
**Guidance for On-Road Testing
Requirements for Enhanced Vehicle
Inspection and Maintenance (I/M)
Programs**



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Transportation and Climate Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

1. Purpose of Guidance

This guidance was developed to clarify how the on-road testing requirement can be met in states with mandatory enhanced vehicle emission inspection and maintenance (I/M) programs. On-road testing is a necessary element of an I/M program that is required by the Clean Air Act (CAA) to be operated at the enhanced performance level. On-road testing involves the collection of emissions data from a sample of subject in-use vehicles within an enhanced I/M program. The analysis of data obtained from on-road testing can be useful in assessing the effectiveness of an I/M program.

In support of efforts to increase compliance, the Environmental Protection Agency (EPA) developed this guidance to help state and local governments meet their CAA and regulatory requirements in enhanced I/M program areas. This guidance also provides options and reflects the latest technologies and practices in use by enhanced I/M programs across the United States. Finally, this guidance was written as a result of a 2018 audit by the Office of Inspector General (OIG) regarding EPA oversight of enhanced I/M programs, entitled, *Collecting Additional Performance Data from States Could Help EPA Better Assess the Effectiveness of Vehicle Inspection and Maintenance Programs* (OPE-FY17-0018).¹

2. What are the Clean Air Act requirements?

The 1990 Amendments to the CAA required I/M programs for certain areas across the country based upon various criteria, such as air quality status, population, and/or geographic location. The CAA established two performance levels of I/M programs: "basic" I/M for ozone nonattainment areas classified as moderate, and "enhanced" I/M. Pursuant to CAA sections 182, 184 and 187, enhanced I/M programs are mandated in the following areas:

- All serious or worse ozone nonattainment areas that had a 1980 urban population of 200,000 or more;
- Metropolitan statistical areas with a 1990 population of 100,000 or more in the Ozone Transport Region (regardless of their air quality classification); and
- All moderate or worse CO nonattainment areas with a design value greater than 12.7 parts per million (ppm) at the time of classification that had a 1980 urban population of 200,000 or more.

One of the obligations of an enhanced I/M program is to perform on-road testing of in-use vehicles for a small percentage of the area's fleet of motor vehicles. Among other things, section 182(c)(3)(B)(i) authorizes EPA to establish "a performance standard achievable by a program combining emission testing, including on-road emission testing..." Additionally, for enhanced I/M areas, section 182(c)(3)(C)(i) requires these state programs to include "on-road testing devices" as a necessary element.

3. What are the on-road testing regulations for enhanced I/M areas?

In 1992, EPA promulgated the original I/M rule at 40 CFR 51 Subpart S, and EPA has since amended the rule several times. The I/M rule establishes the technical, procedural and administrative requirements to be met by basic and enhanced I/M programs. The following paragraphs provide additional information from the current I/M rule's on-road testing requirements.

¹ This report was released on September 25, 2018 and can be found at: www.epa.gov/office-inspector-general/report-collecting-additional-performance-data-states-would-help-epa-better.

Specifically, 40 CFR 51.351(b) establishes on-road testing as part of the enhanced I/M performance standard. The complete set of provisions detailing on-road testing is found in 40 CFR 51.371. This section includes the following:

On-road testing is defined as testing of vehicles for conditions impacting the emission of HC, CO, NO_x and/or CO₂ emissions on any road or roadside in the nonattainment area or the I/M program area. On-road testing is required in enhanced I/M areas and is an option for basic I/M areas.

(a) *General requirements:*

(1) *On-road testing is to be part of the emission testing system, but is to be a complement to testing otherwise required.*

(2) *On-road testing is not required in every season or on every vehicle but shall evaluate the emission performance of 0.5% of the subject fleet statewide or 20,000 vehicles, whichever is less, per inspection cycle.*

Note that section 51.371(a)(2) of the I/M rule establishes the volume of cars to be tested in an on-road testing program, with each enhanced I/M program area being required to evaluate the emission performance of at least 0.5% of that area's subject fleet (or 20,000 vehicles, whichever is less) within the corresponding inspection period.² For example, if an enhanced I/M area has 1 million vehicles that are subject to I/M testing on a biennial basis, then the state shall conduct on-road testing to at least 5,000 vehicles over the course of a two-year period.

