DEPARTMENT OF CONSUMER AFFAIRS

BAR

Bureau of Automotive Repair

Smog Check Performance Report

(An Analysis of Roadside Inspection Data)

2020

7/1/2020

Introduction and Summary

This report provides an update on California's Smog Check Program pursuant to Assembly Bill (AB) 2289,[a] which required an annual evaluation of the program and the performance of Smog Check stations beginning no later than July 1, 2011. This legislation directed the California Bureau of Automotive Repair (BAR) to implement both inspection-based performance standards[b] for stations inspecting directed vehicles[c] and On-Board Diagnostics (OBD II) focused inspections for newer vehicles.[d,e] It also enhanced BAR's ability to identify and take action against stations performing improper inspections.[f] The 2020 Smog Check Performance Report (SCPR) satisfies the statutory reporting requirement for 2020.

BAR evaluates the Smog Check Program primarily by analyzing data collected through inspections performed at Smog Check stations and from BAR's Roadside Inspection Program.[g] The roadside testing described in this report involves pairing of roadside-tested vehicles with their most recent Smog Check certification (i.e., a passing test). This is done to gain insight into the integrity of Smog Check testing. As in past SCPRs, vehicles whose most recent Smog Check is not a certification are excluded from the analyses. In general, due to the inclusion of OBD systems in newer vehicles (1996 and newer), BAR's roadside testing uses two different types of testing equipment, depending on the model year of the vehicle. Model year 1996 and newer vehicles are roadside tested using the OBD Inspection System (OIS).[h] For model year 1976-1999 vehicles, roadside tailpipe testing is performed using a BAR-97 Emissions Inspection System (EIS).[i] In addition, supplemental tailpipe tests have been collected for select vehicles, including model year 2000 and newer at the request of the California Air Resources Board (CARB), to better quantify emissions deterioration as the OBD vehicle fleet ages and to help evaluate excess emissions estimates.

Recent roadside test results from OIS tested vehicles are summarized in Table 1, including the corresponding OIS test results from the 2017-18 roadside sample analyzed for the 2019 SCPR. The table shows results only for model year 2000-2006 vehicles, which represents the vast majority of OIS roadside vehicles tested in both sampling periods. Separate results are shown in the first and second rows of the table, respectively, for the vehicles that initially failed Smog Check (and presumably were repaired, since they subsequently passed Smog Check), and those which initially passed the inspection.[j] Overall, model year 2000-2006 OIS-tested vehicles in the 2018-19 roadside sample failed

[a] Eng, Chapter 258, Statutes of 2010.
[b] BAR implemented the STAR Program in January 2013. The program requires stations interested in inspecting directed vehicles to be STAR-certified. BAR grants certification upon finding that the station meets inspection-based standards based on quarterly performance. In addition to performance, stations must also comply with the enforcement-related standards of the STAR Program.
[c] "Directed vehicles" include all model year 1976-1999 vehicles, and newer vehicles identified as having the greatest likelihood of failing their next inspection. These vehicles are required ("directed") to be certified at STAR-certified stations. The owners of these vehicles are notified on their DMV renewal notice of this requirement.
[d] OBD II systems are self-diagnostic systems incorporated into the computers of vehicles beginning with the 1996 model year. BAR deployed OIS (OBD II focused) testing on June 16, 2014, and mandated its use statewide on March 9, 2015, for 2000 and newer gasoline-powered vehicles, 1998 and newer diesel-powered vehicles, and all hybrids. These vehicles do not require a tailpipe test on the EIS.
[e] For more information about OBD II, see CARB's website: https://ww2.arb.ca.gov/resources/fact-sheets/board-diagnostic-ii-obd-ii-systems-fact-sheet.
[f] As part of the implementation of the OIS, BAR developed, and has since continued to enhance, software that significantly improves detection of improper inspections on newer model year vehicles.
[g] BAR's Roadside Inspection Program provides data that is used to evaluate the effectiveness of the Smog Check Program. The Roadside inspection involves the California Highway Patrol (CHP) directing vehicles into an inspection lane where they are voluntarily tested by BAR using Smog Check equipment.
[h] OIS is the Emission Inspection System for OBD tests of model year 2000 and newer gasoline-powered vehicles, all hybrids, and for model year 1998 and newer diesels.
[i] As used herein, "tailpipe" or "ASM" (Acceleration Simulation Mode) testing refers to placing a vehicle on a treadmill-like device to measure exhaust concentrations of pollutants under prescribed operating conditions.
[j] Historically, about 90% of vehicles overall pass initial inspection. The percentages in Table 1 are higher than that mainly because it's the older fraction of OIS tested vehicles.

at a model year weighted rate of about 18%, which compared to the 19% failure rate found for the similarly weighted (and partially overlapping) 2017-18 roadside sample.[a]

Table 1
Roadside Failure Rates of OIS Tested Gasoline Vehicles, Model Year 2000-2006

Initial Smog Check Result	Roadside OIS Failure Rates within One Year after Smog Check Certification* Calendar Year 2017-2018	Roadside OIS Failure Rates within One Year after Smog Check Certification* Calendar Year 2018-2019
Fail**	35% (732)	33% (660)
Pass***	17% (7,154)	17% (6,535)
Overall Failure Rate	19% (7,886)	18% (7,195)

* Roadside failure rate percentages are weighted by model year group to match the numbers of initial Smog Check tests performed in the State; sample sizes are shown in parentheses beneath the failure rate percentages. "OIS Fail Rate" means OBD fail rates.
** Vehicles failed initial Smog Check, were eventually certified as passing, but "re-failed" at roadside within one year.
*** Vehicles passed initial Smog Check but failed at roadside within one year.

For model year 1976-1999 vehicles that are subject to tailpipe testing as part of their Smog Check, Table 2 summarizes the results from BAR's Roadside Inspection Program. As may be expected due to the greater age of the tailpipe tested fleet, overall weighted roadside failure rates for model year 1976-1999 vehicles tended to be slightly higher (19% vs 18%) than for model year 2000-2006 OIS tested vehicles.

As required by statute, BAR's analyses of roadside data for this and prior SCPRs have attempted to identify and quantify the causes of excessive failures at roadside inspection. Two of the most important factors are vehicle age and the performance of the Smog Check station and inspector that certified each vehicle prior to roadside testing. Older model year vehicles tend to fail more at roadside than newer model years, and vehicles that were certified by high-performing Smog Check stations (those with an FPR score[b] of 0.9 or greater) fail at a significantly lower rate than vehicles that were certified by low-performing stations (e.g., those with an FPR score less than 0.1).

[a] The roadside datasets used for the 2019 SCPR and the 2020 SCPR have one calendar year in common – 2018 – and hence are considered "partially overlapping."
[b] "Follow-up Pass Rate" (FPR) is, in brief, "…a performance measure that evaluates whether vehicles previously certified by each station or technician are passing, in their current cycle, at higher than expected rates." CCR, Title 16, Division 33, Chapter 1, Article 5.5, §3340.1, "Follow-up Pass Rate".

Table 2
Roadside Emission Failure Rates of Tailpipe Tested Gasoline Vehicles, Model Year 1976-1999

Initial Smog Check Result	Roadside Tailpipe Failure Rates within One Year after Smog Check Certification* Calendar Year 2017-2018	Roadside Tailpipe Failure Rates within One Year after Smog Check Certification* Calendar Year 2018-2019
Fail**	31% (612)	32% (456)
Pass***	18% (2,285)	16% (1,878)
Overall Failure Rate	20% (2,897)	19% (2,334)

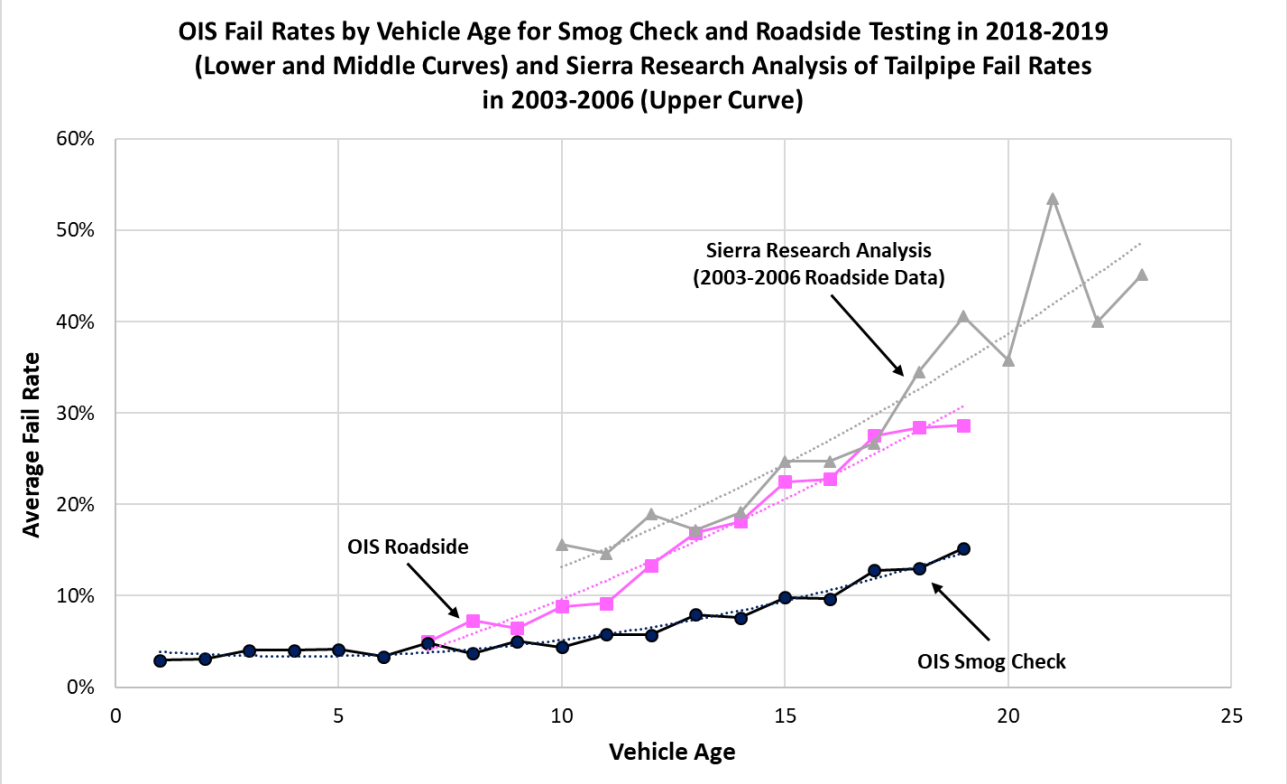
* Roadside failure rate percentages are weighted by model year group to match the numbers of initial Smog Check tests performed in the State; sample sizes are shown in parentheses beneath the failure rate percentages. "Tailpipe Tested" is described earlier in this report.
** Vehicles failed initial Smog Check, were eventually certified as passing, but "re-failed" at roadside within one year.
*** Vehicles passed initial Smog Check but failed at roadside within one year.

