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ANALYSIS OF THE ECO TEST RESULTS FOR VEHICLES IN THE REPUBLIC OF CROATIA

ABSTRACT

The work presents the classification of engines for the ECO test requirement at the technical inspection of vehicles. The types of harmful components in the raw emission of internal combustion engine are listed and described, as well as the possibilities of their reduction. In accordance with the classification of engines for the ECO test requirements the allowed values of harmful components according to the legally stipulated standards in Croatia are given. The study included the number of vehicles that passed the ECO test at technical inspection in 2004 and these were then statistically processed and analyzed according to the type of vehicle, classification of car engines for the ECO test requirements and the year of production.

KEY WORDS

technical inspection, ECO test, Croatia, legal provisions

1. INTRODUCTION

With the aim of improved environmental protection against one of the biggest anthropogenic polluters, the traffic system, the European Union countries have introduced the ECO test for the majority of road vehicles. The ECO test means control of the composition of exhaust gases, and according to legal standards (or factory stipulated catalogue values), a grade which shows whether the road vehicle meets these standards or not. During 2004, the Republic of Croatia performed the ECO test for the majority of road vehicles at regular technical inspections. However, it was not before 1 October 2004 that the ECO test results started to have influence on the pass/fail ratio of the vehicles undergoing technical inspection.

2. CLASSIFICATION OF ENGINES FOR ECO TEST REQUIREMENTS

2.1. PETROL ENGINES

ECO test is applied to engines of all processes except for the Otto two-cycle engines, which belong to a group of engines with the technically obsolete operation. The most common design of petrol engines is the Otto four-cycle process, in which, like in all other petrol mixture propelled engines, the mixture is ignited by a spark from a spark-plug. The preparation, i. e. mixing of the combustible mixture of air and fuel is done before entering the combustion cylinder.

A petrol Otto engine can operate in the area of the volume of excess air λ=0.85-1.2. For smaller values of λ the consumption is increased, and for the higher values of λ the mixture is difficult to ignite. The excess air is the ratio between the actually burnt volume of air in combustion and the theoretically required volume of air for complete combustion.

Petrol engines can be atmospheric or with air pressure charging: dynamic, mechanic pressure charging by compressor or by means of gas turbine propelled by kinetic energy of exhaust gases.

More recent petrol engine designs have the preparation of the combustible mixture in the combustion chamber because of direct fuel injection.

For ECO test requirements the petrol engines are divided into the following types: NO-KAT and REG-KAT.[1]

If the exhaust system is not fitted with a λ probe, the motor vehicle, regardless of whether it may have an unregulated catalytic converter, belongs to the NO-KAT category.

The unregulated catalytic converters are: single oxidation catalytic converter and double reduction-oxidation catalytic converter.

Petrol engines of type REG-KAT have a regulated catalytic converter of triple effect with λ probe, which is the best solution for the reduction of harmful components in the final emission of exhaust gases of the Otto four-cycle engine, and high level of conversion of 95% is insured by maintaining the stoichiometric relation $\lambda=1$ by means of λ probe.

2.2. DIESEL ENGINES

In Diesel engines the mixture is self-ignited due to the compression of air boosting the pressure. In the compression cycle the air is compressed to a temperature higher than the fuel self-ignition temperature, and the fuel is injected at the end of the compression cycle, so that there is no preparation of the mixture in the intake phase. The air is unregulated, and the power is regulated by the change in the fuel volume. Since power regulation is done by changing the fuel volume, this automatically changes also the volume of the excess air λ, the three-way catalytic converter cannot be used. The combustion proceeds at a substantially higher excess air λ than in petrol engines, and it is always within the range of lean mixture ($\lambda > 1$), since, because of the short time of mixing and ignition of the mixture in the cylinder immediately before the ignition there has to be excess oxygen for complete combustion. The generally accepted design is the Diesel four-cycle process.

For ECO test requirements Diesel engines are divided into those with pressure charging (DIESEL-SUPERCHARGED) or without pressure charging (DIESEL-ATMOSPHERIC) of the air.[2]

Unlike atmospheric Diesel engines where the intake-air is of the ambient pressure, in supercharged Diesel engines the air is compressed before being introduced into the combustion area to a pre-pressure in relation to the ambient pressure state. Air supercharging increases the engine power retaining the same volume, and reduces the emission of nitrogen oxides and the blackening of the exhaust gas. Supercharging can be mechanical by means of a compressor or by kinetic energy of the exhaust gases.

