

*REPORT TO THE LEGISLATURE PURSUANT TO ACT 41, SECTION 40 (2023)*

# **Report on Excessive Motor Vehicle Noise**

Presented to:

Senate Committee on Transportation

February 27, 2025

Report on Excessive Motor Vehicle Noise, Feb 2025



# Charge / Purpose

**Authorizing Legislation: Act 41, An Act Relating to Miscellaneous Changes to Laws Related to Vehicles, enacted June 1, 2023**

1. If there should be a noise standard in statute or the Periodic Inspection Manual (PIM), or both, and, if so, what that standard should be;
2. Costs to incorporate noise testing into the Periodic Inspection Manual;
3. Costs to train law enforcement officers on noise testing;
4. Possible options to address excessive motor vehicle noise not involving noise testing (visual inspections, enforcement of the State motor vehicle inspection, and labeling of components of exhaust system components);
5. Approaches to minimize excessive motor vehicle noise from other states (increased enforcement by law enforcement coupled with an objective noise standard)

# Study Overview

- Interviews with representatives of:
  - Vermont League of Cities and Towns,
  - Vermont Sheriff's Association,
  - Vermont Association of Police Chiefs,
  - Vermont State Police, and
  - Vermont Department of Motor Vehicles.
- Research on regulations / legislation from other states and in Vermont
- Report from Parsons, the vendor for the Automated Vehicle Inspection Program

# 1: Should there be a noise standard?

1. If there should be a noise standard in statute or the Periodic Inspection Manual (PIM), or both, and, if so, what that standard should be;
  - Stakeholder opinions were varied
  - Challenges generally about:
    - Enforceability / repeatability
    - Reallocation of law enforcement resources
    - Subjective nature of some noise ordinances – judgement calls for inspection mechanics / LEOs
  - Support from some stakeholders based on:
    - Anecdotal experiences with loud vehicles
    - Feedback from constituents / knowledge of complaints
    - Concerns about noise as a health / safety hazard
  - Report includes no specific recommendation

# 1: What should that standard be?

1. If there should be a noise standard in statute or the Periodic Inspection Manual (PIM), or both, and, if so, what that standard should be;

Report outlined several options for types of noise standards

- Adding visual inspection to the VPIM
- Sound level testing by inspection mechanics through the VPIM
- Sound level testing by law enforcement
  - Roadside measurements of stationary or moving vehicles
- Sound level testing as a defense after citation (similar to Maine)
- Fixed-location sound level testing (similar to a speed camera)

# Options for the VPIM

Option	Challenges	Benefits
<p><b>Visual Inspection</b> - Change VPIM to require inspectors to check for motorcycle exhaust stickers, reject illegal exhaust modifications for passenger vehicles / light trucks, etc.</p>	<p>Affects all vehicles - not just noisy ones;            Adds a step to the inspection process;            May lead to failure for aftermarket exhausts which do not increase noise levels;            May limit Vermont consumers ability to use aftermarket or non-OEM parts;            Potentially requires inspectors to make a judgement call on excessive noise and/or aftermarket status of equipment;            Low efficacy - vehicle owners can remove aftermarket mufflers before inspections and then reinstall them after passing inspection;            Subjective - does not have an objective / quantitative limit.            Will not detect vehicle noise due to motion such as engine braking noise, loud stereos, etc.</p>	<p>Ease of implementation;            Low cost and no recurring cost;            Uses existing inspection system.</p>
<p><b>Noise Testing</b> - as part of the VPIM - vehicle inspectors as enforcement</p>	<p>Affects all vehicles - not just noisy ones;            Difficult to determine the appropriate sound level limit;            Difficult to test noise in a shop environment;            Inspection stations may need to find alternative test locations;            Inspection stations may not be willing to incur additional equipment costs;            Additional equipment required;            Additional time and cost for Vermont residents during inspections;            Low efficacy - vehicle owners can remove aftermarket mufflers before inspections and then reinstall them after passing inspection;            Recurring annual costs due to meter maintenance and calibration;            Will not detect vehicle noise due to motion such as engine braking noise, loud stereos, etc.</p>	<p>Implements an objective standard;            All vehicles tested;            No additional burden on law enforcement.</p>

# Options in Statute - Law Enforcement

Option	Challenges	Benefits
<p><b>Noise Testing - in Statute - Law enforcement as enforcement</b></p>	<p>Difficult / impossible to test noise on the side of road;</p> <p>Difficult to determine the appropriate sound level limit;</p> <p>Law enforcement must make a subjective determination of which cars to test;</p> <p>Only subjectively noisy vehicles tested so some noisy vehicles may be missed;</p> <p>Additional demand on limited law enforcement resources - diverts traffic stop attention away from speed / DUI / other safety enforcement;</p> <p>Law enforcement may not use or implement noise testing equipment due to other obligations.</p>	<p>Implements an objective standard;</p> <p>Testing occurs on vehicles as they are driven, not during a scheduled test - this eliminates owners removing aftermarket mufflers before inspections;</p> <p>Testing can be performed while vehicle is in motion to detect vehicle noise such as engine braking noise, loud stereos, etc.</p>
<p><b>Noise Testing - in Statute - Automated Drive-by-Monitoring by sound level meter or acoustic camera</b></p>	<p>Will require changes to Vermont statutes to allow unattended / remote enforcement;</p> <p>High cost per station;</p> <p>Requires software development and system integration;</p> <p>Legal challenges to accuracy and repeatability - similar to speed cameras; SLMs will not isolate individual vehicles except in specially configured locations.</p>	<p>Implements an objective standard;</p> <p>No additional burden on law enforcement;</p> <p>Measures vehicles in motion as they are driven so will enforce consistent limits for all vehicle noises - exhausts, brakes, stereos, and tire squeal;</p> <p>Acoustic cameras can isolate sound from specific vehicles</p>

## 2: Costs to incorporate testing into the PIM

Costs depend on the type of noise-testing inspection requirement.