Figure 1 shows failure rate vs. age for OIS tested model year 2000 and later gasoline vehicles. The figure shows the trend with age of both the initial failure rates at Smog Check (lower black line) and the OIS roadside fail rate (middle pink line). Both datasets cover calendar year 2018-2019, matching the latest roadside sample. BAR also shows, for comparison, the average roadside tailpipe failure rate vs. vehicle age from the BAR roadside studies of 2003-2006, which were analyzed by Sierra Research (upper gray line) in its 2009 report on the Smog Check Program.[a] Despite the many differences between the earlier tailpipe tested 1976-1995 model year fleet analyzed by Sierra Research and the current OIS tested model year 2000 and newer fleet, the failure rate with age appears to be trending much the same. More specifically, beyond about age ten, vehicles tested on the roadside in 2018-2019 tend to be failing at a slightly lower rate than those tested in 2003-2006 at the same age (upper gray line).

Regarding the quality of Smog Check inspections, California, like other states with decentralized inspection and maintenance programs, faces challenges from stations and inspectors who perform poor quality or fraudulent inspections. On February 21, 2020, BAR issued a news release announcing actions against nine Smog Check stations charged with clean gassing.[b,c] As of this writing, most of the stations listed in the news release have revoked or restricted licenses that prohibit continued tailpipe testing. BAR has also actively pursued enforcement actions against stations performing fraudulent OIS tests. As detailed later in this report, between 2016 and 2019 BAR filed 987 cases with the California Attorney General's Office (AGO), thus far resulting in 663 license revocations and 99 suspensions or probations. This action has already begun to reduce emissions of the in-use fleet, as BAR's analysis of roadside data found that vehicles receiving a passing Smog Check from stations whose licenses were subsequently revoked had double the roadside failure rate relative to properly certified vehicles (i.e., vehicles certified by stations with valid licenses).

a "Evaluation of the California Smog Check Program Using Random Roadside Data," Prepared by Sierra Research for the California Air Resources Board and the California Bureau of Automotive Repair, March 12, 2009. Available at https://ww3.arb.ca.gov/msprog/smogcheck/march09/roadsidereport.pdf. See page 6 of this report for more details on the findings of Sierra's analysis of matching Roadside and Smog Check data.
b See: "Bureau-Of-Automotive-Repair-Initiates-Disciplinary-Action-Against-Nine-Smog-Check-Stations-Engaged-In-Fraud," at: https://thedcapage.blog/news-releases/
c "Clean gassing" refers to the act of introducing a surrogate gas into a test vehicle's exhaust emissions sample to fool the inspection system into passing that vehicle.

Figure 1



Summary of Findings

Analysis of the 2018-2019 roadside testing data, Smog Check inspection data, and related information presented, discussed, and/or cited in this report leads BAR to conclude the following:

1. Model year 2000-2006 vehicles OIS tested in the 2018-2019 roadside sample failed at a weighted average rate of about 18%, compared to the 19% rate found for the 2017-2018 roadside sample.
2. Model year 1976-1999 tailpipe tested vehicles in the 2018-2019 roadside sample failed for emissions at a weighted average rate of about 19%, compared to a failure rate of 20% in the 2017-2018 roadside sample.
3. Model year 2000-2006 vehicles tended to fail in the 2018-2019 roadside sample at a similar but slightly lower rate than vehicles at the same vehicle age in the 2003-2006 roadside sample.
4. BAR's enforcement activities over the past four years are clearly reflected in the roadside data. Model year 2000-2012 vehicles previously certified at a station whose license had been revoked as of May 1, 2020, had a roadside failure rate of 28% versus a failure rate of 14% for those previously certified at stations that were not subject to enforcement actions.
5. BAR and CARB staff estimate that in calendar year 2019, Smog Check could have additionally provided emission reductions on the order of 30 - 50 tons per day (tpd) of reactive organic gases and oxides of nitrogen (ROG + NOx) from model year 1976-2015[a] light- and medium-duty gasoline vehicles if all Smog Check stations operated similar to the "high-performing" stations.

[a] As described later in this report, the emissions analysis accounted for model year 1976 to 2011 vehicles subject to biennial Smog Check inspections as well as a small impact from model year 2012 to 2015 vehicles subject to change-of-ownership Smog Check inspections.

After a brief background review of BAR's Roadside Inspection Program, the remainder of this report describes the following:

- Recent changes to the Smog Check Program to improve station performance, primarily through BAR enforcement actions to curtail Smog Check fraud;
- Information about the effects of vehicle age, Smog Check station performance, and other factors on roadside failure rates;
- The excess emissions caused by poor station performance;
- A report on what other states are doing to reduce emissions through vehicle inspection and maintenance. BAR worked with Saint Malo Solutions, LLC to investigate the best practices of other vehicle inspection and maintenance programs.
- An independent review of the 2019 SCPR by Saint Malo.[a] The section of Saint Malo's report entitled "Specific Comments" has been excerpted and provided as Attachment A to this report, along with BAR's annotated answers to comments and questions from the review.

Background

Roadside Testing

The purpose of BAR's roadside testing is to provide data that can be used to evaluate the effectiveness of the Smog Check Program. Roadside testing, which is voluntary for drivers, entails having CHP officers randomly pull over vehicles, allowing specially-equipped BAR survey teams to check their emission control systems. For certain model year 1976-1999 gasoline-powered vehicles[b], the check is performed using an ASM test of tailpipe emissions, or for ASM incompatible vehicles, a Two-Speed Idle (TSI) tailpipe test. During the ASM test, the vehicle is placed on a chassis dynamometer and emissions tested using an EIS. This is the same type of tailpipe *emission* test that is performed by Smog Check stations in enhanced areas.[c] In addition, during a BAR roadside inspection model year 1996-1999 vehicles receive an OBD test using the OIS. To minimize inconvenience to participating motorists, roadside testing does not include the visual and functional inspection that would be performed during inspections at Smog Check stations. Neither type of roadside inspection impacts the Smog Check status of any participating vehicle; a failed roadside inspection does not require the vehicle to have a follow-up inspection at a licensed Smog Check station.

Roadside vehicles are selected at random using a fleet-weighted stratified method that ensures a representative sample of vehicles subject to Smog Check. Just as with Smog Check inspections, a small percentage of vehicles pulled over at roadside with bald tires, liquid leaks, or other safety issues, are excluded from testing.[d] Older vehicles, while a smaller percentage of the fleet, continue to contribute disproportionately to overall smog-forming emissions of ROG + NOx.[e] Therefore, ensuring these older vehicles are adequately sampled is important to accurately estimate their roadside failure rate and emissions impact.

Roadside inspection locations are selected from ZIP codes within the counties designated as Enhanced Smog Check Program areas. The number of vehicles targeted for sampling within these counties is

[a] In 2018, Saint Malo Solutions, LLC was contracted to conduct an independent review of BAR's 2018 and 2019 SCPRs. The reviews, which are required by statute, are conducted to provide, "an independent validation of the evaluation methods, findings and conclusions presented in the report."

[b] Light-, medium- and some heavy-duty vehicles (GVWR up to 9,999 lbs.) are included.

[c] Enhanced areas are California Smog Check Program areas within any part of an urbanized area of the state that is classified by the U.S. Environmental Protection Agency as not meeting air quality standards. Pre-2000 model year gasoline-powered vehicles registered in enhanced areas require an ASM inspection.

[d] See Attachment A, page 21 for further detail.

[e] Emission reduction measures, including Smog Check, have decreased air pollution levels in California significantly in the past few decades, but air pollution remains a serious health concern and Smog Check continues to be an essential element in California's federally-mandated State Implementation Plan (SIP) to achieve and maintain federal clean air standards, as well as a measure needed to meet State air quality standards.

proportional to the number of vehicles registered within them. Many of the analyses in this report, including the re-fail rates and the estimates for current excess emissions, use sample averages from the roadside data partitioned by model year group. These statistics are weighted to reflect the California vehicle populations being reported based on model year, vehicle type/class, Gross Vehicle Weight Rating (GVWR), and other factors. The latest roadside test data described in this report was collected between January 1, 2018, and December 31, 2019.

