REPORT TO THE CALIFORNIA STATE LEGISLATURE

SENATE BILL NO. 1079
VEHICLES: SOUND-ACTIVATED ENFORCEMENT DEVICES

JANUARY 2025

GAVIN NEWSOM
GOVERNOR
STATE OF CALIFORNIA

TOKS OMISHAKIN
SECRETARY
CALIFORNIA STATE TRANSPORTATION AGENCY

SEAN A. DURYEE
COMMISSIONER
CALIFORNIA HIGHWAY PATROL

IN ACCORDANCE WITH CALIFORNIA VEHICLE CODE SECTION 27150.4

Table of Contents

Table of Figures

Executive Summary

Pursuant to Senate Bill (SB) 1079 (Portantino, Chapter 449, Statutes of 2022), the California Highway Patrol (CHP) conducted a study to evaluate the effectiveness of sound-activated enforcement devices (SAED). The goal of the study was to determine the efficacy of the emergent technology as a tool for monitoring vehicle exhaust noise and enforcing applicable laws. The CHP evaluated the capability of SAEDs from three different companies to accurately identify vehicles producing exhaust noise beyond the allowable sound limits specified in the California Vehicle Code (CVC). After conducting thorough market research, SAEDs from the following three companies were selected for this study: TNL, Intelligent Instruments, and Jenoptik (through its subsidiary, Traffipax). The SAEDs were installed throughout the greater Sacramento area.

TNL

TNL's SAED was installed on the westbound United States (US) Highway 50 on-ramp from northbound Sunrise Boulevard. Installation was completed by the California Department of Transportation (Caltrans) on December 21, 2023. However, the data available through TNL's web-based interface was largely unsuitable for manual review. As a result, a thorough analysis of individual events could not be conducted.

Intelligent Instruments

Intelligent Instruments' SAED was installed on the westbound US-50 on-ramp from southbound Watt Avenue. Installation was completed by Caltrans on February 3, 2024. A total of 328 events from February 9, 2024, to March 27, 2024, were analyzed as part of this study.

Jenoptik

Jenoptik's SAED was installed on the westbound Interstate (I) Highway 80 on-ramp from southbound Elkhorn Boulevard. Installation was completed by Caltrans on February 28, 2024. Jenoptik encountered technical issues after installation and was unable to provide any data for CHP review prior to the completion of this report.

Study Findings

Of the three SAEDs installed, only Intelligent Instruments' SAED generated data which could be analyzed by the CHP on a web-based interface. However, all SAEDs evaluated were determined to be inadequate as a standalone enforcement tool and unsatisfactory in their ability to identify individual offending vehicles to the degree necessary for enforcement action.

Recommendations

Based on the results of the study, the CHP does not recommend the use of SAEDs as a standalone enforcement tool to be used as the sole basis for issuing citations for exhaust noise violations.

An electronic copy of this report can be found on the CHP website, under Office of Special

Representative, Year 2024 Legislative Reports: *https://www.chp.ca.gov/programs-services/programs/office-of-special-representative*. A hard copy can be ordered by contacting the CHP's Commercial Vehicle Section at (916) 843-3400.

Introduction

On September 19, 2022, Governor Gavin Newsom signed SB 1079 (Portantino, Chapter 449, Statutes of 2022) into law, tasking the CHP with conducting a study of SAEDs as a monitoring and enforcement tool for excessive exhaust noise. The purpose of the study was for the CHP to test the efficacy of SAEDs and to determine their ability to capture exhaust noise violations to the degree that the information would allow for enforcement action. This study was a collaborative management effort between the CHP and Caltrans, undertaken with existing staff resources. The CHP's Research and Planning Section coordinated installation of the devices with Caltrans and the respective vendors while Caltrans executed the installation of each device. The analysis of the data and compilation of this report was performed by the CHP's Commercial Vehicle Section.

Pursuant to SB 1079, the CHP is required to submit a report of the study's results to the California State Legislature by January 1, 2025.

Study Administration

In 2023, after conducting thorough market research, the CHP issued a Request for Information which was followed by a Request for Quotation. The CHP eventually identified three vendors which met the minimum requirements and could provide SAEDs for this study. The CHP initiated the purchase of all three SAEDs. In coordination with Caltrans and the three vendors, each manufacturer's equipment was installed on one of three freeway on-ramps throughout the greater Sacramento area. The state procurement process can be time-consuming due to the requirements contained in the State Contracting Manual, California Government Code, and the Public Contracts Code. As a result, the CHP was required to engage in a lengthy bidding and procurement process before any equipment could be acquired. The prolonged state procurement process and the installation process resulted in a condensed operational period for this study, with a reduced period for data acquisition and analysis.

The installation of TNL's SAED was completed on December 21, 2023. The SAED provided by TNL was installed on the westbound US-50 on-ramp from northbound Sunrise Boulevard. California Highway Patrol personnel were granted access to TNL's web-based interface on March 5, 2024. Following the installation of its SAED, TNL provided CHP personnel an initial training on navigating its web-based interface on January 29, 2024; a second training session was provided on February 26, 2024.

The installation of Intelligent Instruments' SAED was completed on February 3, 2024. The SAED was installed on the westbound US-50 on-ramp from southbound Watt Avenue [Figure 1]. California Highway Patrol personnel were given access to Intelligent Instruments web-based interface on February 26, 2024. Intelligent Instruments provided a training session on navigating its web-based interface on February 29, 2024.