Option	Description of Steps	Cost Estimate	
		One Time	Annual Recurring
Visual Inspection – Change VPIM to require inspectors to check for motorcycle exhaust stickers, reject illegal exhaust modifications for passenger vehicles / light trucks, etc.	<ol style="list-style-type: none"> <li>1) Update legislation;</li> <li>2) Make changes to AVIP/Tablet software;</li> <li>3) Update and reissue VPIM;</li> <li>4) Marketing / education campaign to train inspectors on changes</li> </ol>	31k	-
Noise Testing - as part of the VPIM - vehicle inspectors as enforcement	<ol style="list-style-type: none"> <li>1) Update legislation / statute;</li> <li>2) Make changes to AVIP/Tablet software;</li> <li>3) Update and reissue VPIM;</li> <li>4) Purchase sound level meters for inspection stations;</li> <li>5) Develop marketing / education campaign to train inspectors on changes</li> <li>6) Develop calibration and maintenance plan for equipment</li> </ol>	94k – Rules, software, training 550k - SLMs	110k – calibration and maintenance



# 3: Costs for law enforcement training

There are about 1,250 active officers in Vermont.

Training costs assume 250 officers trained per year at \$100 / hr. cost for admin and training time.

Option	Description of Steps	Cost Estimate	
		One Time	Annual Recurring
Noise Testing - in Statute - Law enforcement as enforcement	1) Update Legislation; 2) Develop one-hour training course for officers; 3) Purchase sound level meters for law enforcement; 4) Train officers on sound level meter use; 5) Develop calibration and maintenance plan for equipment 6) Implement continuous training program	250k – SLMs 18k – Develop training	50k – Calibration and maintenance for SLMs 25k – Annual Training

# 4: Options to address excessive motor vehicle noise not involving noise testing

Examples: visual inspections, enforcement of the State motor vehicle inspection, and labeling of components of exhaust system components;

Visual inspections

Product labeling

Public education campaigns

Road signage

# 5: Approaches from other states

5. Approaches to minimize excessive motor vehicle noise from other states (increased enforcement by law enforcement coupled with an objective noise standard);

State	Summary
New Hampshire	Mufflers to be “in good working order” to prevent “excessive or unusual noise”; no straight pipe systems  No quantitative noise limit
Maine	Adequate muffler needed to “prevent excessive or unusual” noise; no cutouts, bypass systems.  May allow for noise testing to be used as a defense, should a person served with a traffic ticket for excessive noise wish to contest the ticket. There are about ten volunteer sound pressure testing stations in Maine. These stations are specifically outfitted to perform noise testing in a controlled environment.  Quantitative Limit: Statute prohibits noise emission above 95 decibels (measured per the SAE J1169 standard). Testing is performed at inspection stations.

# 5: Approaches from other states

State	Summary
Connecticut	<p>Muffler to prevent “unnecessary or unusual noise”; no cutouts, straight pipes. No muffler removal “except to repair or replace the muffler or part for the more effective prevention of noise”</p> <p>Quantitative Limit: Limits moving vehicle noise emission measured at 50 feet based on vehicle age and speed limit zone. Limits range from 72 dBA to 92 dBA at the 50-foot distance, depending on the motor vehicle's speed, weight, and the road surface on which it travels.</p>
Massachusetts	<p>Adequate muffler needed to prevent unnecessary noise; no cutouts or bypass systems.</p> <p>No quantitative noise limit</p>
New York	<p>Adequate muffler system to prevent excessive noise; no cut-outs, bypass systems</p> <p>Quantitative Limit: Limits moving vehicle noise emission measured at 50 feet based on posted speed limit. Noise limits range from 76 dBA to 90 dBA at the 50-foot distance.</p>

# 5: Comparison of state vehicle noise limits

Allowable sound levels in A-weighted decibels at 50 feet from vehicle centerline  
Less than 10,000 pounds vehicle weight (6,000 lbs. for PA)

State	Test Site	Speed ≤ 35 mph	Speed > 35 mph	Reference
Connecticut	Hard	74	81	<a href="https://www.cga.ct.gov/2024/rpt/pdf/2024-R-0106.pdf">https://www.cga.ct.gov/2024/rpt/pdf/2024-R-0106.pdf</a>
	Soft	72	79	
Florida	-	72	79	<a href="http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&amp;URL=0300-0399/0316/Sections/0316.293.html">http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&amp;URL=0300-0399/0316/Sections/0316.293.html</a>
New York	-	76	82	<a href="https://codes.findlaw.com/ny/vehicle-and-traffic-law/vat-sect-386/">https://codes.findlaw.com/ny/vehicle-and-traffic-law/vat-sect-386/</a>
Ohio	-	70	79	<a href="https://codes.ohio.gov/ohio-revised-code/section-4513.221">https://codes.ohio.gov/ohio-revised-code/section-4513.221</a>
Pennsylvania	Hard	78	84	<a href="https://www.law.cornell.edu/regulations/pennsylvania/67-Pa-Code-SS-157-11">https://www.law.cornell.edu/regulations/pennsylvania/67-Pa-Code-SS-157-11</a>
	Soft	76	82	
Rhode Island	-	86	90	<a href="https://dmv.ri.gov/node/1446">https://dmv.ri.gov/node/1446</a>

# 5: Comparison of state vehicle noise limits

Allowable sound levels in A-weighted decibels at 50 feet from vehicle centerline  
Greater than 10,000\_pounds vehicle weight (> 6,000 lbs. for PA)

State	Test Site	Speed ≤ 35 mph	Speed > 35 mph	Reference
Connecticut	Hard	88	92	<a href="https://www.cga.ct.gov/2024/rpt/pdf/2024-R-0106.pdf">https://www.cga.ct.gov/2024/rpt/pdf/2024-R-0106.pdf</a>
	Soft	86	90	
Florida	-	86	90	<a href="http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&amp;URL=0300-0399/0316/Sections/0316.293.html">http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&amp;URL=0300-0399/0316/Sections/0316.293.html</a>
New York	-	86	90	<a href="https://codes.findlaw.com/ny/vehicle-and-traffic-law/vat-sect-386/">https://codes.findlaw.com/ny/vehicle-and-traffic-law/vat-sect-386/</a>
Ohio	-			<a href="https://codes.ohio.gov/ohio-revised-code/section-4513.221">https://codes.ohio.gov/ohio-revised-code/section-4513.221</a>
Pennsylvania	Hard	88	92	<a href="https://www.law.cornell.edu/regulations/pennsylvania/67-Pa-Code-SS-157-11">https://www.law.cornell.edu/regulations/pennsylvania/67-Pa-Code-SS-157-11</a>
	Soft	86	90	
Rhode Island	-	86	90	<a href="https://dmv.ri.gov/node/1446">https://dmv.ri.gov/node/1446</a>