Section 51.371(a)(3) and (4) describe additional requirements for on-road testing programs including the type of testing and compliance:

(3) *The on-road testing program shall provide information about the performance of in-use vehicles, by measuring on-road emissions through the use of remote sensing devices or by assessing vehicle emission performance through roadside pullovers including tailpipe or evaporative emission testing or a check of the onboard diagnostic (OBD) system for vehicles so equipped. The program shall collect, analyze and report on-road testing data.³*

(4) *Owners of vehicles that have previously been through the normal periodic inspection and passed the final retest and found to be high emitters shall be notified that the vehicles are required to pass an out-of-cycle follow-up inspection; notification may be by mailing in the case of remote sensing on-road testing or through immediate notification if roadside pullovers are used.*

² The inspection cycle corresponds to the testing frequency of that particular I/M program. The test frequency is how often a subject vehicle in that I/M program area needs to be tested to comply. The performance standards for I/M programs assume an annual test frequency but another test frequency schedule (such as biennial) may be approved for I/M programs if the required emission targets of the I/M program are achieved. See 40 CFR 51.355(a).

³ When first promulgated in 1992, the I/M rule indicated that the on-road testing requirement must be met by using remote sensing devices or by conducting road-side pull-over, tailpipe testing (57 FR 52950 (Nov. 5, 1992)). However, with the advent of OBD systems, the nature of vehicle I/M testing has changed from predominantly tailpipe testing to analysis of the OBD system. In July 2000, EPA revised the I/M rule to provide additional regulatory options in conducting on-road testing (65 FR 45526 (July 24, 2000)).

Because of the options that states have in designing the on-road testing program for each enhanced I/M area, the provisions of section 51.371(b) obligate the state to outline in their state implementation plan (SIP) how their chosen on-road testing program complies. The SIP for each enhanced I/M program area shall describe the on-road testing program, including the types of testing, test limits and criteria, the number of vehicles to be tested, the methods for collecting, analyzing, utilizing, and reporting the results of on-road testing as well as budget, personnel and legal authority for the program.

Lastly, section 51.371(b)(3) allows for additional emission reduction credits, over and above those projected for other aspects of an I/M program, to be granted for on-road testing programs that require out-of-cycle repairs for high-emitting vehicles identified through the on-road testing program.

4. What OIG recommendation is addressed by this guidance?

The OIG report included a finding that EPA lacked required performance data to assess the effectiveness of some state enhanced I/M programs partly due to inconsistent compliance with on-road testing requirements. As a result, the OIG highlighted that further improvements in mandatory on-road testing compliance were necessary:

When states do not conduct program evaluations and on-road testing, they are failing to meet applicable statutory and regulatory inspection and maintenance requirements. This means that the EPA and states lack complete program performance data to determine whether the program is achieving projected emission reductions. They also do not have a complete picture of the overall performance of the programs in question.⁴

The OIG audit made several recommendations to EPA's Office of Air and Radiation (OAR) for assuring consistent and effective implementation of enhanced I/M programs. The complete list of the OIG's recommendations may be found in Appendix A of the OIG report. Recommendation #4 of the OIG's 2018 report addressed mandatory on-road testing in enhanced I/M areas, and OAR responded that guidance would be issued:

Recommendation 4: *Verify whether states are performing mandatory on-road testing or determine the reason why they are not and offer assistance to obtain compliance.*

Response 4: *OAR agrees with this recommendation and will respond by directing EPA's Office of Transportation and Air Quality (OTAQ) to issue guidance that clarifies that on-road testing is required by the Clean Air Act (CAA) for all mandatory, enhanced I/M programs, that testing using Remote Sensing Devices (RSD) meets the definition of on-road testing, and that using RSD to perform program evaluation testing can be used to meet both the Act's on-road testing requirement for enhanced I/M areas as well as the biennial program evaluation requirement for enhanced I/M programs. OTAQ will also ask the EPA Regional Offices (RO) to provide the status of applicable states performing mandatory on-road testing, to determine the reason(s) for any problems, and to identify technical assistance as needed to obtain compliance.⁵*

⁴ *Collecting Additional Performance Data from States Could Help EPA Better Assess the Effectiveness of Vehicle Inspection and Maintenance Programs* (OPE-FY17-0018), pg. 14.