2.3. Engines with alternative propulsion

The vehicles equipped with alternative propulsion are the vehicles propelled by hydrogen, methane, liquefied propane-butane, fuel cells or electrical engines, and such vehicles are exempted from ECO test during their regular technical inspection.

If liquefied propane-butane propulsion was installed into the vehicle with a petrol engine subsequently, such a car, although it permanently retains both propulsions (both petrol and gas), belongs to the group of engines with alternative propulsion and is permanently exempted from ECO tests[3].

The most common alternative propulsion is the liquefied propane-butane gas, which burns completely, and there is no fuel waste in the exhaust gases, nor is there any emission of harmful particles of soot or ash. The exhaust gases do not contain toxic elements such as lead or sulphur, and emissions of toxic CO (carbon monoxide) are substantially reduced. Also the emissions of NO_x (nitrogen oxide) and CO_2 (carbon dioxide) are reduced. Besides, the price of propane-butane is much lower than the price of petrol.

3. TYPES OF HARMFUL COMPONENTS IN RAW EMISSIONS

3.1. Raw emission composition

The exhaust gases at the engine outlet, before any treatment, form the raw emission, and the final emission is at the outlet into the environment after treatment. The types of harmful elements depend on the type of fuel, fuel additives, and burnt engine oil, and the volume of harmful elements depends on the working regime and the engine type and design.

The raw emission of exhaust gases of the petrol Otto engine contains the highest share of nitrogen (about 72.3%), followed by water vapour (about 12.7%), CO_2 (12.3%), and then inert gases (about 1%), oxygen (about 0.7%), and about 1% of harmful components for the environment, which consist of CO (about 0.85%), NO_x (about 0.085%), then hydrocarbons (about 0.05%) and solid particles (about 0.015%).[4]

The raw emission of exhaust gases generated by Diesel engines contains the majority share of nitrogen (about 76%), followed by oxygen (about 9.7%), CO_2 and water vapour (about 7% of each), and finally about 0.3% of harmful components for the environment, which consist of nitrogen oxides (about 0.15%), solid particles (about 0.05%), then carbon monoxide (about 0.05%), hydrocarbons (about 0.03%) and sulphur dioxide (about 0.02%).[5]

3.1.1. λ – the most influencing factor on the raw emission of harmful components

Regarding the amount of excess air the mixture in the engine can be:

- stoichiometric ($\lambda = 1$)
- lean ($\lambda > 1$, too much air, too little fuel)
- rich ($\lambda < 1$, there is less air than necessary, and too much fuel).

The ideal amount of excess air is 1 in Otto engines, whereas $\lambda > 1$ in Diesel. λ probe in Otto engines with direct fuel injection insures the value of excess air factor 0.97 to 1.03.

The least concentration of hydrocarbons of raw emission in Otto engines is for $\lambda = 1,1$. The reduction of excess air below 1 increases the concentration of carbon monoxide, whereas for $\lambda > 1.1$ results in the fall of the concentration of nitrogen oxides.

For $\lambda > 2$ in Diesel engines the share of carbon monoxide increases.

3.2. Possibilities of reducing harmful emission components

There are three basic groups of measures for the reduction of harmful emissions: design additions and modifications, operative measures and subsequent treatment of exhaust gases.

The most important design measures are: design of the cylinder head and combustion chamber, position of spark plugs (i. e. glow plugs), position and design of injectors, design of intake and exhaust channels, and the number and position of valves.

Operative measures mean: preparation of the fuel mixture, moment of ignition, start and duration of injection, and internal and external return of exhaust gases for the reduction of nitrogen oxide emissions.

Subsequent treatment of exhaust gases can be done by using the catalytic converter, then by adding secondary air because of subsequent oxidation of hydrocarbons and CO_2 (but without influence on NO_x), by insulation of the exhaust system, and by application of thermal reactors and particle filters.

The catalytic converters are divided into one-way, two-way and three-way ones.