The installation of Jenoptik's SAED was completed by Caltrans on February 28, 2024. The SAED was installed on the westbound I-80 on-ramp from southbound Elkhorn Boulevard [Figure 2]. Jenoptik failed to confirm that its SAED was functional at that time. Jenoptik did not provide any training related to its SAED web-based interface. Ultimately, technical issues encountered by Jenoptik prevented the CHP from evaluating the SAED or even accessing its data through a web-based interface.

Figure 1: Intelligent Instruments' SAED (Westbound US-50 On-Ramp from Southbound Watt Avenue).

Figure 2: Jenoptik's SAED (Westbound I-80 On-Ramp from Southbound Elkhorn Boulevard).

The CHP's Commercial Vehicle Section was tasked with manually reviewing and analyzing the data generated by all SAEDs included in this study. Data analysis was conducted at the CHP Headquarters in Sacramento, California. Ultimately, only data generated by Intelligent Instruments' SAED was able to be analyzed for this study. Deficiencies in TNL's SAED,

specifically in the functionality of its web-based interface, did not allow for a thorough analysis of the data, and Jenoptik did not provide timely access to its data so it could not be considered for this study. Notwithstanding, by analyzing the data generated by Intelligent Instruments' SAED, the CHP was able to evaluate the efficacy of an SAED as a tool to monitor exhaust noise and enforce applicable laws.

Each event was reviewed by a CHP officer for: (1) quality and type of sound, (2) noise level reading, (3) accuracy of the SAED in identifying the violating vehicle, (4) lighting conditions, (5) vehicle type, and (6) license plate verification. The data was further categorized into one of four vehicle types: passenger motor vehicle, full-sized pick-up, commercial motor vehicle, and motorcycle. This process allowed the CHP to identify the following:

- How often the device identified a vehicle producing exhaust noise in violation of the limits outlined in the CVC.
- How often the device identified a potential violation not associated with an exhaust noise violation.
- How often the source of the sound captured by the device was not definitively identified.

For the purposes of this study, the noise limits, in A-weight decibel (dBA), used to determine an exhaust noise violation were those codified in Sections 27151, 27202, and 27204 CVC [Figure 3]. This study attributed an approximate gross vehicle weight rating (GVWR) to each identified vehicle based on the reviewing officer's training and experience (the exact GVWR of a vehicle could not be obtained without a proper examination of the vehicle specifications). Where applicable, the date of manufacture was assumed to be the most recent year listed in Sections 27202 and 27204 CVC.

Vehicle Type	GVWR (pounds)	Enforceable dBA
Passenger Motor Vehicle	< 6,000	> 95
Full-Size Pick-Up	6,001 - 10,000	> 80
Commercial Motor Vehicle	>10,000	> 80
Motorcycle	N/A	> 80

Figure 3: The GVWR and Enforceable dBA Used for Each Vehicle Type in This Study.

Sound-Activated Enforcement Device 1 – TNL

TNL, a Dutch company specializing in mobility solutions, provided an SAED consisting of two sound sensors, two cameras, a Class 1 acoustic analyzer, and a 4G cellular connection kit. The price of the device was $194,000.00; service costs—for project management, setup and factory testing, installation, configuration, user training, removal, and support—totaled an additional $141,000.00. Installation was accomplished without issue and CHP personnel were given access to the SAED's web-based interface for review of the generated data. Ultimately, the SAED's web-based interface was highly inadequate in facilitating any potential enforcement action against vehicle exhaust noise violations. Notably, none of the generated video files contained any sound and, in order to listen to any associated audio, a separate audio file had to be played [Figure 4].

Figure 4: TNL's SAED Web-Based Interface Displaying Video and Audio Recordings as Two Separate Files.

TNL was made aware of this inadequacy and advised the CHP its subcontractor would overlay the audio recording to the corresponding video recording as part of its next release. These changes were not made in time to allow for a proper analysis of the data. Additionally, it was generally difficult to visually identify the source of the exhaust noise reading. This was because it was not uncommon to see multiple sound intensity arrays, tracking multiple vehicles, in any given video recording (at times, these appeared to not be tracking a vehicle at all) [Figure 5].

Figure 5. Still Images from Video Recordings Displaying Sound Intensity Arrays Tracking Multiple Vehicles in the Same Event (left) and Sound Intensity Arrays Not Tracking a Vehicle (right).

The web-based interface also presented difficulties when it came to verifying the listed license plate number purportedly associated with the listed dBA level. A zoom or magnifying feature was supposed to be available with the video recording. However, as noted below, this feature was not functioning during this evaluation [Figure 6].

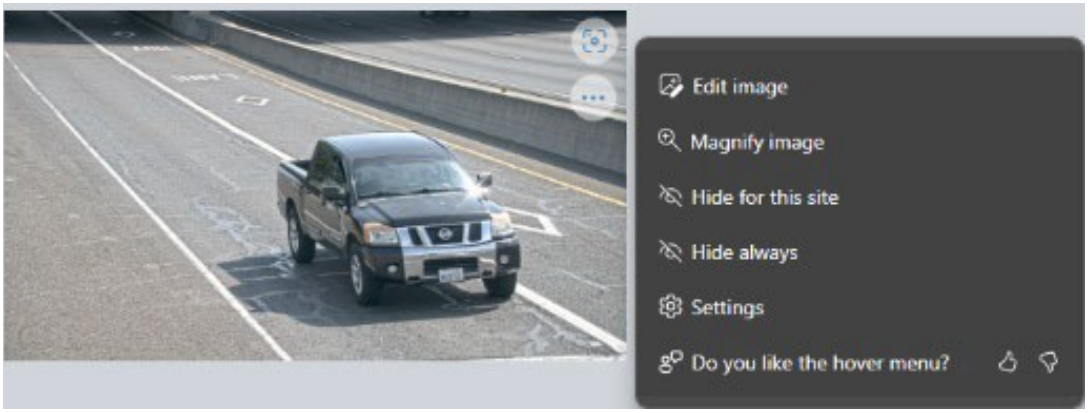

Figure 6. "Magnify image" Feature Available on Still Image of Identified Vehicle.