⁵ *Ibid.* pg. 25.

To satisfy this recommendation, OTAQ worked closely with the EPA Regional Offices to determine the status of enhanced I/M areas satisfying the on-road testing requirement as well as issue this guidance for meeting the requirements in enhanced I/M areas.

5. What methods are available to satisfy the on-road testing requirement?

This section will briefly describe the various options for compliance with the statutory and regulatory requirements for on-road testing in enhanced I/M programs.⁶

a. Remote Sensing Device (RSD) Programs

RSD provides a snapshot of emission rates from a large quantity of vehicles as they are driven on roadways. RSD installations generally are units set up on the side of a roadway with a light (or laser) source and detector, placed either at the side of or above a roadway. RSD units send infrared or ultra violet beams through vehicle exhaust plumes and then use optical sensors to analyze the emissions for a fraction of a second as vehicles pass by the unit. RSD units record speed and acceleration which are measured at the same time as the emissions measurement, providing information about the engine load. Also, a camera captures an image of the vehicle's license plate to identify the vehicle through registration databases.

b. Roadside Pullovers

Roadside pullovers are another means of conducting on-road testing of in-use vehicles in enhanced I/M areas. Just as the name implies, in roadside pullovers, the state air agency in association with a corresponding law enforcement agency stops and tests vehicles alongside the road in the enhanced I/M program area. Roadside pullovers can be random, targeted or a combination of both. One example of why targeted pullovers may be employed by states is to obtain a better sample size of older vehicles with greater high-emitting potential. Older vehicles are a much smaller portion of the subject I/M fleet and without targeted sampling, may be under-represented in an on-road testing program.

EPA's I/M website contains an example roadside inspection program report to be used as a resource for states wishing to conduct their own roadside inspections of subject in-use vehicles.⁷ Because, these on-road testing roadside pullover options mirror similar test procedures conducted at the I/M program area's inspection stations (except that these on-road tests are performed in the field using portable or mobile equipment), more information on specific test procedure details may be found in the I/M rule. Roadside pullovers can be conducted using one or more of the following methods:

- Onboard Diagnostic (OBD) System Check – All model year 1996 and later light-duty vehicles and light-duty trucks are equipped with certified OBD systems. This roadside pullover test option is performed in the same manner as an in-station OBD I/M test. First, a visual Malfunction Indicator Lamp (MIL) bulb test is conducted with an ignition key cycle

⁶ As mentioned in Section 4 of this guidance, OAR's response to Recommendation #4 notes that data collected from on-road testing can be used in conjunction with the enhanced I/M area's biennial program performance evaluation as outlined in CAA section 182(c)(3)(C) and detailed in regulation at 40 CFR 51.353(c). OTAQ is developing additional guidance on biennial program evaluations.

⁷ See <https://www.epa.gov/sites/production/files/2016-06/documents/roadside.pdf>.

(i.e., key-on/engine off). Then an OBD data acquisition device is connected to the OBD system's data link port (or vehicle connector) to evaluate the OBD system's readiness, MIL status as well as any diagnostic trouble codes (DTC) that are commanding the MIL on. More details on OBD test procedures may be found at 40 CFR 85.2222 *Onboard diagnostic test procedures*.

