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State and Local Guidance Manual  
for Police:  
Motor Vehicle Noise Enforcement

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\*The contents of this manual reflect the views of the grantee, who is responsible for the accuracy of the data presented therein, and does not, necessarily reflect the official policy of the United States Environmental Protection Agency.

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PREFACE

This guidance manual for state and local police officers and law enforcement personnel was prepared for the Office of Noise Abatement and Control of the United States Environmental Protection Agency as part of its mandate under the Noise Control Act (P.L. 92-574, 42 U.S.C. 4901 et seq. Supp. 1978). The purpose of the manual is to provide law enforcement personnel with the necessary technical skills to enforce State and Local Motor Vehicle Noise Laws.

The proper enforcement of motor vehicle noise violations requires the noise enforcement officer to develop specific technical skills, both in the use of noise measuring equipment as well as in the application of police practice to noise enforcement. The importance of training is critical where the enforcement officer is utilizing a sound level meter to measure the violation.<sup>1</sup>

<sup>1</sup>See State v. Aquilera, \_\_\_\_\_ Fla. Supp. \_\_\_\_\_ 979; No. 711-1015 (County Court Traffic Division, Dade County Florida, May 7, 1978) where the Court decided that the reliability of a radar reading would not be accepted as evidence that a violation occurred beyond a reasonable doubt. The Court held that the equipment must be improved and that training methods for enforcement officers must include an intensive course of study in both the class room and the field with a written examination for proof of the qualifications of the officer who operates the equipment.

This manual has been written for use both by the police officer who is charged with enforcement responsibilities as well as his supervisor. Each section of the manual corresponds to the modules of the Police Noise Enforcement Program as developed by the International Brotherhood of Police Officers. An Instructor's guide is provided for each module.

The manual may be used in its entirety or section by section, depending on local needs.



MODULE I:  
The Physics of Sound

I. A. Basics of Sound and Sound Measurement

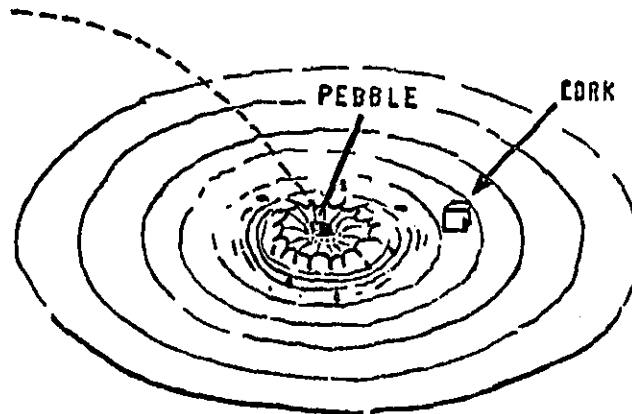
I. A. I. Sound and Noise

SOUND IS PRODUCED BY VIBRATING OBJECTS. Common examples which easily demonstrate this concept are drums, tuning forks, guitar strings, musical reeds, and vocal chords. The vibrating object causes air particles to move with it. As the vibrating object moves back and forth it causes the air around it to carry these vibrations away from it in the form of waves.

Sound is a series of disturbances which travel in the form of waves, similar to waves in the ocean. Sound waves are given off in all directions as when a pebble is gently dropped into a pond and small ripples, or waves, travel outward from the point where the pebble struck the water's surface.

WAVES IN A POND

GRAPHIC I.



For example, if there is a cork floating on the surface of a pond, the cork will bob up and down at a point as the waves pass by. When sound waves pass through the air, the air molecules oscillate in a similar manner about their undisturbed position.

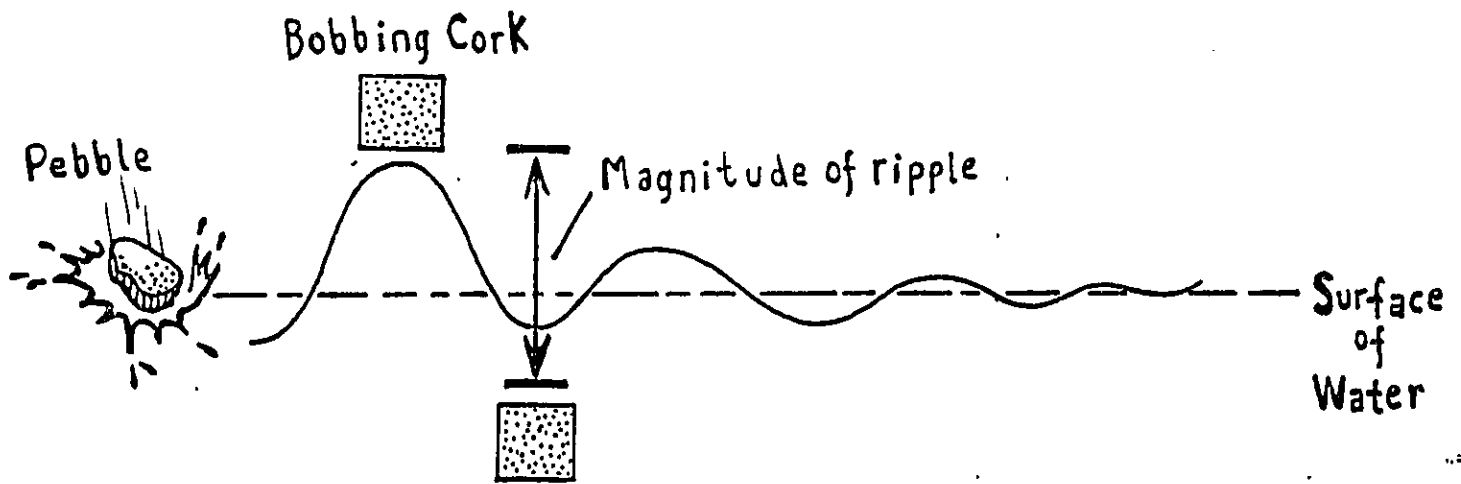
The motion of the cork illustrates three important characteristics of waves: magnitude, frequency, and variation with time.

The magnitude of the wave is the vertical displacement of the cork from the still water surface.

The number of times the cork oscillates up and down per unit of time represents the frequency of the wave motion.

GRAPHIC 2.

Enlarged cross-sectional view of ripple :



... as distance from disturbance (pebble) increases, magnitude of wave or ripple decreases.

-- If you drop only a few pebbles in the pond, the ripples would disappear after a short time. But if you constantly stir the water in phase with the waves, the ripples would continue.

I. A. 2. How Sound Travels

Sound cannot travel in a vacuum; it requires a medium, or substance, in which the molecules can "bump" against each other. Air, water and solids provide the medium.

Sound waves in air are actually pressure waves. The vibrating sound source creates regions of high pressure (compression) as it moves out and low pressure regions (rarefactions) as it moves back in. These high and low pressure waves move out from the sound source in all directions.

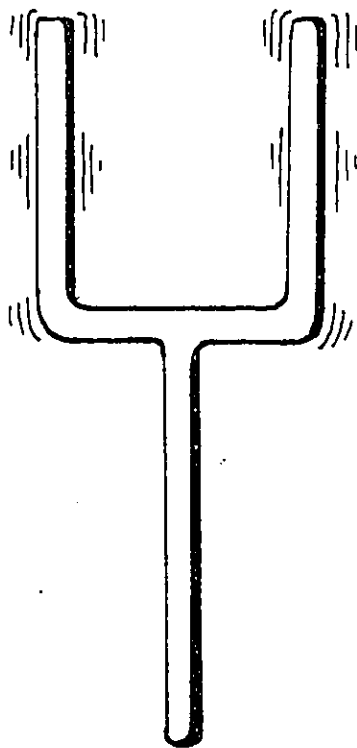
GRAPHIC NO. 3

Sound travels at a rate known as the speed of sound. These "sound waves" travel at 770 miles per hour (1128 feet/sec.) at sea level and "standard conditions". Naturally, as you move away from the sound source, the vibration energy that gets transmitted to the air gets weaker because all this energy is spreading to larger and larger circles around the source. Therefore, the further away you are from the sound source, the lower the sound level. This is called the attenuation of level with distance.

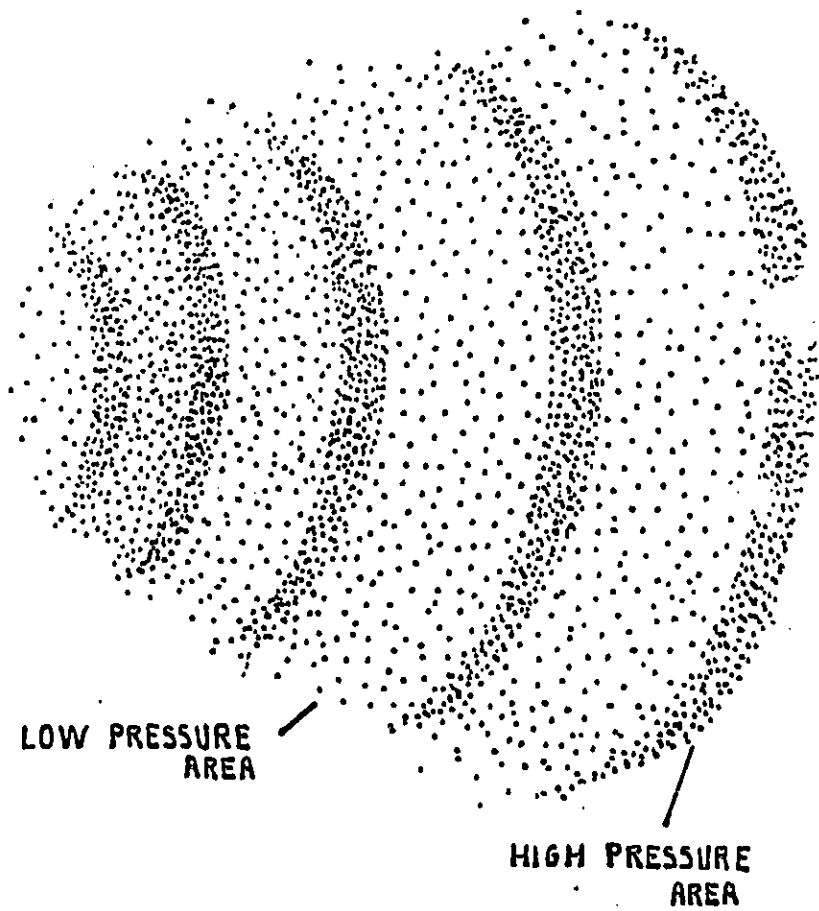
I. A. 3. Frequency

So far, we have only considered the magnitude or level of sound. But sounds have other properties. The "character" of a sound depends on the frequency or pitch of a sound.

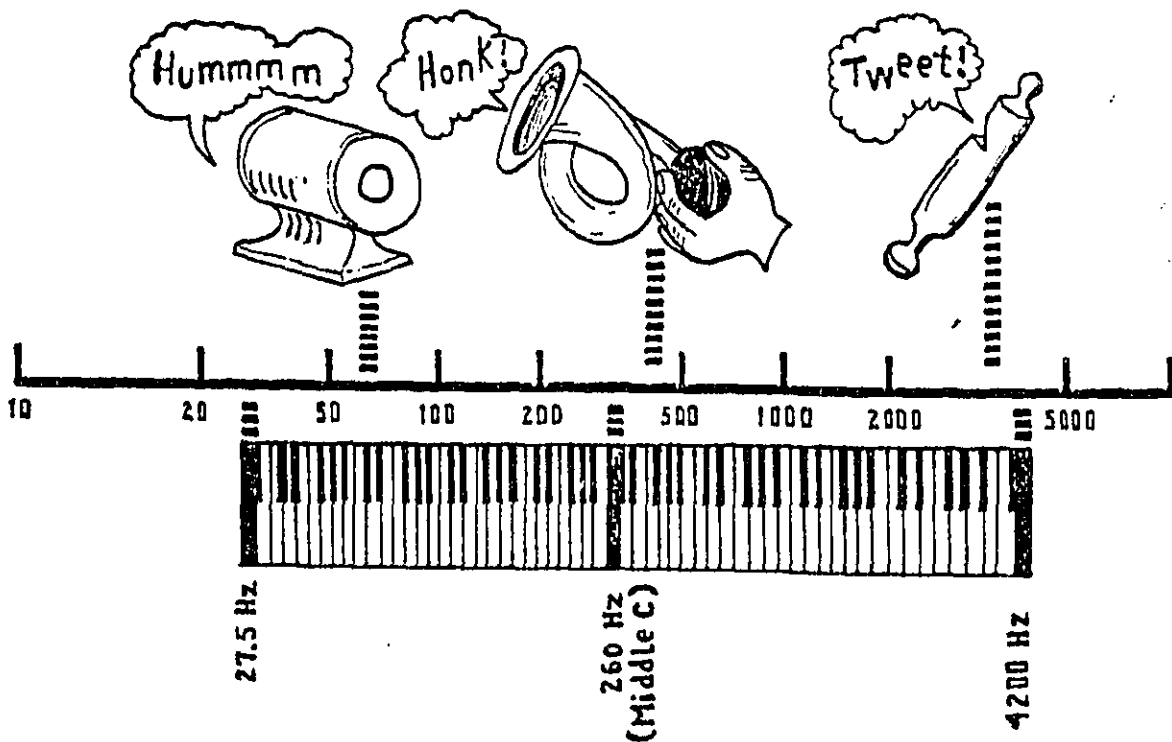
# How Sound Travels:



Vibrating Source  
(TUNING FORK)



# Single Frequency Sounds



Piano keyboard

Consider the example of a loudspeaker. When the diaphragm of the loudspeaker moves back and forth, fluctuations in the air are generated in the form of sound waves. The number of complete to-and-fro vibrations that the sound source, and hence the particles in the medium, make in one second is called the frequency.

GRAPHIC 4.

The frequency of the sound is the same as the frequency at which the diaphragm moves back and forth. Frequency is expressed in cycles per second, also called Hertz (Hz). For example, if the loudspeaker diaphragm moves back and forth 75 times every second continuously, the frequency of sound waves generated will be 75 cycles per second or 75 Hz.

Frequency is important because the ear does not respond to low and high frequency sounds equally well.

GRAPHIC 5.

It is important to know how the ear responds to different frequencies if we are to make a sound level meter respond in a similar way.



# Sound Intensity

Intensity decreases with distance from source because sound spreads out...



I. A. 4. Decibels

Sound measurement is characterized by (1) intensity, (2) frequency and (3) duration. The decibel (dB) is a unit for measuring the magnitude of sound.

A decibel is not a fixed value. It is simply a ratio, indicating the proportion by which one value is greater or less than another. For example, a sound of 10 decibels transmits 10 times as much energy as a 0 decibel sound, a sound of 20 decibels transmits 100 times as much energy as a 0 decibel sound, a sound of 30 decibels transmits 1,000 times as much, and so on.

Sound level meters read directly in decibels. However, the officer must know something about the way several sound sources may interact and affect the decibel reading registered on the sound level meter. Consider two sources that, when measured alone, each register 80 dB. Now, if these two sources are on simultaneously, the meter would register 83 dB. Three 80 dB sources, all on at once, register 85 dB, and 10 sources at once would register 90 dB.

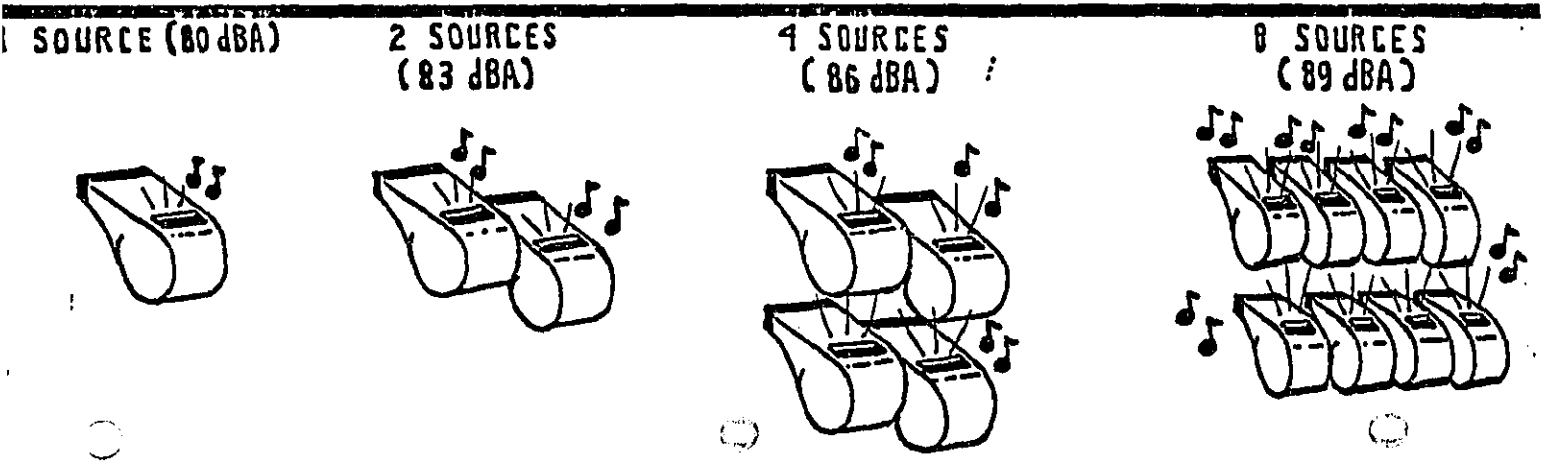
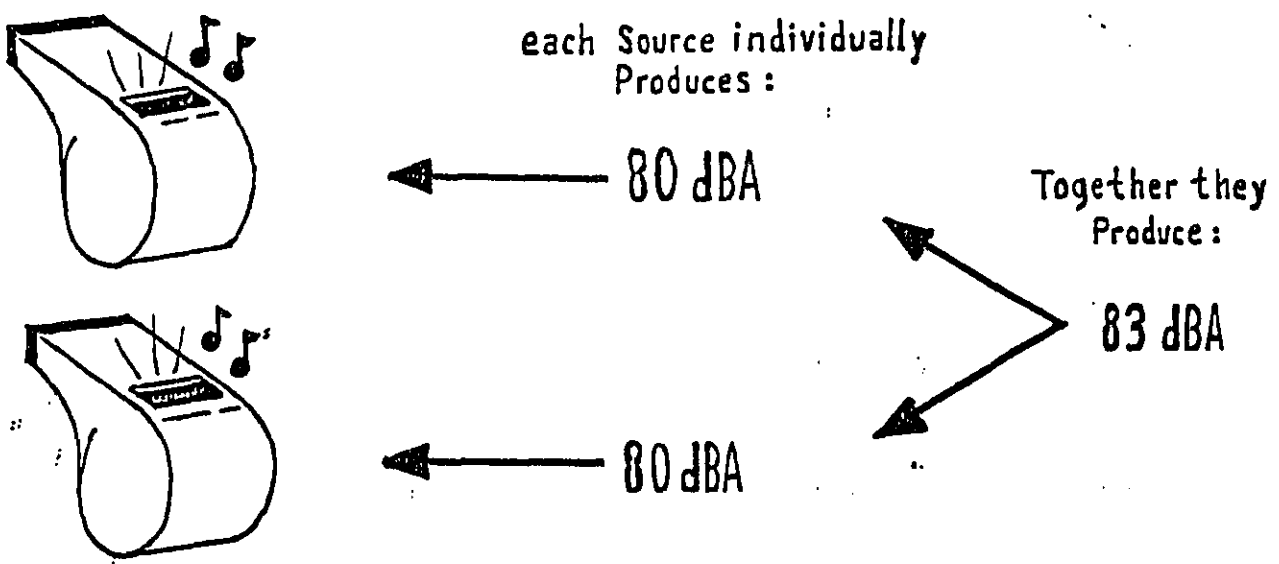
GRAPHIC 6.