One-way oxidation catalytic converter is an unregulated catalytic converter, and serves for reducing the carbon monoxide and hydrocarbons, whereas the contents of nitrogen oxides remain unchanged. The vehicles with petrol engines and this catalytic converter belong to the group NO-KAT.

Two-way reduction-oxidation catalytic converter is an unregulated catalytic converter with two chambers. The shortage of oxygen in the first reduction chamber is favourable for the reduction of NO_x, whereas, before the second, oxidation chamber, which oxidises CO and hydrocarbons, fresh ambient air is added. Vehicles with petrol engines and this catalytic converter also belong to the group NO-KAT vehicles.

The three-way catalytic converter (which treats catalytically CO, NO_x and hydrocarbons) is a regulated catalytic converter with λ probe in front of the catalyst chamber, for petrol engines with direct injection. λ probe maintains the stoichiometric mixture (about $\lambda = 1$). The vehicles with such catalytic converters are in the category REG-KAT.

4. PERMITTED VALUES OF HARMFUL COMPONENTS ACCORDING TO LEGAL CRITERIA IN CROATIA

The ECO test in the Republic of Croatia started to be carried out on 18 April 2001 for the vehicles with petrol engines, and on 18 April 2002 for Diesel engines.

The original idea was to use the ECO test results as factors influencing the passage rate on regular technical inspections for petrol engines starting from 01 January 2003, i. e. from 01 January 2004 for Diesel engines. However, because of a great number of defective vehicles observed in the preparation phase, the time of transition was postponed to 01 October 2004 and since then the ECO test results influence the passing of the vehicle the regular technical inspection.

It was stipulated that passenger cars, buses, combined cars, heavy vehicles and working vehicles are to be subjected to ECO test.

The ECO test is not obligatory for the following vehicles: vehicles equipped with petrol two-cycle engines, "older" cars, cars with alternative propulsion, motorcycles, mopeds, working machines, tractors and trailers.[6]

The catalogue values of exhaust gases indicated by the vehicle manufacturer need to be distinguished from legally stipulated values of exhaust gases, and which values are valid for which types of engines in order to pass the ECO test.

For petrol engines of type NO-KAT for the ECO test, the legally stipulated values of exhaust gases are valid (these are less strict than the catalogue. i. e. factory values). For cars produced after 1970, the share of O_2, CO_2, hydrocarbons and CO in exhaust gases are measured, and the measured share of CO affects the passing of the ECO test. Cars produced after 1986 including also 1986, may contain a maximum of 4.5% CO, and the cars produced after 1986 a maximum of 3.5% CO. Cars with petrol engines produced until 1970 are exempted from the ECO test.

Regardless of the year of production of the petrol engines of type REG-KAT, the factory stipulated catalogue values of exhaust gases are valid at the ECO test, and if the data on the mark and type of engine are not known then the legally stipulated values are valid (mentioned here). The share of O_2, CO_2, hydrocarbons and CO in exhaust gases in idle gear, as well as the share of O_2, CO_2, hydrocarbons and CO, are measured but also the amount of excess air at higher rotation speeds. In idle gear the exhaust gases may contain a maximum of 0.5% CO, and at rotation speed of 2500-3000 min^{-1} a maximum of

0.3% CO with the amount of excess air $0.97 < \lambda < 1.03$.

In Diesel engines only the percentage of blackening (solid particles of unburned carbon – soot) is measured and it affects the ECO test results. Valid for the passing of the ECO test are the catalogue values, and if the data on the mark and type of engine are not known, then the legally stipulated values are valid (mentioned here). Three consecutive samples of blackening are measured, out of which the average dissipation should not exceed 1%. The cars with atmospheric Diesel engines produced in 1980 and later may have the mean degree of blackening of maximum $2.5 m^{-1}$, and those with superchargers produced in 1980 and later, maximum $3 m^{-1}$. The cars with Diesel engine produced before 1980 are not subjected to the ECO test.

5. RESULTS AND METHODS OF STUDYING THE PASSING RATIO OF VEHICLES AT ECO TEST IN CROATIA

Vehicles that have to pass technical inspection in the Republic of Croatia are divided into the types of vehicles that are exempted from the ECO test (mopeds, motorcycles, working machines, tractors and trailers) and vehicles for which the ECO test is obligatory (passenger cars, buses, heavy duty vehicles, combined cars and working vehicles). The group of vehicles that have to pass the ECO test includes the vehicles that are exempted from this obligation (e. g. gas-fuelled cars, vehicles with two-cycle petrol engines, "older vehicles"...).