- Tailpipe Testing – In this type of on-road testing, the state agency responsible for roadside pullovers of subject vehicles employs a gas analyzer to test the vehicles either at idle or, in combination with a portable (trailer-based) dynamometer, under load. Roadside tailpipe testing evaluations have historically been based on either Two-Speed Idle (TSI) or Steady-State testing such as Acceleration Simulation Mode⁸ (ASM). However, it is not clear how prevalent these types of tests are at this time especially for OBD-equipped vehicles which can be covered by other options in this guidance. TSI and Steady-State test procedures may be found in Appendix B of 40 CFR 51 Subpart S.
- Evaporative Emissions (System and/or Gas Cap Pressure) Test – Using mobile or portable test equipment, a state or law enforcement agent conducts an evaporative system integrity test during the roadside pullover using the procedure outlined in 40 CFR 51.357 *Test procedures and standards*.

In addition, any of these roadside pullover options can be combined with visual/anti-tampering inspections. Although visual/anti-tampering inspections do not satisfy the on-road testing requirement by themselves, they provide a beneficial complement to roadside pullovers. During a pullover, a law enforcement or state agent who is trained or certified as an inspector-mechanic can conduct a visual anti-tampering inspection as verification of the vehicle's required emission control components. Visual emission control device checks shall be performed through direct observation or through indirect observation using a mirror, video camera or other visual aid. These inspections include a determination as to whether each applicable device is present and appears to be properly connected and of correct type for the certified vehicle configuration.

c. Remote OBD

Data collected from a Remote OBD program can also be used to satisfy the on-road testing requirement. The verification of the emission systems of OBD-equipped in-use vehicles can be achieved remotely, without a roadside pullover or visit to an inspection station. Remote OBD is the collection of OBD parameters via telematics (e.g., via the cellular phone data network), and this approach can provide additional convenience and flexibility to the motorist and the I/M Program operator. With remote OBD, an electronic device or 'dongle' is connected to an OBD system's data link port. The device reports the vehicle's OBD system status while being driven.

Remote OBD can be continuous, periodic or episodic. That is, the dongle can stay connected to the vehicle all the time, for a certain period of time, or just long enough for the OBD system to become

⁸ See www.epa.gov/state-and-local-transportation/vehicle-emissions-inspection-and-maintenance-im-policy-guidance-and#ASM.

“ready” and report the OBD system’s status. For example, one state has partnered with telematic providers as well as with private business locations such as gas stations, car washes, oil change shops, and repair service centers, to create a device-sharing distribution network. Once a remote OBD test has concluded, a motorist, at his/her convenience, can return the device to one of these locations for re-use.

In addition, many vehicles already have the appropriate self-reporting telematic equipment onboard. Owners of these vehicles have the option of activating a subscription-based, in-vehicle, maintenance communications service. With these services, the motorist can request that the OBD system data be reported to the appropriate state agency. Similarly, many fleet operators already use Remote OBD to monitor their vehicles for logistic and maintenance purposes.

6. Who can I contact for more information on this guidance?

For questions concerning a particular state or I/M program area, contact the I/M coordinator at your EPA Regional Office. A listing of Regional Mobile Source Contacts is available at: www.epa.gov/transportation-air-pollution-and-climate-change/office-transportation-and-air-quality-contacts-topic.

General questions about this guidance can be directed to Joe Winkelmann at EPA’s Office of Transportation and Air Quality at: winkelmann.joseph@epa.gov.

Additional information regarding I/M programs can be found on EPA’s website: www.epa.gov/state-and-local-transportation/vehicle-emissions-inspection-and-maintenance.

Another good resource for I/M programs is the EPA-supported National OBD Clearinghouse: www.obdclearinghouse.com/.

7. Does this guidance create any new requirements?

No, this guidance is based on CAA requirements, existing associated regulations, and does not create any new requirements. The CAA and EPA’s I/M rule at 40 CFR Part 51, Subpart S contain legally binding requirements. This document is not a substitute for those provisions or regulations, nor is it a regulation itself. Thus, it does not impose legally binding requirements on EPA, states, or the regulated community, and may not apply to a particular situation based upon the circumstances. EPA retains the discretion to consider and adopt approaches on a case-by-case basis that may differ from this guidance but still comply with the statute and applicable regulations. This guidance may be revised periodically without an opportunity for public comment.