Table I. 1. Outlines this example.

Table I. 1

Increase in Acoustic Power	Increase in Decibels
2 times	3 dB
3 times	5 dB
10 times	10 dB

# Combining Sound Pressure Levels :



The problem of how adding noise sources together affects the total sound level in decibels has just been answered. However, the next question is how are such changes in sound level perceived in terms of changes in loudness? Not as you might think! For example, a 3 dB increase is barely detectable, a 5 dB increase is clearly detectable, and a 10 dB increase is judged subjectively as TWICE as loud!! Summarizing:

+ 1dB	:	not detectable
+ 3dB	:	just detectable
+ 5dB	:	clearly detectable.
+10dB	:	twice (2) as loud

Therefore, IF A VEHICLE IS OBVIOUSLY NOISIER THAN OTHERS IN TRAFFIC IT'S AT LEAST 5 B ABOVE THE REST. A vehicle judged as much louder than the rest, say twice as loud, is around 10 dB noisier.

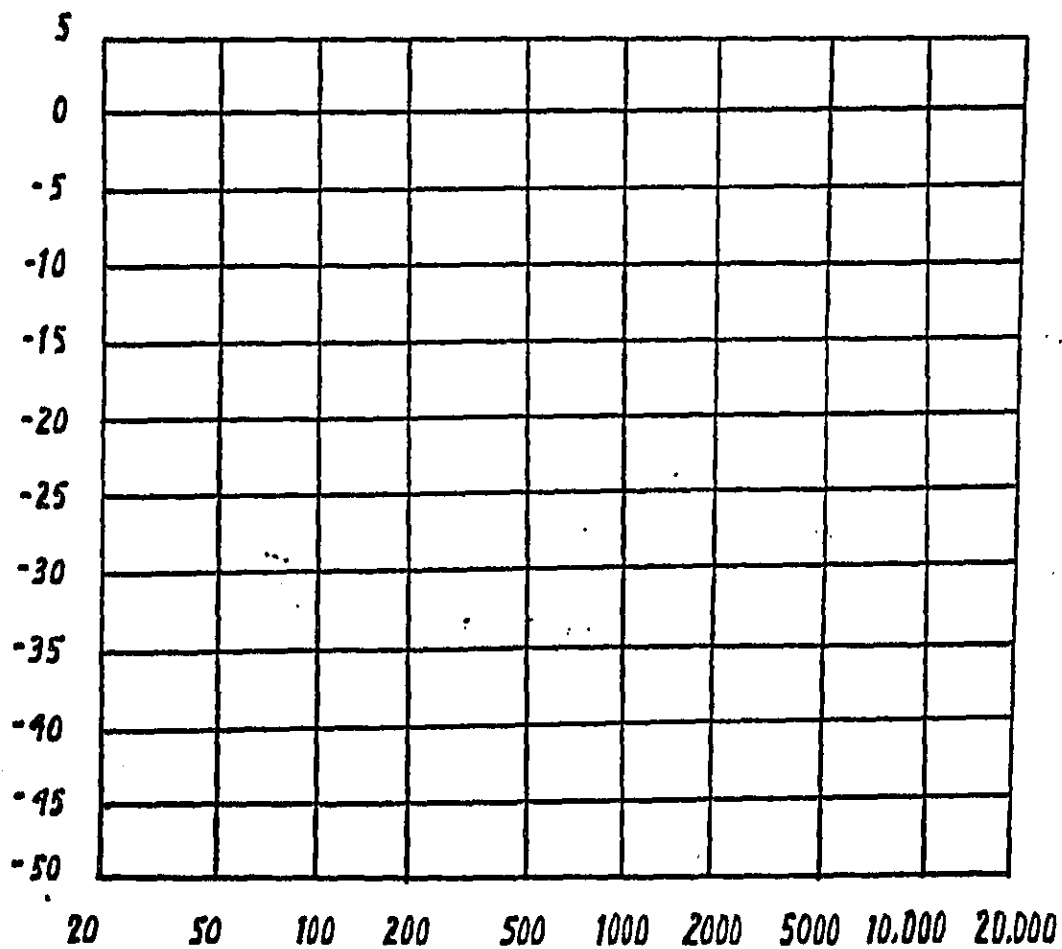
Decibel addition and subtraction as related to actual enforcement methodology is discussed in greater detail in subsequent sections of this manual.

The ear does not respond equally to all frequencies, but is less efficient at low and high frequencies than at medium or speech range frequencies. For this reason, different scales or weightings are applied to the decibel level.

Several weighting scales exist, but most EPA noise criteria are based on the A-weighted decibel scale, abbreviated dB(A). The dB(A) scale shows sound magnitude levels approximating what the human ear would hear because it adjusts for the fact that the ear does not respond equally to low, medium and high range frequency.

GRAPHIC 7.

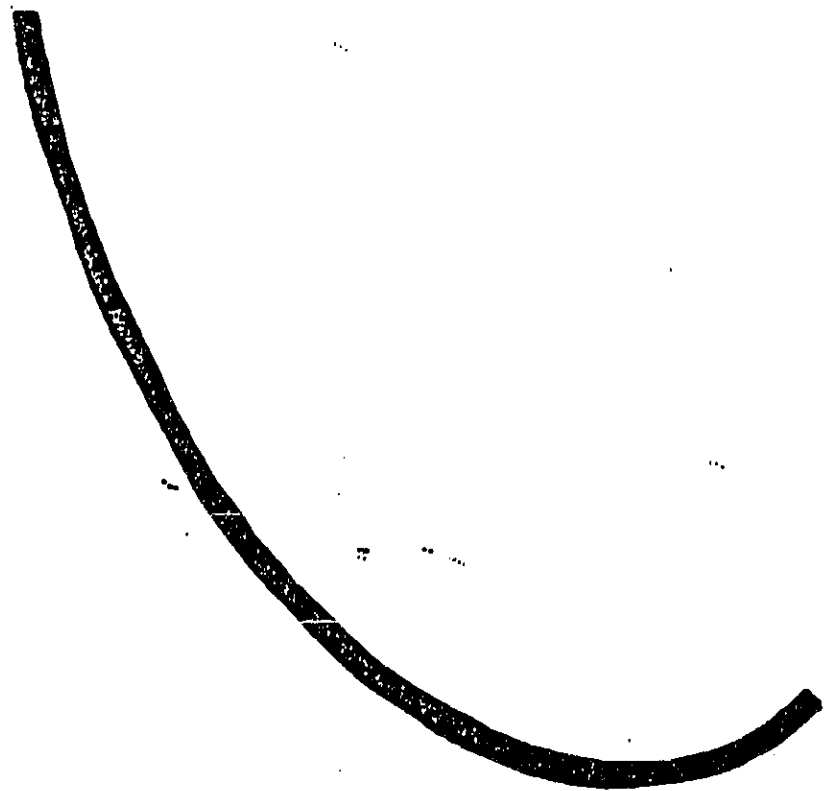
Relative Response - Decibels



Frequency in Cycles Per Second

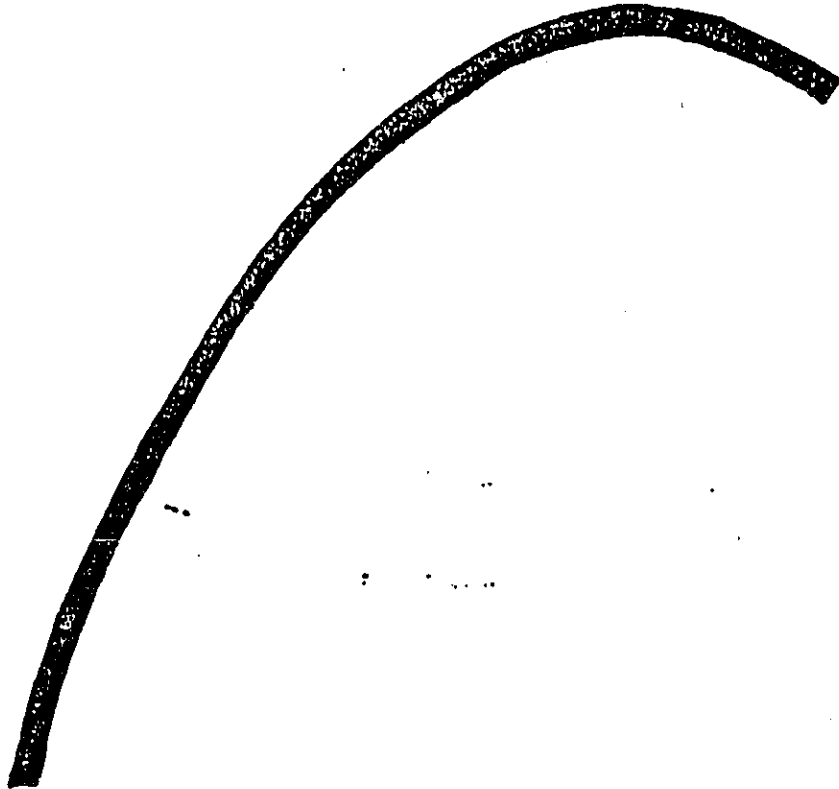
GRAPHIC 8.

Threshold of Hearing :



GRAPHIC 9.

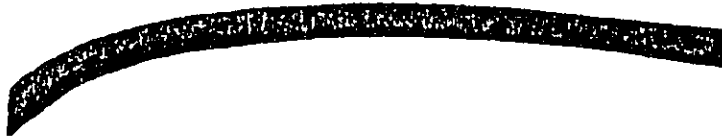
"A" - Weighted Frequency-Response  
Characteristics :



GRAPHIC 10.

# "C" Weighted Frequency- Response

Characteristics :

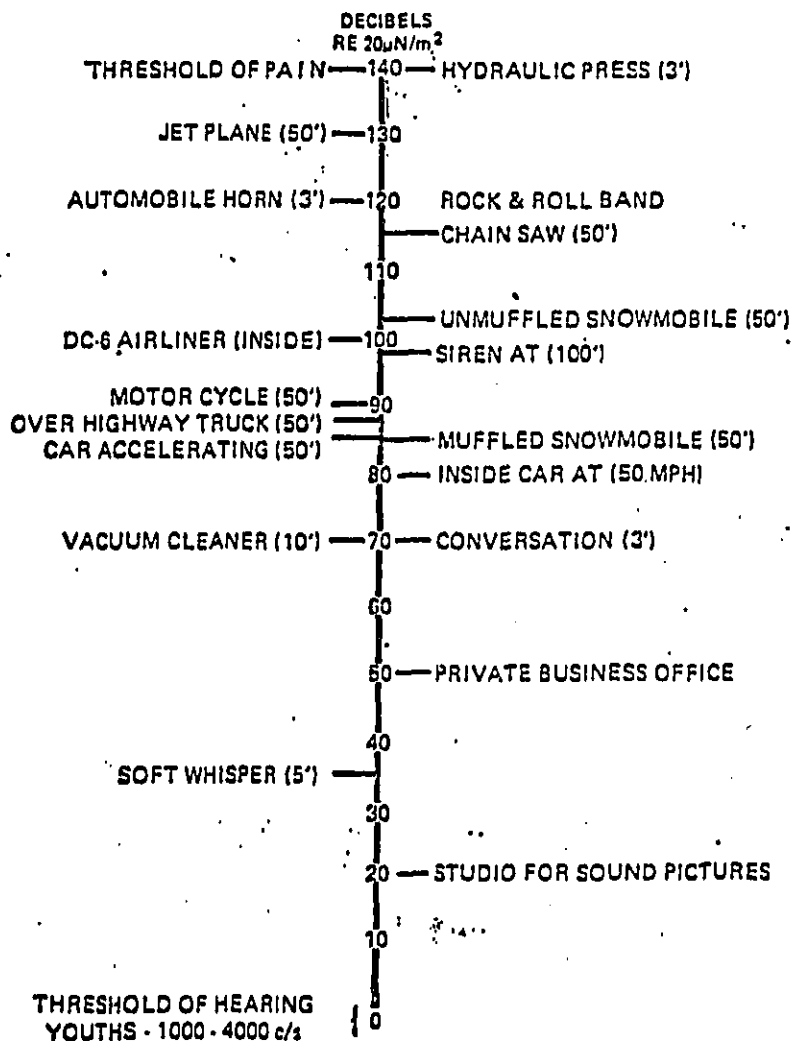




The A-weighted scale is used in all traffic enforcement work.  
Table I.2 indicates the typical range of common sounds on an A-weighted scale.

Table I.2

### TYPICAL A-WEIGHTED SOUND LEVELS



I. A. 5 Loudness

The words loudness and magnitude are often used as if they mean the same thing, though they have different meanings. The magnitude of sound refers to the amount of energy flowing in the sound waves. The loudness of sound is the strength of the sensation received by the eardrum and interpreted by the brain.

Therefore, loudness is a subjective response to noise levels. But for any individual, both the magnitude and loudness of a sound depend on four factors: (1) the distance from the source of the sound, (2) the amplitude of vibration, (3) the density of the medium through which the sound travels, and (4) the area of the vibrating object.

The magnitude and loudness of a sound are dissipated as it travels. As the distance increases between the source of the sound and the person or sound measuring device, the energy flowing in the sound waves decreases as it spreads over a greater area.

The loudness and magnitude of a sound decrease as the density of the medium decreases. Thick fabrics, such as fiberglass, cork, acoustic tiles all serve to "soak up" sound by reflecting spaces between the fibers until they dissipate their energy. For example, a car muffler serves to break up the sound waves and lengthen their travel distance to the outside.

The area, or size, of a vibrating object also affects the loudness and magnitude of a sound. The greater the area of vibration, the greater the loudness and magnitude.

The following table show Typical Sound Levels and Relative Loudness.

**Table I.3**

**Typical Sound Levels and Relative Loudness**

110	Rock-Roll Band (15 Ft)	
105	Jet Takeoff (200 Ft)	Uncomfortably Loud
100	Air Compressor (10 Ft)	
98	Motorcycle (50 Ft)	
	Snowmobile (50 Ft)	
95	Commercial Jet Flyover (500 Ft)	
	Auto Horn (25 Ft)	
	Power Mower	
90	Jackhammer (25 Ft)	Very Loud
85	Garbage Truck (30 Ft)	
80	Helicopter Flyover (200 Ft)	
75	Commercial Jet Flyover (3000 Ft)	
	Dishwasher (5 Ft)	
70	Electric Can Opener (3 Ft)	Loud
	Loud TY (10 Ft)	
60	Bedroom Air-Conditioner (3 Ft)	
	Speech Communication	
50	Large Transformer (100 Ft)	
		Quiet
40	Ideal Residential	
30		

dB(A)

MODULE I  
The Physics of Sound

1. Sound is a series of disturbances which travels in the form of:
  - a) straight lines
  - b) waves
  - c) circles
  - d) molecules
2. The greater the distance from the sound source:
  - a) the lower the sound level
  - b) the greater the sound level
  - c) does not affect the sound level
  - d) the higher the pitch
3. Frequency is the number of complete to-and-fro cycles that the sound source, and hence the particles in the medium, make in one second:
  - a) true
  - b) false
4. Frequency is expressed in cycles per second or:
  - a) amperes
  - b) miles per hour
  - c) decibels
  - d) hertz
5. Two sound sources, when measured alone, each register 80 dB on the sound level meter. Both sources measured together would register:
  - a) 80 dB
  - b) 160 dB
  - c) 83 dB
  - d) 90 dB
6. If a vehicle is obviously noisier than others in traffic it's at least 5 dB above the rest:
  - a) true
  - b) false
7. The \_\_\_\_\_ decibel scale is used in all traffic enforcement work.
  - a) A-weighted
  - b) B-weighted
  - c) C-weighted
  - d) all of the above
  - e) none of the above

II. INSTRUMENTATION AND NOISE MEASUREMENT

II. A. The Sound Level Meter - Components and Operation

The sound level meter is the basic instrument for measuring overall motor vehicle noise or exhaust system noise (see Table II-1). It consists of a microphone, calibrated amplifier-attenuator circuits, frequency weighting networks, and an indicating meter. The microphone (which may be mounted directly to the SLM or attached by a cable) transforms the acoustic pressure signal received at its diaphragm to an equivalent electrical signal which is then amplified and filtered. The A-weighting filter that is used for vehicle noise measurement causes the meter to essentially respond to the sound in the same fashion as the human ear. The sound pressure signal is then displayed in decibels on the indicating meter face (both digital and standard analog displays may be used).

GRAPHIC 11.

GRAPHIC ----.

# Sound Level Meter Features:

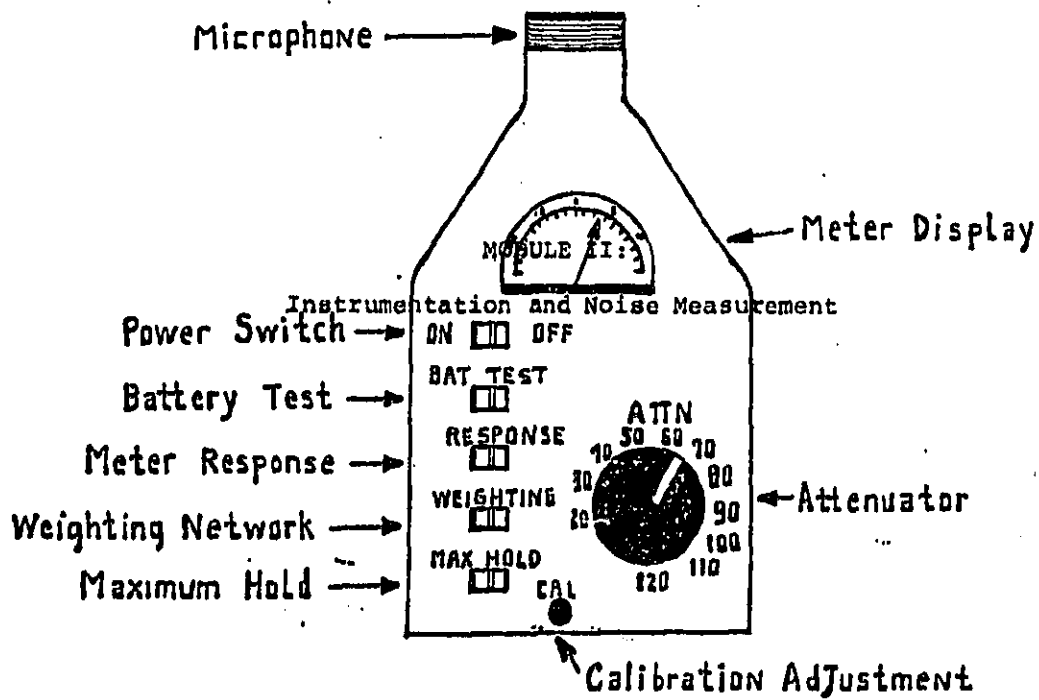


Table II.I

Operating the Sound Level Meter (SLM)

1. Check that the microphone is firmly screwed in and remove the protective dust cover (if one exists).
2. Press the "ON" switch.
3. Press the "BAT. CHECK" switch and note that the pointer lies within the range on the dial marked "BAT." If it does not, DO NOT USE THE METER until the batteries have been replaced and the battery check is satisfactory.
4. Calibrate the Meter (see Calibration check list).
5. Measure Sound Level as follows:
  - (a) Set "Range Switch" to a value which will indicate levels exceeding the maximum permitted limit.
  - (b) Set meter response position to "FAST".
  - (c) Check that the "A" button is depressed (if SLM is designed to measure more than one weighting).
  - (d) Orient meter to the noise source.
  - (e) The meter scale reading is then the SOUND LEVEL in dBA.