# Roadside sound testing challenges

- **Inherent difficulties of roadside measurement:**

- Sound level meters measure the overall sound level – including all sources
- Measurements along roadsides will likely include sound from many vehicles and other environmental noise sources, difficult to defensibly determine sound levels from one vehicle when many vehicles are passing by
- Wind and precipitation can increase sound levels and cause “false positives”. Wet roads can be very noisy
- Ground conditions: Hard (Asphaltic/Frozen) vs. Grassy/Soil
- If performed along with speed testing, difficult to measure speed and sound simultaneously – sound levels are measured while vehicles pass, speed is typically measured at some distance

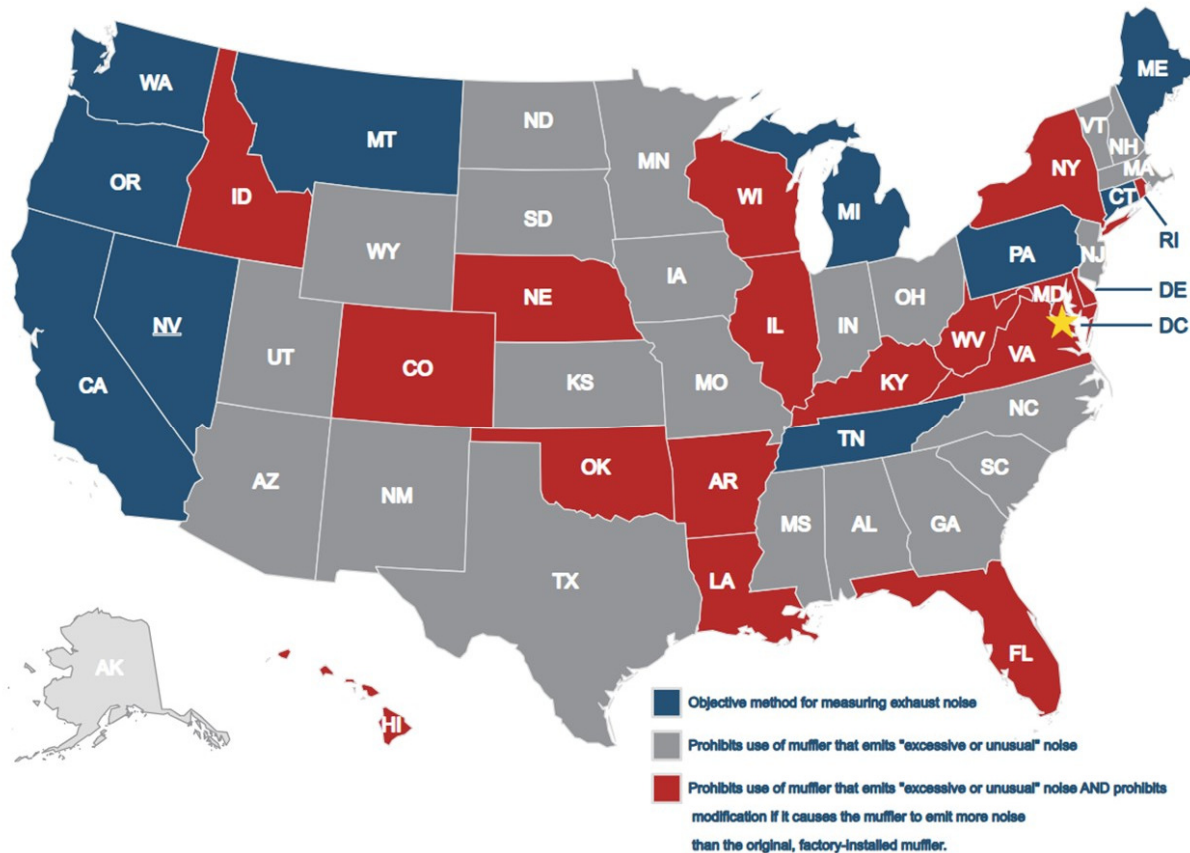
- **Can be addressed during training:**

- If measured at other than 50 feet from the road, sound levels need to be adjusted to 50-foot distance
- Operator must check sound level meter calibration at least twice daily – failure to do so could invalidate the readings in a court case