Assembly Bill 2289 Program Evaluations and Improvements

In March 2009, Sierra Research, Inc. (Sierra) released a report analyzing the effectiveness of the California Smog Check Program.[a] The report found that for model year 1976-1995 vehicles that initially failed, then passed the tailpipe ASM test at a Smog Check station, 49% failed an ASM roadside inspection within one year of certification (i.e., Fail-Pass-Roadside Fail vehicles). Based on its analysis, Sierra concluded that improper or falsified "passing" Smog Checks likely contributed to the re-fails. For model year 1976-1995 vehicles that passed their initial ASM test at a Smog Check station, 19% failed an ASM roadside inspection within one year of certification (i.e., Pass-Roadside Fail vehicles). The roadside inspections occurred, on average, about six months after the vehicle had been certified at a Smog Check station.

Assembly Bill (AB) 2289, which was adopted following release of the Sierra report, required BAR to address specified known issues, including the roadside fail rates of vehicles. In response to the bill and following a series of public workshops, BAR implemented the STAR Program in 2013 and deployed the OIS in 2014. These and other changes are described in the annual SCPRs prepared and published by BAR in cooperation with the California Air Resources Board from 2012 through 2019.

In December 2019, there were 7,902 licensed Smog Check stations in California. 3,882 of these (49%) were "STAR" certified, meaning that they had elected to participate in the STAR program and maintain higher standards of station performance that authorizes them to test "directed vehicles." 3,450 stations (44%) were classified as non-STAR. Fleet, Referee, and other stations made up the remaining 7%. STAR stations, on average, tend to have higher testing volumes. Of the roughly 10.3 million initial Smog Check tests performed in California in 2019, about 8.4 million (82%) were performed by STAR stations and 1.9 million (18%) by non-STAR stations.

BAR's research and experience indicate that most Smog Check stations conduct proper testing. However, a relatively small number of stations and technicians perform a disproportionate number of improper or fraudulent tests. In 2019, 84% of Smog Check tests were tested with the OIS. Accordingly, much of BAR's efforts to prevent fraud are focused on that platform. The next section highlights BAR enforcement efforts for both OIS and EIS platforms, both of which produced measurable benefits in improving Smog Check station performance in 2019.

Recent Changes to Smog Check to Improve Station Performance

Mandatory use of the OIS for model year 2000 and newer vehicles was required beginning in March of 2015. Prior to the full-scale deployment of the new equipment, it underwent over a year of beta testing at licensed Smog Check stations where the OIS test was optional. A review of data generated during that early period in the program showed relatively little evidence of fraud when the program was new. However, by that summer, two different OIS defeat methods emerged at some Smog Check stations: the use of simulators and the use of surrogate vehicles. A simulator is an electronic device that can be used to imitate a vehicle's OBD data with or without the use of the actual vehicle. A surrogate vehicle is a known passing vehicle that is fraudulently substituted for a vehicle that the Smog Check technician has identified as being tested in order to deceive the OIS and allow the failing vehicle to pass.

[a] *Ibid*, Sierra.

BAR's 2019 Smog Check Performance Report (SCPR) presented data on the short-term effects of individual enforcement campaigns directed at intervention in the use of certain Smog Check defeat strategies. In the current report, BAR presents statistics on its enforcement actions against Smog Check station owners and technicians suspected or found to be guilty of committing fraud in the Smog Check program.

BAR Enforcement Efforts

Station owners and technicians who commit Smog Check fraud are subject to revocation of their licenses to operate. Accordingly, formal accusations are filed against licensees committing fraud, and due process is afforded to them through hearings administered by the Office of Administrative Hearings or, when appropriate, through criminal proceedings in other courts. When conditions warrant, licenses may also be suspended or placed under probation through these processes.

Table 3 provides a summary by year of BAR's case filings with the California Attorney General's Office (AGO), along with case outcomes for each year. (Note that case outcomes generally roll over across years, so they do not match yearly case filings.) The table reflects case filings that were based on assessment of Smog Check data only and excludes other Smog Check case filings that were based on more traditional BAR investigations. BAR sharply increased its case filings in 2017 in response to increased detection of fraudulent Smog Check activity, a portion of which was described in the 2019 SCPR. These and subsequent filings led to the substantial increase in Smog Check license revocations, suspensions, and probations that occurred in 2018 and 2019. In total for the 4-year period, BAR filed 987 data-only cases with the AGO, and there were 663 license revocations and 99 suspensions or probations.

Table 3
Summary by Year of BAR Smog Check Data-Only Case Filings and Outcomes
(Outcomes Still Pending on Some Filings as of this Writing)

Year	Case Filings to AGO	Outcome: Revocation	Outcome: Suspension	Outcome: Probation
2016	117	2	0	0
2017	555	39	0	3
2018	252	280	9	9
2019	63	342	30	48
Total	**987**	**663**	**39**	**60**

The surge in case filings in 2017-2018 was a result of focused enforcement efforts to curtail the use of OBD simulators and surrogate vehicles. These efforts were facilitated by new analytical techniques that identified unexpectedly widespread OBD simulator usage and provided evidence to pursue administrative disciplinary cases based solely on data, without using traditional BAR investigative methods. These investigations were completed much more quickly, leading to many stations being served at the same time and producing a surge of cases through the administrative system. As these cases were filed and began filtering through the courts, four things happened. First, BAR implemented certificate blocking (described below), which interrupted stations from engaging in fraud using this first generation of simulators. Second, most stations, now aware of BAR's ability to prosecute such behavior, backed away from using simulators. Third, BAR enforcement staff provided support for the cases now being heard in the courts. Finally, resources that had been allocated to investigate and prosecute the high volume of Smog Check fraud cases in 2017-2018 were re-allocated back to more traditional enforcement activities. The net result of these factors was a substantial drop in Smog Check (data-only) cases filed in 2019. With this type of fraudulent activity largely addressed, Smog Check enforcement cases have more recently been focused on advanced technologies and complex behavior that take far more time and effort to investigate.

As noted above, BAR has implemented a real-time procedure to identify individual vehicles that are suspected of being fraudulently tested. OIS-tested vehicles that show excessive variance from historic or expected computer data for that vehicle, mismatched information, or other irregularities are failed and their Smog Check certificate is blocked.[a] These vehicles are then directed to a BAR Referee station[b] for a re-test. This was implemented in February 2017, and since that time over 27,000 vehicles have had their certificates blocked as a result of potential fraud. Of those vehicles identified, only about half ultimately completed the process to the point of receiving a Smog Check certificate. The remaining vehicles are likely operating on an expired or improperly issued registration, have been removed from the road, or have moved out of state. Eighty percent of the vehicles that do follow-up and receive a certificate do so within six months of the initial test. This element of the program is having a positive influence on both consumer and inspector behavior. During the second half of 2018 and the first half of 2019, blocked certifications averaged 1,300 a month. Since July of 2019, that number has dropped to about 350 a month.

While investigation and prosecution of fraud by stations and technicians conducting OIS tests continues, there has also been renewed effort to investigate and prosecute fraud in tailpipe testing of the model year 1976-1999 vehicle fleet. In 2019, BAR undertook a major new effort to identify, prosecute, and shut down Smog Check stations and technicians performing a type of fraudulent tailpipe testing called "clean gassing."

Despite its name, clean gassing has nothing to do with making vehicle exhaust gasses clean. In fact, it is just the opposite. Clean gassing is a method by which a surrogate gas is introduced into an EIS so that the analyzer will measure the surrogate gas or a mixture of surrogate gas and emissions and issue a passing test result based upon those readings rather than actual vehicle emissions. A news release issued by BAR in February 2020 announced administrative disciplinary action taken against nine Smog Check stations charged with clean gassing.[c] As of this writing, licenses for five of those nine stations have been revoked or restricted, prohibiting continued tailpipe testing. Court proceedings for the others are pending.

Another action undertaken by BAR in 2019 to help stop clean gassing was specifically focused on preventing repeated fraudulent certification of individual vehicles. This process identifies vehicles that are suspected to have been fraudulently tested during their previous Smog Check and requires those vehicles to be tested at a BAR Referee station for their next inspection. Many of these vehicles are "gross polluters" with emissions several times higher, on average, than other failing vehicles, and some of them appear to have been clean gassed multiple times over successive Smog Check cycles.