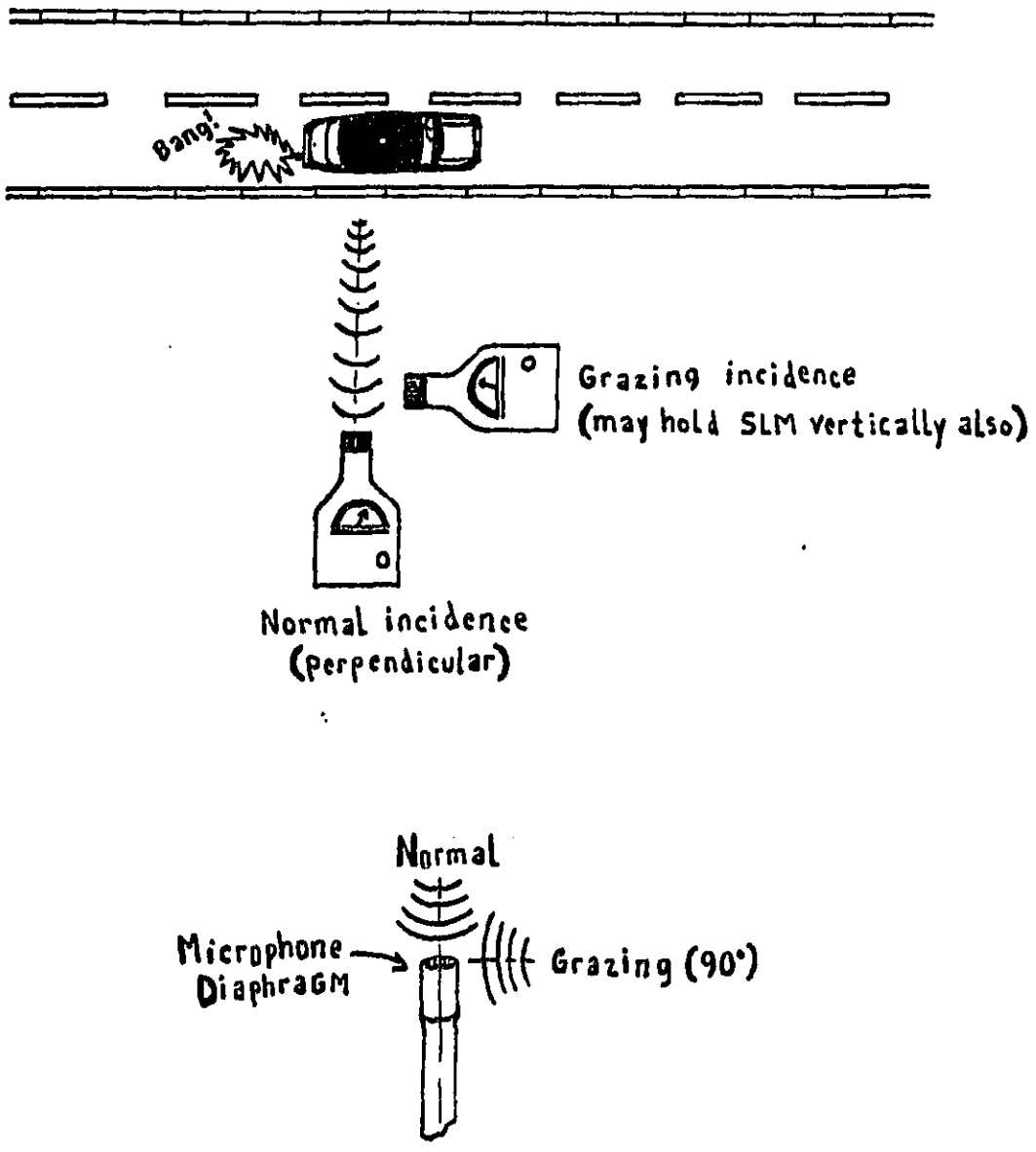
Sound level meters are supplied with microphones that have either normal (perpendicular) incidence or grazing incidence response characteristics. The details of these response characteristics are not important here. What is important, however, is the orientation of the sound level meter while taking noise measurements. Correct orientation depends upon these microphone response characteristics. The sound level meter manufacturer's instructions will define which type of microphone a particular SLM is equipped with. For normal (perpendicular) incidence microphones, the SLM is pointed directly at the source being measured. For grazing incidence microphones, the correct SLM orientation is either pointing in a direction parallel to the traffic lane or pointing up vertically.

#### GRAPHIC 12

Several manufacturers are currently in the process of developing special-purpose sound level meters (typically with digital read-out) with automatic operation features specifically for use in motor vehicle noise enforcement. Regardless of the type of meter purchased, manufacturer's instructions for microphone orientation, meter operation, and calibration must be followed carefully.



GRAPHIC 12.



B. Equipment Needs for Enforcement

The measurement of motor vehicle sound levels requires the following basic equipment:

1. Sound Level Meter (SLM)
2. Microphone Windscreen
3. Acoustical Calibrator

1. Sound Level Meter

The components and operation of the sound level meter have been discussed in the section above.

Equipment needs will vary depending upon the type of enforcement which is carried out. Table IV-2 summarizes the types of equipment needed for a variety of enforcement approaches.

TABLE II.2

Instrumentation User's Guide

SOUND LEVEL METER REQUIREMENTS		ENFORCEMENT APPROACHES				
		New Vehicle Certification (Pass-By)	Pass-By Compliance Testing	Pass-By Observer & Chase Car	Pass-By Single Officer Chase Car (on board monitor)	Short Test
ANSI Grade	Type 1, Precision	***	***	**	**	**
	Type 2, Gen. Purpose	*	*	**	**	***
	Type 3, Survey	0	0	0	0	0
Configuration	Hand Held	**	**	**	0	**
	Tripod Mount-Remote Mic.	***	***	***	0	**
	Car Boom Mic. Mount SIM Remote	0	0		***	**
Dynamic Range (dB)		60-100	60-100	60-100	60-100	80-120
Meter Response F/S		F	F	F	F	S
Filtering	A	***	***	***	***	***
	C	**	**	**	**	
Power	Int. Battery	***	***	***	**	
	RV AMX	**	**	*	***	

<u>Key</u>
*** Best
** Acceptable
* Marginally Acceptable
0 Not Acceptable

Generally, a Type 2 Sound Level Meter will satisfy the needs for traffic vehicle enforcement. All sound level meters used for vehicle noise enforcement must comply with ANSI (American National Standards Institute) S1.4 requirements for sound level meters as amended from time to time. The compliance should be on the equipment or at the least on the shipping carton or provided with the literature and operational instructions.

For specific circumstances, a Type 1 (Precision) sound level meter may be required. If so, it should also comply with the applicable ANSI standard.

As part of the sound level measurement equipment for both Type 1 and Type 2 meters, a Sound Level Calibrator adaptable to the particular meter must be obtained.

In addition to the sound level meter and calibrator, certain other equipment will be required for specific applications, such as:

11.B 2(a) On Highway Measurement - Remote Microphone

(1) A CABLE equal in length to the maximum radius permitted from the microphone location point to permit enforcement personnel and vehicle to remain outside the measurement site.

(2) When using the microphone in a remote operation, A PREAMPLIFIER, either built into the microphone or a type to be attached to the meter, is necessary to prevent signal loss through the cable.

(3) A TRIPOD, to mount the microphone in the remote area. The tripod must have the capabilities of adjustment to mount the microphone within the height parameters of the law or regulation. Usually a photographer's heavy duty light stand will be more than adequate to provide the height ranges and in most instances will be more sturdy and economical than those offered by the sound level meter manufacturer.

(4) All remote on highway measurement operations also prohibit the measurement of vehicle noise during certain atmospheric or climatic conditions, particularly during high winds. Therefore, AN ANEMOMETER IS REQUIRED. This piece of equipment can be the hand held type or the remote type. Each type has benefits and liabilities. (1) The hand held type is least expensive but requires the operator to exit the vehicle or at least hold the device outside the vehicle to determine wind speed. (2) The remote is considerably more expensive but the operator can determine wind speed by merely observing the remote scale which is usually in the vehicle. The wind speed measured is that at the microphone and not at the vehicle some 50 to 100 feet from the microphone. However, with the remote device, an additional tripod for mounting the anemometer is required.

- (5) A CARRYING CASE to prevent damage to the sound level meter and other equipment. A case capable of containing all the equipment, should be provided.

II B. 2b. ON HIGHWAY - VEHICLE MOUNTED MICROPHONE.

- (1) A CABLE sufficient in length to mount the microphone as required.
- (2) A PREAMPLIFIER is usually not required unless the microphone is more than 10 feet (3m) from the sound level meter.
- (3) MICROPHONE MOUNTING DEVICE to securely mount the microphone on the vehicle within the applicable height requirements.
- (4) ANEMOMETER - in this mode of operation, the hand held anemometer is the best suited type.
- (5) A CARRYING CASE to prevent damage to the sound meter and other equipment. A case capable of containing all the equipment should be provided.

II B. 2c. Subjective Screening and Stationary Measurement.

- (1) A CABLE of sufficient length to mount the microphone near the exhaust outlet of the vehicle and have the sound level meter at the driver's side of the vehicle.
- (2) A PREAMPLIFIER is usually not required unless the microphone is more than 10 feet (3m) from the sound level meter.
- (3) MICROPHONE MOUNTING DEVICE to mount the microphone near the exhaust outlet of the vehicle and within height and distance requirements.

- (4) ANEMOMETER - in this mode of operation, an anemometer is usually not required. However, it is recommended that at least a hand held type be available to determine wind speed if it is questionable.
- (5) A solid state TACHOMETER preferably inductive pickup with a guaranteed accuracy of plus or minus 100 revolutions per minute. It must have the capabilities of measuring two and four stroke cycle ignition spark engines or 2,3,4,5,6 or 8 cylinder design equipped with breaker point, breakerless or magnetto ignition.
- (6) A CARRYING CASE to prevent damage to the sound level meter and other equipment. A case capable of containing all equipment should be provided.

II B. 2d.

New Vehicle Measurement and Product Verification.

This method of enforcement would require a sound level meter equal to the type used by the vehicle manufacturer and is in all instances a Type 1 (Precision) meter.

- (1) A CABLE at least 100 feet in length.
- (2) A PREAMPLIFIER built into the microphone to prevent signal loss through the cable.
- (3) A TRIPOD to mount the microphone away from meter and within height requirements.
- (4) A REMOTE operation ANEMOMETER to measure wind speed with accuracy of plus or minus 10 percent.
- (5) A CARRYING CASE to prevent damage to the sound level meter and other equipment. A case capable of containing all the equipment should be provided.

II.B. 3. Microphone Windscreen

Rapid air movement over a microphone causes turbulence, which in turn generates outside noise and can affect SLM accuracy. This noise can cause erroneous high level readings. The use of headphones connected to the SLM output jack (consult manufacturer's recommendation) often will enable the operator to detect wind-generated noise. Therefore, it is good practice to always use a microphone windscreen for all vehicle noise measurements.

The windscreen, which is an open cell foam ball, also protects the sensitive microphone diaphragm from dust, dirt or serious damage should the SLM be dropped. The effectiveness of the windscreen is limited, however. Measurements of wind noise alone at velocities of 25 mph yield readings of approximately 80 dB (A). A proper windscreen is capable of reducing wind noise by approximately 25 dB (A). Therefore, measurements should never be made under high wind conditions (wind velocity over 15 mph).

II.B. 4. Acoustical Calibrator

Sound level meters should never be used unless properly calibrated. An acoustical calibrator provides a means for conducting an overall system check as well as calibration of the sound level meter.

The meter reading is adjusted to match the specified calibrator output sound pressure level. Calibrators are specifically matched to individual microphones; therefore, it is important that only the proper calibrator be used. Otherwise, errors may result and/or the microphone may be permanently damaged.



Calibrator output level is affected by changes in atmospheric (barometric) pressure. Therefore, care must be taken when using the calibrator at atmospheric pressures other than standard (altitudes other than sea level). Calibrator manufacturers provide correction curves for calibrator use under various atmospheric conditions (i.e., for use at higher altitudes).

II.B. 4(a). Field Calibration (external)

- (1) This calibration is performed at the measurement site by the operator.
  - (a) Once the site is established and set up, the sound level meter is field calibrated by use of the calibrator provided with the equipment. This is done initially and at 15 minute intervals until meter drift has stabilized. A drift of  $\frac{1}{2}$  dB or less is considered insignificant.
  - (b) Field calibration is then performed at approximately  $\frac{1}{2}$  hour intervals unless the meter has been moved or some other operation such as battery replacement is performed.
  - (c) It may be advisable to check field calibration after each enforcement action is taken.

II.B 4(b) Factory Calibration (internal)

- (1) This calibration is performed by the manufacturer or a laboratory and must be traceable to the National Bureau of Standards.
- (2) The calibrator should be calibrated at least annually and written certification provided by the person or facility performing the calibration.
- (3) The sound level meter should also be calibrated at least annually, however, depending upon experience, this could be extended to 2 or 3 years. Any malfunction in the meter will be detected during field calibration.

Table II.3

SLM Calibration Checklist

1. Check that the calibrator has the appropriate adaptor the microphone in use.
2. Switch SLM "ON" and allow 30 seconds for warm up.
3. Place calibrator over microphone and insure proper alignment.
4. Set the "Range Switch" to read a decibel inclusive of the calibrator's output level (i.e., for 94 output, use 90-100; for 114 output, use 110-120; etc.).
5. Depress the "A" button (A-weight).
6. Turn calibrator "ON".
7. Adjust calibration adjustment on the SLM to read the value indicated on the calibrator.
8. Switch calibrator "OFF".
9. Repeat calibration
  - (a) after each citation (optional)
  - (b) whenever site changes are made
  - (c) at least every hour and at the end of the day

**N.B.:** Check that calibration labels on SLM and calibrator indicate current manufacturer's calibrations. (Annual factory calibration required.)

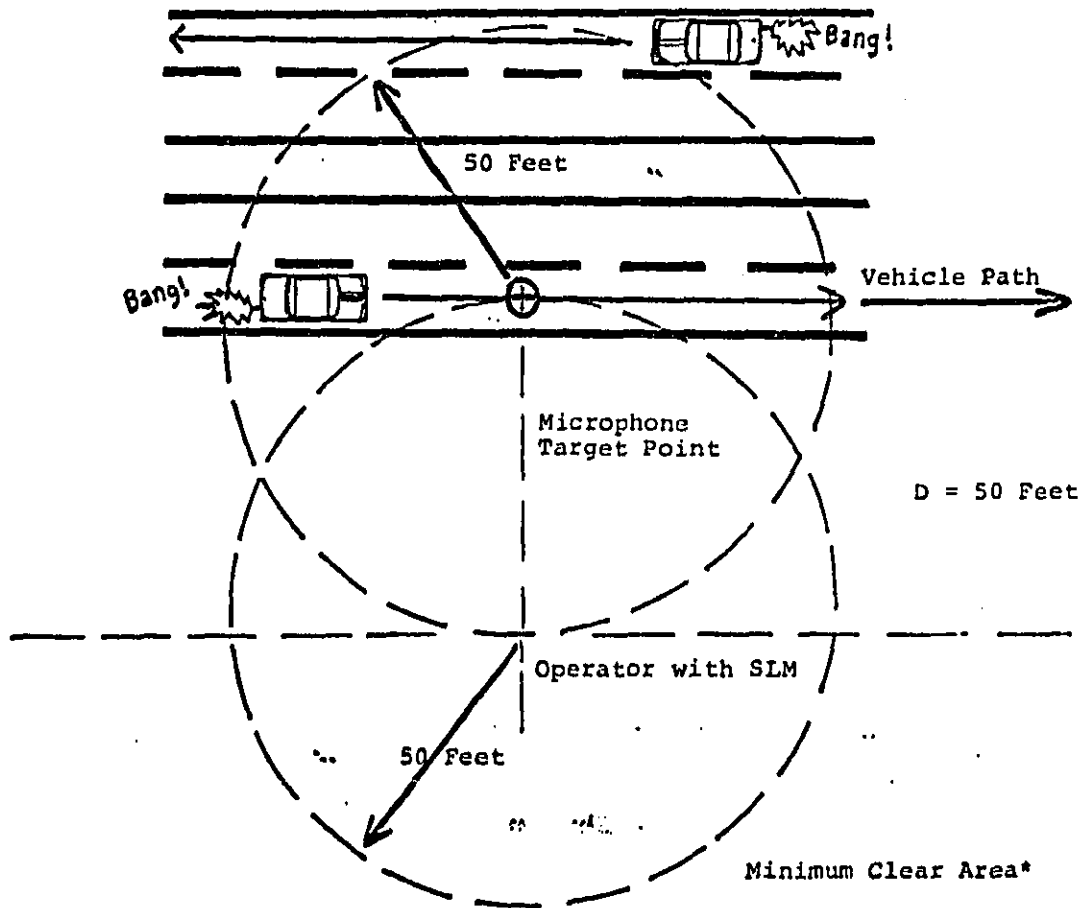
II.C. Measurement Methodology

II.C. 1. Measurement Site Selection

Proper vehicle noise measurement site selection is a crucial element in insuring that reported noise levels are accurate and defensible. Ideally, the vehicle measurement site should be a large clear area, allowing the full 50 foot distance between microphone and center of the travel lane with no large sound reflecting surfaces within a 50 foot radius of either the microphone or the vehicle being measured.

GRAPHIC 13

GRAPHIC 13



\* No large sound-reflecting objects within clear area.

## Measurement Methodology Checklist

Table II.4

1. Do Not Measure When:
  - (a) Raining or Snowing
  - (b) Street is wet
  - (c) Temperature is less than SLM manufacturer's recommendations
  - (d) Wind velocity is greater than 15 mph
2. Battery check: follow the "Calibration Checklist" previously cited.
3. Set up Sound Level Meter (SLM) per checklist.
4. Calculate measurement site adjustment factors from checklist.
5. Determine noise limit (per statute or ordinance).
6. Check for wind noise/meter overload
  - (a) Observe c-weighted level
  - (b) Listen through head phones
7. Measure and record Ambient Sound Level, dBA
  - (a) Set SLM attenuator to a high value
  - (b) Turn attenuator down until needle registers on meter face
  - (c) Observe needle movement for about 30 seconds
  - (d) Observe needle central tendency
  - (e) Ambient should be at least 10dB below enforcement level
8. Set attenuator so that enforcement level is readable on meter.
9. Observe maximum A-weighted values of Passing Traffic.
  - (a) Meter needle must rise and fall at least 6 dB between pass-by "peaks" to obtain a valid reading. (10 dB rise and fall is preferred.)
10. Determine Violation
  - (a) Violation has occurred when the observed level exceeds the noise limit. Observed levels equal to the maximum level would not be in violation unless local law or regulation provides for such.
11. Issue Citation
12. Recalibrate SLM after each citation.

II.D. Recommended Enforcement Procedures

II.D. 1. Enforcement Approach

Each jurisdiction has the power to regulate and enforce vehicle noise levels to protect the public and provide a safe and quiet environment. Depending upon the legislated authority, established requirements and resources, there are several means to accomplish this responsibility.

Depending upon the authority, requirements and resources, the jurisdiction may control vehicle noise in one or several ways. Once the statutory authority has been established, the requirements set forth, the equipment acquired and the personnel properly trained, active enforcement actions can be begun.

If the jurisdiction is implementing a totally new program, it may be extremely advisable to have a period of perhaps six months for a public education and awareness program. This could conceivably result in a greater degree of public acceptance and voluntary compliance.

