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IMPACT OF THE ECONOMIC CRISIS ON THE ROADWORTHINESS OF VEHICLES IN THE REPUBLIC OF CROATIA

Summary. The impact of the economic crisis, i.e. the decrease in purchasing power in the Republic of Croatia, has been reflected negatively on the sales of new road vehicles and the maintenance plan of used road vehicles. A comparison of the results of technical inspections on vehicle roadworthiness has indicated a slight increase in unroadworthy vehicles, with a tendency for this to increase. Unroadworthiness and the average age of vehicles amounting to 12.18 years prompt for thinking about road safety in the Republic of Croatia. This paper aims to establish the extent of the increase in vehicle unroadworthiness and the importance of its reduction in order to increase road safety. The Republic of Croatia has adopted the National Road Safety Program for 2011-2020, accepting thereby a task that will be difficult to accomplish without organising training on the importance of vehicle roadworthiness.

EINFLUSS DER WIRTSCHAFTSKRISE AUF DIE VERKEHRSTAUGSLICHKEIT VON STRAßENFAHRZEUGEN IN DER REPUBLIK KROATIEN

Zusammenfassung. Die Folgen der Wirtschaftskrise bzw. die verminderte Kaufkraft in der Republik Kroatien haben den Verkauf von neuen und den Instandhaltungsplan von gebrauchten Straßenfahrzeugen negativ beeinflusst. Durch den Vergleich der mit der Verkehrstauglichkeit von Straßenfahrzeugen verbundenen Ergebnisse technischer Kontrollen ließ sich ein leichter Anstieg von verkehrsuntauglichen Fahrzeugen, mit einer Tendenz zur Erhöhung, feststellen. Die technische Untauglichkeit sowie das Durchschnittsalter von Straßenkraftfahrzeugen von 12,18 Jahren lassen Bedenken über die Sicherheit des Straßenverkehrs in der Republik Kroatien aufkommen. Das Ziel dieser Untersuchung war es festzustellen, wie stark die Verkehrsuntauglichkeit von Straßenfahrzeugen angestiegen ist sowie auf die Wichtigkeit ihrer Minderung hinzuweisen, mit dem Zweck, die Sicherheit des Straßenverkehrs zu erhöhen. Die Republik Kroatien hat das Nationalprogramm der Sicherheit im Straßenverkehr 2011-2020 verabschiedet und sich dadurch vor eine schwierige Aufgabe gestellt, die sie ohne Schulungsveranstaltungen, welche die Wichtigkeit der Verkehrstauglichkeit von Fahrzeugen zum Thema haben, wohl kaum erfüllen kann.

1. INTRODUCTION

Since its establishment, the Republic of Croatia has experienced two economic crisis. The first economic crisis ended by the middle of 1999, while the second began in the third quarter of 2008. The main indicator of recession in the country is a fall in GDP[1] which has been in the range of -7 to 0% from the onset of the economic crisis.

Under the impact of the economic crisis, vehicle owners are attempting to achieve economic savings through improper maintenance of motor vehicles, i.e. non-adherence to the manufacturers' instructions. The aim of this study is to analyse the data on the technical roadworthiness of vehicles collected by authorized institutions in the Republic of Croatia and to determine the level of technical roadworthiness in order to highlight the need for examining this issue from several aspects.

Misuse and improper maintenance lead to a shorter life cycle of the vehicle, therefore drivers who lack awareness should be educated and demonstrated, in a proper way, what kinds of problems may occur if they do not comply with the manufacturers' instructions.

2. THE ECONOMIC CRISIS IN THE REPUBLIC OF CROATIA

In analysing the state of the Croatian economy, from its establishment to the present, points of economic growth (expansion) and economic downturn (recession) have been established. The relevant model for determining these points is a simple GDP growth rate analysis. There are various methods of determining the rate of growth and decline, but, as such calculations are very complex, a simple GDP growth rate analysis will be used for the purposes of this study, as this method is most frequently applied in everyday life.