Validation of Enforcement Activity with Roadside Data

Given the large number of license revocations shown in Table 3, BAR analyzed the 2018-2019 Roadside data to determine if there was sufficient data to assess the impacts of these and other enforcement efforts. For this analysis, BAR focused on model year 2000-2012 vehicles subject to OIS testing that had received and passed their previous Smog Check within two years before the roadside test. The data were categorized into one of two bins: (1) vehicles previously certified at stations whose licenses had subsequently been revoked as of May 1, 2020, and (2) vehicles previously certified at stations that have not been subject to enforcement actions. Vehicles previously certified at stations with

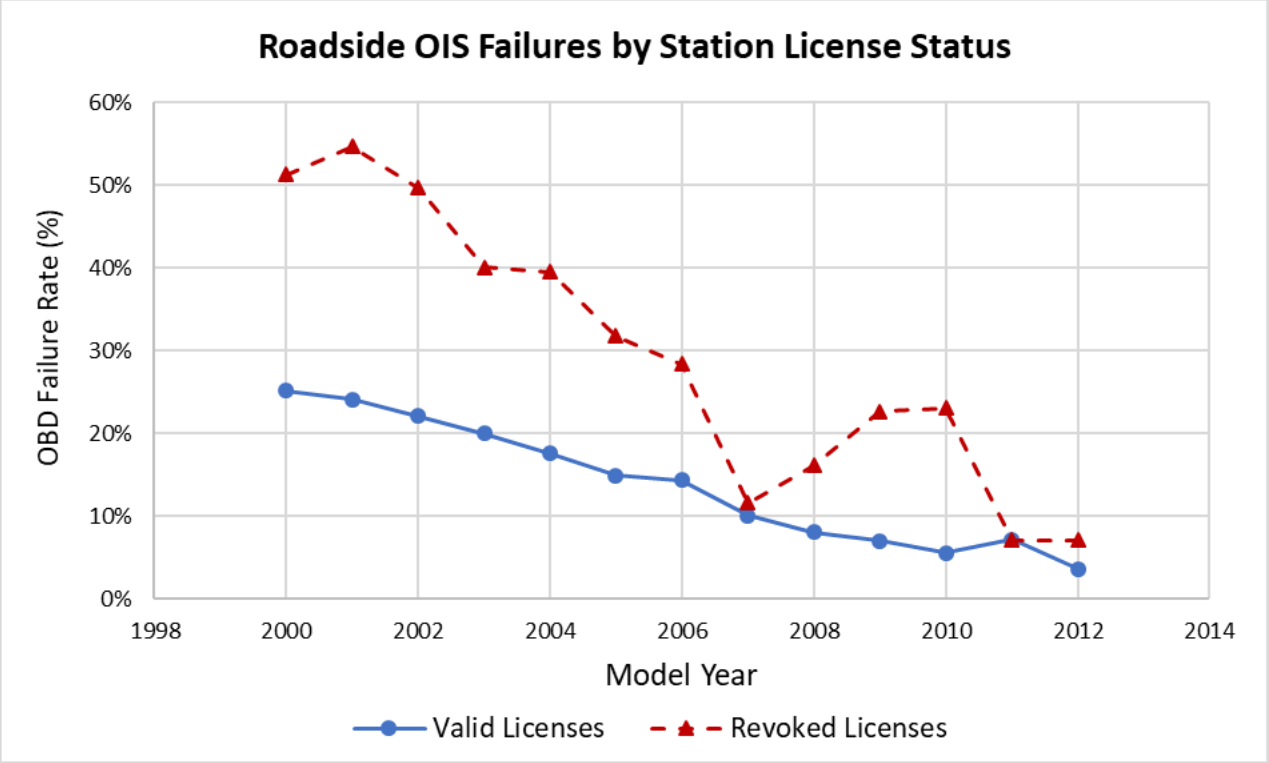
[a] This feature of the program was envisioned and is allowed under Health & Safety Code §44036(b)(3)(K).
[b] The Smog Check Referee Program is a statewide network of stations that provide resources to consumers and Smog Check inspectors including, Smog Check inspection review, parts locator service, law enforcement citations (noise, emissions and smoke), verification of Smog Check exemption, inspections for unusual vehicles (specially constructed, grey market, engine changes), and repair cost waivers. Referee centers are centrally located within certain community colleges throughout California. To find a Referee center near you or to schedule an appointment, visit asktheref.org or call (800) 622-7733.
[c] See: "Bureau-Of-Automotive-Repair-Initiates-Disciplinary-Action-Against-Nine-Smog-Check-Stations-Engaged-In-Fraud," at: https://thedcapage.blog/news-releases/

revoked licenses had double the roadside failure rate relative to vehicles tested at stations with valid licenses:

- Vehicles previously certified at stations with valid licenses: 14,905 tests, 14% failure rate[a]
- Vehicles previously certified at stations with subsequently revoked licenses: 1,097 tests, 28% failure rate

The results of this analysis are shown graphically by model year in Figure 2, which illustrates the impacts that fraudulent Smog Check activity had on the failure rates observed during 2018-2019 roadside testing for vehicles that had previously been certified at stations with licenses that were subsequently revoked.

Figure 2



Effects of Vehicle Age, Smog Check Station Performance, and Other Factors on the Roadside Failure Rate of Vehicles

Measuring vehicle failure rates during roadside inspections is important because it provides information about how well Smog Check stations are performing. However, interpreting the roadside results requires care because many factors can influence the roadside failure rate, including the following: (1) vehicle age, (2) performance of the Smog Check station that last certified the vehicle, (3) time since the vehicle was last certified, and (4) whether the vehicle failed and was repaired prior to the last certification. These factors are considered in the analyses that follow.

[a] Roadside failure rate percentages were weighted by model year to match the number of initial Smog Check tests performed in the state. The unweighted values are: 18% failure rate for vehicles previously certified at stations with valid licenses, and 40% for vehicles certified at stations that were subsequently revoked.

Analysis for Tailpipe Tested Vehicles: Effects of Vehicle Age, Station Performance, and Prior Smog Check Result on Roadside Failure Rates

BAR has modeled the emission failure rate for the 2018-2019 roadside data from ASM tested model year 1976-1999 vehicles. The results are summarized in Figure 3, which shows how vehicle age affects the roadside failure rate. For this sample, model year 1996-1999 vehicles are the youngest, with an age of 19-23 years, and vehicles from the 1970s are the oldest, with an age of 39-43 years. The width of the 95% confidence bands tends to be greatest for the older vehicles because the estimated fail rate becomes less certain as the population of vehicles in the fleet and the corresponding roadside sample diminish in size. The overlap of confidence bands beginning at about age 30 shows that as vehicles age, not only do failure rates continue to rise for both previous passing and failing vehicles, but beyond about 30 years, a prior result of fail or pass becomes less important in determining roadside fail rate. This is due both to the relatively high failure rate at this age and to the sparse sample.

Figure 3

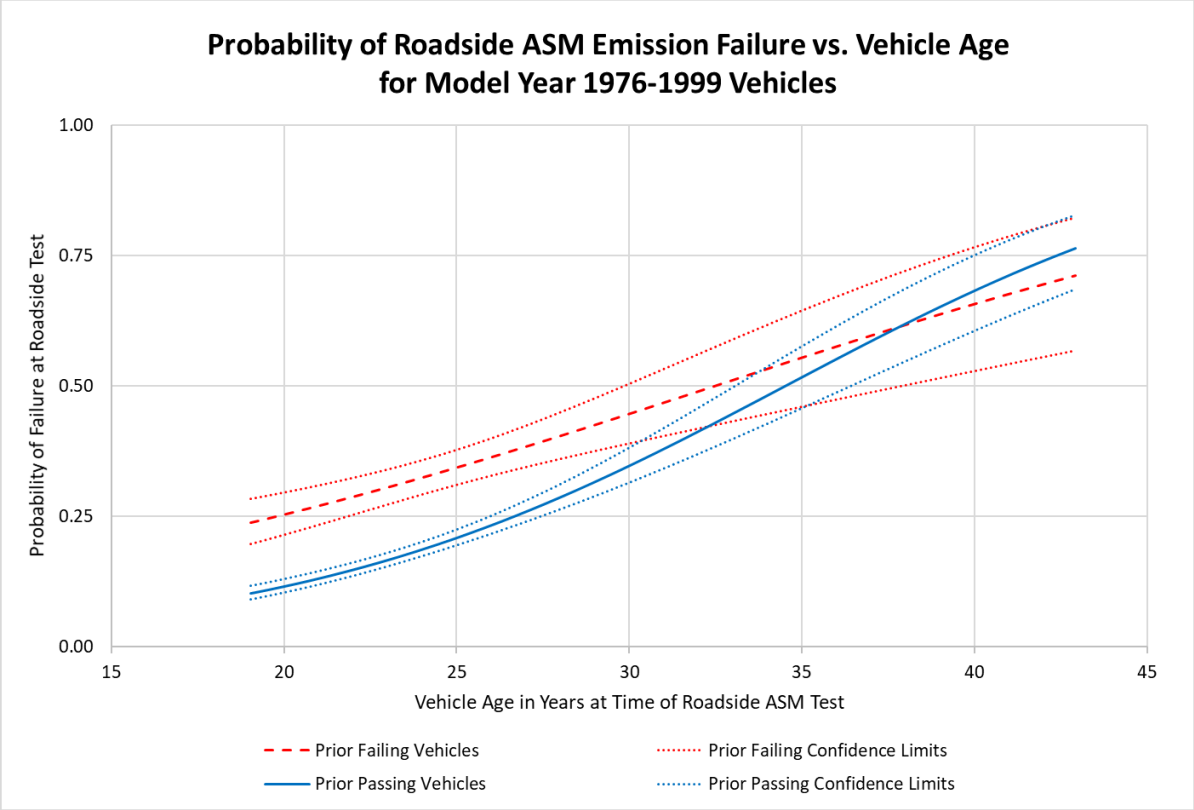
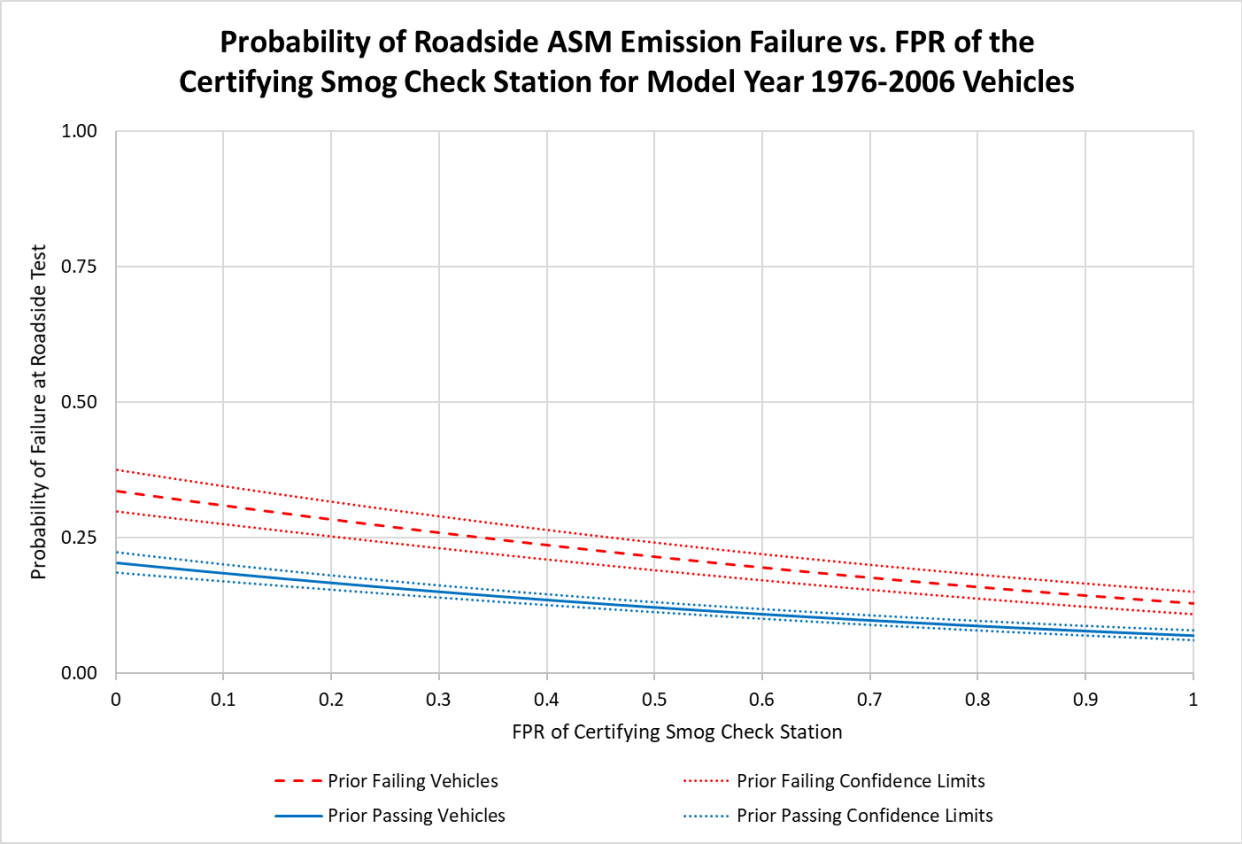