There are basically two techniques by which vehicle noise measurement and enforcement are performed: (1) on highway remote mounted microphone and (2) on highway vehicle mounted microphone.

On Highway Remote Mounted Microphone.

This procedure requires two persons, a monitor or technician and the stopping officer. The monitor or technician does not necessarily have to be an officer with enforcement powers. However, he must be properly trained in the use of the equipment, the

site requirement and ability to describe the violating vehicle. It may be advisable to have both the monitor and stopping officer have full enforcement powers and have them alternate duties to reduce monotony. Additionally, if one is required to be absent, any other enforcement officer may be called upon to assume the duties of a stopping officer even though he may not be thoroughly trained in all aspects of vehicle noise enforcement. It may also be advisable to train the supervisors of those persons responsible for noise enforcement. This way they would be more aware of the duties and responsibilities of noise enforcement personnel.

For this means of enforcement, the microphone is mounted on a tripod at a prescribed distance from the center of the nearest lane of travel. Where the microphone is located is referred to as the microphone location point and the center of the nearest lane of travel is referred to as the microphone target point. A clear area, free of reflective surfaces with a radius equal to the distance between the microphone location point and the microphone target point, must be maintained around both the microphone location point to the ends of the radii from the microphone target point. Within this triangular area there cannot be any vehicles other than the one being measured.

The police officer must also be outside the entire test site. If he is standing while monitoring the meter, he may be within the site but not closer than 2 feet from it and be directly behind it.



The on highway remote mounted microphone method of enforcement is probably the most prevalent in use at this time. The result of this type of enforcement is the identification of gross violators when a vehicle is operated in a cruise or power mode. Since the majority of vehicle operation is in this mode, it could be said this method of enforcement is the most appropriate.

However, there are certain limitations in the application of this method. (1) An area of considerable size is required, thus limiting the scope of enforcement. (2) When the remote microphone is used, either tripod mounted or hand held, two people are required. Depending upon climatic conditions, two vehicles may also be required. (3) Additional equipment is required. A preamplifier in the microphone, additional cable, and a tripod is necessary. (4) Extreme care must be taken to insure no other vehicles or reflective surfaces are within the site. (5) And, this method may be the least cost-effective. To aid in off-setting costs, a concentrated public awareness and information program should be conducted during both the initial and on-going phases of the program.

#### On Highway Vehicle Mounted Microphone

This method has the microphone mounted on the monitoring vehicle behind the operator and at a pre-determined height above the roof line of the vehicle (usually 16 inches). The sound level meter is inside the vehicle, where the operator observes the meter and the vehicle being monitored.

The microphone should be mounted on the tripod at a prescribed height above the plane of the roadway. If the microphone is hand held, it also must be held within the prescribed height parameters.

A standard test site requires a distance of 50 feet between the microphone location point and the microphone target point. This distance may be adjusted from 35 feet to 83 feet, and, if adjusted, the then becomes a non-standard site. In either a standard or non-standard site, the radius used to determine the clear area around the microphone location point and the microphone target point is equal to the distance between the microphone location point and the microphone target point.

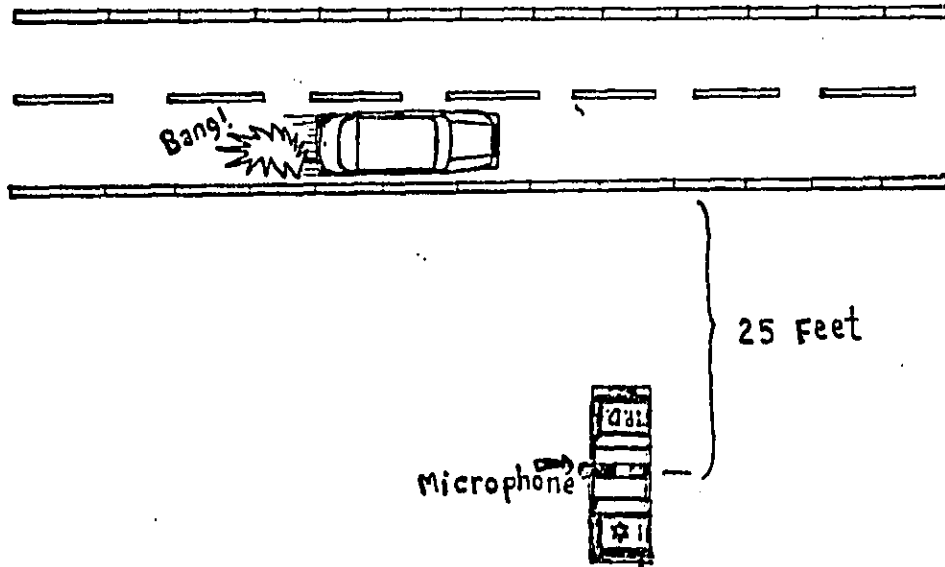
Both a standard and non-standard site require the microphone to be mounted or held between 3 feet and 6 feet above the plane of the roadway on which the vehicle is traveling. The preferred height is  $3\frac{1}{2}$  feet.

Basically all noise levels are established by using a standard test site. If a non-standard site is used or additional lanes are to be monitored, these limits must be adjusted to compensate for the increase or decrease in distance between the microphone location point and the microphone target point. This adjustment is usually in the range of adding 1 dB for each 12 feet of decrease in distance and subtracting 1 dB for each 12 feet of increase in distance.

To insure no other vehicles are within the triangular site, there must be a 6 dB rise and fall from the maximum level obtained from the vehicle being monitored.

The monitoring vehicle is located a pre-determined distance from the center of the nearest lane of travel (usually 25 feet). It may be parked either parallel or perpendicular to the highway.

Graphic 14



If the vehicle is parked parallel to the highway, 1 dB must be added to the limit. The area within a 25 feet radius of the vehicle and the center of the nearest lane of travel must be free of reflective surfaces. If additional lanes of travel are to be monitored, the limits must be adjusted as required by local law or ordinance. However, in no instance should the vehicle be located closer than 25 feet from the highway. This procedure can only be applied to those vehicles not regulated by the Bureau of Motor Carrier Safety and the Environmental Protection Agency. Those vehicles regulated by BMCS and EPA for noise levels can

only be enforced by a means identical to that required by those agencies of the federal government.

This method is used by some jurisdictions with favorable results and would be best suited to municipal or suburban areas where large clear areas are limited. The system is a one person operation, using one vehicle, and is also aimed towards the gross violator. It can be employed against vehicles in the cruise or power mode of operation as well as an urban acceleration mode (vehicles accelerating from a stop sign, traffic light or other traffic control devices).

Consideration must be given to the possible loss and damage of equipment. This would especially apply to the microphone and the windscreen.

#### II. D. 2. Decibel Addition and Subtraction

In many situations, however, it is difficult to locate sufficient sites that satisfy the aforementioned requirements. Hence, correction factors have been provided to account for measurement distances other than 50 feet (31-118 feet are allowed) and for the presence of reflecting surfaces; either in the vicinity of the microphone, the moving vehicle being measured, or both. It is important, however, that in selecting a measurement site, that every effort be made to utilize areas that require minimum correction factors.

When actual enforcement procedure does not allow measurement at 50 feet, the following decibel correction scale may be used.

Table II.5

Distance Increase Factors	Sound Level Decrease	Distance Decrease Factor	Sound Level Increase
1	0.0	1	0
1 1/2	- 3.5	2/3	+ 3.5
2	- 6.0	1/2	+ 6.0
2 1/2	- 8.0	2/5	+ 8.0
3	- 9.5	1/3	+ 9.5
3 1/2	- 10.9	2/7	+ 10.9
4	- 12.0	1/4	+ 12.0
4 1/2	- 13	2/9	+ 13.0
5	- 14	1/5	+ 14.0
5 1/2	- 14.8	2/11	+ 14.8
6	- 15.6	1/6	+ 15.6
6 1/2	- 16.3	2/13	+ 16.3
7	- 16.9	1/7	+ 16.9
7 1/2	- 16.5	2/15	+ 17.5
8	- 18	1/8	+ 18

**Example:**

At 50 feet the sound level is 87 dBA.

What is the sound level at 100 feet? The distance increase factor from 50 feet is 2, so  $87 - 6 = 81$  dBA.

What is the sound level at 300 feet? The distance increase factor from 50 feet is 6, so  $87 - 15.6 = 71.4$  dBA.

What is the sound level at 20 feet? The distance decrease factor from 50 feet is 2/5 so,  $87 + 8 = 95$  dBA.

What is the sound level at 25 feet? The distance decrease factor from 50 feet is 1/2, so  $87 + 6 = 93$  dBA.

II. D. 2. (a) Corrections for Sound Reflecting Surfaces

Measure the distance between the microphone and its nearest sound reflecting surface (L1) and between the center line of the vehicle lane of travel and its nearest sound reflecting surface (L2). Locate these distances on the correction factor chart on their respective axes, and connect the two marks by a straight line. The point on the central axis that is intersected by the straight line indicates the dB correction factor to be added to the measured sound level for each vehicle passing through the site. (The dotted line in the correction factor chart illustrates a +2 dB correction for sound reflecting surfaces at L2=52 feet from the center of the lane of travel and L1=25 feet from the microphone.)

1. The correction factors determined by the correction factor chart should be used only for sound reflecting surfaces that are parallel to the lane of travel.
2. Basically parallel surfaces may have irregularities or projections of not more than 2 feet, measured perpendicular to the lane of travel, with the distances illustrated on the correction factor chart measured from the nearest projecting surface.
3. Sound reflecting surfaces not basically parallel to the lane of travel should be 100 feet or more from the microphone. This restriction does not apply to surfaces that are perpendicular to the lane of travel and behind the parallel surface for which corrections are made, such as a fence or the side walls of a building.

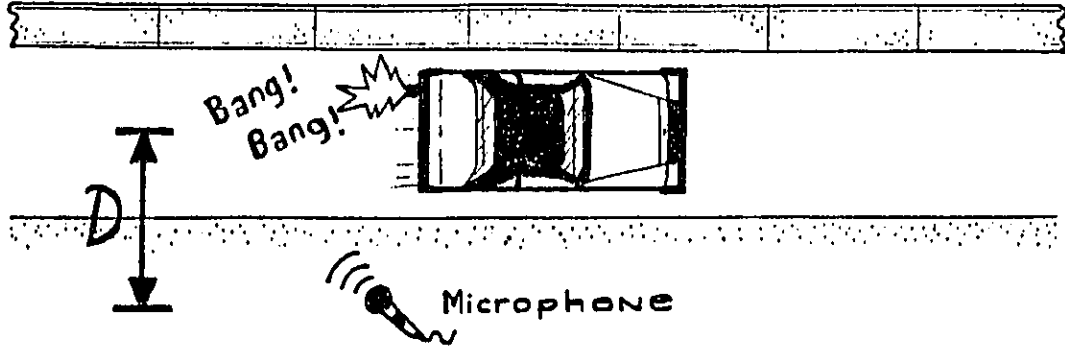
GRAPHIC 15.

For in-city measurements of traffic noise, it is often difficult (if not impossible) to locate measurement sites that comply with the Reference Site clear area requirements (particularly within residential areas). There is often a fence or a building within the specified clear area. Use of the decibel correction chart will permit measurement at otherwise "unusable" locations.

GRAPHIC 16



GRAPHIC 16



Distance in feet (D)	Sound Level Limits (dBA):						
	ON HIGHWAY M/C'S			AUTOS & LT. TRUCKS			
	POSTED SPEED ZONE			POSTED SPEED ZONE			
	≤ 35 mph Level Road	45 mph or Less	Greater Than 45 mph	≤ 35 mph Level Road	45 mph or Less	Greater Than 45 mph	
21 - 29	81	85	89	77	79	85	(+7)
29 - 32	80	84	88	76	78	84	(+6)
32 - 35	79	83	87	75	77	83	(+5)
35 - 39	77	81	85	73	75	81	(+3)
39 - 43	76	80	84	72	74	80	(+2)
43 - 48	75	79	83	71	73	79	(+1)
48 - 58	74	78	82	70	72	78	
58 - 70	73	77	81	69	71	77	(-1)
70 - 83	72	76	80	68	70	76	(-2)
83 - 99	71	75	79	67	69	75	(-3)
99 - 118	70	74	78	66	68	74	(-4)

II. D. 3. Vehicle Pass-By Noise Measurement

As discussed in earlier sections of this manual, measurements cannot be conducted in the presence of precipitation, wet streets, or wind velocities greater than 15 mph.

Prior to actual vehicle measurement, it is necessary to check for wind noise effects, even though the wind screen is in place. Wind velocity can be easily measured with a small hand held device. It consists of a small plastic tube with holes in the bottom and a graduated scale along its length. A small foam ball is contained inside the tube. To measure wind velocity, the tube is held vertically and the wind causes the ball to rise inside the tube. Wind velocity is read off the scale opposite the ball.

Next, if your measurement system is so equipped, listen to the sound the meter is receiving through a set of headphones attached to the meter output socket.

The sounds of the passing traffic should be clear and well defined. The presence of static and crackling and popping in the headset may indicate excessive low frequency wind noise which is overloading the amplifier circuitry in the SIM.

Another check for excess wind noise is to observe both the C-weighted and A-weighted sound levels (some meters may not be equipped with a C-weighting filter) in the absence of passing traffic. A C-weighted reading of 10 or more dB above the A-weighted reading indicates the presence of a strong low frequency source of noise (typically wind). If switching to

C-weighting causes the meter needle to go off scale (without changing the attenuator setting from when the A-weighted reading was taken), this again suggests that wind noise may be overloading the meter.

The final prerequisite before actually measuring vehicle noise involves measuring the ambient noise at the site selected. The ambient noise level, which may consist of people noise, other traffic, etc. must be at least 10 dB below the level at which enforcement is planned.

In order to have a valid reading of a passing vehicle's noise level, the meter needle must rise 6 dB or more to the maximum observed level and then must fall at least 6 dB as the vehicle passes to insure no other sound source has influenced the reading. (Digital SLM's built especially for vehicle noise enforcement incorporate this 6 dB rise and fall requirement into their circuitry such that a maximum level will not be held unless this requirement is met.) A 10 dB rise and fall is actually preferred. This 6 dB rise and fall requirement suggests that in heavy traffic, accurate noise measurements will be difficult to obtain. However, the gross noise offenders may still be apprehended.

II. D. 4. Vehicle Inspection

The following checklist may be useful when inspecting a vehicle for compliance with the local noise statute or ordinance.

VEHICLE INSPECTION CHECKLIST

1. Determine the year of manufacture of the vehicle
  - (a) was the vehicle manufactured prior to the effective date of state/local statute/ordinance
  - (b) was the vehicle manufactured after the effective date of the state/local statute/ordinance
2. Establish the vehicle category
  - (a) registered on-highway
  - (b) off-road
  - (c) competition
  - (d) export only
3. Determine if the equipment is original or replacement equipment
  - (a) question operator
  - (b) check appearance
    - presence of cross-over pipe
    - standard markings or manufacturer's V.I.N.
    - thin wall or heavy wall construction
    - inseparable components

For label match-up inspection, check the vehicle for the following:

1. Original or replacement equipment
2. Exhaust system components
3. Competition vehicle only
4. Export only

For exhaust system deterioration inspection, check the vehicle for the following:

1. Holes or rusted portions
2. Parts missing or loose
3. Baffels or insets missing (in mufflers)
4. Glass - paks "blown out"

II. D. 5. Motor Vehicle Citation Procedure

The following citation procedure is recommended for the police officer:

1. Curb Vehicle (Standard Police Procedure)
2. Record All Pertinent Information
  - Fill out violation form (sample attached)
3. Advise Motorist of Violation
  - Cite ordinance provisions
  - Present information "fact sheet" (see CHP example 6 attached)
  - Explain options/legal rights
  - Explain compliance procedure(s)/penalty for noncompliance
4. Conduct Vehicle Inspection - Re: Checklist
  - Obtain necessary motorist consent
5. Establish "Probable Cause" of Violation
  - Faulty/improper exhaust equipment
    - Tampering - Deterioration
  - Vehicle Operation:
    - excessive rate of acceleration
    - squealing tires
    - overrevving engine
    - backfiring, out-of-time
  - Both (separate factual observations from officer's opinion)
6. Issue Summons

Samples of Summonses and Citation forms utilized by the Maryland State Police are attached in the Appendix. The samples are enclosed as suggested forms which may be adopted by a state or local police agency.

II. D. 6. Compliance Testing

While many forms of compliance test procedures are currently in use in vehicle noise control programs around the country, it is felt that these procedures need to be standardized and yield test results that correlate directly with the maximum new motorcycle noise emission limits established by the U.S. EPA. The test procedure recommended in this manual is the procedure known as the "Short Test". This procedure requires the owner/operator of the vehicle, after being cited for a violation of the established noise level limits, to submit the vehicle for noise testing at a predetermined site on a particular date. If the vehicle, upon testing, is found to exceed the established limits, the owner/operator is given a time period in which to correct the vehicle and submit it for further testing and certification. On the other hand, if the vehicle is in compliance, no further action is taken.

A more detailed discussion of the Short Test, particularly as it applies to motorcycles, is contained in subsequent modules.

II. E. Required Technical Skills

The method of enforcement and the type of local ordinance will determine the kind of technical skills a police officer will need to effectively enforce the local noise law. For example, if the state/local law limits the maximum level of sound in decibels emitted from a motor vehicle, the police officer will need technical skills in the operation of the sound level meter, a skill which is not as necessary if the officer is enforcing a "label match-up" statute.

Table II.6 summarizes the necessary technical skills for a variety of motor vehicle noise enforcement measures.