This method uses a simple rule of thumb that states the following: if you record two consecutive negative (positive) annual growth rate values, the first quarter in which the negative (or positive) growth rate was recorded indicates the beginning of the recession (or expansion). A simple GDP growth rate analysis indicates the third quarter of 2008 as a relevant turning point in the economy of the Republic of Croatia.
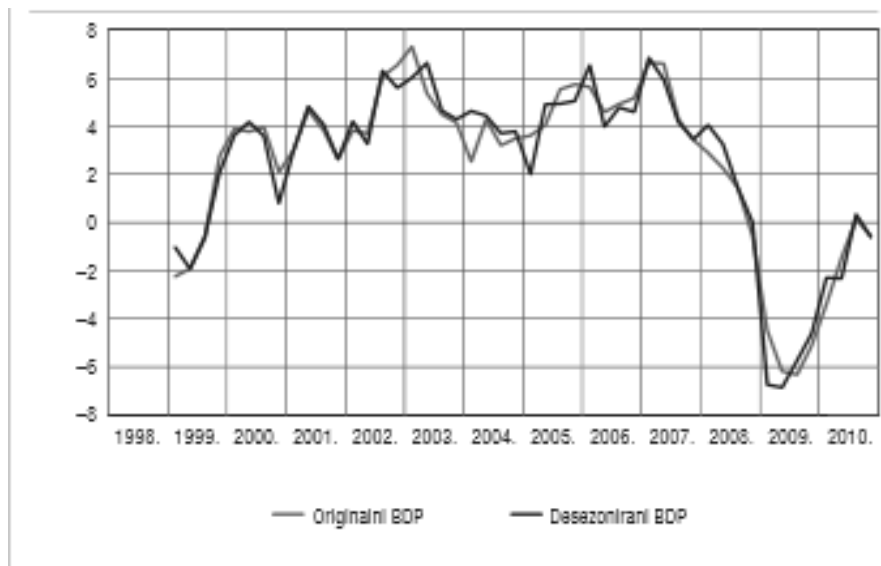

Fig. 1. A model showing a simple GDP growth rate analysis for the Republic of Croatia
Bild 1. Modell der einfachen Analyse der BIP-Wachstumsraten in der Republik Kroatien

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[1] GDP - Gross Domestic Product, a macroeconomic indicator that shows the value of final goods and services produced in a country during a given year, expressed in monetary units

The described rule of thumb suggests that the Republic of Croatia emerged from post-war depression in the third quarter of 1999, after which it experienced economic expansion until the second quarter of 2008 (established peak). After that, the Croatian economy entered a recession, which in fact began two quarters before this was indicated by the annual growth rate of the GDP, as shown by the latest data published by the Central Bureau of Statistics. Consequently, the Croatian economy has been characterized by negative economic growth, i.e. recession [1].

Rates of change in real GDP, according to the Croatian National Bank, for the period from2002 to 2012, are shown in Fig. 2 [2].
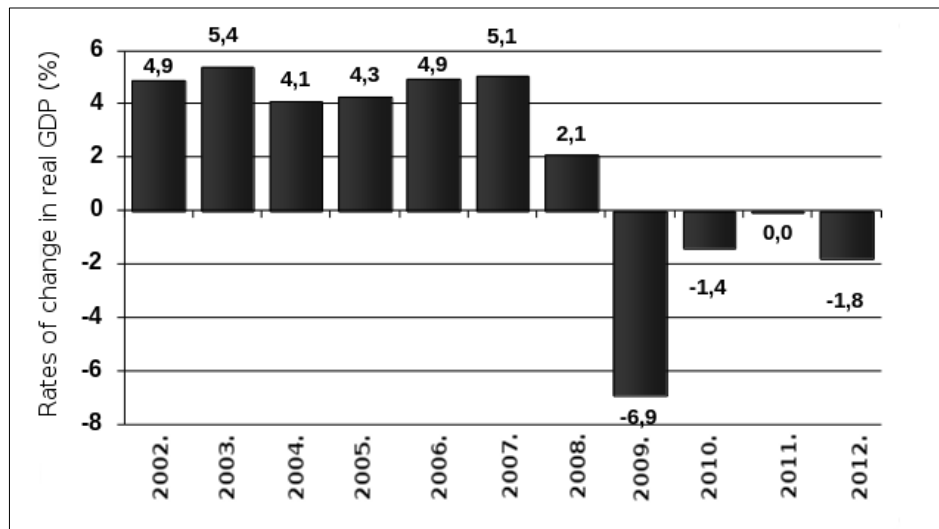