Figure 4 shows how FPR and initial pass/fail status prior to the vehicle's last certification affects the likelihood of roadside failures. One difference made to the Figure 4 model compared to Figure 3 is the inclusion of model year 2000-2006 roadside data for which BAR has continued to collect both OIS[a] and tailpipe data. This change increased the sample size by 56% (from 4,234 to 6,611 vehicles) and improved the model's performance, but there was no discernable change in the plot of roadside failure rate vs. FPR (shown in Figure 4 for the larger dataset).[b]

[a] For Smog Check, model year 2000 and later gasoline vehicles are subject to OIS testing. However, in cooperation with CARB, BAR has continued both OIS and tailpipe testing for the 2000 and newer model years at the roadside to better understand how OBD systems are performing and how the OBD fleet is responding to aging.

[b] For both models, the odds of failing at roadside was 2-times higher for prior failing vehicles and over 3.5-times higher for vehicles certified at a low-performing station (FPR ≤ 0.1) versus those certified at a high-performing station (FPR ≥ 0.9).

Figure 4

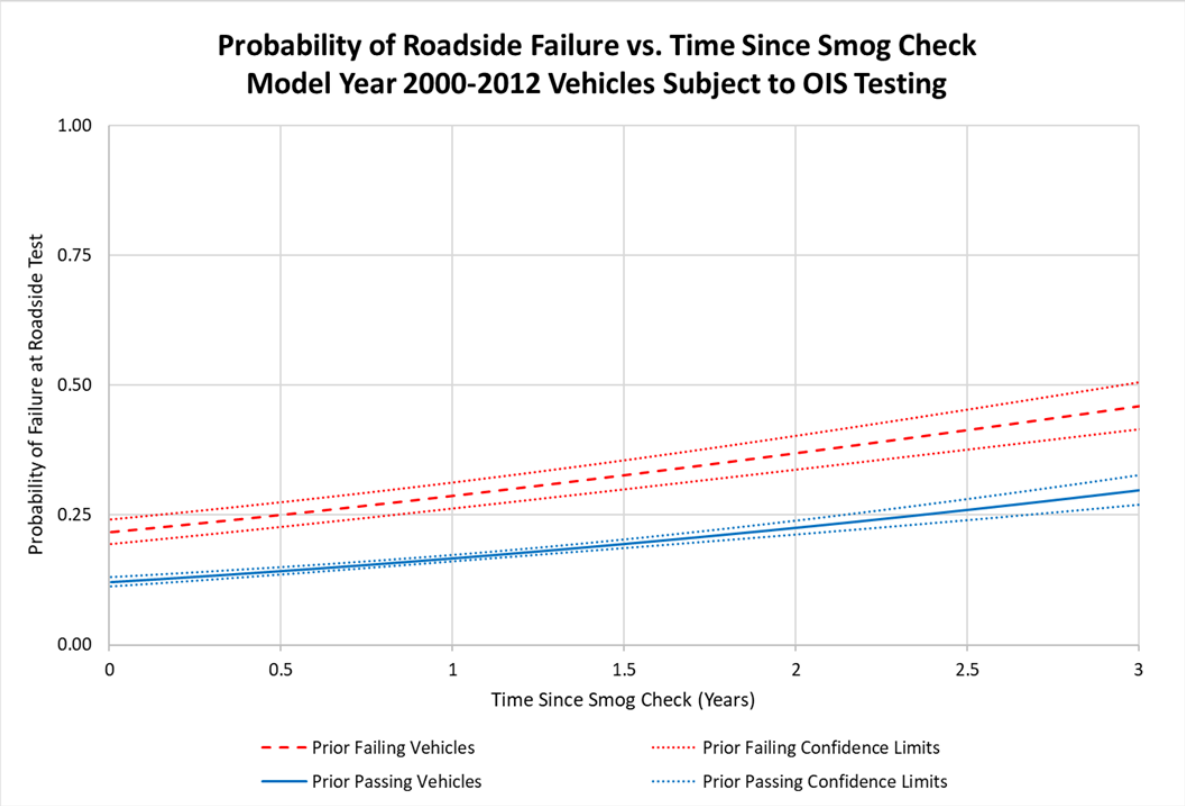


Analysis for OIS Tested Vehicles: Effects of Time Since Last Passing Smog Check Inspection and Prior Smog Check Result on Roadside Failure Rates

As noted above, the time between the roadside OIS inspection and when the vehicle was last certified also influences the failure rate observed at roadside. This is illustrated in Figure 5, which shows the probability of failing at the roadside versus time since the most recent Smog Check certification for model year 2000-2012 vehicles subject to OIS testing. As reflected in the figure, the probability of failure increases by 30-40% after one year, 70-90% after two years, and 110-150% after three years.[a] Consistent with Figures 3 and 4, vehicles initially failing their previous Smog Check show a much higher failure rate than initially passing vehicles. Also, of note is that the failure rate at the end of two years for prior passing vehicles is approximately the same as that of prior failing vehicles at year zero.

[a] While the majority of vehicles included in the matched Roadside-Smog Check data used for this report were tested at the roadside within the two-year window of the biennial test cycle, there were 422 vehicles (2.6% of the OIS-tested sample) that exceeded two years between Smog Check certification and the roadside inspection.

Figure 5



Analyses prepared for prior SCPRs have found that vehicles tested on the OIS and previously certified at STAR stations have lower first-year roadside failure rates than those certified by non-STAR stations.[a] For the 2020 SCPR, BAR performed an evaluation of the 2018-2019 roadside data to compare to the results from the 2018 SCPR which were based on 2016-2017 roadside data. Results from the two analyses, which evaluated first-year roadside failure rates for model year 2000-2006 OIS tested gasoline vehicles, are summarized in Table 5. Several points can be made with respect to that table:

- The total number of non-STAR tests is much lower in the 2018-2019 dataset, representing 6% of the sample, while 17% of the 2016-2017 vehicles were tested at non-STAR stations prior to the roadside test.
- For both samples, vehicles failing their initial Smog Check and eventually being certified as passing are failing at the roadside at higher rates for vehicles certified at non-STAR stations.
- Vehicles certified at non-STAR stations have a lower failure rate at the roadside for initially passing vehicles and overall than STAR stations in the 2018-2019 sample, which is inconsistent with previous analyses. While this may be partially attributable to the relatively small non-STAR sample size in the 2018-2019 roadside data, BAR continues to seek ways to ensure that STAR stations provide high-quality inspections.

