

Primary results of OBD tests collected during PTI of vehicles in Croatia

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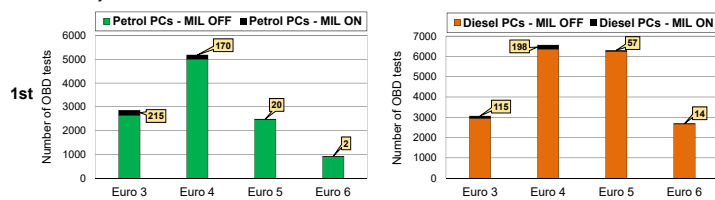
Introduction

Due to resolution or measurement precision limitations, existing emission testers used in periodic technical inspection (PTI) stations often cannot measure neither the CO volume fraction of Euro 6 petrol engine vehicles, nor the opacity of the Euro 6/VI diesel engine vehicles. The fact is that it is much more difficult to measure smoke opacity in DPF equipped vehicles. (Giechaskiel et al., 2014). Therefore, the application of these devices to the Euro 6/VI vehicles becomes less important. Also, today's electronic units continuously control the correct operation of several exhaust system components as well as the emissions. For vehicles complying with emission classes Euro 6/VI, OBD systems are becoming more effective in assessing emissions. According to the Directive 2014/45/EU, for roadworthiness tests the OBD test can be used as an equivalent to standard tailpipe emission testing for vehicles of emission classes Euro 6/VI (Official Journal of the European Union, 2014).

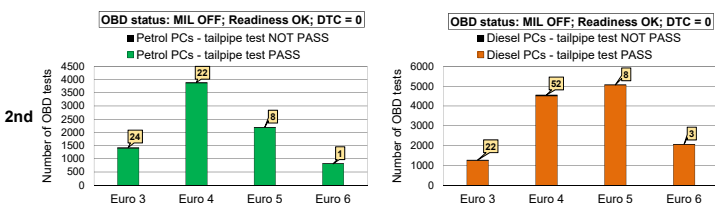
Effective from 1st January 2019 OBD testing methods are implemented in Croatia. An OBD connection is required in vehicles belonging to emission classes Euro 3 and newer wherein the following data are collected: MIL status, Readiness-code status, number of DTCs, coolant temperature and engine speed. In addition to the OBD test, the classic tailpipe test is also performed on vehicles of all Euro classes. Data on the passenger car (PC) fleet that underwent PTI during January 2019 was gathered from the database of Centre for Vehicles of Croatia (CVH), the company whose primary activity is performing PTI on vehicles in Croatia. Tailpipe and OBD test results were processed for both petrol and diesel PCs, as shown below.

OBD test results

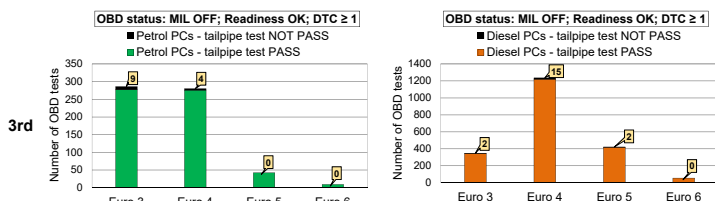
The lower the Euro emission class is, the higher is the percentage of PCs with MIL status ON (1st row). These vehicles do not undergo the tailpipe test but nevertheless are declared technically defective.



