

## From "Check Engine" to "Check A.I."

By Tom Fournier, CTO, Opus Inspection



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Unlike Europe, Latin America, and Asia, periodic inspection of motor vehicles in the U.S. favors emissions testing over safety testing by more than two to one. Government mandated emissions inspection programs operate in thirty-two U.S. states, while safety testing occurs in only fourteen. The 1970 U.S. Clean Air Act mandates that states take corrective steps when local ambient air pollutants exceed federal standards. Those steps include testing cars for excessive emissions and requiring repairs. No such Federal mandate forces in-use vehicle safety inspections.

In the absence of Federal mandates, it's left to state and local legislatures to determine whether safety testing is in the best interest of their constituents. Those localized decisions involve balancing public safety against motorist convenience and economic concerns. More often than not, convenience and cost

drive the decision away from safety testing; however, that could change. Disruptive advances in autonomous driving technology might usher in renewed interest in periodic vehicle safety testing using diagnostic methods first established for emissions.

Historically, tech advances have shaped emissions testing in the U.S., and current inspection methods bear little resemblance to the originals. The industry has evolved from sampling vehicle exhaust and measuring its pollutants to interrogating the engine control module in search of fault codes related to emissions control equipment—i.e. from counting molecules to counting bits. This paradigm shift resulted from development of vehicle on-board diagnostic (OBD) systems which infer whether the car is polluting based on software analysis of on-board sensors and servos regulating air/fuel ratio. Improper function illuminates the “Check Engine” light signaling motorists that repairs are necessary.

Despite this automation of emissions diagnostics, motorists often ignore the “Check Engine” light and continue to operate their vehicles until forced to seek an emissions test by government mandate. That’s because digital engine control systems keep cars running under a wide variety of emissions failures. Additionally, vehicles are routinely driven well beyond the federally mandated 80,000 mile emissions warranty due to the increased design durability and the high cost of buying new. Out of warranty emissions repairs can be costly.

If it weren’t for government mandates to periodically inspect emissions, many ill-maintained vehicles would pollute throughout the later portion of their useful lives.

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As driving functions become increasingly automated, similar circumstances may inspire greater interest in periodic vehicle safety inspections, because safe transport will eventually become a matter of vehicle condition more so than human driver competence. My employer contracts with federal, regional and local governments around the world to develop and operate vehicle inspection programs, and our recent technology investments are made with an eye toward autonomous vehicle safety. Are we jumping the gun?

Not likely. Most professionals in the automotive industry are familiar with the statistics. More than 37,000 people were killed in vehicle accidents on U.S. roads in 2017. That’s equivalent to two Boeing 777 jetliners crashing every week. In 94 percent of cases, this staggering loss of life involves human error. That fact is the driving motivation behind the race to develop fully autonomous vehicles (AVs). Once perfected, tens of thousands of lives could be saved each year in the U.S. alone, and hundreds of thousands could be saved worldwide.

This potential for human good is causing the National Highway Traffic Safety Administration (NHTSA) to give wide birth to companies developing AVs by offering voluntary guidance that is technology-neutral, and by modernizing outdated regulations impeding the progress of AVs. AV test facilities simulating busy, real-world city streets are springing up around the nation, and many state and local governments are changing traffic ordinances to invite autonomous test vehicles onto public streets. Legislatures, regulators, manufacturers, and insurance companies are displaying an unprecedented level of cooperation as they wrestle with the tricky issue of certifying the safe design of this emerging technology without unduly obstructing its progress. That intense focus on safe AV design has delayed discussion about safe in-use maintenance.

AVs rely on software fusion of a wide array of sensor outputs, including: laser light radar (LIDAR), low power radar, machine vision cameras, infrared imaging, and ultrasound. On board Artificial Intelligence (A.I.) processes the output of these sensors not only to form an accurate image of the outside world, but also to give meaning to what is 'seen'. It makes complex decisions about other vehicles, pedestrians, traffic signals, road conditions, weather, navigation, and much more. This means that, eventually, our safety will no longer depend only on the familiar notions of properly functioning brakes, suspension, and lighting. It will also require proper function and calibration of LIDAR, radar, cameras, and ultrasound sensors as well as working circuitry and software. Whether it is a discreet light or a digital display that flashes "Check A.I.", the concept behind our current "Check Engine" light will be extended to tell us when a vehicle is unsafe for autonomous driving. Yet, that might not be enough. Not every unsafe condition can be self-diagnosed— just as not every personal computer successfully determines when its software has been corrupted or whether the devices connected to its USB ports are working correctly.

Those of us who work in the field of periodic vehicle inspections are planning for a future where our test lanes include in-depth digital interrogation of vehicle A.I. as well as checks of sensor function and calibration. We will perform these in addition to OBD scans for emissions faults and traditional mechanical inspections. It remains to be seen whether the U.S. follows the lead of the rest of the world and widely adopts periodic safety inspections as a requirement to ply public roads; however, the advent of fully autonomous vehicles may be reason enough to move the needle in that direction.

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