[a] BAR implemented the STAR Program in January 2013. The program requires stations interested in inspecting directed vehicles to apply for STAR certification. BAR grants certification upon finding that the station meets inspection-based standards based on each calendar quarter's performance. In addition to performance, stations must also comply with the enforcement-related standards of the STAR Program.

Table 5
First-Year Roadside Failure Rates of Model Year 2000-2006 OIS Tested Gasoline Vehicles
2016-2017 vs. 2018-2019 Roadside Data

Initial Smog Check Result	All Stations (2016-2017)	STAR (2016-2017)	Non-STAR (2016-2017)	All Stations (2018-2019)	STAR (2018-2019)	Non-STAR (2018-2019)
Fail**	31% (702)	29% (591)	39% (111)	33% (651)	33% (624)	48% (27)
Pass***	16% (6,685)	16% (5,573)	19% (1,112)	18% (6,534)	18% (6,142)	14% (392)
Overall Failure Rate	17% (7,387)	17% (6,164)	20% (1,223)	19% (7,185)****	19% (6,766)	17% (419)

* Roadside failure rate percentages are weighted by model year group to match the numbers of initial Smog Check tests performed in the state; sample sizes are shown in parentheses beneath the failure rate percentages. "OIS Fail Rate" means OBD fail rates.
** Vehicles failed initial Smog Check, were eventually certified as passing, but "re-failed" at roadside within one year.
*** Vehicles passed initial Smog Check but failed at roadside within one year.
**** Note that there are ten fewer total tests for 2018-2019 data in this table versus Table 1 because Referee stations were excluded in the analysis performed for Table 5.

BAR is in the process of developing regulations to make changes to certain aspects of the STAR program to ensure that participating stations are of the highest quality and that they maintain that high quality well beyond initial STAR certification. Under the current rules, suspension of STAR certification is a lengthy process that can take up to two years to enforce, during which the station can continue to operate under the STAR banner. Three proposed revisions to the regulations would help to speed the process of suspending STAR certification for poor performing stations, better ensuring that STAR stations are performing to elevated standards:

(1) Reviewers of appeals would be able to assign penalties immediately, with less onerous penalties when warranted (e.g., a month suspension rather than complete decertification).
(2) STAR inspection privileges for stations found to be out-of-compliance with STAR regulations would be maintained until the effective date of an informal hearing decision to suspend the privileges.
(3) Stations with no previous FPR score would not be allowed to employ inspectors with no previous FPR score and become STAR certified. One or the other would need a passing FPR score to qualify the station for STAR certification.

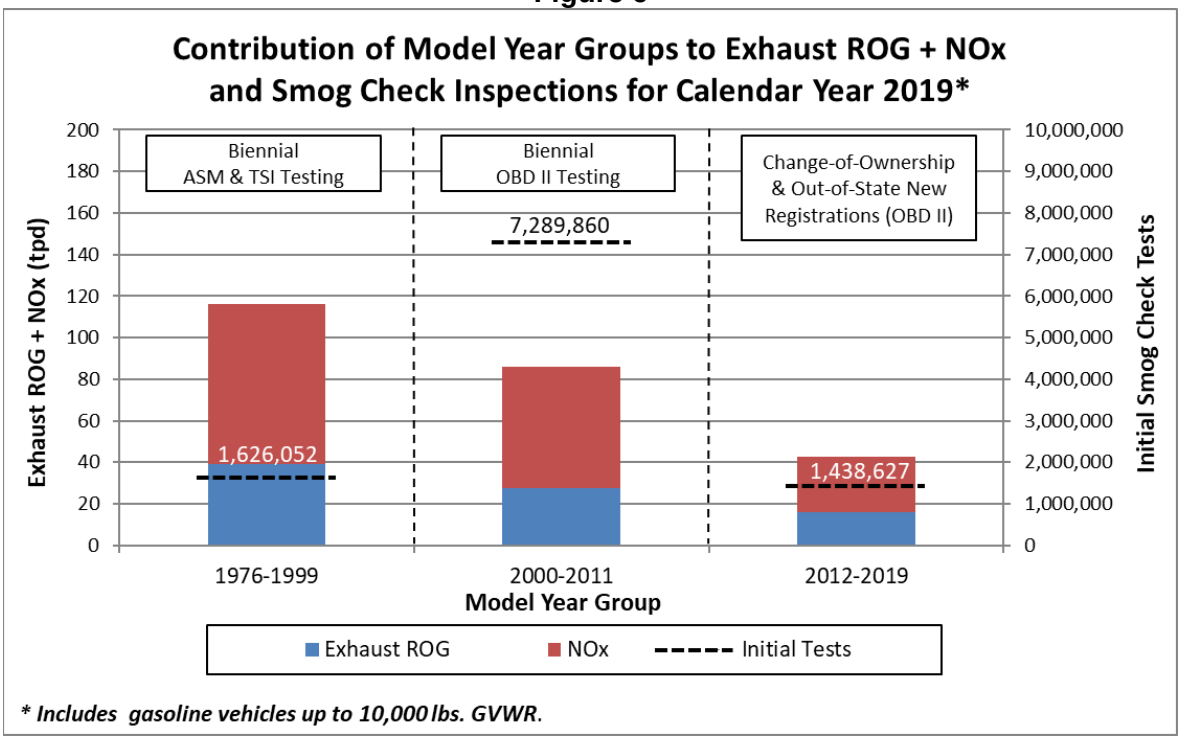
Current Excess Emissions

This report defines excess emissions in terms of the emissions that could have been reduced if all vehicles were inspected at "high-performing" Smog Check stations. In part, the method to estimate these excess emissions relies on the CARB EMFAC2017 model as an estimate for current emissions from on-road gasoline-powered vehicles in California. The average roadside ASM concentration for vehicles certified as passing Smog Check at "high-performing" stations and subsequently tested at the roadside is compared to the average roadside ASM concentration for vehicles certified at all stations. The ratio of the averages is used as a factor to apply to the current on-road emissions from the EMFAC model in order to estimate the emission reductions. This method is applied separately by vehicle type and model year group. The following estimate was made using this methodology:

- The estimated additional achievable emission reductions for model year 1976 to 2015 light- and medium-duty gasoline-powered vehicles in the Smog Check Program is on the order of 30 to 50 tons per day of reactive organic gases and oxides of nitrogen (ROG + NOx) for 2019.[a]

Of the 10.3 million initial Smog Check tests conducted in 2019, 16% were tailpipe tests (primarily ASM tests, but also including TSI tests) and 84% were OBD tests. However, approximately 70% of the excess emissions identified by roadside testing coupled with the CARB EMFAC2017 model is attributable to the pre-2000 model year vehicles subject to tailpipe testing. Figure 6 shows the contribution of different model year groups to the 2019 exhaust ROG and NOx emissions inventory for gasoline vehicles up to 10,000 lbs. GVWR, along with their Smog Check test requirements. While the pre-2000 model year vehicles make up a relatively small fraction of the California fleet and Smog Check inspections, they contribute significantly to the on-road vehicle emissions inventory. This illustrates the importance of ensuring these vehicles are subject to high-quality inspections in the Smog Check Program.

Figure 6



Evaluation of Best Practices of Other Vehicle Inspection Programs

The following is an evaluation of best practices and recommendations of other vehicle emissions inspection and maintenance (I/M) programs covering 32 states, plus Ontario, Canada. Saint Malo Solutions, LLC provided the research and much of the language for BAR to use in this section of the report. One or more of the following tests are implemented in each of the involved states:

- OBD Test: Usually administered to 1996 and newer vehicles equipped with OBD II systems.

[a] In 2019 model year 1976 to 2011 vehicles were subject to biennial inspections, while model year 2012 to 2015 vehicles were subject to change-of-ownership inspections. Accordingly, the potential reduction from the model year 2012 to 2015 vehicles observed in the roadside data was scaled by the fraction of vehicles in these model years undergoing change-of-ownership inspections.