TABLE II.6  
Required Technical Skills - Guide

KEY	
X	Required
*	Helpful, but not necessary

SUBJECT MATTER	MOTOR VEHICLE NOISE ORDINANCE PROVISION					
	Equipment Deterioration	Non-Quantified Operational Limits	Quantified Operational Limits	Restricted Areas of Use/ Curfews	Label Match-Label Match-Up & Control	Label Match-Up
Acoustics Fundamentals	*	X	*			*
Motorcycle Noise Characteristics	X	X	X	*	*	X
Vehicle Noise Laws	X	X	X	X	X	X
Legal Issues	X	X	X	X	X	X
Instrumentation Functionality & Use	*	*	X			
Enforcement Procedures	X	X	X			X
Vehicle Inspection Procedures	X	X	X		*	X
Citation Procedures	X	X	X	X	X	X
Compliance Certification	X	*	*		X	X
Courtroom Testimony	X	X	X	X	X	X



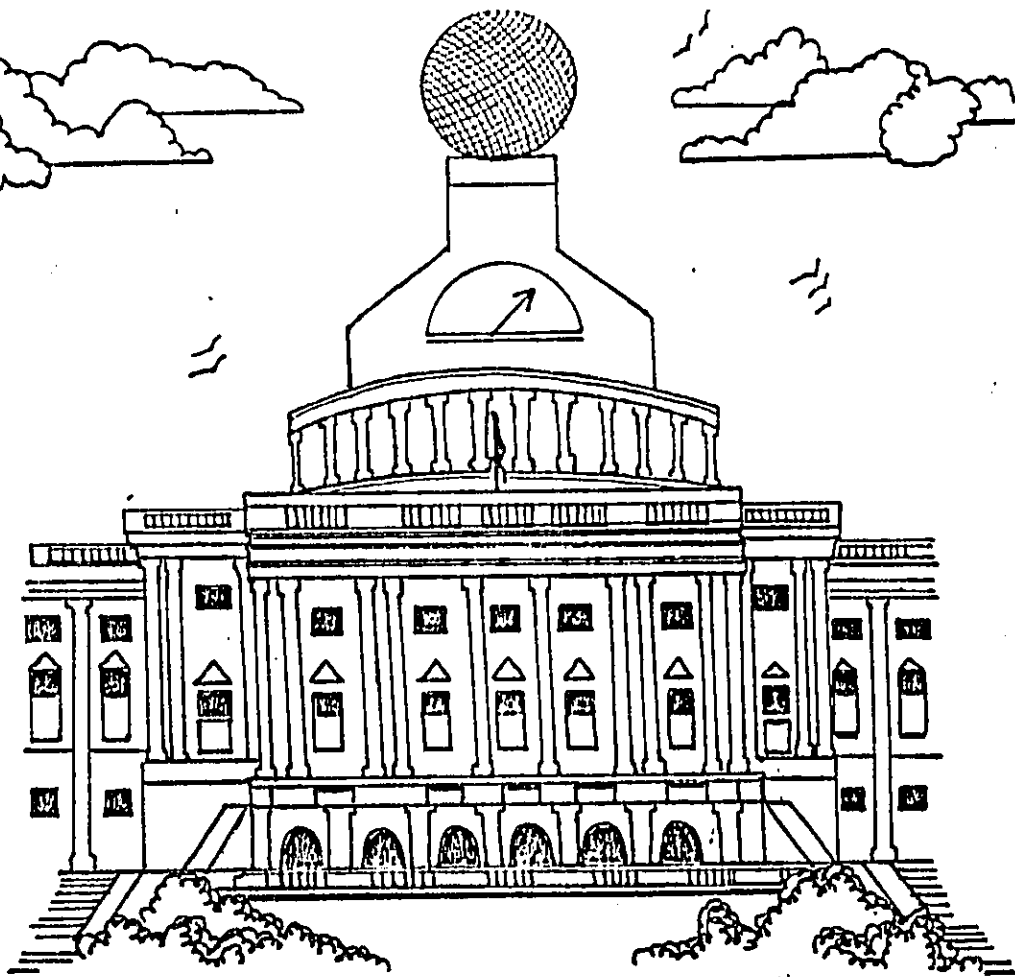
MODULE II

Instrumentation and Measurement

1. The measurement of motor vehicle sound levels requires the following basic equipment:
  - a) Sound Level Meter
  - b) Microphone Windscreen
  - c) Acoustical Calibrator
  - d) all of the above
  - e) none of the above
2. High wind conditions (velocity over 15 mph) have no effect on the accuracy of SLM readings.
  - a) true
  - b) false
3. To obtain a valid reading, the meter must rise and fall at least \_\_\_\_\_ between pass-by "peaks":
  - a) 1 dB
  - b) 6 dB
  - c) 25 dB
  - d) 83 dB
4. The SLM should be calibrated after each citation:
  - a) true
  - b) false
5. In either standard or non-standard site, the radius used to determine the clear area around the microphone location point and the microphone target point is equal to:
  - a) the distance between the microphone location point and the microphone target point
  - b) 50 feet
  - c) 35 feet to 85 feet
  - d) all of the above
  - e) none of the above
6. The On Highway Vehicle Mounted Microphone method requires the microphone to be mounted or held \_\_\_\_\_ above the plane of the roadway on which the vehicle is traveling:
  - a) 0-3 feet
  - b) 3-6 feet
  - c) 6-9 feet
  - d) Height of the microphone does not matter
7. The ambient noise level at the site selected must be at least \_\_\_\_\_ the level at which enforcement is planned:
  - a) equal to
  - b) 3 dB below
  - c) 10 dB below
  - d) 6 dB above
8. Once the meter is calibrated by the manufacturer it need not be calibrated again:
  - a) true
  - b) false

**MODULE III:**

**Statutory Basis of Noise Enforcement**



Noise Control Act of 1972

III. A. Introduction to Noise Control

In a 1977 survey, the Environmental Protection Agency (EPA) identified vehicles such as motorcycles, trucks, and cars and construction activity of various kinds as major noise sources. The survey ranked annoying noise sources as illustrated in Table III.1 and III.2

TABLE III.1

NOISE SOURCES RANKED BY PERCENT  
OF URBAN POPULATION HIGHLY ANNOYED

RANK	SOURCE	% Highly Annoyed
1	Motorcycles	11.7
2	Large Trucks	6.9
3	Autos	3.5
4	Construction	5.8
5	Sports Cars	5.4
6	Helicopters	4.0
7	Constant Traffic	3.9
8	Airplanes	3.4
9	Small Trucks	3.1
10	Buses	2.8
11	Power Garden Equipment	1.9

TABLE III.2

## OTHER SOURCES RATED HIGHLY ANNOYING

RANK	SOURCE	Number of Sites	Number of Mentions
1	Sirens	8	14
2	Fire Trucks	7	12
3	Ice Cream Trucks	5	6
4	Trash Pickup	4	4
5	Gun Shots	4	4
6	Trains	4	4
7	Burglar Alarms	2	4
8	Auto Horns	3	3
9	Chain Saws	3	3
10	Hot Rods - Drag Racing	2	2
11	Defective mufflers	1	1
	Defective Pump	1	1
	Refrigerator Truck	1	1
	Air Conditioner	1	1
	Model Airplanes	1	1
	Cement Mix Truck	1	1
	Welding Equipment	1	1

### III. B. Health and Environmental Effects of Noise

According to recent EPA reports, over 90 million Americans are currently exposed to traffic noise which has been determined to be in excess of safe levels.

Although many of the health effects of noise are not yet clearly understood, there is little doubt that noise can cause a range of physical and psychological injuries. Even noises with no permanent physical health repercussions may still cause annoyance, sleep loss and other forms of mental stress.

#### Physiological Impacts

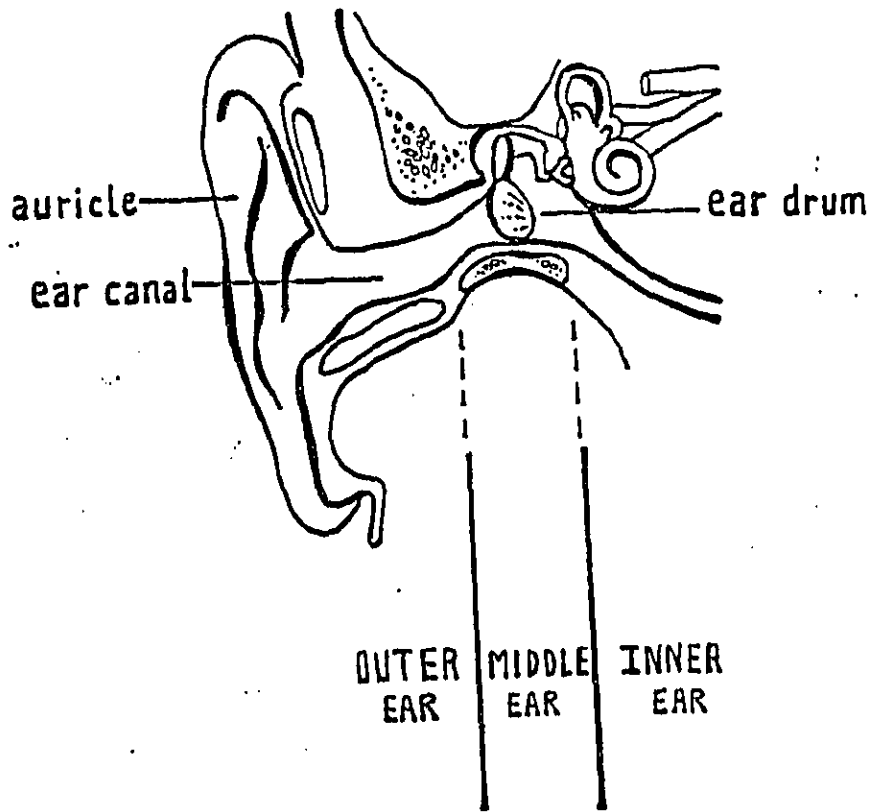
Noise may cause serious physiological effects on the human body ranging from deafness to enhanced risk of heart disease to adverse effects on fetal nervous systems. Clearly, the most common health effect is damage to the human ear.

#### GRAPHIC NO. 17

The body interprets noise as stress. At approximately the 75-80 decibel (dB) range, a number of physical reactions take place. Heart rhythm and blood pressure changes occur, blood cholesterol levels rise, pupils of the eye dilate, and stomach acid secretion may change leading to gastrointestinal malfunctions. Some automatic physical reactions such as blood vessel constriction may continue for some period even after the noise stops.<sup>1</sup>

A recent medical discovery has linked noise and prenatal development. Physicians now believe that external noises can trigger changes in fetuses.<sup>2</sup>

# The Human Ear :



### Psychological Impact

Noise, by itself or in conjunction with physical fatigue, can trigger unpredictable psychological behavior. There is evidence to indicate that noise may cause irritability, anxiety, nervousness, and general aggressive tendencies.<sup>3</sup>

Sounds that convey distress or alarm, such as a police car siren or a fire engine bell, may have greater psychological effects than sound associated with a necessity.

Although a direct link between noise and mental illness has not been established, experts do note that noise may act to aggravate a preexisting mental condition. However, one study indicated higher rates of admission to psychiatric hospitals among people living close to airports.<sup>4</sup>

### Secondary Human Impacts

Sound loud enough to interfere with conversation or mental concentration may have adverse secondary effects in the educational or work environment. For example, reading and language development in school children may be impaired by a noisy environment if a child is unable to distinguish certain sounds or if the noise distorts sounds. Distractive noise may reduce worker productivity and even become a workplace safety hazard where noise prevents a worker from hearing warnings of potential danger. Disturbing noise levels may also reduce the enjoyment of recreational opportunities.

### Environmental Impacts

The psychological reaction of animals to noise is very similar



to that of humans. Hearing loss or damage to the auditory system is the best documented physiological effect of noise on test animals. Experiments also show evidence of change in the urinary, adrenal, and reproductive functions of animals under certain noise conditions. Animals may even experience disruption of breeding, nesting, and migratory habits.

Noise and accompanying noise vibrations can adversely affect structural materials. Cracked plaster and broken windows and dish-ware left in the wake of a sonic boom are the best known examples of damage from excessive noise levels, but they are not the only examples. Heavy construction equipment operation may cause damage to neighboring structures. Noise and vibrations can also damage delicate scientific and health care instruments.

III. C. Objective Noise Control Measures

Specific noise statutes and ordinances are legislative responses to noise problems at the state and local levels which deal exclusively and comprehensively with noise and are tailored to the specific needs of the jurisdiction. These statutes and ordinances can be objective or subjective in nature, depending upon whether sound violations are defined in terms of quantitative or qualitative standards.

The objective nature or quantitative standards arises from the use of measures of noise magnitudes in terms of decibel levels. These noise control regulations usually prescribe maximum permissible decibel levels for a given area or for specific noise sources.

The use of quantitative standards in noise ordinances involves unique enforcement considerations. For example, decibel measurement requires special equipment and expertise. Consequently, quantitative measurements require additional enforcement costs for a community in purchasing equipment and training. Moreover, decibel measurements alone do not provide for variations in the frequency of the noise occurrence -- a factor which greatly affects the annoyance level of a given noise. To compensate for frequency variations, multiple readings of the noise source must be made, increasing the time and expertise necessary for measurement.

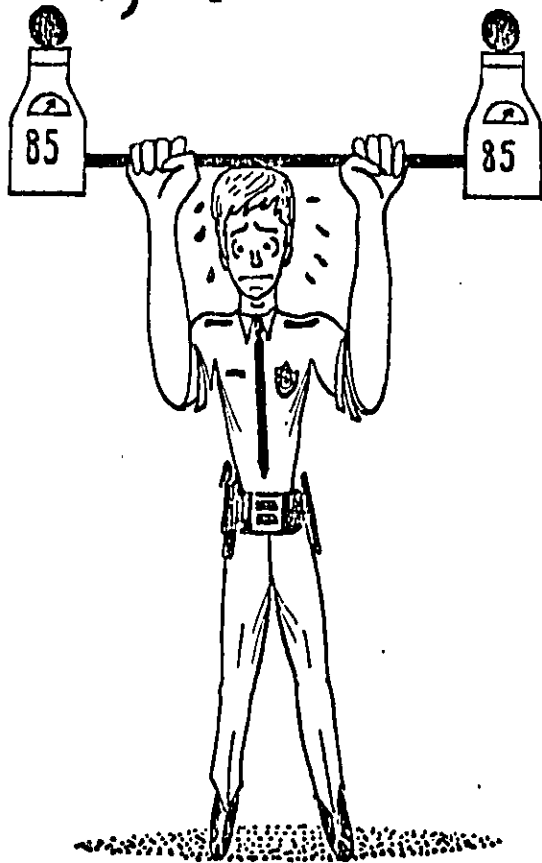
The major benefits of quantitative measurements are specificity and reliability. The specificity of quantitative standards also

enables these ordinances to survive Constitutional challenges on the basis of the First Amendment Freedom of Speech and Fifth Amendment Due Process Vagueness. In addition, reliability of permanent records of noise incidents is greatly increased with quantitative measurement. Recording the sound emitted from a noise source provides concrete evidence to prove violations or noise regulations. Thus there is no dependence upon subjective definitions and subjective testimony of noise enforcement agents, police or witnesses to prove that noise violations have occurred.

# Sources of State & Local Authority to Control Noise

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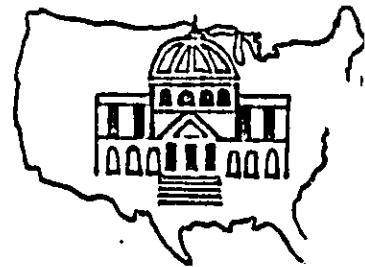
1.) Police Power



2.) U.S. Constitution



3.) Local Provisions



III. D. Sources of State and Local Authority to Control Noise

The authority to regulate noise is within the powers of the states under a variety of sources.

III. D. 1. Police Power

The police power of the states is the broadest grant of power. Essentially, it allows a state to pass laws to regulate the health and welfare of citizens and to provide for the public convenience and the public good. The only limitation upon police power is that state laws and regulations may not be inconsistent with state or federal constitutions.

III. D. 2. Tenth Amendment

The Tenth Amendment of the United States Constitution states: "The powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively or to the people." It is through this grant of authority that many states assume the responsibility of regulating noise levels.

III. D. 3. Individual State Constitutions

A more specific method of regulating noise is the state constitution. Such constitutional provisions allow a state to provide for the general welfare or protect the environment. For example:

The people shall have the right to clean air and water, freedom from excessive and unnecessary noise, and the natural, scenic, historic and aesthetic qualities of their environment; and the protection of the people in their right to conservation, development and utilization of the agriculture, mineral, forest, water, air and other natural resources is hereby declared to be a public

purpose.  
The general court shall have the power  
to enact legislation necessary or expedient  
to protect such rights.

MASS. CONST. art. 49 (1972)

States may, in turn, give local governments the authority to enact or enforce local programs and policies. For example, a substantial majority of state constitutions include home rule provisions which allow for generous local powers. Following are the two basic types of home rule provisions.

- (1) home rule flows directly from the constitution:

Municipalities shall have authority to exercise all powers of local self-government and to adopt and enforce within their limits such local police, not in conflict with general law.

OHIO CONST. art. XVIII 3 (1912)

- (2) the state legislature is granted the power to grant home rule to local government:

. . . The legislative assembly shall provide by law for the establishment of home rule in cities and villages.

N.D. CONST. art. VI (1966)

#### III.D. 4 Enabling Legislation

Even in the absence of broad home rule authority, local governments may have power to control noise through authority granted in specific enabling legislation. Many states presently use this method to grant local authorities power to enact and enforce noise provisions. The Oregon Revised Statute 467.100 (1974) is an example of enabling legislation.

Pursuant to this chapter, in order to protect the health, safety and welfare of its citizens, a city or county may adopt and enforce noise ordinances or noise standards otherwise permitted by law.

Thus, a state may adopt a "State Noise Control Act" as a response to a variety of noise problems.

A Model State "Noise Control Act" is provided in the appendix.

States may, in turn, give local governments the authority to exact or enforce local programs or policies. For example, many state constitutions include "home rule" provisions, which allow a generous local power.

A Model Community "Noise Control Ordinance" is provided in the Appendix.

A further discussion of the statutory basis of noise enforcement is also contained in Module V, where model legislation with respect to motorcycle noise is presented.

III. Endnotes

1. See generally, EPA, Public Health and Welfare Criteria for Noise, (1973); EPA, Report to the President and Congress on Noise, (1971); EPA, Noise: A HEALTH PROBLEM (1978).
2. EPA, NOW HEAR THIS (1974).
3. Donnerstien and Wilson, "Effects of Noise on Perceived Control on Ongoing and Subsequent Aggressive Behavior," 34 Journal of Personality and Social Psychology 774 (1976).
4. I. Abey-Wicherama, M. A'Brook, F. Gattoni, and C. Herridge, "Mental Hospital Admissions and Aircraft Noise," Lancet 1275, December 13, 1968.



### MODULE III

#### Statutory Basis of Noise Enforcement\*

1. Noise may cause serious physiological effects on the human body. The most common health effect is:
  - a) gastrointestinal malfunctions
  - b) damage to the human ear
  - c) changes in fetal development
  - d) enhanced risk of heart disease
2. The psychological impact of excessive noise may cause:
  - a) irritability
  - b) anxiety
  - c) nervousness
  - d) aggressiveness
  - e) all of the above
3. Sound loud enough to interfere with conversation or mental concentration may have adverse secondary effects in the educational or work environment:
  - a) true
  - b) false
4. \_\_\_\_\_ as/are among some of the environmental impacts of noise:
  - a) damage to delicate scientific and health care instruments
  - b) disruption of breeding habits of animals
  - c) change in urinary function of animals
  - d) all of the above
  - e) none of the above
5. The major benefits of quantitative measurements are:
  - a) specificity and reliability
  - b) cost-effectiveness
  - c) no need for special equipment
  - d) all of the above
  - e) none of the above
6. The authority to regulate noise is within the powers of the states under the following sources:
  - a) Police power
  - b) Tenth Amendment
  - c) Individual State Constitutions
  - d) all of the above
  - e) none of the above
7. Many states use authority granted in specific Enabling Legislation to grant local authorities power to enact and enforce noise provisions.
  - a) true
  - b) false

\*Questions on the local law/ordinance may be added

MODULE IV  
The Law and Its Application

#### IV. THE LAW AND ITS APPLICATION

##### IV. A. Introduction

Noise enforcement statutes or ordinances<sup>1</sup> may be categorized into two distinct groups. The first group are those ordinances which prohibit noise that exceeds specific decibel levels, (i.e., any noise that exceeds 82 dBA is prohibited). Throughout this section, these ordinances will be referred to as "Objective Noise Ordinances."

The second category is an ordinance which prohibits an individual from creating or operating an instrumentality which creates unreasonably loud or excessive noise. (i.e., no person shall operate any vehicle in such a manner as to create unreasonably loud or excessive noise). These will be referred to as "Subjective Noise Ordinances."

This manual does not advocate one type of ordinance over another. However, since there are distinct differences between the two types of ordinances, the manual will consider them separately. In the next sections, the two types of ordinances will be discussed along with the ancillary legal problems which arise when an individual is stopped or arrested.<sup>2</sup>

##### IV. B. Two Kinds of Ordinances.

##### IV. B. 1. Objective Ordinances.

As mentioned previously, this manual will categorize noise

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The author would like to express his appreciation to the authors of a draft report, Legal-Enforcement Issues in Community Noise Control: Summary, from which much of this section is taken.

ordinances into two groups -- objective and subjective. An objective ordinance is one that defines the noise violation in specific terms, usually in decibel levels. Since the violation level is set out in the ordinance, the Fifth Amendment problem of vagueness is usually averted.