Clicking on the "Magnify image" feature opened a separate pop-up window that would not load [Figure 7].

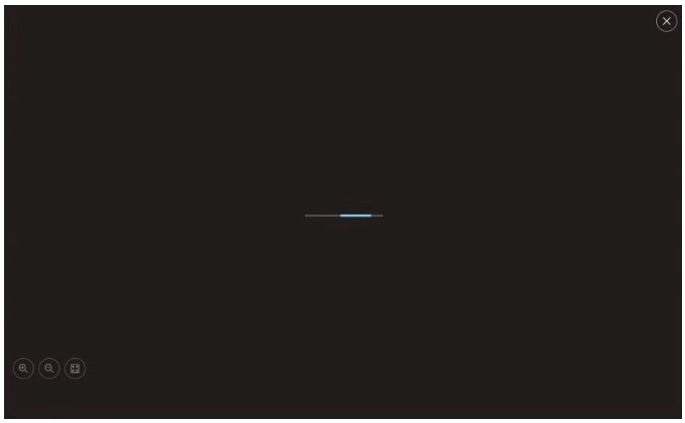

Figure 7. Non-Functional Pop-Up Window to Enable Magnification of Image.

The data provided was insufficient to measure the variables required to meet proposed SAED standards. Together, the absence of synchronization between the video and the audio recordings, the presence of multiple sound intensity arrays within a given video recording, and the lack of a means to magnify the video to properly verify vehicle license plate numbers, resulted in TNL's SAED being an ineffective tool for monitoring and enforcing exhaust noise violations.

Sound-Activated Enforcement Device 2 – Intelligent Instruments

Intelligent Instruments, a provider of smart monitoring platforms based out of the United Kingdom, provided a second-generation SAED. The SAED utilized for this study was comprised of two high-resolution NDAA Section 899-compliant cameras, along with a precision microphone conforming to the Class 1 accuracy standards in the International Electrotechnical Commission's (IEC) standard IEC 61672:2013, as required by statute. The device used a microphone array to determine where vehicle exhaust noise was coming from, resulting in a red dot visible in the overview video accessible through the web-based interface.

In response to the Request for Quotation, Intelligent Instruments stated that its SAED was in "full compliance" with Section 27150.4 CVC, including the following requirements specified in the statute:

- Activates when noise levels have exceeded the legal sound limit established in Section 27151 CVC.
- Obtains a clear video of a vehicle and its license plate.
- Records audio, precision accuracy noise levels, and high-definition video in two directions.
- Utilizes an automated system that triggers when excessive vehicle noise over the limit is detected and saves the data for review.
- Automatically deletes any evidence not related to a violation.
- Permits the CHP to manually review evidence to ensure a violation has occurred.

The total cost of the device was $38,000.00, which included the first year of service (licensing, software updates, and product support). After the first year, servicing costs are $1,125.00 per quarter. Calibration services would be necessary on an annual basis, which required the device to be removed and shipped to Intelligent Instruments in the United Kingdom. The calibration cost per camera was quoted at $1,150 (does not include shipping costs).

Intelligent Instruments Data Analysis

The analysis of Intelligent Instruments' data revealed the SAED was generally effective in detecting vehicle exhaust noise, but ineffective as a prospective standalone tool for citing and taking enforcement action for violations of the applicable vehicle exhaust noise laws.

Exhaust Noise Detection

According to Intelligent Instruments, their SAED was not designed to trigger an event at a specific exhaust noise level. Instead, the device would trigger an event recording using a bespoke algorithm tuned to detect exhaust noise (as noted by Intelligent Instruments, the sensitivity of the trigger could be adjusted, if required). As a result, almost all events captured from February 9, 2024, through March 27, 2024, contained vehicle exhaust noise. Out of the 328 events analyzed during this time period, 324 events were confirmed to have captured vehicle exhaust noise, with noise level readings ranging from 72.7 dBA to 115.3 dBA. A total of six events were found to have been triggered by exhaust noise other than loud muffler sounds that would not have been a violation of any of the exhaust noise statutes. Two of the six events were triggered by exhaust noise levels (72.7 dBA and 73.8 dBA) below the threshold for any exhaust noise violation. The remaining four events were triggered by a variety of other sounds, including construction equipment noise (two events), horn noise (one event), and screeching tires (one event).

Vehicle Types

To determine how many potential enforcement actions could be taken from the 324 events that captured vehicle exhaust noise, 20 events (six percent) where the source of the exhaust noise could not be identified with certainty were disregarded (leaving a total of 304 events with potentially enforceable exhaust noise violations); the events were then divided into four vehicle

types: passenger motor vehicle, full-size pick-up, commercial motor vehicle, and motorcycle. The associated GVWR and dBA limits are listed in Figure 3. From there, vehicles without license plates, vehicles with unreadable license plate numbers, and vehicles that produced exhaust noise below the statutory limits were determined to either be not in violation or in violation with no ability to take enforcement action. Vehicles which produced an exhaust noise level above the statutory limits and that had an identifiable license plate number were determined to be in violation of the exhaust noise law and subject to enforcement action [Figure 8].