- ASM or Transient Dynamometer Test (ASM5015 – ASM2525 – IM 147 – IM240): Usually administered to pre-1996 model year vehicles weighing 14,000 lbs. GVWR or less.
- A Steady State or Two Speed Idle Test: Usually administered to older vehicles and/or vehicles that cannot be tested on a dynamometer.
- Opacity Test: For diesel vehicles, this test measures the level of opacity in the vehicle's exhaust.
- A Gas Cap Seal Test
- A visual Catalytic Converter Inspection

Program findings include:

- On January 1, 2020, the state of Washington ended its emission testing program after 38 years.
- Citing low failure rates and cost savings to the public, as of April 1, 2019, Ontario, Canada no longer requires owners of light-duty vehicles to get an emissions inspection test.
- Effective January 1, 2020, tailpipe testing in Ohio was discontinued for all vehicles manufactured prior to 1996.
- 21 states, including California, operate decentralized programs. Four oversee hybrid programs with both centralized and decentralized elements. Five states and the District of Columbia operate centralized programs, and as stated earlier, the State of Washington and the province of Ontario, Canada have ended their test programs.
- 22 states, including California, tie compliance with registration renewal, while the remainder of participating states issue windshield stickers.
- Like California, 10 states require inspection upon vehicle resale.
- Unlike California, 14 states require periodic safety inspections.
- Like California, nine other states conduct statewide inspections while the remainder operate only in those areas of the state where air quality is adversely impacted due at least in part to vehicular emissions.
- In support of their programs, California contracts with OnCore Consulting LLC, 14 others contract with Opus Inspection, 4 with Applus+ Technologies, 4 with Worldwide Environmental Products, and 3 each with Gordon Darby and Parsons. Two states, Maine and Nevada use no outside contractor to support their programs.
- Test network sizes range from as few as two stations in the District of Columbia, to as many as 10,000 in the state of New York. Pennsylvania ranks second with 8,000 stations. Rounding out the top five networks are: #3 – California with 7,900 stations, #4 – Texas with 5,600 stations, and #5 – North Carolina with 4,500 stations.
- The average cost of an inspection in California is between $50 and $60 depending on the inspection type. The cost of inspection in other states ranged from free (state sponsored) to as much as $60.
- All 32 states and the District of Columbia require hybrid vehicles to be inspected.
- 16 states including California require an inspection every two years (biennial), 12 require annual inspection, and the remaining states vary inspection frequency by vehicle type and age.
- Many states defer the requirement for first emissions inspection (clean screen) for several years. The first required inspection for vehicle owners ranges from 0 years in some Northeast states (Maine, New Hampshire, and Vermont), to 8 years of age in California (e.g., a model year 2012 gasoline-powered vehicle is first tested in calendar year 2020). Change-of-ownership inspections begin in California at 4 years of age.
- Seven states (not including California) utilize remote sensing technologies (RSD) to screen the fleet to either detect high emitting vehicles for inclusion in the program (dirty screening) or to detect vehicles for exemption from testing requirements (clean screening).

- Three states, including California, utilize remote OBD system checks (remote OBD or OBD III) either as an integral part of their programs (Oregon) or as pilot programs (California and Utah). Government fleets participating in BAR's Continuous Testing Program (CTP) equip their vehicles with transponders that send information to BAR on the status of the OBD system and if any faults are present. Vehicles participating in the program are exempt from biennial Smog Check requirements provided they remain in compliance (i.e., no stored fault codes) as verified by periodic checks of the OBD data.
- Three states and the District of Columbia utilize self-service OBD kiosks as components of their I/M programs.

List of Attachments

A. Excerpted “Specific Comments” from “Review of the 2019 Smog Check Performance Report,” Saint Malo Solutions, LLC, March 7, 2020 with BAR annotations.

B. Acronyms

Attachment A

This attachment consists of the section entitled, "Specific Comments" from "Review of the 2019 Smog Check Performance Report," by Saint Malo Solutions, LLC, March 7, 2020, with annotation (*in italics*) by BAR. Saint Malo's comments on specific statements, tables, and page numbers refer to BAR's 2019 SCPR. Citations in BAR's responses refer to the current (2020) SCPR, unless stated otherwise. The entire independent review by Saint Malo of the 2019 SCPR (without annotation) is available upon request at BAR.PRA@dca.ca.gov.

Saint Malo: Page 2 - "Overall, model years 2000-06 OIS-tested vehicles in the 2017-18 roadside sample failed at a model year weighted rate of about 19%, which compared to the 18% failure rate found for the similarly weighted ***(and partially overlapping)*** 2016-17 sample."

Page 6 - "The latest roadside test data described in this report was collected between January 1, 2017, and December 31, 2018."

Question: Could the authors explain the nature and extent of the overlap between the 2016-2017 sample and the 2017-2018 sample. Was some subset of the vehicles tested included in both samples?

BAR Response: *This is an insightful question that BAR will answer and expand upon in the 2020 SCPR. The short answer is that each two successive annual SCPRs includes one common calendar year of roadside sampling, which in this case is 2017. The reason for doing this is to have the report, which is produced annually, reflect as closely as possible the entire California vehicle fleet in which each vehicle is regularly tested only biennially. There are a few subtleties in this approach, such as the fact that in each report the newer of the two calendar years may be slightly underweighted because fewer of the vehicles that were certified at their Smog Check two years earlier were likely tested at roadside (compared to the older of the two years). However, the advantage of this approach is that it provides the most recent roadside data available at the time of the annual report and that the report is produced using the same basic time framework each year so that results from different annual reports can be compared.*

Saint Malo: Page 3 – "More specifically, beyond about age ten, newer vehicles tested on the OIS tend to be failing at a slightly lower rate than vehicles tested on the EIS were failing when they were at the same age (upper gray line). This could be attributed to greater durability of the emission control system on newer vehicles."

Page 5 – Finding 3 – "Model year 2000-06 OIS tested vehicles tended to fail (for OBD) in the 2017-18 roadside sample at a similar but slightly lower rate than vehicles receiving an EIS tailpipe inspection at the same age in the 2003-06 roadside sample. This could be attributed to greater durability of the emissions control system on newer vehicles."

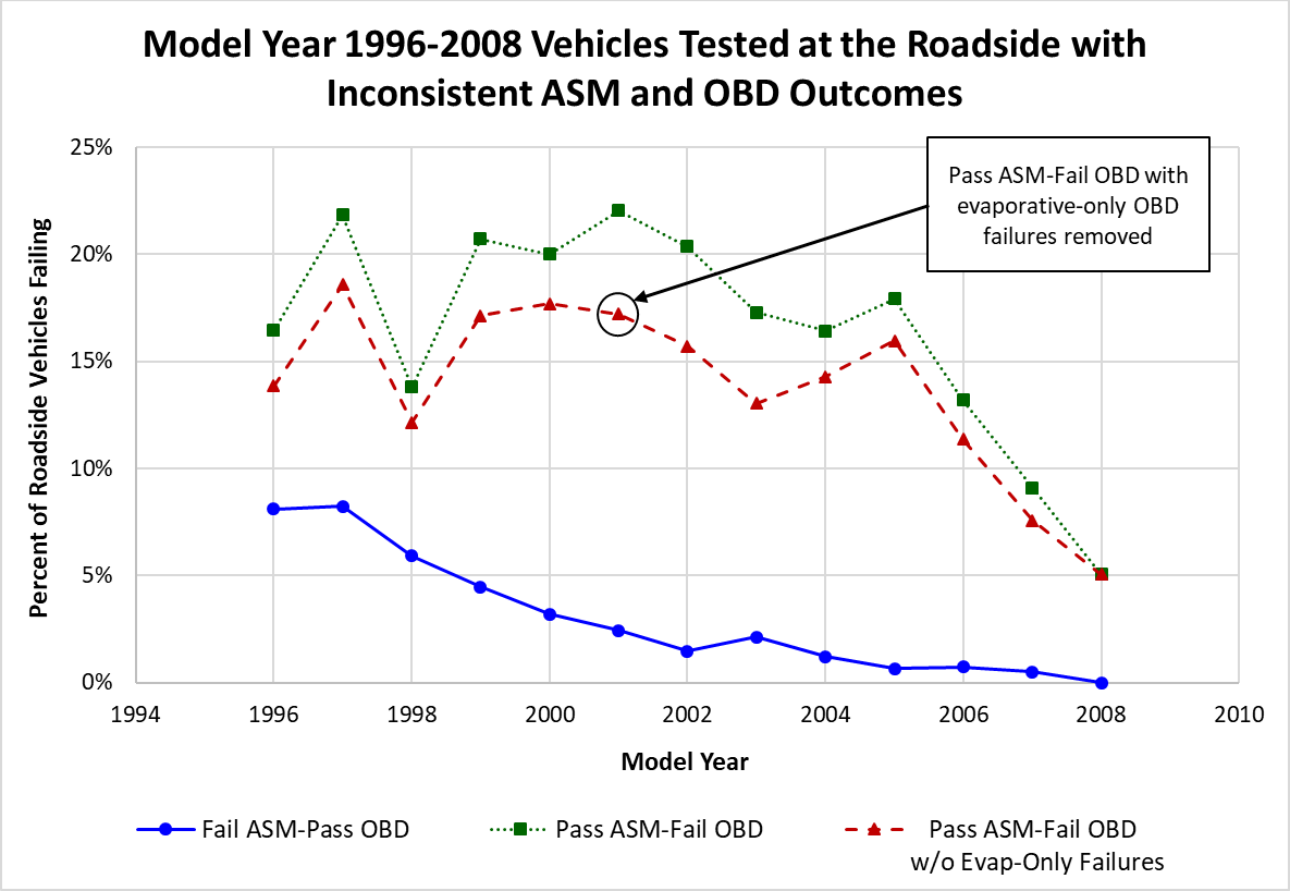
Question: Might some of the observed differences in the failure rates be attributable to the difference in the test itself (OIS vs EIS)?

BAR Response: *Because the OIS is designed to be a more comprehensive and continuous check of the engine and emission control system, one might expect that it would result in a higher roadside fail rate than the tailpipe test rather than the lower roadside fail rate that is seen in Figure 1 (comparing the upper "Sierra Research analysis" curve from roadside tailpipe testing and the middle "OIS Roadside" fail rates curve of same-age vehicles.)*

Elaborating on this issue, BAR evaluated the OIS/OBD failure rates versus the EIS/ASM failure rates observed in the 2018-2019 roadside data for model year 1996-2008 vehicles for cases in which vehicles were subject to both OIS and EIS tests (each individual model year included in this analysis

had at least 99 data points). As noted above, because the OBD system is a more rigorous check of the emission control system, there are many more Pass ASM-Fail OBD vehicles than Fail ASM-Pass OBD vehicles. This is shown in Figure A-1 below.