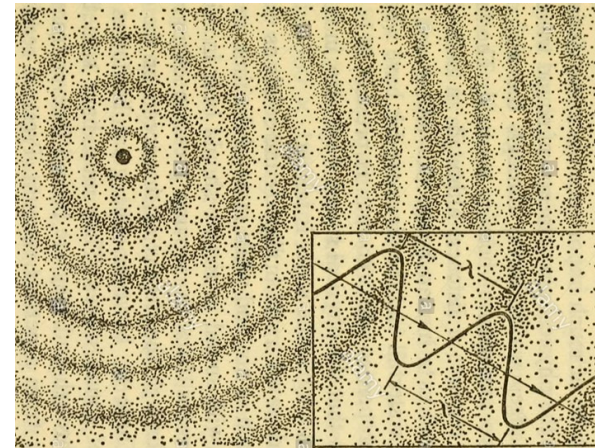
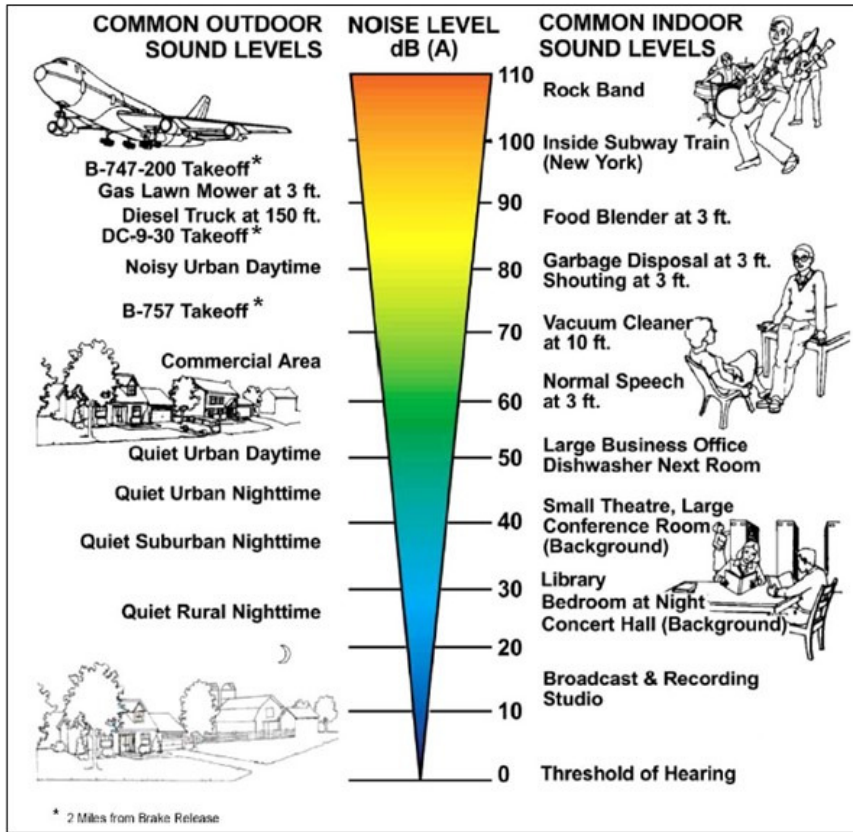
# Additional Background Slides – To Be Referenced as Needed