Below dBA	Events where the recorded exhaust noise was below the statutory limit.
Enforceable Actions	Events where the recorded exhaust noise was above the statutory limit and a readable license plate number was present.
Non-Exhaust Noise	Noise from another source (e.g., construction, vehicle horns, screeching tires).
No Plate	The license plate was missing.
Unreadable Plate	The license plate was present, but unable to be clearly read.

Figure 8: Terminology Used for This Study.

Passenger Motor Vehicle

Pursuant to Section 27151(b) CVC, a passenger vehicle with an exhaust noise level above 95 dBA is deemed to be in violation of the statute. In this study, 175 events (58 percent of the 304 events with potentially enforceable exhaust noise violations) contained a passenger vehicle, as identified by the reviewing officer. Of those events, 47 (27 percent of the 175 events with passenger vehicles) contained a passenger vehicle with an exhaust noise level at or below 95 dBA and, therefore, not in violation. One event (less than one percent of the 175 events with passenger vehicles) contained a passenger vehicle without a license plate that produced an exhaust noise level above 95 dBA; no enforcement action could be taken against vehicles in this category. A total of ten events (six percent of the 175 events with passenger vehicles) contained a passenger vehicle with an exhaust noise level above 95 dBA and a license plate number which was unreadable; no enforcement action could be taken against vehicles in this category. Ultimately, out of the 175 passenger vehicles identified, 118 passenger vehicles (67 percent) produced an exhaust noise level above 95 dBA and had an identifiable license plate number; these passenger vehicles were deemed to have produced illegal vehicle exhaust noise and were determined to be subject to enforcement action [Figure 9].

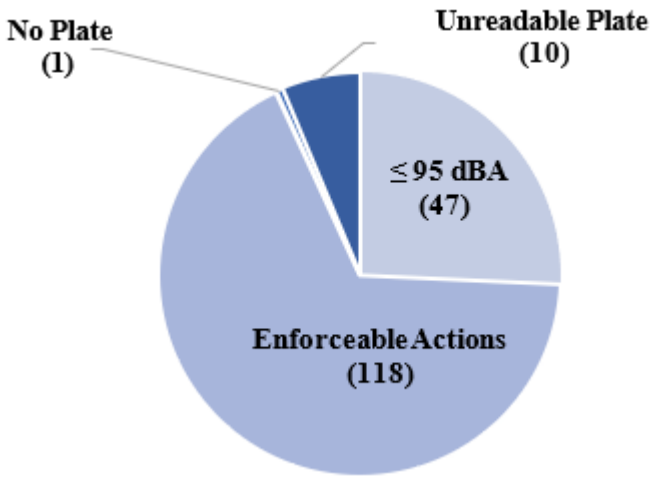

Figure 9: Breakdown of the Passenger Motor Vehicle Events.

Full-Size Pick-Up

Full-size pick-ups were deemed to be in violation of Section 27204 CVC at an exhaust noise level above 80 dBA. In this study, 57 events (19 percent of the 304 events with potentially enforceable exhaust noise violations) contained a full-size pick-up, as identified by the reviewing officer. Of those events, one (two percent of the 57 events with a full-size pick-up) contained a full-size pick-up with an exhaust noise level at or below 80 dBA and, therefore, not in violation. Additionally, four events (seven percent of the 57 events with full-size pick-ups) contained a full-size pick-up with an exhaust noise level above 80 dBA and a license plate number which was unreadable; no enforcement action could be taken against vehicles in this category. Ultimately, out of the 57 full-size pick-ups identified, 52 full-size pick-ups (91 percent) produced an exhaust noise level above 80 dBA and had an identifiable license plate number; these full-size pick-ups were deemed to have produced illegal vehicle exhaust noise and were subject to enforcement action [Figure 10].

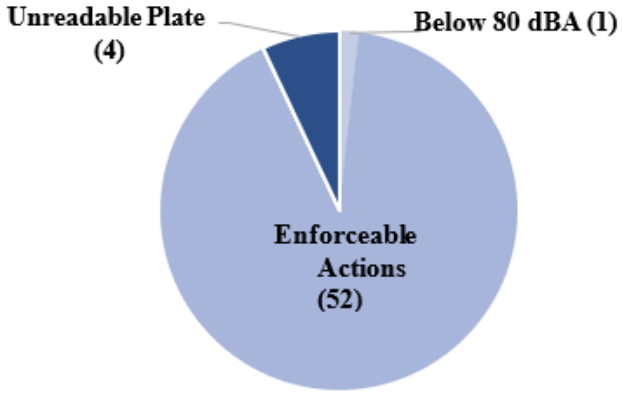

Figure 10: Breakdown of the Full-Size Pick-Up Events.

Commercial Motor Vehicle

Commercial motor vehicles were deemed to be in violation of Section 27204 CVC at an exhaust noise level above 80 dBA. In this study, seven events (two percent of the 304 events with potentially enforceable exhaust noise violations) contained a commercial motor vehicle, as identified by the reviewing officer. All seven of the commercial motor vehicles produced exhaust noise levels above 80 dBA and had identifiable license plate numbers, making them subject to enforcement action.