Figure A-1



Two points can be made with respect to the figure:

(1) A higher rate of Pass ASM-Fail OBD vehicles is taking place as expected, as the OBD system identifies defects that would not be captured on the ASM test such as evaporative system leaks and defects that impact cold-start emissions (e.g., air injection); the impact of removing evaporative-only OBD failures from the Pass ASM-Fail OBD is also shown in the figure. This supports the conclusion that the slightly reduced failure rates in the newer roadside evaluations compared to the 2003-2006 roadside data used for the Sierra Research study are likely the result of factors such as improved vehicle durability and Smog Check program improvements rather than the ASM tailpipe test being more effective at identifying emission control system defects than an OBD-based inspection.

(2) There is a strong downward trend in the Fail ASM-Pass OBD vehicles with model year, which reflects: (a) improvements to the OBD systems over time (1996 was the first model year for OBD II, and the program requirements have undergone strengthening several times in the ensuing years), and (b) more stringent tailpipe certification standards for the newer model years that are not reflected in the ASM cutpoints, making the ASM test less effective in identifying high emitters relative to the emission standards for the newer model year vehicles (the California LEV II emission standards were phased in between the 2004 and 2010 model years).

Saint Malo: Page 4 – "Figure 2, below, shows the immediate effect of the coordinated enforcement action, indications of program defeat methods usage were reduced by 85%, to 68 fraudulent test indicators per day." Figure 3 shows that the incidence of fraud has a regional element with South El Monte, Culver City, San Jose and Riverside County displaying high before and after intervention fraud compared to other areas.

Questions: Can the authors provide a bit more information on this issue? For example:

- How were these fraudulent acts distributed? Is this problem reflective of a few bad actors or is it systemic?
- What percentage of stations were impacted by the enforcement action?
- Given the apparent area specific nature of fraudulent acts, might socioeconomics be an underlying factor?
- Are fraudulent tests being performed for a particular age group of vehicles or is it fleet wide?
- What is the nature of the remaining 68 fraudulent acts per day?
- Given BAR's ability to detect fraudulent tests, what are the remaining obstacles to their elimination?

BAR Response: *BAR is reluctant to reveal too many details that could help those trying to elude BAR enforcement efforts. The description of BAR's actions in the report represents its best effort to balance openness while ensuring the confidentiality of methods and practices to discover fraudulent practices. BAR continues to diligently pursue fraudulent behaviors using all avenues available.*

Saint Malo: Page 6 – "Consistent with prior reports, this report focuses on data from tailpipe tests, not OBD tests."

Question: Given that the fleet subject to Smog Check is dominated by vehicles subject to OIS rather than EIS testing – according to the authors, "In 2018, 84% of Smog Check tests were tested with the OIS" (page 7) - shouldn't more emphasis be placed on OBD based testing?

BAR Response: *Yes, BAR plans to focus future reports more on OBD testing. BAR began OBD-focused testing in March 2015 and has continually increased the amount of Roadside OBD testing over the last year (early 2019). In general, this reporting looks back 2-3 years in Smog Check history to match to the roadside event. All these factors have caused BAR to wait to focus the report on OBD inspections. Finally, BAR has had concern with changing the base criteria of the report as it may obfuscate comparisons to prior reports if the methodology changes each year.*

Saint Malo: Page 6 – "To minimize inconvenience to participating motorists, roadside testing does not include a visual or most functional inspection that would be performed during inspections at Smog Check stations."

Question: Does this deviation from standard procedure make station-based and roadside comparisons problematic? For example, is it not possible that a vehicle initially failed some visual or functional test at a Smog Check station and subsequently passed at roadside because these inspections are not performed?

BAR Response: *The analysis in the report only considers the tailpipe or OBD portions of the inspection results from Smog Check stations that correlates to the abbreviated roadside inspection. This analysis method puts the inspections on the same terms.*

Saint Malo: Page 6 – "Just as with Smog Check inspections, a small percentage of vehicles pulled over at roadside with bald tires, liquid leaks, or other safety issues, are excluded from testing."

Question: Could the authors elaborate on whether all of the vehicles exempted from roadside inspection for safety purposes were subject to EIS testing? Bald tires, for example, would not pose a safety issue during OIS testing.

BAR Response: *There are very few vehicles that are excluded from roadside testing based on safety issues, and those are almost exclusively EIS related issues. The roadside crew uses their discretion and automotive knowledge when determining which vehicles to reject and from which test method to reject them. The overriding concept is to be sure that no damage is done to the vehicle during roadside testing.*

Saint Malo: Page 6 – "Older vehicles, while a smaller percentage of the fleet, continue to contribute disproportionately to overall smog-forming emissions of hydrocarbons (HC) and nitrogen oxides (NOx)."

Comment: The report focuses almost exclusively on failure rates rather than the impact on emissions. Although it is implied, and generally understood, that an increase in one signifies an increase in the other, some further discussion of this disproportionality may be useful when discussing a comparison of EIS failures to OIS failures for example.

BAR Response: *In the 2020 SCPR, BAR documents the fact that most of the 30-50 tons per day of "excess emissions" of ROG+NOx due to less than high-performing Smog Check stations are from model year 1976-1999 vehicles. The dominant impact of emissions from older vehicles is particularly notable because there are far fewer model year 1976-1999 vehicles in the fleet than newer vehicles, and the older vehicles travel far fewer miles per year on average. This disproportionate emissions impact of the older, tailpipe-tested vehicles underscores the importance of BAR's current enforcement efforts to combat clean gassing as well as BAR's proposed revisions to existing regulations that would help to speed the process of suspending STAR certification for poor-performing stations.*

Saint Malo: Page 6 – "These statistics are weighted to reflect the California vehicle populations being reported based on model year, vehicle type/class, Gross Vehicle Weight Rating (GVWR), and other factors."

Question: What other factors? On page 11 of the report it is suggested that there are a total of five factors in the "full" model. Are these other factors not mentioned because they are not important (statistically significant) to the analyses or modeling?

BAR Response: *The summary data presented in Tables 1 and 2 were weighted and binned using essentially the same factors used by Sierra in its original analysis (albeit with different weightings to reflect changing model year population and groupings). BAR used these same variables so that the annually reported performance measures, which are specified by statute, could be compared in the most direct manner over time. The modeling of factors that affect roadside fail rates that is described beginning on page 10 of the 2019 SCPR, is intended to provide BAR's "…best efforts explanation…" of roadside pass and fail rates, which is a related but specific statutory requirement of the SCPR. The former requirement may be found in California Health and Safety Code Section 44024.5 (b) Subsections 2 and 3, while the latter is in Subsection 5. All the factors reported in BAR's analysis of roadside tailpipe fail rates are statistically significant. Two of the factors mentioned on page 6 of the SCPR and cited by the Reviewer, "vehicle type/class" and "Gross Vehicle Weight Rating", are not part of the roadside fail rate modeling; rather, they were used as part of BAR and CARB's calculation of current excess emissions.*

Saint Malo: Page 11 – "One difference made to the Figure 5 model compared to Figure 4, is the inclusion of 2000-06 model years roadside data for which BAR has continued to collect both OIS and tailpipe data."

Question: In the 2018 SCPR the authors mentioned that 1.5% of vehicles that failed an ASM passed the OIS test. Has additional testing altered this finding? Since these vehicles would have passed their required test, could the authors elaborate on the impact of these apparent errors of omission?

BAR Response: *Based on the 2018-2019 roadside data, BAR found that 1.4% of the model year 1996-2012 vehicles, when weighted by their proportion in the fleet,[a] were failing ASM-passing OIS at the roadside.*

As a final comment, BAR thanks its reviewer, Saint Malo Solutions, for the thoughtful and helpful comments.

[a] Vehicle population by model year was based on EMFAC2017 analyzed for 2019.

Attachment B
Acronyms

AB, Assembly Bill

AGO, Attorney General's Office

ASM, Acceleration Simulation Mode

BAR, Bureau of Automotive Repair

BAR-97, BAR-certified EIS for testing model year 1976-1999 vehicles

CARB, California Air Resources Board

CCR, California Code of Regulations

CHP, California Highway Patrol

CO, Carbon Monoxide

CTP, BAR's voluntary Continuous Testing Program to assess remote OBD system checks on government fleets

EIS, Emission Inspection System

FPR, Follow-up Pass Rate

GVWR, Gross Vehicle Weight Rating

HC, Hydrocarbon

I/M, Inspection and Maintenance

LEV, Low Emission Vehicle

LEV II, Phase II of the Low Emission Vehicle program phased in between 2004 and 2010 model years

NOx, Oxides of Nitrogen

OBD II, On-Board Diagnostics, 2nd generation, generally equipped on model year 1996 and newer light duty vehicles

OBD III, On-Board Diagnostics, theoretical 3rd generation, involves transmitting OBD data remotely

OIS, OBD Inspection System for testing OBD-equipped vehicles including, gasoline model years 2000 and diesel 1998 and newer

ROG, Reactive Organic Gases, the portion of hydrocarbon emissions that are reactive in the atmosphere and participate in reactions that form ozone

RSD, Remote Sensing Device, an analyzer capable of measuring the concentration of HC, CO, and NOx from vehicles operating on the road

SIP, State Implementation Plan, the state's commitments to the United States Environmental Protection Agency to achieve air quality standards

SCPR, Smog Check Performance Report

STAR, Classification of stations that can certify directed vehicles

tpd, Tons per day

TSI, Two-Speed Idle