Fig. 2. GDP values for the Republic of Croatia during the last 10 years
Bild 2. BIP-Werte in der Republik Kroatien in den letzten 10 Jahren

3. VEHICLE ROADWORTHINESS

The vehicle as a technical system affects the functioning of the transport system. In order for this technical system (vehicle) to function reliably and safely in the exploitation process, intellectual and material investments are necessary [3]. Reliability is defined as the probability that a component or system will perform its required function within a specified period of time, if used within a controlled environment [4]. The technical roadworthiness of a system, i.e. vehicle, is a requirement which must be met for a system to be characterized as reliable.

Vehicle exploitation refers to the utilization of vehicles with respect to their installed capacity, as prescribed by the technical maintenance handbook, and it depends on the way maintenance is carried out. Vehicles cannot be at their full power throughout their service life, but after a certain number of kilometers, the technical condition, and thus also the quality of the vehicle, changes. A distinctive characteristic of any system is maintenance, which represents a series of actions which need to be undertaken in order to restore the system or maintain it in an effective working condition [5]. The technical condition of a vehicle throughout its service life can be defined by several aspects: its structural characteristics according to the manufacturer's declaration (new vehicle), the maintenance of technical roadworthiness during the exploitation (vehicle repairs – workshops) and the technical roadworthiness of the vehicle at the technical inspection stations, as both new and old vehicles participate in traffic [3].

The technical roadworthiness of motor vehicles is a very significant factor which contributes to traffic safety, while the control of vehicle roadworthiness at technical inspection stations represents an important preventive measure ensuring adequate vehicle roadworthiness in traffic and increasing traffic safety [6].

The Road Traffic Safety Act ("Official Gazette of the Republic of Croatia", nos. 67/08, 48/10, 74/11) stipulates that the owners of two-year-old or older vehicles are required to perform technical inspections every 12 months from the last regular technical inspection. Exceptions are the owners of new or one-year-old vehicles, who are required by law to subject their vehicles to a technical inspection in the month in which the term of 24 months from the registration or the first technical inspection expires [4].

The Ordinance on Technical Inspections, adopted pursuant to Article 255 paragraph 6 of the Road Traffic Safety Act, distinguishes between regular technical inspections for testing exhaust gases from motor vehicles and preventive and extraordinary technical inspections. Depending on the type of technical inspection, specific tests for determining roadworthiness are also carried out [5].

3.1. Technical inspections incorporating tests for exhaust gases from motor vehicles

This type of technical inspection is the most demanding, whereby the supervisor verifies roadworthiness in 17 points. It is important to note that the person responsible for the roadworthiness of motor vehicles must have authorization or a license issued by the Ministry of Interior and possesses at least a B category driving license for motor vehicles.[2]

When inspection is carried out in this manner, the following components and circuits are tested: steering mechanism, braking mechanism, lighting mechanism and signalling mechanism, mechanisms that provide normal visibility, underpart and chassis cab including the bodywork, suspension components, vehicle noise, electrical devices and electrical installations, gears, control and signalling systems, vehicle exhaust gases, mechanisms used for connecting the tow vehicle and trailer, other equipment and vehicle parts, vehicle equipment, registration plates, markings and gas installations.

3.2. Preventive technical inspections

Preventive technical inspections are performed on a daily basis (daily preventive checks) and within prescribed time limits (periodic technical inspection and periodic technical inspection of brakes).

Daily preventive technical inspections check the following components and circuits: the steering wheel, working and auxiliary brake, tachometer, lighting devices on the vehicle, windshield, mirrors, windshield wipers, tires, exhaust system, instruments signals in the cabin, towing mechanism for connecting the tow vehicle and trailer, vehicle equipment.