Motorcycle

Motorcycles were deemed to be in violation of Section 27202 CVC at an exhaust noise level above 80 dBA. In this study, 65 events (21 percent of the 304 events with potentially enforceable exhaust noise violations) contained a motorcycle, as identified by the reviewing officer. Of those events, nine events (l4 percent of the 65 events with a motorcycle) contained a motorcycle without a license plate that produced an exhaust noise level above 80 dBA; no enforcement action could be taken against vehicles in this category. Additionally, 19 events (29 percent of the 65 events with a motorcycle) contained a motorcycle with an exhaust noise level above 80 dBA and a license plate number which was unreadable; no enforcement action could be taken against vehicles in this category. Ultimately, out of the 65 motorcycles identified, 37 motorcycles (57 percent) produced an exhaust noise level above 80 dBA and had an identifiable license plate number; these motorcycles were deemed to have produced illegal vehicle exhaust noise and were determined to be subject to enforcement action [Figure 11].

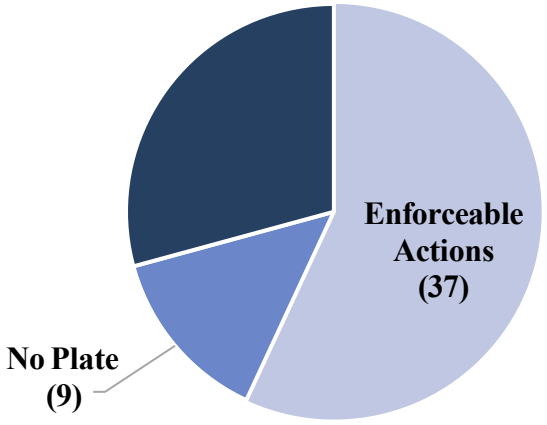

Figure 11: Breakdown of the Motorcycle Events.

Day Versus Night

To understand how well the Intelligent Instruments SAED performed during variable natural lighting conditions (artificial lighting in the testing area was low), the 324 events that captured exhaust noise were separated based on time of day (dawn, day, dusk, and night), and the readability of the vehicle license plates was analyzed, regardless of exhaust noise level [Figure 12]. Events where a singular license plate could not be identified were removed from this analysis. This included 14 events where there were multiple vehicles in the frame and a single offender could not be determined, six events where the SAED was detecting a vehicle on

the main-line of the freeway, and ten events where the vehicle in frame had no license plate present. A total of eight dawn events were analyzed, and two license plates (25 percent) were found to be unreadable. A total of 234 events occurring during the day were analyzed, and 24 license plates (ten percent) were found to be unreadable. A total of one dusk event was analyzed, and it was found to be readable. A total of 51 events occurring at night were analyzed, and nine license plates (18 percent) were found to be unreadable.

Dawn Events		**Day Events**		**Dusk Events**		**Night Events**	
Total Events	8	Total Events	234	Total Events	1	Total Events	51
Unreadable	2	Unreadable	24	Unreadable	0	Unreadable	9
Percent Unreadable	25%	Percent Unreadable	10%	Percent Unreadable	0%	Percent Unreadable	18%

Figure 12: The Percentage of Unreadable License Plates for Intelligent Instruments' SAED, Based on Time of Day.

Location

The installation of Intelligent Instruments SAED on the westbound US-50 on-ramp from southbound Watt Avenue had both positive and negative impacts on the effectiveness of the device. At this location, a ramp meter, or traffic signal, installed on the on-ramp regulated the flow of traffic entering westbound US-50 [Figure 13].

Figure 13: The Ramp Meter on the Westbound US-50 On-Ramp from Southbound Watt Avenue.

Additionally, from February 9, 2024, to February 12, 2024, roadway construction had reduced the on-ramp from three traffic lanes to one traffic lane, further impacting the flow of traffic [Figure 14].

Figure 14: Reduction of the On-Ramp from Three Traffic Lanes to One Traffic Lane.

Beginning on February 13, 2024, roadway construction had reconfigured the on-ramp to include two traffic lanes which then combined into one merging lane [Figure 15].

Figure 15: Reconfigured Roadway with Two Traffic Lanes and One Merging Lane.

Overall, the roadway configuration and the ramp meter assisted with vehicle identification and in reducing instances where multiple vehicles were captured in one video. The roadway construction (lane reconfiguration, temporary barrier [K-Rail], etc.) on the on-ramp, however, was possibly detrimental to the performance of Intelligent Instruments SAED, as the changing layout of the traffic lanes may have had an impact on the camera alignment and automation detection points [Figure 16].

Figure 16. Roadway Layout on February 9, 2024, Versus Roadway Layout on February 14, 2024.

In at least two instances, construction equipment in the active construction zone produced a false positive for vehicle exhaust noise [Figure 17].

Figure 17: Construction Activity on the On-Ramp.

The effectiveness of Intelligent Instruments SAED was also impacted by other elements in the immediate environment. For instance, as noted by Intelligent Instruments, the soundwall directly behind where the SAED was installed occasionally affected the tracking performance of the microphone array, although this did not prevent the identification of the exhaust noise-producing vehicle [Figure 18].

Figure 18: The Soundwall Located Behind the Intelligent Instruments SAED.

Additionally, the low lighting conditions at the location made vehicle identification difficult during hours of darkness [Figure 19].