One characteristic of the objective ordinance is that the enforcement officer must utilize a device to measure the dBA level. Such device is the sound level meter which enables the officer to determine the dBA level of a specific noise or instrumentality. Some meters create a permanent record of the violations and some record the violation on tape. The officer then can play the tape in Court to provide the violation. These objective pieces of evidence are far superior to prove the existence of a noise violation than the testimony of a noise enforcement officer that he believed the noise he heard violated the ordinance.

An example of an objective ordinance is as follows:

Sec. 17.3-5. Maximum nighttime sound levels in residential zones.

No person shall operate or cause any source of sound in such a manner as to create a sound level in a residential zone during the hours between 10:00 p.m. and 6:00 a.m. in excess of 65 dBA when measured at the property boundary of the receiving land.

Sec. 17.3-6 Motor vehicle maximum sound levels.

(a) No person shall operate or cause to be operated a public or private motor vehicle or motorcycle on a public right-of-way at any time in such a manner that the sound level emitted by the motor vehicle or motorcycle when measured at a distance of fifty (50) feet or more, exceeds the level set forth in the following table:

<u>Vehicle Class</u>	<u>Sound level in dBA</u>	
	<u>Speed limit 35mph or less</u>	<u>Speed limit over 35mph</u>
All motor vehicles of GVWR or GCWR or 6,000 lbs. or more	86	90
Any motorcycle	82	86
Any other motor vehicle or any combination of vehicles towed by any motor vehicle	76	82

(b) The foregoing provision shall not apply to any motor vehicle engaged in interstate commerce, as defined in Sec. 17.3-2(f).

Sec. 17.3-9. Penalties.

(a) Any person who violates any provision of this chapter shall be deemed to be guilty of a Class IV misdemeanor.

(b) Each day of violation of any provision of this chapter shall constitute a separate offense.

Fredericksburg Virginia, City Code, Chapter 17-3.

IV. B. 2. Subjective Ordinance.

A subjective ordinance utilizes qualitative standards rather than quantitative ones to designate a violation. Ordinances which prohibit "excessive" or "loud or raucous" noise fall into this category. Unlike the objective ordinance which uses a specific dBA level to determine the violation, these ordinances rely on the enforcement officer's discretion to determine whether a particular noise violates the statute.

An example of a subjective ordinance is as follows:

835.040 Excessive Noise --

No person shall operate any vehicle constructed or so out of repair, or loaded in such a manner as to create unreasonably loud or excessive noise.

St. Louis, Mo. Traffic Code, sec. 836.040

The manual does not advocate one type of ordinance over another. Both have their own problems. However, it is clear that there are significant differences between them. In the Fredericksburg ordinance, the violation is clearly set out whereas in the St. Louis ordinance, the violation is not so clear. The clarity of the violation and the ability of the enforcement officer to determine if a violation occurred raise secondary problems in the enforcement of the ordinance. Some of these problems will be discussed in the next sections.

IV. C. Problems Which Go To The Validity Of The Noise Violation.

The noise enforcement official faces two distinctly different types of problems when he stops a person for a noise violation. First, are the problems which go to the essence of the noise violation. Setting aside for the moment the question of whether the officer can prove his case, the noise violation may be dismissed because the ordinance is too vague or because the procedures used by the officer to stop a motor vehicle were unconstitutional.

IV. C. 1. Fifth Amendment - Vagueness Doctrine.

One problem with a subjective ordinance is that the Courts may refuse to enforce it because it is too vague.

ISSUE: Are noise control provisions, such as those prohibiting "loud", "excessive" or "unreasonable" noise, unconstitutionally vague under the Fifth Amendment?

BRIEF ANSWER: Case law is divided concerning whether qualitative noise provisions violate the due process clause of the Fifth Amendment. Provisions are generally upheld as constitutional if the terms used to define violations are within common knowledge and usage.

DISCUSSION: The Fifth Amendment provides that no person shall "be deprived of life, liberty, or property without due process of law." The Courts have interpreted the Fifth Amendment due process clause to require that laws be sufficiently definite to put a reasonable person on notice of what conduct constitutes a violation of a given law. Herndon v. Lowry, 301 U.S. 242 (1937). Because the Fifth Amendment protection has been extended to the state level through the Fourteenth Amendment, state and local governments must comply with the Fifth Amendment due process requirements in drafting and enforcing noise control regulations.

The Supreme Court considered the following provision of the Rockford, Illinois noise ordinance:

No person, while on public or private grounds adjacent to any building in which a school or any class thereof is in session, shall willfully make or assist in the making of any noise or diversion which disturbs or tends to disrupt the peace or good order of such school session or class thereof. Grayned v. City of Rockford, 408 U.S. 104 (1972).

Although the court upheld this ordinance, it listed three reasons for the Fifth Amendment requirement that a law must be sufficiently precise:

(First) Vague laws may trap the innocent by not providing fair warning. Second, if arbitrary and discriminatory enforcement is to be prevented, laws must provide explicit standards for those who apply them. Third, where a vague statute abut(s) upon sensitive areas of basic First Amendment freedoms, it operates to inhibit the exercise of (those) freedoms. Id. at 108-109.

State courts have upheld noise control regulations which use language falling within "common usage". For example, the California Vehicle Code, which provides that motor vehicles:

. . . shall at all times be equipped with an adequate muffler in constant operation and properly maintained to prevent any excessive or unusual noise . . . Smith v. Peterson, 280 P.2d 522 (Cal. 1955).

has been upheld by the California Appeals Court.

Additionally, the California Court described the "common usage" test as follows:

It is not required that a statute have the degree of exactness which inheres in a mathematical theorem . . . The requirement of reasonable certainty does not preclude the use of ordinary terms to express ideas which find adequate interpretation in common usage and understanding. Id. at 525.

Therefore, subjective standards in noise control regulations may withstand a Fifth Amendment challenge if the language is sufficiently specific and falls within the scope of common understanding so as to put a reasonable person on notice of what conduct is prohibited.

Noise ordinances which have been challenged as vague usually identify the prohibited noise by its general character or nature rather than by specific standards. The following provision of the Muskegon, Michigan noise ordinance was held unconstitutionally vague:

It shall be unlawful for any person to make, continue, or cause to be made or continued any noise which either annoys, disturbs, injures or endangers the comfort, repose, health, peace or safety of others, within the limits of the city. United Pentacostal v. Steenham, 412 N.W. 2d 866 (Mich. App. 1979).

The Michigan Court of Appeals stated that the danger of such vague language was the apparently unlimited discretionary power involved in identifying persons who were violating the ordinance.

SUMMARY: Subjective ordinances may be subject to a constitutional challenge of vagueness, whereas objective ordinances for noise control, which are sufficiently specific to provide notice of what conduct



constitutes the violation, should survive constitutional challenge on the basis of vagueness.

IV. C. 2. Fourth Amendment: Stopping Motor Vehicle

The Fourth Amendment poses another problem which goes to the essence of the noise violation conviction.

ISSUE: Does the stopping of a motor vehicle for a noise violation violate the Fourth Amendment of the U.S. Constitution?

BRIEF ANSWER: The Fourth Amendment of the United States Constitution permits reasonable searches and seizures which are based upon probable cause, pursuant to consent, a proper warrant or fall within one of the exceptions to the warrant requirement. The Supreme Court has decided that a stop of a motor vehicle is within the ambit of the Fourth Amendment. If noise enforcement officials do not have probable cause to stop a vehicle, then the noise violation will not be upheld in the Courts.

Recently, the Supreme Court of the United States decided the case of Delaware v. Prouse, 99 S.Ct. 1391 (1979).

In the Prouse decision, the Supreme Court affirmed that, within the meaning of the Fourth Amendment, stopping a motor vehicle and detaining its occupants constitutes a seizure even though the purpose of the stop is limited and the resulting detention is quiet brief. Under the Fourth Amendment, any seizure based on the discretion of an enforcement officer must be based on a reasonableness standard. The reasonableness of the law enforcement practice is judged by balancing the person's Fourth Amendment rights with legitimate governmental interests.

In Prouse, the Court held that spot checking for license and registration was a physical and psychological intrusion on the

occupants of the motor vehicle. These stops were found to be inconvenient, to consume time, and also to create a substantial anxiety. The Court also found that the use of spotchecks to aid in highway safety was minimal at best.

Therefore, in balancing the reasonableness of the enforcement method utilized, with the governmental interest, the Court concluded that the stopping of a vehicle purely at the discretion of the enforcement officer was intrusive and unjustifiable under constitutional standards. An officer must have a factual basis for suspicion directed at a particular vehicle or have some other substantial and objective standard to govern the exercise of his discretion in stopping a motor vehicle.

The enforcement of a noise ordinance which prohibits loud or excessive noise or which sets a maximum dBA level which may not be exceeded, is patently different from the situation in the Prouse case. In Prouse, the law enforcement officer acted entirely within his own discretion -- he had no probable cause to believe that the driver of the vehicle was violating a traffic regulation nor did he have any other articulable basis amounting to reasonable suspicion that the driver was unlicensed or his vehicle unregistered. The probable cause or reasonable suspicion in an objective ordinance is that the vehicle exceeded the dBA level as measured by the sound level meter. In a subjective ordinance, the probable cause or reasonable suspicion is the officer's own observation or those of others that the vehicle was creating loud or excessive noise.

Although a subjective ordinance is not effected by Prouse, it is still subject to the vagueness test of the Fifth Amendment.

Legal Problems That Noise Enforcement Officer May  
Encounter When Enforcing The Ordinance Which Do Not  
Affect The Validity Of The Noise Violation.

Noise enforcement officers when issuing a noise violation may encounter incidents of other criminal activity. Although this other activity may not involve the noise violation, the enforcement officer may have a duty to report the incidents or even to seize the materials or arrest the violator.

Most problems involve searches and seizures under the Fourth Amendment to the U.S. Constitution. Basically, the Fourth Amendment requires a law enforcement officer to obtain a warrant before searching or seizing anything. The warrant requirement recognizes that people have a reasonable expectation of privacy in their homes, automobiles and for articles contained in their homes or automobile. The Supreme Court has held that "searches conducted outside the judicial process, without prior approval by a judge or a magistrate, are per se unreasonable -- subject to only a few specifically established and well-delineated exceptions." Katz v. United States, 389 U.S. 347 (1967).

IV. C. 3. Exceptions to the Warrant Requirement.

IV. C. 3. (a) Search incident to a valid arrest.

This exception permits law enforcement officers to search an individual that they have arrested." In United States v. Robinson, 414 U.S. 218, (1973), the Supreme Court upheld a warrantless search of an individual who had been arrested for operating a motor vehicle after revocation of his license. However, to qualify as an exception to the warrant requirement, the search must not be too far removed from the time and place of the arrest.

This exception would permit a noise enforcement officer who validly arrested a person for violating a noise ordinance to then search the person without a warrant. In U.S. v. Edwards, 415 U.S. 800 (1974), the Court held that the search of an arrested person's possessions at the place of detention was sufficiently related to the arrest to qualify under the search incident to lawful arrest warrant exception. (Emphasis added).

The right to search incident to a lawful arrest without a warrant is contingent upon some requirements:

1. The arrest must be lawful; that is, all legal requirements for a valid arrest must be met. If the arrest is unlawful, so is the search.
2. The search must be made immediately upon arrest or at a time sufficiently related to the arrest in order to suffice under the rationale that the search is conducted to protect the police officer and to deprive the suspect of an escape.
3. The arrest must be in good faith and must not only be a means to conduct the search.

IV. C. 3. (b) Valid Consent.

A warrant is not required where the individual gives his consent to the search. Schneckloth v. Bustamonte, 412 U.S. 218, (1973). However, consent to a warrantless search must be voluntary. Voluntariness is tested by the totality of the circumstances surrounding the consent; for example, the age and intelligence of the consenting party, the words and actions of the officer, coercion, if any, and the setting where the consent was given, are factors which the Court considers in determining whether the person who gave the consent had the authority to consent to a warrantless search. For example, a person with possessory rights to the area being searched generally ha

authority to consent to a warrantless search.

In some cases, a person may not have the authority to give consent to a warrantless search. In U.S. v. Matlock, 415 U.S. 164 (1974), the Court upheld the search of a bedroom that was occupied by two people. One of the persons consented to the search -- the other was not home at the time of the search. The Court found that the consent of one who possesses common authority over premises or effects is valid as against the absent nonconsenting person with whom that authority is shared.

IV. C. 3. (c) Exigent Circumstances.

This is another exception to the warrant requirement under the Fourth Amendment. This exception permits warrantless searches where the exigencies of the circumstances make that course imperative. McDonald v. U.S., 335 U.S. 451 (1948). In Warden v. Hayden, 387 U.S. 294 (1967), the Court upheld a search of a private home without a warrant by law enforcement officers. The Court found that the officers were informed that an armed robbery that had occurred less than five minutes before they arrived and that the suspect had entered a certain address. The Court upheld the arrest of the robber and the seizure of two weapons and the clothes the robber was identified as wearing because of the exigent circumstances of the case. Speed here was essential, and only a thorough search of the house for persons and weapons which could be used against them or to effect and escape, Id.

IV. C. 3. (d.) Automobile Exception.

The Supreme Court has also permitted an exception to the warrant requirement of the Fourth Amendment for the seizure of automobiles. Carroll v. U.S., 267 U.S. 132 (1925). Its rationale for this exception

is twofold:

- (1) the inherent mobility of the automobile often makes it impracticable to obtain a warrant; and
- (2) the configuration, use and regulation of automobiles often may dilute the reasonable expectation of privacy that exists with respect to other situated property. Arkansas v. Sanders, 442 U.S. 753 (1969), (citations omitted).

However, the automobile search does not apply in all circumstances. The exception is only justified when there is a situation where the automobile may be moved or its contents removed. In Coolidge v. New Hampshire, 403 U.S. 91 (1971), the Court invalidated a warrantless search and seizure of an automobile because there was no evidence that it was impractical to obtain a warrant. There was not present a criminal bent on flight, contraband or stolen goods, a fleeting opportunity on a highway after a high speed chase or confederates waiting to move the evidence.

Noise enforcement officials should be very wary of this exception. If they arrest a person and impound his car, they should obtain a warrant before they search the car.

IV. C. 3. (c) Plain view.

This exception is one which the noise enforcement officer may encounter very frequently. If the officer has validly stopped a car for a noise violation, then he may seize any contraband in plain view. For example, if an officer who has stopped a car for a noise violation, sees marijuana or other contraband in the back seat, then he may seize it. The basis for the plain view exception is that the officer had prior justification for the intrusion in the course of

which he came inadvertently across the contraband. Coolidge v. New Hampshire, 403 U.S. 91 (1971).

Recently, there have been a number of cases decided by the Court on the issue of searching luggage or clothing which has been seized pursuant to the plain view exception or the exigent circumstances exception. Arkansas v. Sanders, 442 U.S. 753 (1979); Robbins v. California, 101 U.S. S.Ct. 2841 (1981); and New York v. Belton, 101 S.Ct. 2860 (1981). In these three cases, the Court found that the seizure of the items was proper, but in Sanders and Robbins, the warrantless search of the luggage was invalid. In Belton, the Court held that the search of a jacket in plain view in the passenger compartment of the car was a lawful search. However, in Sanders, the Court invalidated a search of a suitcase found in the trunk of the car and in Robbins, it invalidated the search of a sealed, wrapped container in the rear compartment of the station wagon. These cases may indicate that the law on warrantless searches is unclear and is constantly changing. Robbins and Belton were decided on the same day and the difference in the treatment of the search seems to fall on the fact that in Robbins, the police searched a container, but in Belton, they searched a jacket - not a very clear distinction!

Noise enforcement officers should be very wary of the Fourth Amendment and procure a warrant if possible prior to any search or seizure.

#### IV. D. Evidentiary issues.

Evidentiary issues are very important to everyone who is involved in law enforcement. The evidence that a judge will admit and the weight

that he will place on that evidence is central in obtaining a conviction. An officer who is aware of the evidentiary issues involved in the enforcement of motor vehicle noise violations is able to collect, pocket, and present admissible evidence which will enhance the prosecution of the noise violation.

IV. D. 1. Evidence.

Evidence is facts or other proof introduced at a trial or other legal proceeding for the purpose of proving a certain fact in dispute. As mentioned previously, the judge has the discretion to admit or exclude evidence at trial. This section will discuss the introduction of certain types of evidence, (i.e., the noise and speed of motor vehicles), which is central to noise violation cases.

IV. D. 2. Prima Facie Evidence.

Prima facie evidence is evidence which is sufficient to establish a fact unless contradicted or overcome by other evidence. For example, a noise ordinance may state that the measurement of noise exceeding a specified noise level is prima facie evidence of a violation of that ordinance. For example, Ashland, Ohio has an ordinance which provides:

The creation of noise by the squealing of tires, or the creation of tire marks on the roadway shall be prima facie evidence of a violation of this section.  
Ashland, Ohio, Codified Ordinances, Sec. 333.06 (1969).

Under this ordinance, a noise officer who testifies that he heard or saw a person operate a car by squealing its tires or creating tire marks on the roadway, and can identify the operator and the car, has made out a prima facie violation of the Statute.

One definition of prima facie evidence of a noise violation is evidence which, if explained or uncontradicted, is sufficient to



establish that a noise violation occurred but which may be contradicted by other evidence. However, this definition implies that a prima facie case, if unrebutted, requires a judgment in favor of the person who introduced the evidence and this fact is not always true. A more cautious definition of prima facie evidence is:

(W)here the proponent, having the first duty of producing some evidence in order to pass from the judge to the jury, has fulfilled that duty, satisfied the judge, and may properly claim that the jury be allowed to consider his case. 9 J. Wigmore, Evidence Sec. 2494 at 293-294 (3d ed. 1940).

An objective noise ordinance which contains specific references to mechanical measuring devices and which delineates the permissible limits beyond which a violation occurs, will best assure that a prima facie case is established. However, even though an officer presents a prima facie case which is unrebutted, under the second definition, there is no guarantee that the jury or trier of fact will find a violation.

#### IV. D. 3. Sound Level Meter as Evidence.

During the 1940's, increasing auto speeds and resulting traffic injuries led to increased concern for enforcement of highway speed limits. This concern, along with the uncertainties of opinion testimony as to vehicle speed, led to the development and widespread use of the radar speed meter.<sup>3</sup> Similarly, the continual increase of motor vehicle noise control regulations had led to the development and use of the sound level meter<sup>4</sup> -- an electronic instrument calibrated to read sound levels directly in decibels -- for motor vehicle noise enforcement.

The sound level meter (SLM) is similar to the radar speed meter.

Therefore, a look at the historical development of radar speed meter readings as admissible evidence in court may prove helpful in predicting the development of case law involving the use of sound level meter readings as evidence.

The use of radar as a means of enforcing speed limits was first tested in Delaware Court in the case of State v. Moffit, 110 A.2d 778 (1953). In this case, two highway patrolmen introduced into evidence the electronic radar speed meter readings to prove the speed of the defendant's car. The defendant objected to the State's attempt to introduce the speed meter reading into evidence on two grounds:

(1) the speed meter had never been recognized as being a reliable instrument to record the speed of vehicles on the highway; and

(2) even if admitted, the speed meter reading should not constitute conclusive evidence of the defendant's speed. Id. at 779.

In Moffit, the State produced an expert witness who testified to the construction, operation and purpose, margin of error if properly functioning, and the manner of testing the accuracy of the speed meter which the officers had actually used to determine the speed of the defendant's car. Based on this testimony, the judge admitted the radar speed meter evidence subject to the jury's determination as to its accuracy in measuring the speed of the defendant's car. The court gave the following instructions to the jury:

The mere fact that the test in the present case was made by a person not skilled in electronics is not of sufficient import to render the Speed Meter inadmissible in evidence . . .