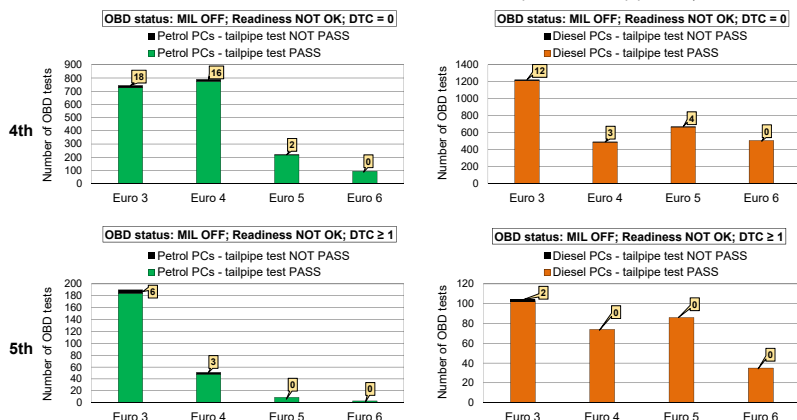
Vehicles with MIL status OFF undergo both OBD and tailpipe tests. The majority of vehicles meets the following requirements: MIL OFF, Readiness OK and DTC counter = 0. There is a certain number of PCs that, despite passing the OBD test, did not pass the tailpipe test. The data also shows the following: The lower the Euro emission class is, the higher is the percentage of PCs which did not pass the tailpipe test (2nd row).



Vehicles with OBD status MIL OFF, Readiness OK and DTC counter ≥ 1 also passed the OBD test. There is also a certain number of PCs that, despite passing the OBD test, did not pass the tailpipe test (3rd row).

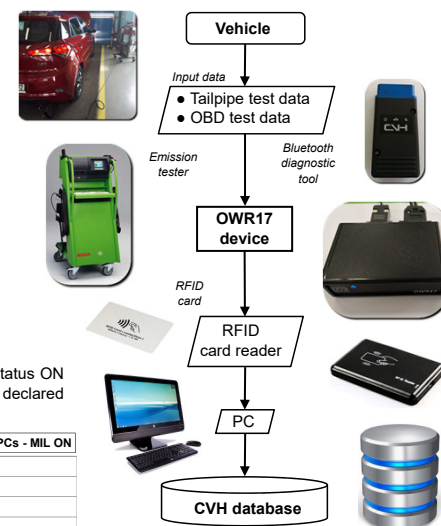


All Euro 6 vehicles with OBD status MIL OFF and Readiness NOT OK passed the tailpipe test (4th and 5th row).



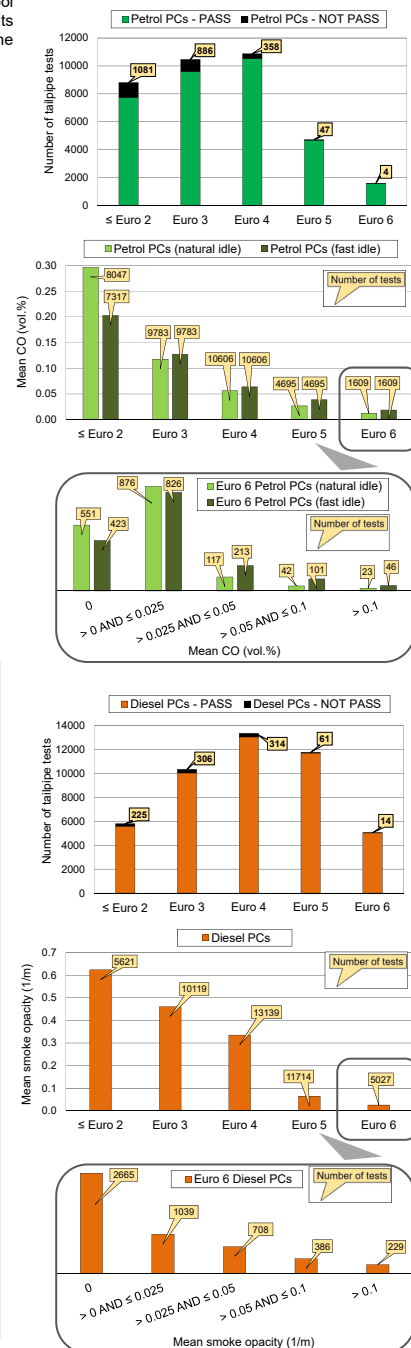
Method

During the PTI, the emission tester and OBD diagnostic tool should be connected to the vehicle. Tailpipe and OBD test results are collected and stored on the OWR17 device. Then all the collected data is transferred to CVH database using RFID card. Tailpipe and OBD test data collecting procedure is shown below.