The results of technical inspection collected in the Microsoft Access program have been studied. The data were processed by means of the Microsoft Excel program and scientific methods of analysis, synthesis, comparison and statistical methods were used in the research.

According to types of vehicles, Table 1 presents the share of vehicles that took the ECO test in 2004, in relation to the number of vehicles that attended technical inspection, especially for passenger cars, buses, heavy duty vehicles, combined cars and working vehicles. Out of 1,139,368 vehicles that had technical inspection 89.5% are passenger cars, 9.3% are heavy-duty vehicles, then 0.7% combined cars, and the rest are buses and working vehicles. The ECO test tested over 99% passenger cars, and about 98% of other types of vehicles.

The highest passing rate at the ECO test (Table 2) was accounted for by the buses (84.21%), then heavy-duty vehicles (82.5%), and then working vehicles (81.48%), combined vehicles (75.23%) and finally passenger cars (72.41%). Since the highest number of passenger cars took the ECO test, the total passing rate in 2004 was only 73.41%.

Table 1 - Share of vehicles taking the ECO test in 2004 compared to the total number of vehicles at technical inspection

Type of car at technical inspection	Total no. of vehicles at:		Share of veh. at ECO test (%)
	technical insp.	ECO test	
Passenger cars	1019951	1011011	99.12%
Buses	3982	3927	98.62%
Heavy-duty vehicles	105730	103625	98.01%
Combined automobiles	7897	7718	97.73%
Working vehicles	1808	1771	97.95%
Total	1139368	1128052	99.01%

Table 2 - Passing rate of vehicles at ECO test in 2004

Type of vehicle	Tested total	Passed ECO test		Failed ECO test	
		number	%	number	%
Passenger cars	1011011	732075	72.41%	278936	27.59%
Buses	3927	3307	84.21%	620	15.79%
Heavy-duty vehicles	103625	85494	82.50%	18131	17.50%
Combined automobiles	7718	5806	75.23%	1912	24.77%
Working vehicles	1771	1443	81.48%	328	18.52%
Overall	1128052	828125	73.41%	299927	26.59%

Table 3 - Passing rate of passenger cars at ECO test in 2004 from the aspect of classification of engines for ECO test requirements

Classification of engines for ECO test requirements	Tested total	Passed ECO test		Failed ECO test	
		number	%	number	%
REG-KAT	469462	366443	78.06%	103019	21.94%
NO-KAT	253860	133734	52.68%	120126	47.32%
DIESEL-ATMOSPHERIC	159074	127262	80.00%	31812	20.00%
DIESEL-SUPERCHARGER	128615	104636	81.36%	23979	18.64%
Overall	1011011	732075	72.41%	278936	27.59%

Table 4 - Share of passenger cars that passed the ECO test in 2004, but with a recommendation to visit to the authorized auto repair service because of the observed irregularities

Classification of engines for ECO test requirements	Passed ECO test	Visit to auto repair service recommended	
	number	number	%
REG-KAT	366443	194327	53.03%
NO-KAT	133734	109947	82.21%
DIESEL-ATMOSPHERIC	127262	60741	47.73%
DIESEL-SUPERCHARGED	104636	46010	43.97%
Total	732075	411025	56.15%

5.1. Study of the passing rate of passenger cars from the aspect of engine classification for eco test requirements

Out of the total of 1,011,011 passenger cars that took the ECO test in 2004, 46.44% were with petrol engines of type REG-KAT, 25.11% with engine NO--KAT, 15.73% with engine of type DIESEL-ATMOSPHERIC and 12.72% with engine DIESEL-SUPERCHARGED.

The highest passing rate at the ECO test in passenger cars with engine type DIESEL-SUPERCHARGED (81.36%), then with the engine DIESEL--ATMOSPHERIC (80%), followed by passenger cars with petrol engines REG-KAT (78.06%), and the lowest passing rate is for engines of type NO-KAT, only 52.68% (Table 3).

Out of the total of 732,075 passenger cars that passed the ECO test, only about 43.85% were ecologically completely satisfactory, whereas for the remaining 56.15% a visit to the authorized auto repair service was advised because of the observed irregularities (Table 4). From the aspect of the ECO test only about 31.76% of passenger cars completely satisfied the test.

