False Failures

Drive Clean will make a difference
—Drive Clean website

There's a sucker born every minute.
—P.T. Barnum

by Paul Coninx

The increasingly wobbly credibility of vehicle emission inspection and maintenance (I/M) programs, such as Ontario's Drive Clean, has been shaken again by a recently released Ontario study (Coninx, 2003). The study found that when older vehicles were tested after a brief "preconditioning" procedure, the failure rate plummeted from a historical mean of 30 percent to only 4, indicating that many, if not most of the vehicles that fail Drive Clean's official test are tested before their emission control systems (ECS) have had a chance to stabilize.[1] It is commonly recognized, even by Drive Clean, that vehicle emissions are elevated during this transitory state and do not accurately characterize emission levels in normal on-road service (Drive Clean, 2000).

Ironically, the study, performed by the Ontario consumer organization Car Help Canada and funded by a grant from Industry Canada, was originally designed to look at a potential alternative to traditional I/M programs, specifically, the scheduled replacement of two important ECS components—the oxygen sensor and the catalytic converter. The project involved recruiting a set of representative 10- to 17-year-old vehicles in the Toronto region. Vehicles failing the official Drive Clean test due to either a faulty oxygen sensor and/or catalytic converter were to have those components replaced free of charge and be given another official Drive Clean test. In exchange for free official Drive Clean testing and free repairs, if required, participants would allow their vehicles to undergo a battery of additional tests to reveal the condition of the two ECS components.

The project used Drive Clean test equipment and required accurate emission measurements. Yet results from I/M test equipment have a long history of variability (US GAO, 1992). In an investigation carried out in 1999 for example, the same non-modified 1988 Pontiac Sunbird passed 11 official Drive Clean tests and failed 9, with test scores varying by as much as 800 percent (see figure 1) (Coninx, 2000). As the investigation progressed, it became apparent that the official test score was highly dependent on the way the car was driven and the way it was prepared immediately before the test.

To reduce the extraneous effect of incomplete or improper "preconditioning" in the 2003 study, each vehicle was driven for 3.2 km on the same, mostly semi-industrial route, with a maximum speed limit of 50 km per hour. The route included a number of full stops. Immediately afterwards, the car was driven onto the Drive Clean dynamometer and run an additional 2 minutes exactly, at just over 40 kph before the official test commenced. It is important to note that the preconditioning drive and the additional period on the dynamometer is in no way "cheating" or "superheating" the vehicle's emission control system. On the contrary, it reasonably approximates the everyday use of consumer vehicles.

Researchers expected that the scrupulous preconditioning procedure would result in fewer cars failing the test than predicted by the Drive Clean historical failure rate because of the previously-observed lackadaisical manner in which Drive Clean inspectors typically deal with preconditioning (Coninx, 2000). However, even they were surprised when no failures occurred after a dozen tests. In fact, instead of the 7 or 8 failures predicted for the 26 vehicles tested, only a single vehicle failed the official test.[2] Since no change was made to the Drive Clean test procedure, and the only added factor was the additional preconditioning procedure prior to the

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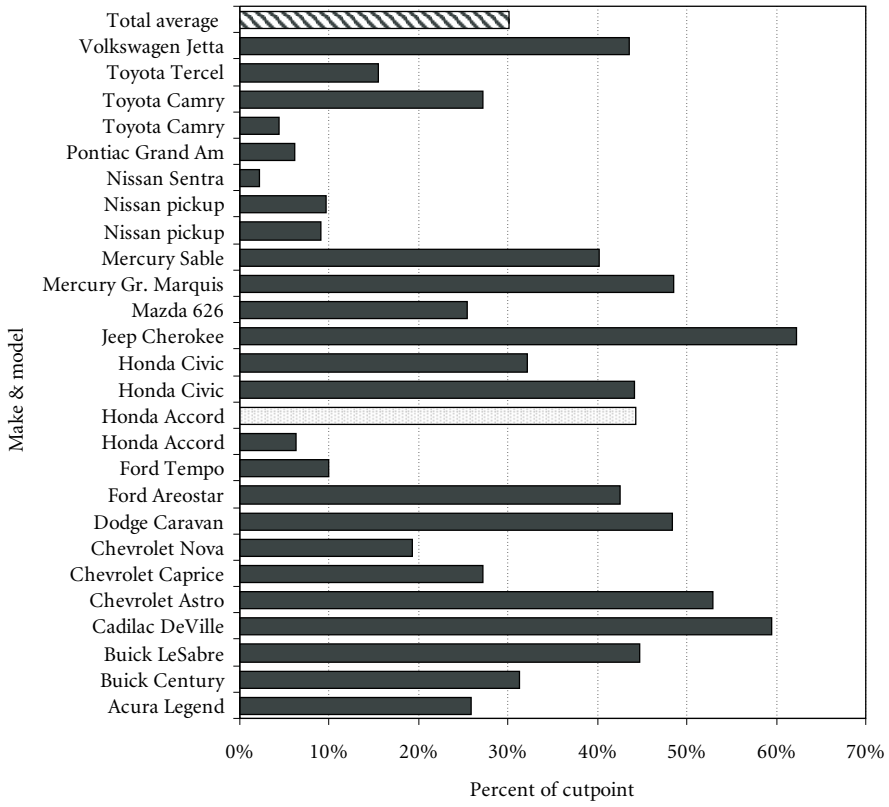
Figure 1: Average Score of 10- to 17-Year-Old Vehicles