Periodic technical inspection and periodic technical inspection of brakes are carried out within specified time limits, and for a specified group of vehicles, they are regulated by the Road Traffic Safety Act. The test includes the inspection of the following components and circuits: steering mechanism, stopping mechanism, signal instruments, devices that provide normal visibility, underpart and chassis cab and bodywork, suspension components, engine, noise, transmission mechanism, control and signalling devices, towing mechanism for connecting trailer and towed vehicles, vehicle equipment.

3.3. Extraordinary technical inspections

An extraordinary technical inspection tests all the elements and circuits as would be done in a technical inspection but also includes a vehicle emission test.

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[2] B-category - this category includes motor vehicles, except for the A1, A2, A, F, G and M categories where the maximum permissible weight may not exceed 3,500 kg and which are designed and engineered to carry up to eight passengers, not including the driver's seat; vehicles in this category may be combined with a trailer, where the maximum permissible weight may not exceed 750 kg

It is performed when there is doubt concerning the essential roadworthiness of a vehicle with respect to those vehicle circuits which can be checked or measured by instruments. A police officer is required to accompany the vehicle to the nearest vehicle inspection station where an extraordinary technical inspection is then performed on the vehicle.

4. ANALYSIS OF VEHICLE ROADWORTHINESS

The study analysed data from technical inspections including tests of emissions from motor vehicle. The roadworthiness analysis included all vehicles in the Republic of Croatia, regardless of their use and technical category as stipulated by the Ordinance on Technical Requirements for Vehicles in Road Traffic.

With respect to the total number of inspections carried out from 2007 to 2012, a constant increase in the number of technical inspections was observed, with the exception of 2012, when there was a decrease of 0.17%. The average increase until 2012 amounted to 1.97% (Table 1) [6].

Table 1

Percentage of unroadworthy vehicles in the Republic of Croatia

Year	2007	2008	2009	2010	2011	2012
Rate of change in real GDP [%]	5.1	2.1	-6.9	-1.4	0	-1.8
Inspected vehicles	1,706,592	1,774,767	1,781,052	1,819,397	1,848,171	1,844,967
Unroadworthy vehicles	309,086	372,779	373,706	381,395	375,998	386,596
Percentage	**18.11 %**	**21.00 %**	**20.98 %**	**20.96 %**	**20.34 %**	**20.95 %**

When comparing the number of technical inspections performed and the number of unroadworthy vehicles, in 2007 and 2008 there was a large increase in unroadworthy vehicles. In 2008, unroadworthy vehicles amounted to 21.00%, an increase of 2.89% compared to 2007. The negative trend has been maintained even today and 20.85% of vehicles are, on average, unroadworthy [9].
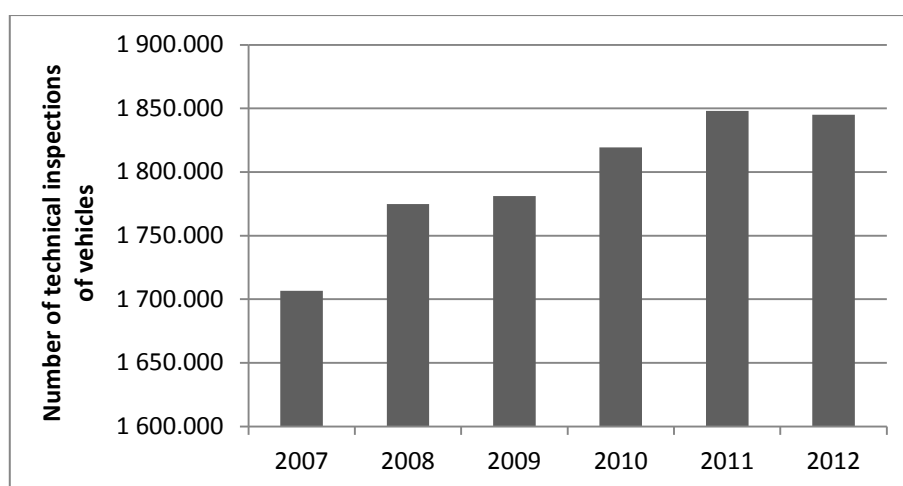