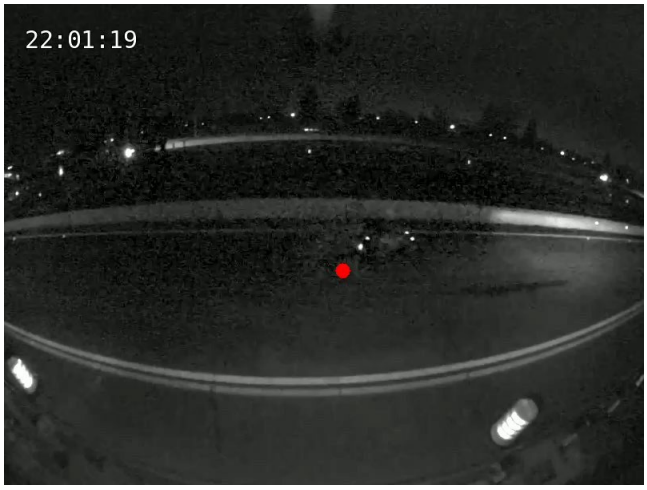

Figure 19: Video Still Demonstrating Low Visibility During Hours of Darkness.

The layout of the highway, where the main lanes of the freeway were in the backdrop, created situations where the SAED tracked a vehicle on the freeway lanes as opposed to the one on the on-ramp [Figure 20].

Figure 20: Video Still Showing the SAED Tracking Exhaust Noise on the Main-Line of the Freeway.

Sound-Activated Enforcement Device 3 – Jenoptik

Jenoptik, headquartered in Jena, Germany, was the provider of the third SAED chosen for this study. The SAED consisted of an Automatic Number Plate Recognition (ANPR) camera paired with an acoustic monitoring panel with a Class 1 microphone. The cost of the device, including installation, was $59,821.00; training services cost an additional $2,500.00. The initial installation of the SAED on the westbound I-80 on-ramp from southbound Elkhorn Boulevard was completed on February 28, 2024. Jenoptik encountered technical issues after installation and was unable to provide any data for CHP review prior to the completion of this report.

Sound-Activated Enforcement Device Video Samples

Video recording samples from the TNL and Intelligent Instruments SAEDs were downloaded onto a compact disc and are included as an attachment to this report, as required by Section 27150.4 CVC. The TNL video recordings do not contain audio; the audio is included as a separate file, as designed by the vendor. The TNL video recording captures multiple vehicles and multiple sound intensity arrays tracking those vehicles. The Intelligent Instruments video recording contains audio and captures a motorcycle; a red dot tracks the motorcycle to indicate which vehicle is producing the exhaust noise.

Programs in Other States and Canada

Knoxville, Tennessee (TN)

The city of Knoxville, TN, began testing SAEDs in February of 2022. Intelligent Instruments provided an SAED for its study, which was installed in downtown Knoxville. The SAED was programmed to trigger an event at Knoxville's current noise ordinance laws and the data was used to identify problem areas. The city did not issue citations during the testing period and is continuing to explore different options for vehicle noise enforcement and mitigation.

New York, New York (NY)

New York, NY began piloting SAEDs in late 2021. During the pilot, potential violators received a notice directing them to an inspection facility to ensure compliance with state and city noise requirements. New York reported issues with excess sound in the areas where the SAEDs were originally installed; background noise in the areas would drown out any noise emitted by vehicle exhaust. The city determined that, because of the SAED's sensitivity, the ideal location for installation would be a two-lane roadway, away from major highways. The city concluded that determining the source of the noise and taking a corresponding enforcement action involved manual review of recorded events, with one staff member monitoring two SAEDs. In December 2023, the New York City Council approved the "Stop Spreading the Noise Act," allowing for the installation of no less than five devices in each of its five boroughs and for the ticketing of violators without any follow-up inspection.

Edmonton, Alberta, Canada

Edmonton began piloting SAEDs in several phases from 2016 to 2020. For three months out of 2020 alone, their pilot program cost 192,000 Canadian dollars for equipment rentals, installations, monitoring, maintenance, and software use. The devices were activated at noise levels of 85 dBA and above. Currently, the city of Edmonton no longer uses SAEDs and has returned to traditional enforcement methods. The pilot study found that the technology could not discern between sources of noise or identify offending vehicles to the precision required by court.

Conclusions

Suitability as a Standalone Enforcement Tool

The original version of SB 1079 would have authorized six undetermined cities to conduct a pilot program to evaluate the use of SAEDs to capture illegal vehicle noise levels. Under that pilot program, those cities would have been authorized to issue citations for any vehicle exhaust noise violation. A subsequent amendment of SB 1079 required the CHP to conduct an evaluation and produce a legislative report related to SAED deployments. The applicable exhaust noise laws codified in the CVC (including Sections 27151, 27202, and 27204) set noise limits according to the specified manufacturer's GVWR and/or vehicle type. The SAED is not able to determine this component of a noise violation and, therefore, cannot sufficiently provide the evidence required for prosecution. While it is possible for a reviewing law enforcement official to estimate a vehicle's GVWR, the actual GVWR of a vehicle cannot be obtained without physical examination of the vehicle. Additionally, the SAED does not comply with the test procedures referenced in statute for compliance with the codified noise limits.