Out of the total number of passenger cars that passed the ECO test in 2004, which were recommended for the visit to an authorized auto repair service, the highest share is of those with petrol engines of type NO-KAT (82.21%), then with engine REG--KAT (53.03%), and with type DIESEL-ATMOSPHERIC (47.73%) and DIESEL-SUPERCHARGED (43.97%).

The analysis of the ECO test passing rate of passenger cars with petrol engines NO-KAT shows that only 23,787 out of 253,860 (i. e. only 9.37%) are completely ecologically satisfactory.

5.2. Study of the level of passage of passenger cars from the aspect of year of production

This research included all the passenger cars that took the ECO test in 2004, with the year of production between 1985 and 2003, which is 93% of the tested passenger cars.

Passenger cars were divided according to types of engines for ECO test requirements. For each engine type a table presents the passing rate of vehicles according to their years of production (Tables 5, 6, 7 and 8), as well as the graph-dependence of the share of passenger cars that passed the ECO test on the year of production (Figures 1, 2, 3 and 4). This dependence has been treated statistically in Microsoft Excel and approximated by a regression line for each engine type, and the correlation coefficients have been computed as well.

The values of all four correlation coefficients are greater than 0.93, which indicates that the passing rate of passenger cars at ECO test in 2004 depends almost linearly on the year of production. The direction coefficients of regression lines are smaller for the vehicles with Diesel engines than for those with petrol engines, which, in case of larger sections on the ordinate axis for Diesel engines, shows that the passing rate at ECO test is less influenced by the year of production in Diesel engines than in petrol engines.

Table 5 - Passing rate of passenger cars at ECO test in 2004 according to year of production, and for petrol engines of type REG-KAT

Year of production	REG-KAT engine		
	tested	passed	
		number	%
1985	173	66	38.15%
1986	379	147	38.79%
1987	1218	532	43.68%
1988	3493	1573	45.03%
1989	7429	3576	48.14%
1990	15467	8012	51.80%
1991	28476	14819	52.04%
1992	19500	11267	57.78%
1993	22243	13841	62.23%
1994	22760	15519	68.19%
1995	27404	20409	74.47%
1996	38206	29869	78.18%
1997	52922	43053	81.35%
1998	48888	41031	83.93%
1999	44527	38115	85.60%
2000	50716	44614	87.97%
2001	46540	42626	91.59%
2002	38464	36832	95.76%
2003	469	439	93.60%
Total	469274	366340	78.07%

Table 6 - Passing rate of passenger cars at ECO test in 2004 according to year of production, and for petrol engines of type NO-KAT

Year of production	NO-KAT engine		
	tested	passed	
		number	%
1985	8684	4395	50.61%
1986	11623	5879	50.58%
1987	17275	8607	49.82%
1988	29575	15250	51.56%
1989	39455	20252	51.33%
1990	37848	20618	54.48%
1991	39127	19069	48.74%
1992	6107	3524	57.70%
1993	1593	1013	63.59%
1994	2057	1454	70.69%
1995	2835	1803	63.60%
1996.	2196	1368	62.30%
1997	2357	1602	67.97%
1998	1765	1297	73.48%
1999	1204	941	78.16%
2000	1048	942	89.89%
2001	606	553	91.25%
2002	77	77	100.00%
2003	1	1	100.00%
Total	205433	108645	52.89%

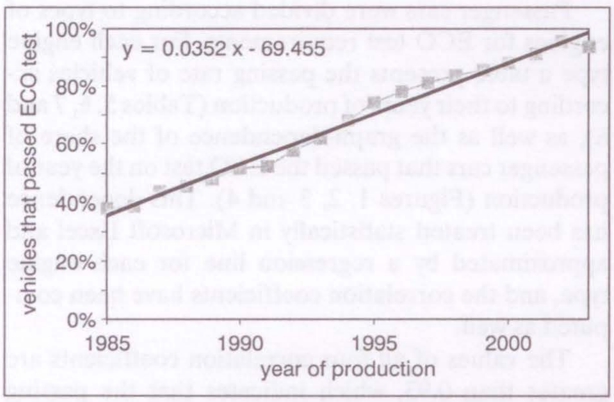

Figure 1 - Dependence of the share of passenger cars that passed the ECO test in 2004 on the year of production, and for petrol engines of type REG-KAT (correlation coefficient of regression line is r = 0.992)