Make	Number of OBD tests				
	Total	MIL OFF (%)	MIL ON (%)	0 DTC (%)	≥ 1 DTC (%)
VOLKSWAGEN	5442	96.88	3.12	94.06	5.94
OPEL	3156	96.29	3.71	92.55	7.45
RENAULT	3104	98.84	1.16	75.10	24.90
PEUGEOT	1918	97.91	2.09	68.98	31.02
ŠKODA	1781	97.25	2.75	92.59	7.41
CITROEN	1717	96.68	3.32	68.55	31.45
FORD	1550	98.00	2.00	93.61	6.39
AUDI	1367	97.59	2.41	93.78	6.22
MERCEDES	1243	96.86	3.14	87.77	12.23
BMW	1242	98.79	1.21	86.55	13.45
HYUNDAI	1120	98.04	1.96	91.43	8.57
TOYOTA	1064	98.12	1.88	95.49	4.51
FIAT	783	96.81	3.19	68.33	31.67
MAZDA	716	96.79	3.21	91.34	8.66
KIA	615	99.51	0.49	96.91	3.09
CHEVROLET	575	95.65	4.35	86.09	13.91
SEAT	516	95.35	4.65	90.12	9.88
NISSAN	455	96.68	3.32	83.96	16.04
DACIA	405	99.01	0.99	83.21	16.79
SUZUKI	390	97.69	2.31	94.62	5.38
HONDA	275	98.91	1.09	88.73	11.27
VOLVO	236	97.46	2.54	81.78	18.22
SMART	151	91.39	8.61	84.11	15.89
ALFA ROMEO	96	92.71	7.29	82.29	17.71
MITSUBISHI	83	93.98	6.02	85.54	14.46
MINI	77	97.40	2.60	85.71	14.29
JEEP	46	97.83	2.17	89.13	10.87
LAND ROVER	37	100.00	0.00	97.30	2.70
LANCIA	24	91.67	8.33	83.33	16.67
DAEWOO	21	85.71	14.29	71.43	28.57
SUBARU	21	100.00	0.00	100.00	0.00
JAGUAR	17	76.47	23.53	76.47	23.53
PORSCHE	16	100.00	0.00	100.00	0.00
CHRYSLER	12	91.67	8.33	58.33	41.67
SAAB	11	100.00	0.00	90.91	9.09
SSANGYONG	10	90.00	10.00	30.00	70.00
All other	32	94.00	6.00	81.25	18.75
Σ	30324				

Tailpipe test results



Discussion and conclusions

In order to ensure a higher quality of PTI of vehicles, it is necessary to introduce new testing methods. The OBD test can be a viable method of verifying proper operation of a large number of electronic devices and components in a vehicle, including the devices and components that affect the quality of exhaust emissions. This research includes OBD test results gathered from the PTI of PCs in Croatia, collected during January 2019. Before the implementation of OBD tests, an inspector could check the MIL status only visually on the dashboard. This is why owners whose MIL would turn on would often think with the system so as to conceal the MIL status. Using the OBD test, the amount of unprofessional tinkering has been greatly reduced because the necessary information is gathered straight from the ECU, regardless of the MIL status on the dashboard. The ECU is also used to gather the VIN, which makes it easier to ascertain whether it matches with the VIN in the documents and on the chassis itself. The OBD system can also show the vehicle's Readiness-code, according to which it is possible to establish which of the vehicle's systems were checked during the diagnostics procedure. Furthermore, the DTC counter shows the total number of faults in the system. It is planned to integrate other functions, i.e. the OBD2 PID codes used to request data available from the vehicle, into existing OWR17 devices. The implementation of OBD tests not only improves the quality of PTI procedures, but also adds to the overall traffic safety. Finally, these tests can help reduce the negative impact of exhaust emissions on the environment and human health.

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