Fig. 3. The number of technical inspections of vehicles in the Republic of Croatia
Bild 3. Anzahl der technisch geprüften Fahrzeuge in der Republik Kroatien

In the technical inspections, it was discovered that the most defective mechanisms belonged to the light signalling group. The number of these defects did not decline in the period from 2008 to 2012. Its share in the total number of defects in 2008 was 31.40%, in 2009 32.12%, in 2010 31.74%, in 2011 32.63% and in 2012, it was 33.06%.

The economic crisis that affected Croatia in 2008 has had an impact on the roadworthiness of vehicles and the age of car fleets, which is evident when comparing this data with GDP prior to and after the onset of the crisis. GDP is an indicator of economic development of any country.

When comparing the data on GDP for 2007 with the roadworthiness of vehicles in the same year, which is evident is that prior to the onset of the economic crisis, the number of unroadworthy vehicles was smaller than in 2008, when the economic crisis began. In 2007, GDP in the Republic of Croatia was 4.10%, while the number of unroadworthy vehicles for the same period was 18.11% of the total number of vehicles that had undergone a technical inspection. In 2008, the economic crisis began with the fall of GDP to 2.10%. That year, the number of unroadworthy vehicles increased to 21.00%. In the period between 2009 and 2012, GDP in the Republic of Croatia did not surpass 0.00%, which means that the economic crisis continued, and for the same period the percentage of unroadworthy vehicles remained at 21.00%.
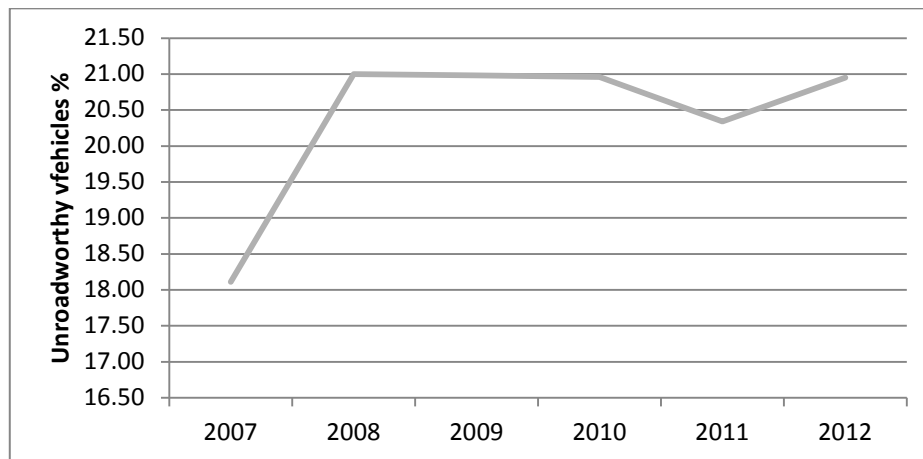

Fig. 4. The percentage of unroadworthy vehicles in the Republic of Croatia
Bild 4. Anteil der verkehrsuntauglichen Straßenfahrzeuge in der Republik Kroatien

Since the beginning of the economic crisis, the average age of the vehicle fleet in the Republic of Croatia has been at a constant increase. The decline in sales of new motor vehicles has increased the average fleet age to 12.18 years, which is a 15.45% increase compared to 2007 (Table 2) [6].

Table 2

Average age of road vehicles in the Republic of Croatia

Years	2007	2008	2009	2010	2011	2012
10 and more	833,936	876,583	822,271	937,700	990,235	1,047,680
6-9 years	364,157	365,291	385,902	391,120	298,615	409,407
2-5 years	377,033	393,943	410,041	438,028	503,055	342,011
1 year	131,466	138,320	73,184	52,548	56,266	45,868
Average age	**10.55**	**10.57**	**11.06**	**11.17**	**11.58**	**12.18**

When comparing the data on GDP and data on the age of vehicle fleet in the Republic of Croatia for the period before and during the economic crisis, there is an evident link between the age of the vehicle fleet and the economic crisis that has affected the Republic of Croatia in 2008.