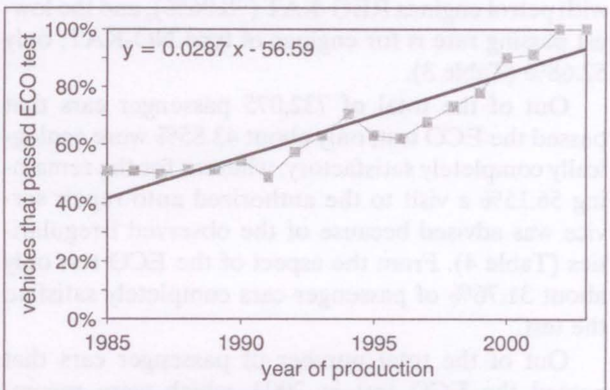

Figure 2 - Dependence of the share of passenger cars that satisfied the ECO test in 2004 on the year of production, and for petrol engines of type NO-KAT (correlation coefficient of regression line is r = 0.932)

Table 7 - Passing rate of passenger cars at ECO test in 2004 according to the year of production, and for engines of type DIESEL-ATMOSPHERIC

Year of production	DIESEL-ATMOSPHERIC engine		
	tested	passed	
		number	%
1985	5590	3775	67.53%
1986	5864	4069	69.39%
1987	6952	4758	68.44%
1988	8011	5566	69.48%
1989	8306	5869	70.66%
1990	7319	5182	70.80%
1991	8496	6155	72.45%
1992	7282	5641	77.46%
1993	7980	6265	78.51%
1994	7490	6096	81.39%
1995	7836	6612	84.38%
1996	10838	9353	86.30%
1997	10524	9353	88.87%
11998	8369	7522	89.88%
1999	7405	6729	90.87%
2000	7437	6954	93.51%
2001	9159	8635	94.28%
2002	11144	10551	94.68%
2003	219	213	97.26%
Total	146221	119298	81.59%

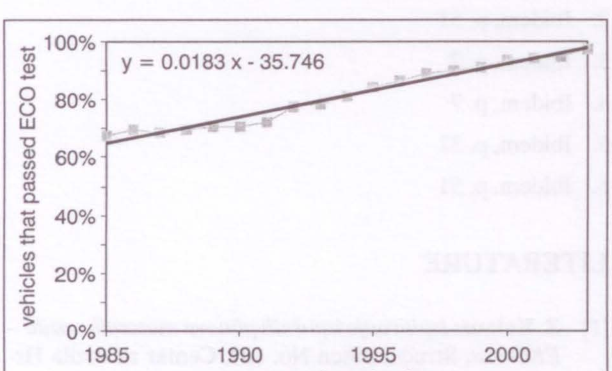

Figure 3 - Dependence of share of passenger cars that passed the ECO test in 2004 on the year of production, for the engines of type DIESEL-ATMOSPHERIC (correlation coefficient of regression line is r = 0.987)

Table 8 - Passing rate of passenger cars at ECO test in 2004 according to the year of production, and for engines of type DIESEL-SUPERCHARGED

Year of production	DIESEL-SUPERCHARGED engine		
	tested	satisfied	
		number	%
1985	4111	2913	70.86%
1986	4388	3219	73.36%
1987	5811	4140	71.24%
1988	6451	4613	71.51%
1989	6773	4912	72.52%
1990	6149	4423	71.93%
1991	7518	5495	73.09%
1992	6224	4831	77.62%
1993	6741	5322	78.95%
1994	6239	5077	81.38%
1995	6515	5563	85.39%
1996	9013	7899	87.64%
1997	7585	6688	88.17%
1998	6864	6180	90.03%
1999	6137	5575	90.84%
2000	6061	5661	93.40%
2001	7175	6691	93.25%
2002	8504	7957	93.57%
2003	195	189	96.92%
Total	118454	97348	82.18%