test, results strongly indicated ($p<0.001$) that the method and amount of preconditioning played an overwhelming role in determining whether a vehicle would pass or fail the official Drive Clean test.

This is not to say that all the passing vehicles were in perfect condition. In fact, the repair technician working on the project identified a number of problems with many of the vehicles that passed, such as rough idling and stalling. In one case, after the car passed the official Drive Clean test and the test data were collected, he replaced the oxygen sensor anyway because the car ran so poorly. The single Drive Clean failure was diagnosed as blocked passages in the engine, creating uneven air/fuel/exhaust gas charges to different cylinders, confusing the ECS computer. Diagnostic testing revealed that simply disconnecting an ECS component (the exhaust gas recalculation valve) would have brought the car into compliance.[3]

The single failed car (light shading, figure 1) was not the worst polluting vehicle, when all five tests were averaged as percentage of maximum allowable emissions or "cutpoints." The 5-test average scores also varied considerably from under 5 percent to just over 60 percent of the cutpoints for the different 10- to 17-year-old vehicles tested. By comparison, the average scores for three 2003 vehicles (treated as a separate data set) ranged between 0 and 3 percent.

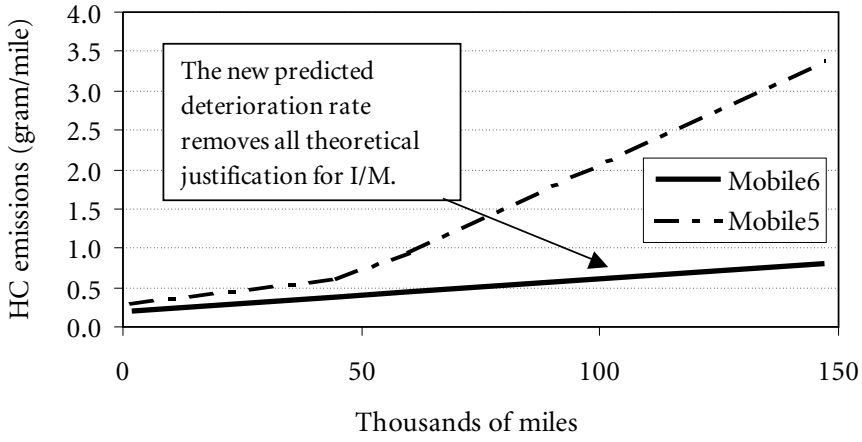
A final set of data again indicates how sensitive the official Drive Clean test score is to preconditioning. A 1988 Chevrolet Astro van failed the official Drive Clean test, presumably without the same care taken in proper preconditioning, at another facility in early December. When tested (following the preconditioning procedure) again in January without any repairs being performed, the van scored considerably lower. The van would have passed using the original cutpoints. However, just after the first test, Drive Clean had lowered the cutpoints in January, so the van failed again, despite its lower emission scores. Three days later the van was tested again, but this time, special care was taken to not allow the van to idle on the test dynamometer while data were entered into the Drive Clean system. The van passed.

When the same car passes the same test 11 times and fails it 9 times, by whopping margins (as happened in the 2000 study), when adding a simple preconditioning procedure drastically reduces the number of failures, when the single failing car is not the worst polluter, when the worst polluters are not identified, and when fine-tuning the preconditioning procedure can produce significant changes in a vehicle's score, we are left with the question: what does the Drive Clean test actually *test*?

Standard operating procedures

In describing the *initial* test procedure, the Drive Clean *Standard Operating Procedures* (SOP) manual (Drive Clean, 2000) merely warns the Drive Clean inspector to "[c]onfirm that the vehicle is at normal operating temperature and is not overheating." Inspectors are to avoid false failures, they are informed, because *if* the customer gets a proper test at another facility, it "may then result in a customer complaint against the test facility that originally failed the vehicle." No mention is made of the false failure wasting hundreds of consumer dollars on needless repairs.[4]

Figure 2: Comparison of (old) MOBILE5 with (new) MOBILE6 Estimated Vehicle ECS Deterioration



Drive Clean emission reduction estimates were made on the basis of the discredited MOBILE5.