As specified in Section 27151 (b) CVC, compliance with the referenced noise limit is dependent upon the testing being conducted according to a very specific standard:

> *For the purposes of exhaust systems installed on motor vehicles with a manufacturer's gross vehicle weight rating of less than 6,000 pounds, other than motorcycles, a sound level of 95 dBA or less, when tested in accordance with the most current SAE international standard, complies with this section.*

A similar requirement is codified in Section 27200 (c) CVC for the noise limits referenced in Sections 27202 and 27204 CVC:

> *Test procedures for compliance with this article shall be established by the Department of the California Highway Patrol, taking into consideration the test procedures of the Society of Automotive Engineers.*

The CHP was not provided any evidence from the selected vendors in this study that the noise levels captured through the SAED were obtained in accordance with any applicable Society of Automotive Engineers (SAE) International standard. To ensure that this statutory requirement is met, any citation issued using the SAED for a violation of Section 27150 or 27151 CVC would require an inspection of the vehicular exhaust system to be conducted in accordance with Section 27150.2 CVC. This statute requires stations providing referee functions to provide for the testing of vehicular exhaust systems and the issuance of certificates of compliance for vehicles that have received a citation for a violation of Section 27150 or 27151 CVC. Testing under Section 27150.2 CVC is required to be conducted in accordance with the most current SAE International standard.

Location Limitations

Due to the sensitivity of the SAED, installation locations should be limited to roadways with two to three lanes and minimal occurrences of non-exhaust noise. An effort should be made toward choosing locations away from major highways and construction zones, which may cause interference with the SAED. The lighting at these locations should also be sufficient to assist with vehicle identification during hours of darkness.

Review and Enforcement Process

Each alleged violation will have to be reviewed to determine if a valid violation exists. Individuals tasked with reviewing SAED data should have a working knowledge of the applicable exhaust noise laws (including Sections 27150 and 27151 CVC, and Article 2.5 of the CVC, beginning with Section 27200 CVC) and of the general GVWRs associated with the varying vehicle types. Additionally, these individuals should receive training from the SAED vendor; this training should include information related to the individual components of the device, how the device works, and how to navigate its web-based interface. These individuals would also need training suited for the necessary processing of evidence associated with exhaust noise violations. Depending on the size of the SAED program undertaken, it would become necessary for multiple individuals to be permanently assigned to manage the program.

Prior to implementation of an SAED program, it will need to be determined how legitimate violations will be prosecuted (i.e., civil or criminal). The nature of the violation (civil vs. criminal) will determine evidence requirements and the admissibility of such evidence in a court of law, if required. Additionally, the use of automated enforcement technology can present several other challenges, such as privacy concerns for not just those who were found to be in violation, but those who are monitored by the automated systems.

Costs

Jurisdictions seeking to implement an SAED program should be prepared to absorb operational costs (including contracts with SAED vendors and staffing costs) in excess of any revenue that may be generated through enforcement. As an example, the table below offers a breakdown of the projected costs that the CHP would incur in implementing an SAED program, including costs for additional officer staffing in each of the CHP's eight field divisions [Figure 21] any training required for the proper review of video footage and the issuance of citations would be in addition to these costs.

Class Code	8397
Classification	Officer, CHP
Number of Requested Positions	8
Annual Mid-Salary	$131,000
Annual Benefits	$128,000
OE&E Beginning Year (BY)	$51,000
OE&E BY + 1	$23,000
FY 2025/2026	$2,480,000
FY 2026/2027 and Ongoing	$2,256,000
*OE&E=Operating Expenses and Equipment. *OE&E includes $10,000 in Year 1 for Facilities Improvements.	

Figure 21: Breakdown of the Additional Personnel Costs Associated with Implementation of an SAED Program.

The discontinuation of the Sacramento County red-light camera program in March 2024 serves as a prominent example of an automated enforcement program that did not generate enough revenue to overcome the deficit costs from maintenance and staffing. The program included 23 red-light cameras at intersections throughout the Sacramento area and was managed by the Sacramento County Sheriff's Department. The total costs of the program included an annual $898,000 contract with Redflex Traffic Systems and compensation costs for four sheriff's department employees managing the red-light camera program. The operational costs, for a program originally intended to be cost-neutral, created budgetary issues that eventually led to the dissolution of the program.

Future Studies

To be considered for future studies, any technology selected should include the following, at a minimum:

- Video recordings with audio embedded.
- A functional, web-based interface that allows for thorough review of video recordings on an Internet browser, including the ability to magnify video recordings for the purposes of verifying license plate numbers.
- Training on how to use the web-based interface.
- Verification from the vendor that the device is fully functional and that there are no issues with video sound and viewing quality.
- A tracking mechanism, visible in the video recording, to identify a potential violator.

Any subsequent studies should also consider the State of California's lengthy bidding and procurement process and allow for a longer operational period. A longer operational period would provide adequate time for equipment installation; troubleshooting of potential technical issues; and data compilation, review, and analysis. It is also suggested that any future studies consider installing SAEDs on roadways other than freeway on-ramps, for a better idea of the effectiveness of the devices in varying conditions. Lastly, future studies must consider the requirements imposed by current California exhaust noise laws when it comes to measuring vehicle exhaust noise for enforcement purposes. These laws, as outlined earlier, necessarily require that a specified manufacturer's GVWR be determined, and that testing be conducted in accordance with the most current SAE International standard. As a result, future studies should consider the viability of SAEDs as a tool for directing potential violators to state referee stations to verify compliance with exhaust noise limits.

Recommendations

Ultimately, based on this study, the CHP does not recommend the use of SAEDs as a standalone enforcement tool to be used as the sole basis for issuing citations for exhaust noise violations. This recommendation is based on the currently available technologies' failure to consistently and reliably produce a positive identification of vehicles in violation of California's exhaust noise laws.

ANNEX A - SENATE BILL 1079
SOUND-ACTIVATED ENFORCEMENT DEVICES

Senate Bill No. 1079
CHAPTER 449

An act to add Section 27150.4 to the Vehicle Code, relating to vehicles.
[Approved by Governor September 19, 2022. Filed with Secretary of State September 19, 2022.]