In the present case, however, before you can return a verdict of guilty under this contention - that is, a finding by reason only of the Speed Meter - you must be satisfied beyond a reasonable (sic) doubt that the Speed Meter used in the present case was functioning properly, was properly operated at the time, and was in fact an accurate recorder of speed; further, that its accuracy had been properly tested within a reasonable time from the date of its use . . . Id.

The content of this jury instruction is very important to the noise enforcement officer who utilizes a SLM. Although the Court admitted the evidence, it left to the jury to decide whether the speed meter produced such a reading as to find the defendant guilty. The factors which the judge charged the jury to consider: the proper use of the speed meter, its proper operation, its accuracy and the testing of its accuracy all involve the training of the operator and in some cases testimony of an expert witness. If SLM's can be analogized to radar speed meters, it is imperative that the operator undergo vigorous training program on the operation of the SLM prior to his operation of it on the highway.

Today, many jurisdictions take judicial notice that radar, when properly functioning and properly operated, is a reliable device for measuring the speed of a moving vehicle. Judicial notice means that the Court will recognize the results of radar without requiring expert testimony on the nature, function and scientific principles which underly it. However, when a prosecutor begins to introduce evidence from an SLM, in a noise violation case, he must be prepared to present testimony about its operation, how it works and the competency of the operator.

Recently, a lower court in Florida decided not to accept the reliability of radar to prove the speed of automobiles, State v. Aquilera,

supra.

In Aquilera, the court did not hold that the scientific principles underlying radar are faulty. It merely held that, before it would accept the reliability of radar beyond a reasonable doubt, the manufacturers of the equipment and the state and local governments entities in Florida must work together to improve the equipment and the competency and qualifications of the operators of the equipment.

It is important to note that this decision was based on speed measuring equipment and operator training methods utilized by the State of Florida and therefore, its scope is restricted to Florida. Most courts still take judicial notice of the general accuracy of the radar speed measuring device, provided that it has been proven that the particular speed meter is accurate, that the operator is qualified, and that the device was properly operated in the case before the court. State v. Reading, 389 A.2d 512 (1978).

IV. D. 4. Burden of Proof.

In a case which involves a violation of an ordinance which prohibits the operation of motor vehicles and motorcycles on public streets, over a certain dBA level, the burden of proof is on the prosecution to show that the defendant was in fact operating a vehicle on a public street and that the vehicle emitted noise in excess of proscribed dBA level. Depending on how a motor vehicle noise violation is defined by the ordinance, either the civil (preponderance of the evidence) or the criminal (beyond a reasonable doubt) standard of proof will apply.

In order to successfully prosecute a motor vehicle operator, the prosecutor must be able to show that:

1. The defendant operated or caused to be operated a motor vehicle or motorcycle on a public street;
2. The motor vehicle or motorcycle was operated in such a manner that the sound level emitted exceeded the limits established in the ordinance;
3. The use of the sound measuring device was proper and that the sound measuring device was in good working order; and
4. The operator was qualified to use the sound measuring device.

### Endnotes

<sup>1</sup>Throughout this section, the terms "statute" and "ordinance" are used interchangeably. Generally, a statute is the enactment of the legislature of a state and an ordinance is an enactment of municipal corporation.

<sup>2</sup>For example, searches and seizures under the Fourth Amendment.

<sup>3</sup>The radar (an abbreviated form for "radio detection and ranging") speedmeter is essentially a high frequency radio transmitter and receiver. It transmits a radio beam down the road, then picks up its reflected beam on a receiver.

<sup>4</sup>The sound level meter has a microphone that converts a sound pressure variation in the air into an electrical signal, an amplifier powered by a battery to raise the signal level enough to operate an indicator needle, and an attenuator to adjust the signal level within the range of the meter's scale. Raymond D. Berendt, et al., Quieting: A Practical Guide to Noise Control (Washington, D.C. 1976) at 3.

MODULE IV

The Law and Its Application

Please answer the following with a brief essay:

1. Explain the difference between an objective and a subjective ordinance.
2. State the reason why a court would hold that an ordinance is too vague to enforce.

3. Define prima facie evidence.

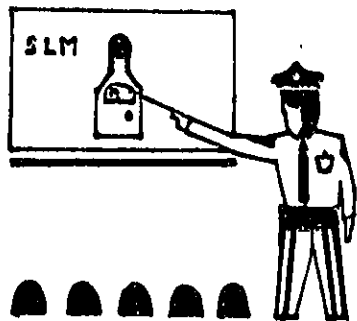
4. What are the three requirements for the search incident to a valid arrest exception to the 4th Amendment warrant requirement?



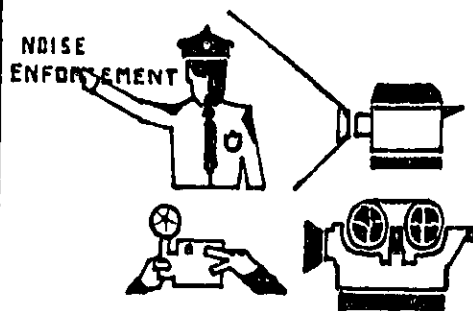
Module V  
Field Experience

# Field Experience ...

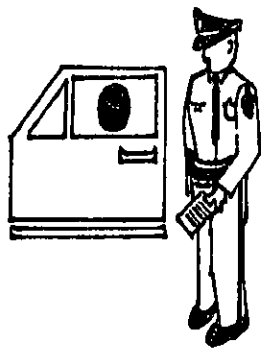
## 1. Training



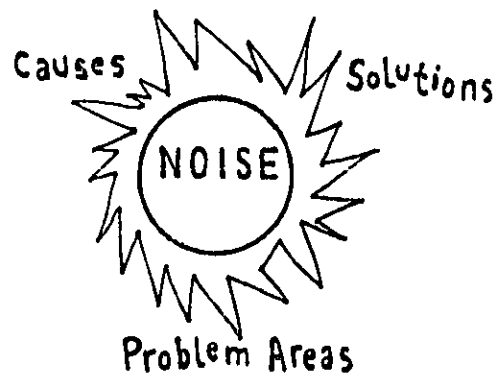
## 2. Implementation



## 3. Enforcement



## 4. What to Look for :



VI. Field Experience

Field Experience provides the practical application of noise enforcement skills and techniques learned in the classroom portions of the training program. The following describes the three phases of Field Experience: Training, Program Implementation, and Active Enforcement.

VI.A. Training

The initial experience in the Training phase provides the foundation for future noise enforcement experiences. Field Experience in the Training mode will:

1. Demonstrate to the trainee the site selection and establishment process via a practical application of classroom theory.
2. Enable the trainee to select and establish sites for actual future enforcement. This process, however, is dependent upon the locale in which the training is given.
3. Provide the trainee with practical diagnosis of vehicle noise sources and develop expertise in the identification of a vehicle in violation before it passes through a site.

When the training phase has been completed, the basic knowledge and expertise acquired can be applied to the Program Implementation and Active Enforcement phases of Field Experience.

VI.B. Program Implementation

Extensive local or statewide press coverage, public awareness, as well as development of the enforcement personnel's self-confidence should both precede and accompany the Program Implementation phase. A public relations effort has been shown to effectively promote public acceptance of and

voluntary compliance with a new enforcement program. For example, increased public awareness resulted when noise enforcement officers met with civic and community organizers during the Implementation period. Additionally, the courts, prosecutors and defense attorneys should be made aware of the enforcement program during this phase.

The initial implementation of a noise enforcement program would first involve a policy where only warnings, either verbal or written, are issued to violators. This initial period of time, of perhaps six months, will provide the enforcement officer with additional practical experience. Moreover, the officer will develop a greater degree of self-confidence at this time as personal one-on-one public contact with violators, without actual enforcement action, is put into practice. The Implementation period can also be used to locate and establish additional sites and to determine, by monitoring traffic, whether such sites would in fact be worthwhile.

#### VI.C. Active Enforcement

Following the Training and Program Implementation stages, noise enforcement personnel and the public are ready for the Active Enforcement phase. The period of Active Enforcement focuses on these three major areas: public awareness, establishment of sites, and preparation for the first court case.

VI.C.1. Public Awareness

Again, extensive press coverage, local or state-wide, should be employed to announce the commencement of active noise enforcement.

VI.C.2. Establishment of Sites

During the Active Enforcement stage, pre-established sites are used. However, additional sites could be established at this time. The location of these additional sites could be based on noise patterns and trends, citizen complaints, or any other means appropriate or necessary to local enforcement concerns.

(a) Citizen Complaints

When complaints are received from the public, personal contact should be made with the complainant. If action is not possible at the scene of the complaint, the complainant should be advised of the results of the investigation, so that this citizen is at least aware that some enforcement action has been attempted.

VI.C.3. Preparation of the First Case

It is during the Active Enforcement phase that the first court case is being developed. This test case will usually be the determinant of the success of the noise enforcement program and future court cases. Therefore, the utmost care should be taken in the preparation of this case.

(a) All avenues of attack by the defense should be addressed.

1. There should be no doubt as to the measured limit of the violator.

2. There should be no doubt that the defendant's vehicle was in violation.
  3. The credentials of the officer will be documented by the training received.
- (b) As much information as possible should be documented.
- (1) The date and time of violation.
  - (2) The location of the site.
  - (3) The type of site - standard or non-standard.
  - (4) Direction of travel of traffic monitored.
  - (5) Equipment used - include identifying numbers.
  - (6) Personnel involved.
  - (7) Any adjustments for distance or reflective surfaces.
  - (8) Identify any reflective surfaces.
  - (9) Ambient noise level.
  - (10) Wind speed.
  - (11) Calibration - field and factory.
  - (12) Identification of noise source (vehicle).
  - (13) Noise level recorded.
  - (14) Maximum noise level permitted.
  - (15) Rise and fall of noise level (if vehicle involved).
  - (16) Description of vehicle or noise source.
  - (17) Identification of defendant (operator of vehicle).

Forms should be developed to document the above information so that uniformity will be maintained throughout the agency.

(Sample forms are included in the Appendix.)

Through experience, enforcement personnel develop greater expertise that is accepted by the courts. The officer will develop a "calibrated ear" - the ability to determine a possible violation even before the vehicle enters the measurement site.

VI.D. Common Issues

1. Areas of noise problems or complaints.
2. Causes of noise.
  - (a) Vehicle operation.
  - (b) Traffic flow.
  - (c) Vehicle modification.
  - (d) Vehicle defects.

VI.E. Common Solutions

1. Alter driving habits by enforcing other laws.  
Example: spinning wheels, careless or negligent driving, speeding, etc.
2. Re-route or employ one-way traffic during peak periods.
3. Enforce vehicle equipment modification laws.  
Example: motor vehicle inspection, spot checks, etc.
4. Enforce defective equipment laws.  
Example: citing for defective equipment and requiring certification of repairs.

VI.F. Special Problems and Solutions

The use of CB radios presents a problem in rural enforcement and may or may not be an issue in municipal settings. A solution to the use of CB's to announce police noise enforcement activities is the development of subjective screening and stationary testing of vehicles. Such a program requires the adoption of officer authority to issue a directive to the vehicle operator, based on probable cause, for exceeding the established noise level limits.

The directive requires the operator to submit the vehicle for stationary testing of exhaust noise. Failure to comply would result in suspension of the vehicle registration, issuance of a citation or summons for a court appearance. There may be situations where the operator is cited and the case is adjudicated, but because the vehicle is not owned by the operator, the owner may fail or refuse to correct the vehicle. In such cases, it may be necessary to cite the owner rather than the operator.

VI.G. Retesting

Retesting is a viable and successful approach only if the noise enforcement program includes a subjective screening and stationary testing provision. Because retesting requires only limited space, the police or municipal building parking lot would be an adequate site. A tachometer or "engine kill" device is the only additional equipment needed.

However, if the noise enforcement program entails only pass-by enforcement, retesting would be practically impossible. To retest would require site space equal to the highway measurement site as well as an area for deceleration.

The development of retesting and certification of compliance, by promoting correction of the vehicle in violation, could mean that court action may not be necessary.



A new vehicle certification program is another means of aiding noise reduction efforts.

The primary objective of a noise program should be the correction of the noise source and, ultimately, a high degree of voluntary compliance.

APPENDIX

#/

**NOISE ENFORCEMENT LOG**

Site No./ County \_\_\_\_\_ Date/Time: \_\_\_\_\_

Operator: \_\_\_\_\_ Equipment Serial Nos. \_\_\_\_\_

Interceptor: \_\_\_\_\_ Sound Level Meter: \_\_\_\_\_

Calibrator: \_\_\_\_\_

Poated Speed: \_\_\_\_\_ Microphone: \_\_\_\_\_

Site Adjustment: \_\_\_\_\_ Preamplifier: \_\_\_\_\_

**1. Site Adjustment**

	A Maximum Allowable	B Site Adjustment	C Corrected Level (A+B)
Trucks			
Motorcycles			
Autos			

**2. Lane Corrections**

(Nearest Lane is Lane 1)

	A Lane 1	B Lane 2	C Lane 3	D Lane 4
Corrections:				

**3. Maximum Allowable Adjusted Noise Levels with Lane Corrections**

Corrected Level (Item 1, Column C)	Maximum Allowable Adjusted Noise Levels (Use Correction from Item 2)			
	Lane 1	Lane 2	Lane 3	Lane 4
Trucks				
Motorcycles				
Autos				

Operator's Signature: \_\_\_\_\_

NOISE ENFORCEMENT SCHEDULE




#4

VEHICLE NOISE  
COMPLAINT

DATE COMPLAINT RECEIVED

FILE NUMBER

COMPLAINANT

ADDRESS

PHONE

LOCATION OF COMPLAINT AND TIME

REMARKS:

RECEIVED BY

ASSIGNED TO

DATE

ASED Form 55



NOISE COMPLAINT INVESTIGATION

#5

FILE NUMBER

DATE COMPLAINT RECEIVED

COMPLAINANT

ADDRESS

PHONE-- WORK

HOME

LOCATION OF COMPLAINT AND TIME

INITIAL

SUPPLEMENT

ATTEMPTS TO NOTIFY:

ACTION TAKEN:

SUPPLEMENT DUE: Yes  No

TOTAL MAN HOURS \_\_\_\_\_ DATE OF REPORT \_\_\_\_\_ SIGNATURE \_\_\_\_\_





HARRY HUGHES  
GOVERNOR

GORDON C. KAMKA  
SECRETARY  
PUBLIC SAFETY AND  
CORRECTIONAL SERVICES

STATE OF MARYLAND  
DEPARTMENT OF  
PUBLIC SAFETY AND CORRECTIONAL SERVICES

MARYLAND STATE POLICE  
PIKESVILLE, MARYLAND 21208  
AREA CODE 301 486-3101

#6  
EDWIN R. TULLY  
DEPUTY SECRETARY  
FOR PUBLIC SAFETY

COLONEL THOMAS S. SMITH  
SUPERINTENDENT  
MARYLAND STATE POLICE

Captain B. E. Diehl, Commander,  
Automotive Safety Enforcement Division  
Maryland State Police  
Pikesville, Maryland 21208

Dear Captain Diehl:

I, \_\_\_\_\_  
(Name) (Address)

hereby grant permission to the Maryland State Police, to place noise abatement  
monitoring equipment on my property located on \_\_\_\_\_

This permission may be withdrawn by me at any time, I so desire.

\_\_\_\_\_  
(Signature) (Date)

\_\_\_\_\_  
(Witness) (Date)

\_\_\_\_\_  
(Witness) (Date)

23-40 (3/78)

**INSTRUCTIONS**

**To be completed in original and two copies**

**Noise Team Retain-Original Copy**

**Noise File-Carbon Copy**

**Property Owner-Carbon Copy**

**GLOSSARY**

A-Weighting -- A-weighting refers to a particular processing of sound signals in which low frequencies are de-emphasized. This weighting has been found to correspond fairly well to subjective human response to sound signals. See also  $L_A$ .

Absorption -- Absorption is the removal of a portion of the original sound energy when sound is reflected from a surface.

Absorption Coefficient -- The absorption coefficient of a given surface is the ratio of the sound energy absorbed by the surface to the sound energy incident upon the surface.

Accelerometer -- An accelerometer is a device used to measure acceleration.

Acoustics -- Acoustics is the name of the scientific study of sound.

Acoustic Trauma -- Acoustic trauma refers to a permanent elevation in hearing threshold which follows a one-time exposure to high level sound.

Ambient Noise -- The ambient noise of an environment is the average sound level due to the combined effect of all the sound sources in that environment. It is sometimes identified as the sound level that is exceeded 90% of the time ( $L_{90}$ ).

Amplitude -- The amplitude of a sound is a measure of the amount of energy (i.e., pressure, power, intensity) of that sound.

Anvil -- The anvil is one of the three bones of the middle ear. See Ossicles.

Attenuation -- Attenuation is the loss of a portion of sound energy as a result of passing through matter (through a wall, for example).

Attitude Survey -- An attitude survey is a process that seeks to determine how people feel about any matter of interest by asking them about it.

Audiogram -- An audiogram is a record of hearing threshold levels of a particular individual at various frequencies. These threshold levels are referenced to statistically normal hearing levels.

Audiometer -- An audiometer is a device for measuring hearing threshold levels.

Audition -- Audition is the process of hearing.

Auditory Nerve -- The auditory nerve carries neural impulses from the hair cells of the inner ear toward the brain, and from the brain to the inner ear.

Auditory Sensitivity -- Auditory sensitivity is a term that describes the ability of the human ear to respond to sounds.

Auricle -- See Pinna.

B-Weighting -- B-weighting is an infrequently used processing of sound signals in which there is a slight de-emphasis of the low frequencies.

C-Weighting -- C-weighting is a processing of sound signals that treats all frequencies from about 30 Hz to about 8000 Hz with equal emphasis.

Calibration -- Calibration is the process by which the accuracy of a measuring instrument is certified.

Calibrator -- A calibrator is any standard device used to calibrate other devices; in acoustics this commonly refers to a device used to certify the accuracy of sound level meters.

Community -- As used in this manual, a community is any jurisdiction that is smaller than a state (usually a city or a county).

Compression -- A compression is that portion of a cycle during which, or the portion of space within which, the molecules are crowded closer together than normal.

Continuous -- A continuous signal is a signal that is always present over the interval of observation although the level of the signal may vary considerably over this interval.

Cycle -- A cycle of a periodic occurrence is the complete sequence of values that occur during a period.

Decibel -- The decibel (abbreviated dB) is a convenient unit used to express the magnitude of sound as a logarithmic ratio of variables. The level of an acoustical quantity is usually expressed in decibels. (See Level,  $L_A$ , and also Chapter 1, Section 1.3.2.)

Decrement -- A decrement is a decrease in a quantity.

Demographic -- Demographic is a term referring to any characteristic of a person or population that may be relevant to behavior and attitudes.

Descriptor -- A descriptor is any number used to describe a situation. Some descriptors used to describe sound level are  $L_A$ ,  $L_{eq}$ ,  $L_{dn}$ , etc.

Diffraction -- Diffraction is the bending of waves when they encounter an obstacle.

Direct Interview -- A direct interview is one in which the respondent is aware of the central concern of the interview.

Eardrum -- The eardrum is a membrane which separates the outer ear and the middle ear, and which vibrates in response to sound pressure.

Etiology -- The etiology of a process is the set of related events leading to it.

Fast Response -- A setting of one of the controls of a sound level meter that allows the indicator to follow the variations in sound level as closely as possible.

Fixed-Alternative Questions -- Fixed-alternative questions are those for which the respondent must choose from the responses provided by the survey instrument.

