollution reduction. Therefore, investing solely in advanced technology has no significant effect if this process does not include also the drivers' education. The carried out analysis of the European experiences in the area of different methods of education indicate the fact that the education of drivers and the application of the learned can significantly affect fuel consumption, i.e. environmental pollution. These have shown that there is significant difference in the results achieved in case of beginner drivers and drivers with a certain driving experience, as well as in case of drivers educated as part of the driving school curriculum and the drivers educated for this at a qualified educational centres. The obtained results show that ECO-driving in relation to other traffic measures does not only represent efficient driving from the aspect of economical efficiency but rather allows large savings for the society as a whole, which emerges from the results of numerous analyzed studies, as well as the simulation shown in the paper.

Regarding the analysis of different eco-drive projects in the world, as well as the experiences of eco-driving of the carried out analysis in the Republic of Croatia, it may be concluded that investment into eco-driving, efficient method of reducing environmental pollution, is justified. Therefore, the next phase should include the defining of a long-term model of systemic education of drivers about eco-driving at specialized educational centres and the obligation of eco-drive training especially for young drivers.

Dr. sc. **DANIJELA BARIĆ**
E-mail: danijela.baric@fpz.hr
Dr. sc. **GORAN ZOVAK**
E-mail: goran.zovak@fpz.hr
MARKO PERIŠA, doktorand
E-mail: marko.perisa@fpz.hr
Sveučilište u Zagrebu, Fakultet prometnih znanosti
Vukelićeva 4, 10000 Zagreb, Hrvatska

SAŽETAK

UČINCI EDUKACIJE O EKO-VOŽNJI NA SMANJENJE POTROŠNJE GORIVA I EMISIJE CO_2

Održiva mobilnost temeljni je i dugoročni cilj prometne politike. Eko-vožnja predstavlja jednu od 40 mjera koje trebaju do 2050. godine doprinijeti 60% smanjenju emisija iz prometa. U radu je prikazan značaj edukacije vozača o eko

vožnji kao i trening eko-vožnje s ciljem smanjenja potrošnje goriva i emisije CO_2. Tijekom istraživanja provedena su testiranja vozača u tri ciklusa, prije edukacije, neposredno nakon edukacije i eko-treninga i tri mjeseca nakon eko-treninga. Prema rezultatima mjerenja u ovom istraživanju, vidljivo je da se nakon edukacije i treninga eko-vožnje, potrošnja goriva i emisija CO_2 smanjila za 32%. Analiza rezultata ukazuje da vožnja prema eko pravilima omogućava brzo i učinkovito smanjenje potrošnje goriva i emisije CO_2, a samim time i potrebu sustavne i periodične izobrazbe vozača o eko-vožnji u specijaliziranim edukacijskim centrima koja za sada prema navedenom modelu ne postoji u Republici Hrvatskoj.

KLJUČNE RIJEČI

eko-vožnja, potrošnja goriva, emisija CO_2, održivi razvitak, edukacija

REFERENCES

[1] White paper: *European transport policy for 2010 : time to decide*, Luxembourg: Office for Official Publications of the European Communities, 2001

[2] White paper: *Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system*, COM(2011) 144, 28.04.2011

[3] **Alispahić, S.**, **Antunović, S.**, **Bećirović, E.**: *Training of Drivers in the Function of Road Traffic Safety*, Promet-Traffic&Transportation: Scientific Journal on Traffic and Transportation Research. Volume 19, No. 5, 2007,

[4] **Beusen, B.**, **Denys, T.**: *Long-term effect of eco-driving education on fuel consumption using an on-bord logging device*, URBAN TRANSPORT XIV - Urban Transport and the Environment in the 21st Century; WIT Transactions on the Built Environment, Volume 101, 2008, Pages 395-403

[5] *Program smanjenja negativnog utjecaja prometa na okoliš* (*Program of reducing negative impact of transport on the environment*), Prva mjera: Smanjenje emisije štetnih plinova cestovnih vozila (kategorije N2, N3 i M3) (First measure: reduction of road vehicle-generated harmful gases (Categories N2, N3 and M3)), Ministry of the Sea, Transport and Infrastructure, Zagreb, 2009

[6] *Pravilnik o početnoj i periodičkoj izobrazbi vozača*, NN 78/09 (Regulation on initial and periodical education of drivers)

[7] http://www.ecodrive.eu/en.aspx

[8] *Co Eco-Driving: Pilot Evaluation of Driving Behavior Changes among U.S. Drivers*, University of California Transportation Center UCTC-FR-2010-20, 2010

[9] http://www.ecodrive.org/en/what_is_eco-driving-/benefits_of_eco-driving/

[10] *Summary of Eco-Drive Training Courses*, Quality Alliance Eco-Drive, and the Swiss Federal Office of Energy (BFE), 2004

[11] **Wengraf, I.**: *Easy on the Gas the effectiveness of eco-driving*, RAC Foundation, London, 2012

[12] http://www.keydriving.be/en

[13] *Aspects and influence of eco-driving on the environment*, Research project, Faculty of transport and traffic sciences, Zagreb, 2011

[14] *Registar prijevoznika u cestovnom prometu RH* (Register of Croatian road hauliers), Ministry of the Sea, Transport and Infrastructure, 2013