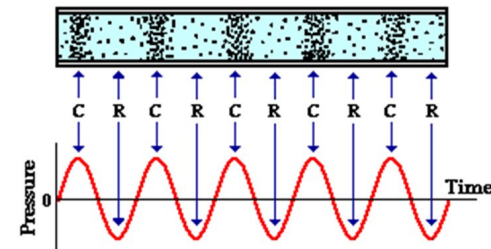
# Vehicle Noise Law by State\*



# Background on Sound

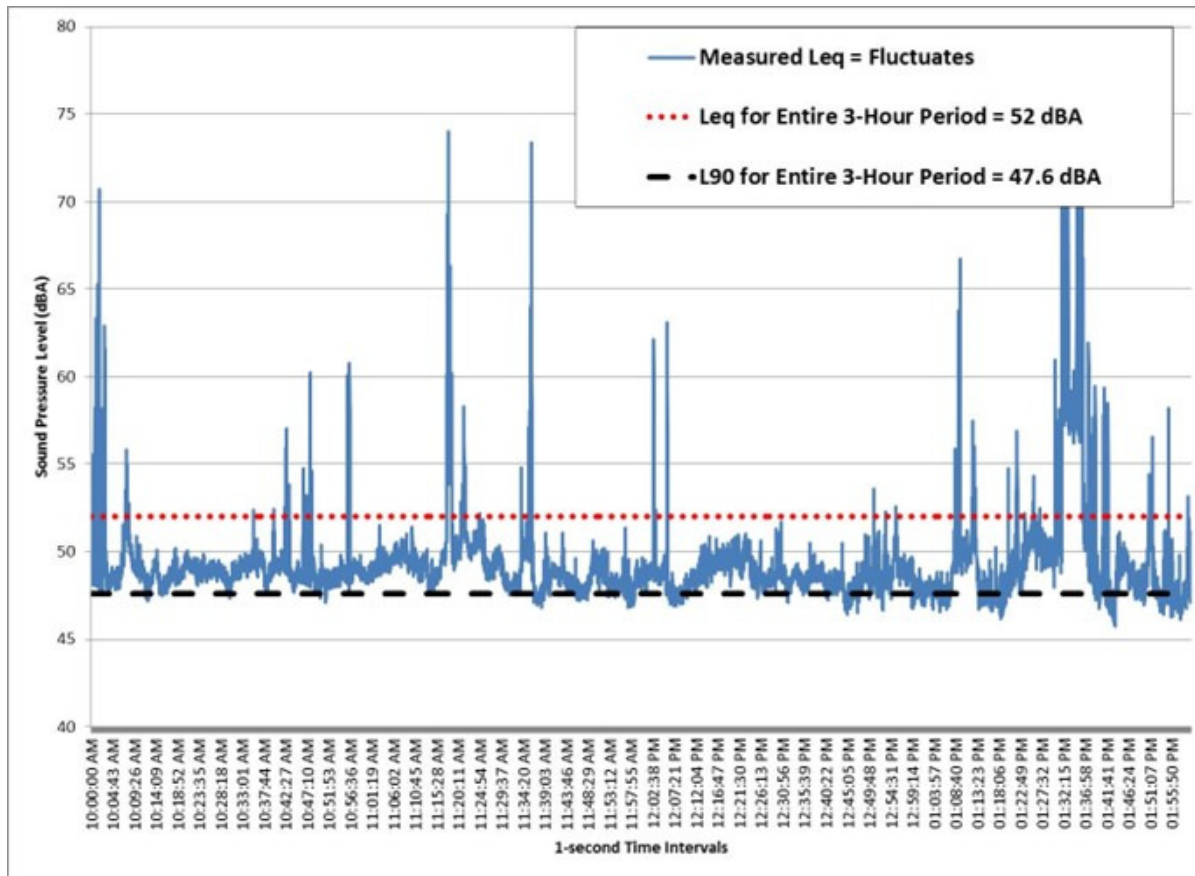


Sound is a Pressure Wave



NOTE: "C" stands for compression and "R" stands for rarefaction

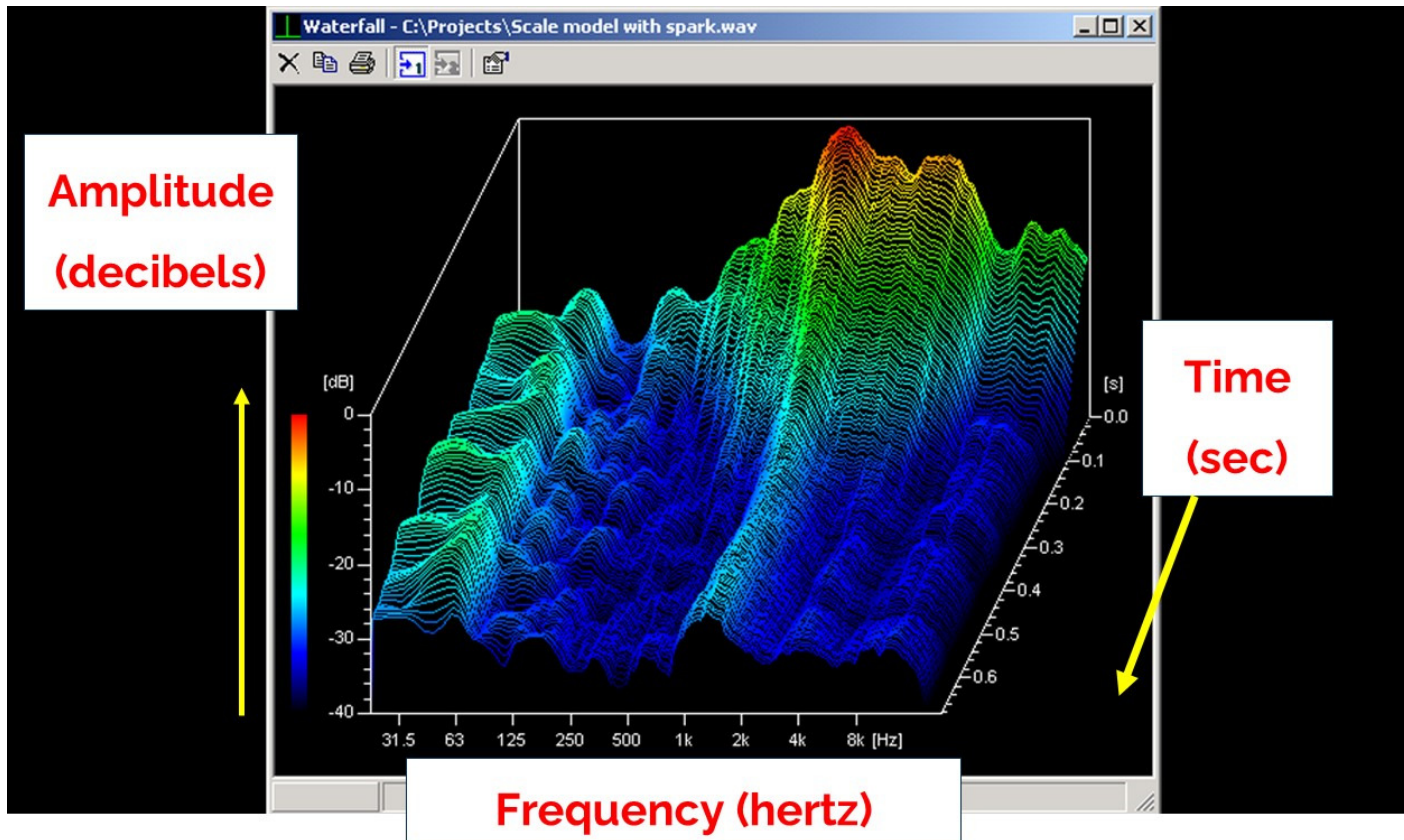
# Background on Sound



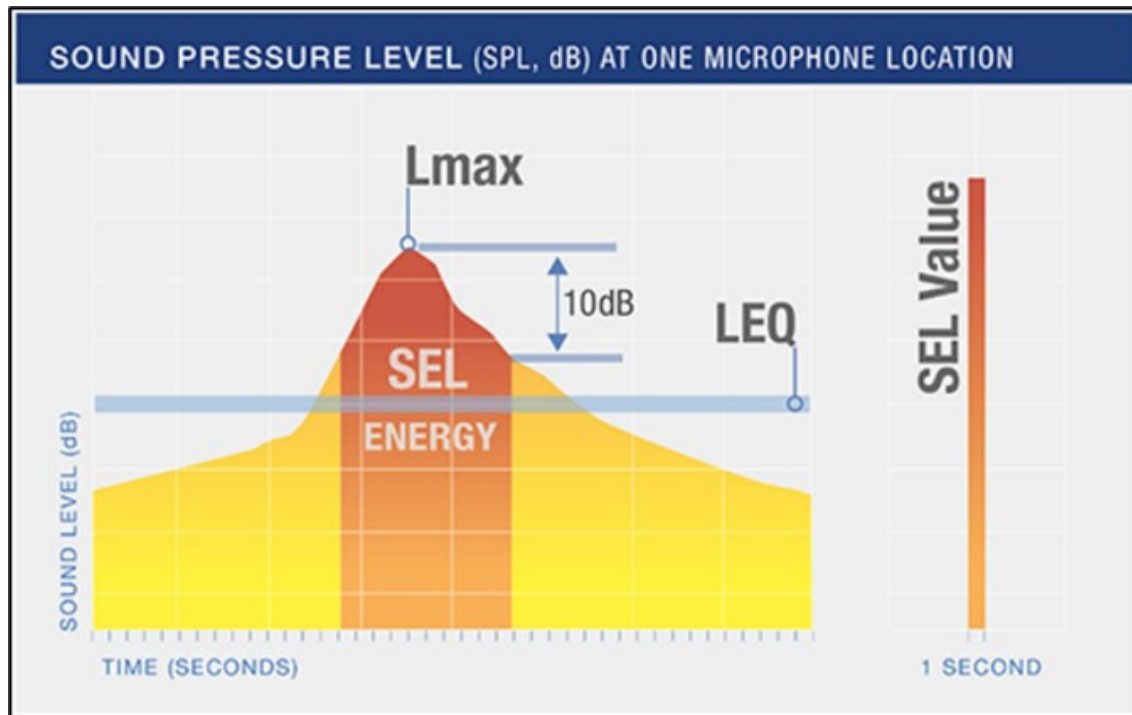
Graph showing the effects of time averaging on sound levels.