LEGISLATIVE COUNSEL'S DIGEST

SB 1079, Portantino. Vehicles: sound-activated enforcement devices.

Existing law requires every motor vehicle subject to registration to be equipped with an adequate muffler in constant operation and properly maintained to prevent any excessive or unusual noise and prohibits a muffler or exhaust system from being equipped with a cutout, bypass, or similar device. Existing law further prohibits the modification of an exhaust system of a motor vehicle in a manner that will amplify or increase the noise emitted by the motor of the vehicle so that the vehicle exceeds existing noise limits when tested in accordance with specified standards.

This bill would require the Department of the California Highway Patrol to evaluate the efficacy of sound-activated enforcement devices by evaluating devices from at least 3 different companies, and would require the department, on or before January 1, 2025, to prepare and submit its findings and recommendations from the evaluation in a report to the Legislature, as specified.

Existing constitutional provisions require that a statute that limits the right of access to the meetings of public bodies or the writings of public officials and agencies be adopted with findings demonstrating the interest protected by the limitation and the need for protecting that interest.
This bill would make legislative findings to that effect.

The people of the State of California do enact as follows:

SECTION 1. Section 27150.4 is added to the Vehicle Code, to read:

27150.4. (a) The Department of the California Highway Patrol shall evaluate the efficacy of sound-activated enforcement devices by evaluating devices from at least three different companies.

(b) (1) On or before January 1, 2025, the department shall prepare and submit its findings and recommendations from the evaluation in a report to the Legislature, which shall include all of the following information:

(A) How effective the devices are at determining that a vehicle was not equipped with an adequate muffler in constant operation and properly maintained in accordance with the requirements of Article 2.5 (commencing with Section 27200).

(B) How often the device identified a potential violation that was not related to a violation of Section 27150, and the types of sounds other than a loud muffler that triggered the device.

(C) What percentage of time an officer was unable to determine the source of the sound that activated the device.

(D) How often the device was required to be serviced.

(E) What, if any, technology does the sound-activated enforcement system use to determine the direction or source of the sound that violated the sound limits provided for in Article 2.5 (commencing with Section 27200).

(F) Where the devices were located, and whether the location had any consequences to the effectiveness of the device.

(G) The number of devices the department tested and from which companies were the devices that were tested.

(H) Recommendations on all of the following:

(i) Which, if any, device or devices would the department recommend be used for the purposes of enforcing Sections 27150 and 27151, and the reasons for that determination. If the department determines that it does not recommend any of the devices tested, the report shall include the standards and parameters that shall be met by future technology.

(ii) What, if any, restrictions should be placed on the use of sound-activated enforcement devices in enforcing Sections 27150 and 27151, including, but not limited to, the decibel level setting for triggering a potential violation for the purposes of enforcement.

(iii) Where the devices should be optimally located in order to reduce the chances of a false violation.

(iv) Descriptions and explanation of any necessary and associated training that an individual reviewing these violations would need to go through in order to operate the device, including recommendations for what is necessary for a robust human review process.

(v) Any other recommendations the department believes would be necessary for authorizing the use of sound-activated enforcement devices.

(I) A video demonstrating the device. The video shall be edited to remove any personally identifying information, including the blurring of persons recorded in the video, street addresses, and license plates.

(2) The report required by this subdivision shall be submitted in compliance with Section 9795 of the Government Code.

(c) The department shall delete all videos recorded on a highway by a device within five days of the video being recorded. However, the department shall keep 15 videos from the devices of each company evaluated for the purposes of preparing the report required by this section and documenting the issues related to each device that helped the department make its recommendations. The department shall not keep any recording that picked up audio of a person speaking, if recorded on a highway.

(d) Notwithstanding Division 10 (commencing with Section 7920.000) of Title 1 of the Government Code, or any other law, information collected and maintained by the department using a sound-activated enforcement device that could be used to identify the identity or location of any individual shall be confidential and only be used for purposes of this section, and shall not be disclosed to any other persons, including, but not limited to, any other state or federal government agency or official for any other purpose, except as required by the reporting requirements in this section, state or federal law, court order, or in response to a subpoena in an individual case or proceeding.

(e) For purposes of this section, “sound-activated enforcement device” or “device” means an electronic device that utilizes automated equipment that activates when the noise levels have exceeded the legal sound limit established in Section 27151 and is designed to obtain clear video of a vehicle and its license plate. A sound-activated enforcement device shall do all of the following:

(1) Record audio, precision accuracy noise levels, and high definition video in two directions.

(2) Utilize an automated system that triggers when excessive vehicle noise over the limit is detected and save the data for review.

(3) Automatically delete any evidence not related to a violation.

(4) Permit the department to manually review evidence to ensure a violation has occurred.

(5) Conform to the class 1 accuracy standards in the International Electrotechnical Commission’s (IEC) standard IEC 61672:2013, or any other accuracy standard determined to be appropriate by the department.

SEC. 2. The Legislature finds and declares that Section 1 of this act, which adds Section 27150.4 to the Vehicle Code, imposes a limitation on the public’s right of access to the meetings of public bodies or the writings of public officials and agencies within the meaning of Section 3 of Article I of the California Constitution. Pursuant to that constitutional provision, the Legislature makes the following findings to demonstrate the interest protected by this limitation and the need for protecting that interest:

To protect the privacy interests of persons who are issued notices of violation under a sound-activated enforcement device program, the Legislature finds and declares that the records generated by a sound-activated enforcement device shall be confidential.