In the observed period between 2007 and 2012, there was a fall of GDP, which has been negative after 2008. In 2007, GDP was at 5.10%, in 2008 2.10%, in 2009 6.90%, in 2010 -1.40%, in 2011. 0.00%, whereas in 2012, it was -1.8%. In 2007, the average age of vehicles was 10.55 years. At the beginning of the economic crisis in 2008, the average age of vehicles began to increase, hence in 2008, the average age was 10.57 years and in 2009, the average age increased to 11.06 years. In the following period between 2010 and 2012, with the continuation of the crisis, the average age continued to increase, so that in 2012, it was 12.18 years.

The vehicle fleet in the Republic of Croatia are becoming increasingly older, therefore it can be assumed that, the percentage of unroadworthy vehicles will in future increase, which could have a very negative impact on overall road safety.
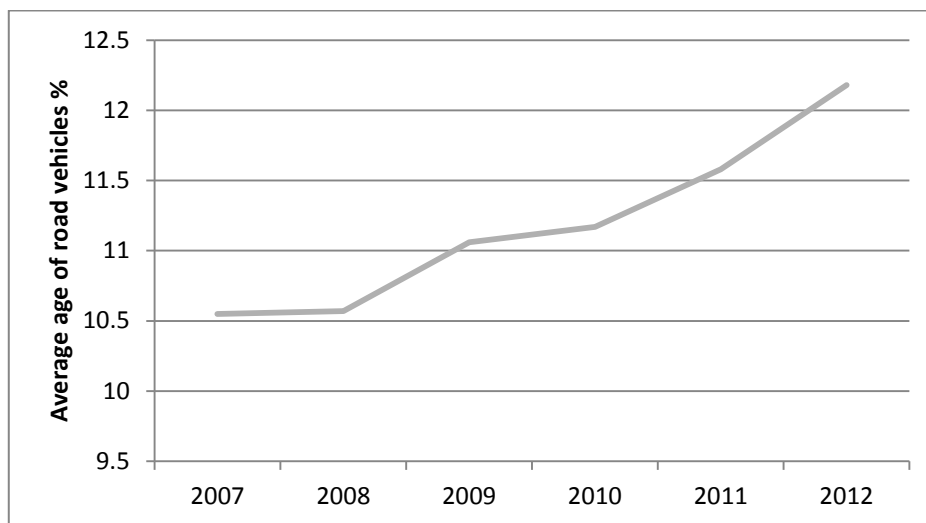

Fig. 5. Average age of road vehicles in the Republic of Croatia
Bild 5. Durchschnittsalter des Fuhrparks in der Republik Kroatien

5. CONCLUSION

Maintaining the roadworthiness of vehicles requires a substantial financial commitment by motor vehicle owners. The economic situation in the country has affected the owners' ability to invest in vehicle maintenance and thus vehicle roadworthiness. By analysing the results of vehicle roadworthiness in Croatia, a negative trend has been identified, as reflected in the results obtained from the competent institutions responsible for roadworthiness.

When a vehicle is exploited, its technical condition is changed. The results that have been processed and presented in this research paper clearly indicate that the average age of the vehicle fleet in the Republic of Croatia has increased. With the continued worsening of the economic situation in the Republic of Croatia, along with the displayed research results, it can be assumed that the number of unroadworthy vehicles will continue to increase.

As it can hardly be expected that this problem will resolve on its own, the Croatian Government has to be intensely involved in solving this problem and finding an appropriate solution.

An improvement of the economic situation in the Republic of Croatia would most certainly bring about positive progress in terms of vehicle age and roadworthiness. As the time of economic recovery in the Republic of Croatia is unknown, the need arises to implement other measures and mechanisms for improving the current situation.

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