The short-term sound level (in blue) is highly variable but contains the same sound level energy as the red-dotted line, the 3-hour equivalent sound level.

# Background on Sound



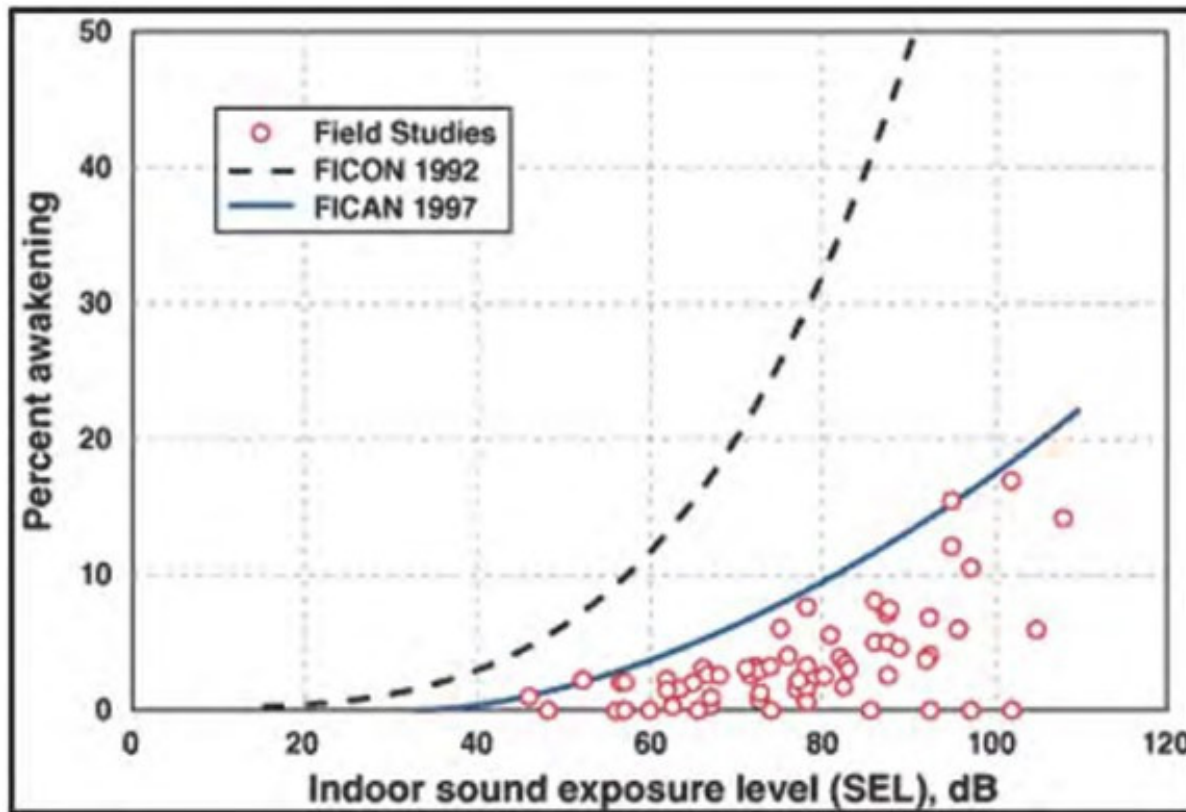
# Background on Effects of Noise - SEL



SEL – Sound Exposure Level – Sound energy for a transient event, like a vehicle pass by, is compressed into a one-second interval. This allows comparison for events with different time durations.



# Background on Effects of Noise

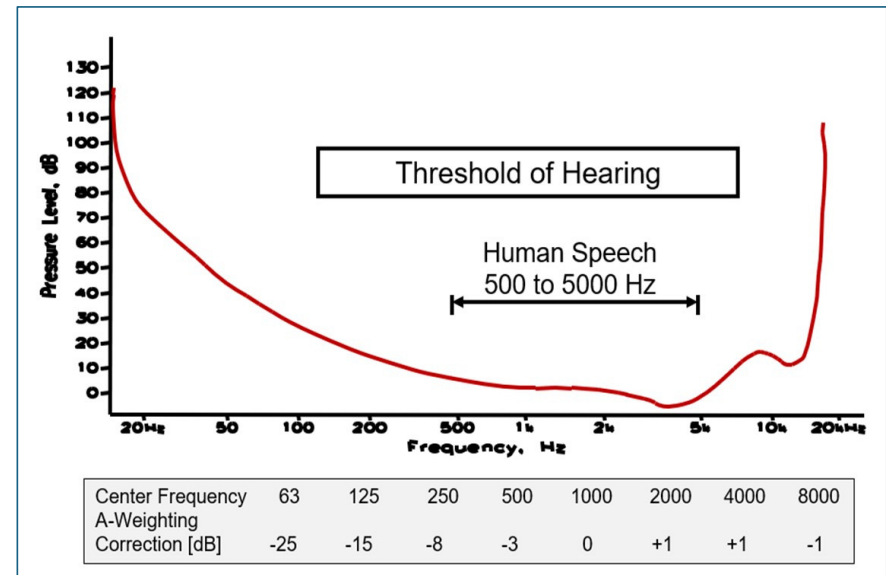
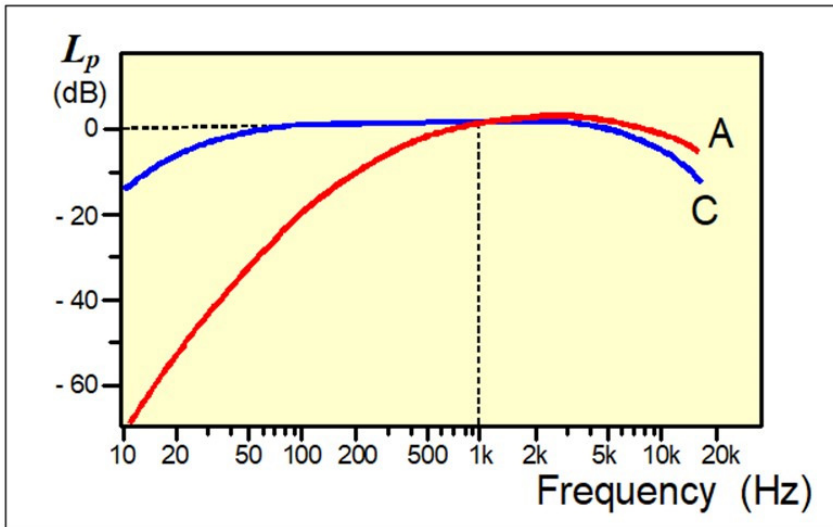