However, towards the back of the SOP manual, in Appendix B, which deals with a vehicle "that has failed at an Accredited Drive Clean Testing Facility," (that is, once the consumer is on the hook for repair charges) a much more detailed, 2-page discussion of preconditioning can be found. "The preconditioning that a vehicle undergoes immediately before an emissions test can significantly affect the test's outcome."[5]

In the appendix, repair technicians are specifically warned that prolonged idling can adversely affect catalyst efficiency (leading to false failures), a warning not found in the section of the SOP manual describing the initial test. In the field, prolonged idling was observed to be a common, albeit often well-intentioned, method of bringing the vehicle to "normal operating temperature" in preparation for initial testing. In the 2000 study, extended idling almost always resulted in a test failure (Coninx, 2000).

It is important to eliminate false failures from the testing system by changing pre-conditioning protocols, since consumers are unlikely to detect false failures for a number of reasons, including:

- Most vehicles (about 85% for Drive Clean) pass the initial test, including those owned by motorists who understand the importance of preconditioning and will likely take appropriate steps to avoid failing the initial test, so the issue doesn't arise.
- People with older vehicles, which are more prone to false failing, tend to have fewer resources to investigate the cause of their initial I/M failure.
- Very few private individuals have both the inclination to have multiple tests performed to confirm a false failure and an adequate understanding of the importance and the method of proper preconditioning.
- The few false failures that are identified, sometimes described in the "Letters to the Editor" section in local newspapers, can usually be officially dismissed as the result of a "natural variation" in the vehicle's ECS characteristics (AirCare, 2003).[6]

Conclusion

From a scientific, technical, and environmental perspective, I/M programs such as Drive Clean are largely a waste of time, resources, and regulatory focus. For over a decade, studies by independent scientists have shown I/M programs to be ineffective, or much less effective than claimed by program administrators and paid consultants retained to audit the programs. In a 2001 report, the US National Academy of Sciences agreed with the independent analysts (National Academies Press, 2001).

Preceding the National Academy of Sciences report, in 2000 the US Environmental Protection Agency (EPA) released its newest version of its MOBILE computer model used to estimate emission reductions from I/M programs. The original justification for I/M is based on the premise that as vehicles age, their emissions will increase substantially and compulsory "maintenance" is required to keep emissions levels closer to those of new vehicles. Drive Clean Director David Crump claimed that EPA's (now obsolete) MOBILE 5 computer model was used to predict the emission reductions from the Drive Clean program (Crump, 2000). According to MOBILE 5, a 1992 vehicle with 150,000 miles (240,000 km) would produce about ten times the emissions as it did when it was new (see figure 2). In MOBILE 6, the estimated 1992 automobile ECS deterioration rate is much, much lower than that estimated by MOBILE 5. Because only a small fraction of the already greatly reduced estimate of older vehicle emissions is actually correctable through repairs, virtually all the theoretical justification for I/M vanishes.

The weight of evidence says I/M programs don't work, or at least they don't work nearly as well as has been claimed

by proponents. In addition, the false failure phenomenon is causing many Canadians to go through a false failure/repair/retest cycle that is costly, time consuming, and absolutely unnecessary. At the very least, Drive Clean officials should fix the preconditioning problem, but given the poor performance of programs like Drive Clean, a still better approach to fixing vehicle emission testing would be to end it altogether.

Notes

[1]A vehicle's ECS begins to fully function only after the engine and the exhaust gases reach a certain minimum temperature. Virtually all vehicles, especially older ones, naturally produce higher emissions for up to several minutes when started after their engines have cooled down (so-called "cold start" conditions). Many vehicles also produce higher emissions after about ten minutes or more of continuous idling. Assuring the relevance of test results to real-world emissions requires proper preconditioning, either by driving a vehicle on the road or on a test dynamometer (a device with one or two large rollers) for sufficient time for the vehicle to perform during the emissions test as it does during the vast majority of its service life.

[2]One other vehicle failed its first official test, but further diagnostic testing revealed no fault with the vehicle, which was then given the official test again and passed.

[3]The technician did not do this, however, because it would have violated the law. However, the car's owner did not have the passages cleared at the test garage and it is not known what the owner ultimately did in order to pass the Drive Clean test.

[4]People who drive the older cars that tend to fail emissions tests tend to have lower than average incomes (Aroesty *et al.*, 1994) and are the least capable of absorbing the cost of such useless repairs.

[5]Clearly, this advice is not always followed.

[6]Of course there will be variation, because without proper preconditioning, the vehicle's ECS is in transition! As a result, the test score does not represent the real-world emissions the vehicle produces when it is in normal use.

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