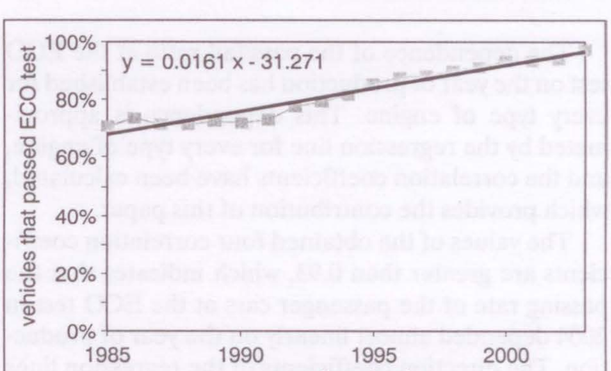

Figure 4 - Dependence of the share of passenger cars that passed the ECO test in 2004 on the year of production, for engine type DIZEL-SUPERCHARGED (correlation coefficient of regression line is r = 0.973)

The ECO test as part of technical inspection is obligatory for the following types of vehicles: passenger cars, buses, heavy-duty vehicles, combined automobiles and working vehicles. Within these types, some vehicles are exempted from the ECO test. During 2004 there were about 0.99% out of the total number of vehicles that attended technical inspection.

Out of the total number of vehicles that took the ECO test in 2004 (1,128,052) the highest share is of passenger cars (89.6%). The highest passing rate at the ECO test is for buses (84.21%), and the lowest is for passenger cars (72.41%). 73.41% of all vehicles that took the ECO test met the Croatian law-stipulated ecological standards.

In 2004 the ECO test in the Republic of Croatia included 71.5% of passenger cars with petrol engines, and 28.5% with Diesel engines, which clearly shows that there were about 2.5 times more passenger cars with petrol engines than those with Diesel engines.

For the needs of ECO test the petrol engines were divided into types of REG-KAT and NO-KAT, and the Diesel engines into DIESEL-ATMOSPHERIC and DIESEL-SUPERCHARGED. The passing rate of passenger cars at ECO test with Diesel and REG-KAT engines was about 80%, and with type NO-KAT only 52.68%. An even worse situation is when one considers the share of vehicles that satisfied the ECO test, but due to the observed irregularities a visit to the authorized auto repair service was recommended. There were about 46% of such vehicles with Diesel engines, about 53% with engine REG-KAT, and with NO-KAT even 82.21%. Out of the total number of passenger cars with type NO-KAT only 9.37% showed no irregularities.

In studying the passing rate of passenger cars at ECO test regarding the year of production the tested vehicles were produced within the period from 1985 to 2003, which accounts for about 93% of the tested passenger cars.

6. CONCLUSION

The dependence of the pass/fail ratio at the ECO test on the year of production has been established for every type of engine. This dependence is approximated by the regression line for every type of engine, and the correlation coefficients have been calculated, which provides the contribution of this paper.

The values of the obtained four correlation coefficients are greater than 0.93, which indicates that the passing rate of the passenger cars at the ECO test in 2004 depended almost linearly on the year of production. The direction coefficients of the regression lines are smaller for the vehicles with Diesel engines than those with petrol engines, which, with greater sections on the ordinate axis for Diesel engines indicates that the year of production of Diesel engines has less influence on the passing rate at the ECO test than in case of petrol engines.

The authors would recommend in further research the analysis of the passing rates of vehicles at ECO tests in the years 2005 and 2006 which has remained an open issue.

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SAŽETAK

ANALIZA PROLAZNOSTI VOZILA NA EKO TESTU U REBUBLICI HRVATSKOJ

U radu je dana podjela motora za potrebe EKO testa na tehničkom pregledu. Nabrojane su i opisane vrste štetnih komponenti u sirovoj emisiji motora s unutarnjim izgaranjem, a prikazane su i mogućnosti smanjenja istih. U skladu s podjelom motora za potrebe EKO testa dane su dopuštene vrijednosti štetnih komponenti prema zakonom propisanim normama u Republici Hrvatskoj. Istraživana je, statistički obrađena i analizirana prolaznost vozila na EKO testu tehničkog pregleda u 2004. godini sa stanovišta vrste vozila, podjele automobilskih motora za potrebe EKO testa i godine proizvodnje osobnih automobila.

KLJUČNE RIJEČI

tehnički pregled, EKO test, Hrvatska, zakonske norme

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