This graph shows the potential for sleep disturbance a function of single event noise exposure.

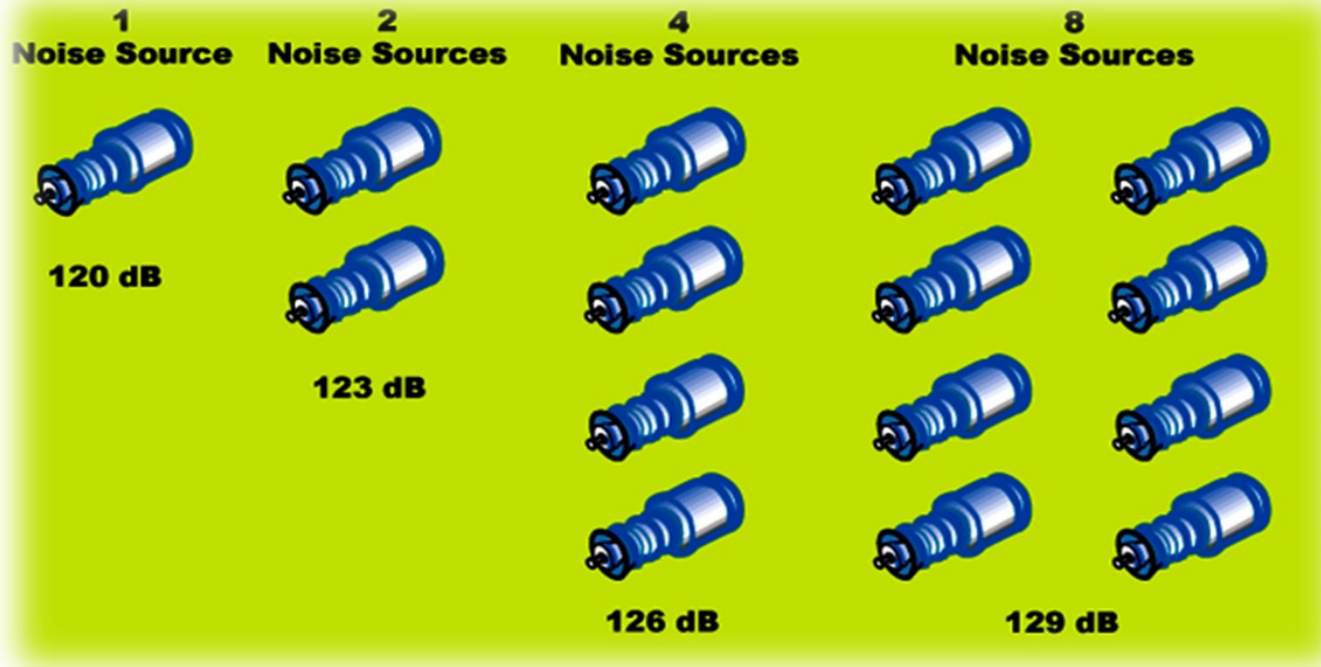
Indoor SEL is generally 15 dB lower than outdoor SEL for a house with windows open.

# A-Weighting

Sound pressure levels in individual frequency bands are adjusted to match human hearing response. The reference adjustment is 0 dB at 1,000 Hz. The human ear is much less responsive at low frequencies. An A-weighted sound level is the total contribution from all sound frequencies, with the appropriate weighting factors applied (“dBA”).



# Decibel Addition



**Example:**  $120 \text{ dB} + (10 \times \log_{10} 4 \text{ identical sources}) = 126 \text{ dB}$



# Background on Vehicle Noise

- Primary source of noise is tire/road interaction at high speeds.
- Exhaust / engine / radiator noise dominate at low speeds.



Report on Excessive Motor Vehicle Noise, Feb 2025

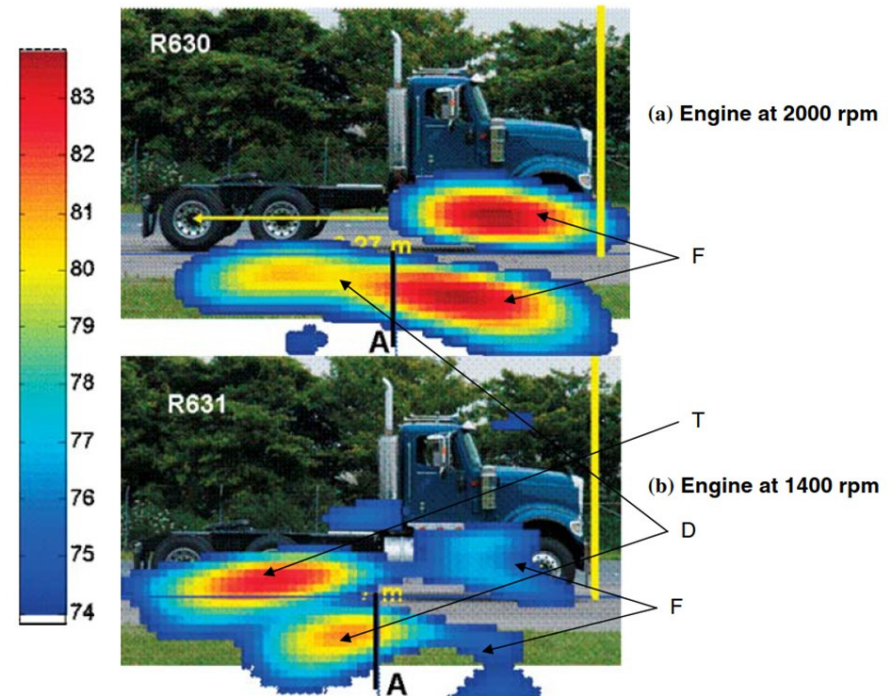


Figure 54. Source distribution at frequency of 868 Hz of the 5900i truck moving to the right at 50 mph with engine at (a) 2000 rpm and (b) 1400 rpm.

# Background on Vehicle Noise

- Complaints typically center around loud / modified exhausts and engine compression release braking.



# Sound Level Meters (SLMs)

- Wide range of features/costs
- Some easy to use, others require training
- Would be used for an LEO approach
- Would be used in a testing facility
- Detect the overall sound level, but not the source or direction of the arriving sound.



# Acoustic Camera

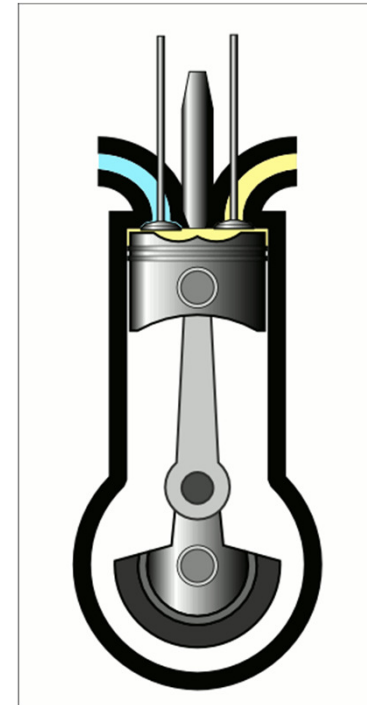
- Emerging technology
- Handheld or stationary
- Localizes the noise source
- Can determine source and direction.





# Background on Engine Braking

- Engine compression release braking – aka engine braking, Jake brakes, or Jacob brakes
- Uses the engine as additional braking force
- Sound levels can be managed through use of good condition exhaust mufflers



# Objective/Subjective

A statute intended to place a quantitative limit (in decibels, dB) on noise emission needs to be:

- reasonable,
- easily interpreted,
- and easily enforceable.

Human reaction to noise is subjective, so a limit deemed reasonable by some may not be considered reasonable by others. Some might consider the limit too restrictive or not restrictive enough.

# Current Vermont Regulations

Current Vermont motor vehicle laws related to noise are limited to ensuring that all vehicles are in good mechanical condition and properly equipped with a muffler.

The inspection guidance limits the scope of the inspection to “parts or systems that are relevant to a vehicle’s safe operation”.

There are no objective standards or quantitative methods in the law to define good mechanical condition, other than referring to “as installed by the manufacturer”.

# Key Quotes From Report - Stakeholders

- Observations that noise is not a high priority for the stakeholder’s constituents
- Concerns about the need to dedicate limited resources to noise enforcement that would be better spent on other traffic safety issues such as excessive speed or DUI enforcement
- Concern about the arbitrary nature of some noise standards that reference “excessive” or “unusual” noise levels.
- There were consistent concerns about any noise standard that would require a judgement call from law enforcement or inspection mechanics.
- Stakeholders noted that judgement calls or non-quantitative enforcement requirements are not compatible with current guidelines for traffic enforcement. Several stakeholders pointed out that there has been a general trend to reduce traffic stops and traffic enforcement, with significant reductions in the number of traffic stops across the state over the last several years. There was concern about the legal implications of law enforcement discretionary stops based on noise.
- Concerns about adding additional responsibilities onto law enforcement personnel, such as the training required to use SLMs and methodology for standardized noise testing
- Difficulty in accurate / repeatable / defensible noise testing
- Concerns about adding additional steps to the VPIM. Stakeholders noted that the VPIM was reduced in scale and scope significantly in 2019, and adding a noise requirement would reverse that work to some extent
- Concerns that noise testing during an inspection might impose additional costs on Vermont residents
- Concerns that visual inspections by law enforcement personnel are not practical, as personnel cannot be expected to climb under vehicles during traffic stops to investigate the presence of required equipment.
- Concerns that visual inspections by inspection mechanics may be too subjective and lead to inconsistencies in the inspection process.



# Vermont Periodic Inspection Manual (VPIM)

VPIM contains no methodology for quantifying sound levels (in decibels, dB) emitted by a vehicle. The manual does not consider noise as critical to safe vehicle operation. It contains no procedure requiring measurement of noise emission or rejection of a vehicle due to noise.

Implementation of such a mechanism, such as incorporation of noise testing, would require a Rule change to the VPIM. Noise testing would also require new equipment, training, and changes to the Automated Vehicle Inspection Program (AVIP)/Tablet software.

Currently, the VPIM requires inspection mechanics to “Advise” passenger vehicle and light truck owners if there is a muffler, muffler cutout, or similar device that causes excessive noise. Inspection mechanics are required to “Reject” a motorcycle if there have been any changes or modifications to the exhaust system that would cause it to generate an unreasonable sound level.

A stakeholder in the interview process noted that, in their opinion, including exhaust changes in the “Reject” category for motorcycle inspections was a clerical error made by the committee when rewriting the VPIM in 2019. In the stakeholder’s opinion, the intent of the committee was to include this as an Advise rather than Reject.

# Noise Testing in the VPIM

Objective vehicle noise standard - noise test during inspection

Subjective standard - visual inspection of vehicle components during the inspection procedure.

Either of these would depend on vehicle inspection mechanics to enforce the noise standard or to perform the visual inspection, and any decisions or judgement calls would be at the discretion of the individual inspection mechanic.