Fluctuating -- A fluctuating sound is one that varies in pressure level during the period of observation, but remains above the ambient noise level most of the time (it may descend to the ambient level no more than once during the period of observation).

Frequency -- The frequency of a sound is the number of complete cycles of that sound occurring in one second. Most sound sources produce more than one frequency at a given moment.

Frequency Band -- A frequency band is a range of frequencies. Examples of frequency bands are octave bands, broad bands, critical bands, etc.

Frequency Spectrum -- The frequency spectrum of a sound is a representation of the frequencies present and their amplitudes.

Hair Cell -- A hair cell is one of the sensory cells in the inner ear that can respond to sound by initiating neural impulses in the auditory nerve.

Hammer -- The hammer is one of the three bones of the middle ear.  
See Ossicles.

Hearing Handicap -- Hearing handicap is defined as the existence of an average hearing threshold level of more than 25 dB in the better ear; this average is based on measurements at 500, 1000, and 2000 Hz.

Hearing Loss -- Hearing loss is any measureable difference for which the hearing of the subject is poorer than that of the population used to define normal hearing.

Hearing Threshold -- Hearing threshold is the minimum signal level (in dB) that can be detected by a subject during a hearing test. This level may be different at different frequencies.

Hearing Threshold Level -- Hearing threshold level is a scale for reporting the level of a sound (in dB) referred to average, normal hearing thresholds (see above). The zero level for this scale is based upon a statistically determined normal hearing population. This is the scale generally used for reporting hearing threshold results in the clinical audiogram.

Intermittent -- An intermittent sound is one that switches off and on two or more times during the period of observation.

Incus -- See Anvil.

Impedance -- Impedance is that property of a medium which determines the extent of its response to an external force and how well it will transfer energy to another medium.

Impedance Matching -- When the impedances of two media are equal, a condition of impedance matching exists, and maximum energy can be transferred from one medium to the other. The more the ratio of the impedances differs from one, the smaller is the fraction of energy transferred.

Infrasonic -- Infrasonic sounds are those with frequencies smaller than can be detected by persons of normal hearing.

$L_A$  --  $L_A$  is the A-weighted sound pressure level. It is the most commonly used descriptor of instantaneous sound pressure level. Many earlier documents state this level in units of dB(A).

$L_{dn}$  --  $L_{dn}$  is equivalent to the  $L_{eq}$  measured over a 24-hour period with a 10 dB penalty added for the nighttime hours.

$$L_{dn} = 10 \log_{10} \left[ \frac{1}{24} \left( \sum_{7 \text{ am}}^{10 \text{ pm}} 10^{\frac{L_{eq}}{10}} + \sum_{10 \text{ pm}}^{7 \text{ am}} 10^{\frac{L_{eq} + 10}{10}} \right) \right]$$

$L_{eq}$  --  $L_{eq}$  is a descriptor of the total noise exposure during a finite time interval. The equivalent sound level,  $L_{eq}$ , has the same total sound energy as the actual time varying A-weighted sound during the specified period.

$$L_{eq} = 10 \log_{10} \left[ \frac{1}{T} \int_0^T \frac{p^2}{p_{ref}^2} dt \right] \text{ where } T \text{ is normally 1 to 24 hours}$$

Level -- The level of any quantity, described in decibels (dB) is proportional to the logarithm (base 10) of the ratio of that quantity to a reference value of the same quantity. Both the value and the reference value should be stated in the same units.

$L_{10}$  --  $L_{10}$  is that sound level that is exceeded in 10% of a set of observations.  $L_{10}$  is frequently close in numerical value to  $L_{eq}$ .

$L_{50}$  --  $L_{50}$  is that sound level that is exceeded in 50% of a set of observations.

$L_{90}$  --  $L_{90}$  is that sound level that is exceeded in 90% of a set of observations. This descriptor is often taken as the ambient sound level.

Loudness -- Loudness is that aspect of human perception of sound that corresponds most closely with the amplitude of the sound.

Malleus -- See Hammer.

Manual Sampling -- Manual sampling requires the presence of a human observer, usually to record the data.

Masking -- Masking is the obscuring (partial or total) of one or more sound signals by the presence of other sound signals.

Neural Impulse -- A neural impulse is a signal within the nervous system.

Noise -- Noise is any unwanted sound. Objective measurements of noise are made with instruments, most often with a sound level meter.

Noise Abatement -- Noise abatement is the reduction of existing noise through corrective measures.

Noise Control -- Noise control is the reduction of noise through preventive measures.

Noise Dose -- A noise dose is the ratio of the duration of exposure to the duration permitted for exposure at a specific sound level based on a damage risk criterion. The total noise dose is the sum of the individual noise doses at each exposure level.

Noise Emission Standard -- A noise emission standard is a limit, set by government regulations, on the output of sound measured at a specified distance from regulated operating devices.

Noise Exposure Limit -- The noise exposure limit is a figure established by the OSHA Act. It is designed to limit the hearing loss associated with work.

Noise-Induced Hearing Loss -- Noise-induced hearing loss is the hearing loss that results from exposure to noise. The total hearing loss is the result of noise plus other factors such as aging and disease.

Noise-Induced Permanent Threshold Shift (NIPTS, also PTS) -- Noise-induced permanent threshold shift is the irreversible elevation in the threshold of hearing (quietest sound a person can hear) which follows chronic immersion in high level noise.

Noise-Induced Temporary Threshold Shift (NITTS, also TTS) -- Noise-induced temporary threshold shift is a reversible elevation in the threshold of hearing (quietest sound a person can hear) which follows immersion in high level noise. In cases of TTS, the hearing threshold of the exposed listener will return to pre-noise-exposure levels if the listener is placed in a quiet environment for a period of time. Subscript numbers following "TTS" indicate the duration in minutes between noise cessation and hearing threshold testing (e.g., TTS<sub>2</sub> = hearing test 2 minutes after noise cessation).



- Noise Map** -- A noise map is a set of contours of equal noise exposure (such as equal  $L_{eq}$ ) based upon measurements of noise in the region of interest.
- Noise Survey** -- A noise survey is a set of measurements of the sound levels or sound exposures in an environment of interest. In some surveys octave band (or even narrower band) analysis may be included.
- Octave Band** -- An octave band is a frequency band with its upper band edge equal to twice its lower band edge. Octave bands are usually named by their center frequencies. An example of an octave band is the one that has a center frequency of 1000 Hz: its lower band edge is at 707 Hz and its upper band edge at 1414 Hz.
- Ordinance** -- An ordinance is a municipal regulation set forth by a government authority.
- Ossicles** -- The ossicles are the three bones located in the middle ear. The hammer (or malleus) is attached directly to the eardrum at one end and to the anvil (or incus) at the other. The stirrup (or stapes) is attached to the anvil at one end and to the oval window (entrance to the inner ear) at the other.
- Performance Standard** -- A performance standard is a quantitative statement of the requirements that a particular product must meet to be acceptable.
- Permanent Threshold Shift** -- See Noise-Induced Permanent Threshold Shift.
- Pink Noise** -- Pink noise is a form of broad band sound in which each octave band has the same total energy.
- Pinna** -- The pinna (or auricle) is that portion of the ear that extends outward from the head.
- Pitch** -- Pitch is that aspect of an observer's perception of sound that corresponds most closely to the frequency of the sound.
- Presbycusis** -- Presbycusis is the loss of hearing that is associated with the aging process.
- Pressure** -- Pressure is force per unit area. In acoustics the variation in pressure associated with a sound signal, called the sound pressure, is the variable of primary interest.
- Probability Sample** -- A probability sample is one for which the individuals sampled are accurately representative of the population being studied.
- Propagation** -- Propagation is the passage of a signal from its source to a receiver. Some of the processes involved in propagation are absorption, reflection, and transmission.

Psychosocial -- Psychosocial refers to the interactive combination of psychological and social factors in the situation under consideration.

PTS -- See Noise-Induced Permanent Threshold Shift.

Pure Tone -- A pure tone is a sound signal whose instantaneous sound pressure can be represented by a simple sine wave. A pure tone has a single frequency.

Quality -- Quality is that aspect of an observer's perception of sound that corresponds most closely to the frequency spectrum of the sound.

Random Sample -- A random sample is one for which every member of the population under study has an equal chance of being selected.

Rarefaction -- A rarefaction is that portion of a cycle during which, or the region of space in which, the molecules are spread further apart than normal.

Reflection -- Reflection is the process in which some portion of an incident wave, upon encountering a barrier, is returned back into the medium from which it came.

Regulation -- A regulation is a statement issued by a governmental agency specifying some required condition or behavior.

Resonance -- A resonance is a condition for which the response of a system to a stimulus is unusually large. In acoustics, resonance is associated with increased response at certain frequencies, which are therefore called resonance frequencies.

Sensor -- A sensor is any physical device or physiological structure that responds to stimuli. The term is most often applied to certain structures of the human sense organs and to certain devices that respond to same types of stimuli as do the human senses.

Slow Response -- Slow response is a setting of one of the controls of a sound level meter that slows the movement of the level indicator (usually a meter movement) so that rms pressure variations occurring more rapidly than 0.5 seconds can be observed as a relatively steady value.

Sociocusis -- Sociocusis refers to those hearing losses associated with non-work exposures to noise.

Sound -- Sound, as used in this manual, refers to oscillations in pressure, particle position, and particle velocity.

Sound Analyzer -- A sound analyzer is a device that measures the sound pressure level in narrow bands (usually in octave or 1/3-octave bands).

Sound Intensity -- The sound intensity at a particular location is the average rate at which sound energy is transmitted through a unit area perpendicular to the direction of propagation.

Sound Level Meter -- A sound level meter is a device for measuring rms sound pressure level. Such meters fall into three types, called types 1, 2, and 3. Type 1 meters are the most accurate; Type 3 are the least accurate. Type 1 and Type 2 meters normally are used for measurement of community noise.

Sound Pressure -- Sound pressure is the variation in pressure that occurs when a sound signal is propagated through a medium. Sound pressure is expressed mathematically as:  $p = p(t)$  where pressure changes as a function of time. It is the instantaneous difference between the actual pressure and the static or barometric pressure at a given time. The value that is usually measured is the root-mean-square (rms) sound pressure. The rms sound pressure at a measurement point is the square root of the mean-square value of the instantaneous sound pressure over a time interval. Expressed mathematically;

$$p_{rms} = \sqrt{p^2} = \sqrt{\frac{1}{T} \int_0^T p^2(t) dt}$$

Sound Pressure Level -- The sound pressure level,  $L_p$ , expressed in decibels (dB) is 20 times the logarithm to the base 10 of the ratio of the rms sound pressure to the rms reference pressure of 20 micropascals (newtons per square meter), or 20  $\mu$ Pa. The mathematical expression for sound pressure level is:

$$L_p = 20 \log_{10} \left[ \frac{p}{p_{ref}} \right] = 20 \log_{10} \left[ \frac{p_{rms}}{p_{ref}} \right]$$

Sound Wave -- A sound wave is a variation in sound pressure associated with the propagation of a periodic sound signal.

Standard -- A standard is a set of specifications drawn up by a professional body that describes the required performance of a system, process, or device.

Stapes -- See Stirrup.

Stationary Source -- A stationary source is a source that remains within a pre-determined boundary line (for example, a property line) throughout a noise measurement.

Steady-State -- A steady-state noise is one whose sound pressure level is essentially constant throughout the period of observation.

Stirrup -- The stirrup is one of the three bones of the middle ear. See Ossicles.

**Stratified Random Sample** -- A stratified random sample is one for which two or more aspects of a population are sampled in proportion to their representation in the total population being studied.

**Stressor** -- A stressor is any stimulus that produces a condition of stress in the human body. Noise is an example of a stressor.

**Structure-Borne Vibration** -- Structure-borne vibration is any vibration propagated from a source at one location in a building to other locations through the structural elements (framework, floors, walls, etc.) of that building.

**Structured Interview** -- A structured interview is one in which the questions to be asked have been completely determined prior to the interview.

**Survey** -- A survey is any study of some aspect of a population or an environment that utilizes sampling techniques to obtain data.

**Survey Instrument** -- A survey instrument, as used in connection with social surveys, is a technique (such as an interview or questionnaire) for obtaining information.

**Temporal Pattern** -- The temporal pattern of a sound is the variation of sound pressure level with time.

**Temporary Threshold Shift** -- See Noise-Induced Temporary Threshold Shift.

**Transducer** -- A transducer is any device that receives an input signal in one form (e.g., mechanical) and puts out a signal in a different form (e.g., electrical).

**Transmission** -- Transmission is the passage of energy through a medium. The term often is used in connection with the sound energy that passes through a barrier.

**Transmission Loss** -- The transmission loss (TL) of a sound barrier is obtained by taking ten times the logarithm (base 10) of the ratio of the incident acoustic energy to the acoustic energy transmitted through the barrier.

**TTS** -- See Noise-Induced Temporary Threshold Shift.

**Ultrasonic** -- Ultrasonic sounds are those with frequencies greater than can be detected by persons of normal hearing.

**Vibration** -- Vibration is a back and forth motion of a system. The frequency of vibration can be either infrasonic, audible, or ultrasonic.

**Vibration Perception Threshold** -- The vibration perception threshold is reached when the vibrations can either be seen or felt by touch.

Wavelength -- One wavelength of a wave is the distance between two consecutive crests of the wave (more generally, the distance between any two consecutive points of identical phase).

White Noise -- White noise describes a sound source that has equal energy per unit frequency over a specified frequency range.

Police Enforcement of Noise Regulations  
A Three-Day Model Curriculum

Day 1

9:00-9:30	<u>Welcome and Introduction</u> <ol style="list-style-type: none"><li>1. Purpose of Workshop<ol style="list-style-type: none"><li>a. Training</li><li>b. Test Manual and Training Techniques</li></ol></li><li>2. Outline of Curriculum</li><li>3. Introduce Staff/Instructors</li><li>4. Registration</li></ol>	<u>Instructor</u> Conference Coordinator or Program Director
9:30-10:45	<u>Basics of Sound and Sound Measurement</u> <ol style="list-style-type: none"><li>1. Concepts and Definitions<ol style="list-style-type: none"><li>a. Sound and Noise</li><li>b. How Sound Travels</li><li>c. Frequency</li><li>d. Decibels</li><li>e. Loudness</li></ol></li></ol>	Acoustical Engineer
10:45-11:00	<u>Break</u>	
11:00-12:30	<u>Introduction to the Sound Level Meter</u> <ol style="list-style-type: none"><li>1. Components of SLM</li><li>2. Types of SLM's</li><li>3. Reading a SLM</li><li>4. Acoustical Calibrators</li><li>5. On-Hand Experience</li></ol>	Acoustical/ Mechanical Engineer
12:30-2:00	<u>Lunch</u>	
2:00-3:15	<u>Instrumentation and Measurement</u> <ol style="list-style-type: none"><li>1. Equipment Needs for Enforcement</li><li>2. Measurement Methodology</li><li>3. Basic Measurement Conditions</li><li>4. Site Selection</li></ol>	Acoustical Engineer and Police Enforce- ment Instructor.
3:15-3:30	<u>Break</u>	
3:30-4:30	<u>Instrumentation and Measurement Continued</u>	

Police Enforcement of Noise Regulations

Day 2

9:00-10:15	<u>Community Noise</u> 1. Monitoring Stationary Noise 2. Recommended Enforcement Procedures	<u>Instructor</u> Police Enforce- ment Instructor
10:15-10:30	<u>Break</u>	
10:30-12:00	Community Noise Con't. 1. Field Experience	
12:00-1:15	Lunch	
1:15-2:15	<u>Motor Vehicle Noise</u> 1. Monitoring Motor Vehicle Noise 2. Recommended Enforcement Procedures	
2:15-2:30	<u>Break</u>	
2:30-4:00	<u>Motor Vehicle Noise Con't.</u>	
4:00-4:30	<u>Test and Evaluation</u>	

Police Enforcement of Noise Regulations

Day 3

9:00-10:00	<u>Statutory Basis of Noise Enforcement</u> 1. Local Ordinance Provisions/Problems 2. Ordinance Drafting 3. Community Programs for Noise Abatement	<u>Instructor</u> Attorney and Local Noise Control Official.
10:00-10:15	<u>Break</u>	
10:15-12:30	<u>The Law and Its Application</u> 1. Legal Issues 2. Evidentiary Issues 3. Preparing for Court	<u>Attorney</u>
12:30-1:00	<u>Test and Evaluation</u>	



Police Enforcement of Noise Regulations

Faculty List

## V.D. MODEL LEGISLATION

### History/Preamble

It has been determined that motorcycles (motor vehicles) are a significant source of excessive traffic noise. The noise source is often the exhaust and particularly that of modified motorcycles. Therefore, to preserve public health and welfare, it is the policy of name of jurisdiction to prevent such noise.

### V.D.1. SHORT TITLE

This chapter, ordinance, statute, section may be cited as the Motorcycle (Motor Vehicle) Noise Control Act.

### V.D.2. DEFINITIONS:

All terms and words not hereinafter defined in the Model Legislation shall be in conformance with the applicable terms and definitions as contained in the state or local law or publications of the American National Standards Institute.

- (a) ANSI - the American National Standards Institute.
- (b) "A-Weighted Sound Level" - the sound pressure level in decibels as measured on a sound level meter using the A-weighting network. The level so read is designated as dB(A) or dBA.
- (c) "Decibel" (dB) - a unit for measuring the volume of a sound equal to 20 times the logarithm to the base 10 or the ratio of pressure of the sound measured to the reference pressure which is 20 micropascals (20 micronewtons per square meter).
- (d) "Excessive or Unusual Noise" - noise which tends to interfere with health, welfare, safety or quality of life and can be identified as such by the normal human ear or with a sound level meter.
- (e) "Exhaust System" - the components or combination of components which provide for the enclosed flow of exhaust gases or an internal combustion engine from the exhaust port or ports of the engine to the atmosphere, excluding brackets, clamps,

or mounting hardware.

(f) "Motor Vehicle" - as defined in the state or local code or any vehicle which is self propelled, but does not include vehicles which obtain power from overhead wires. This includes, but is not limited to, passenger cars, multi-purpose passenger vehicles, trucks, truck-tractors, motor homes, go-carts, snow-mobiles, amphibious craft on land, dune buggies or racing vehicles but excludes motorcycles.

(g) "Motorcycle" - as defined in the state or local code; as defined in The Code of Federal Regulations; or any motor vehicle other than a tractor that has two or three wheels; has a curb weight (mass) not more than 1499 lbs. (680 kg.); and with a 176 lb. (80kg.) operator that is capable of achieving a maximum speed of at least 15 mph (24 km/hr) on a level paved surface.

(h) "Muffler or Sound Dissipative Device" - a device designed and used for the flow of exhaust gases and effective in reducing the exhaust noise from an internal combustion engine.

(i) "Noise" - any unwanted sound.

(j) "Off-Road Motorcycle" - any motorcycle that is not a street or competition motorcycle.

(k) "Person" - any individual, association, partnership, or corporation and also includes any officer, employee, department, agency or instrumentality of a state or any political subdivision thereof.

(l) "Sound" - a series of disturbances which travel in the form of waves and having characteristics such as duration, frequency, and intensity.

(m) "Sound Level Meter" - an instrument which includes a microphone, amplifier, RMS detector, integrator or time averager, output meter, and weighting networks used to measure sound pressure levels, designed to meet ANSI requirements.

(n) "Tampering" - the removal or rendering inoperable, except for maintenance, repair, or replacement, of any device or element of design incorporated into any new vehicle for the purpose of noise control.

### V.D.3. OPERATION OF MOTORCYCLES (MOTOR VEHICLES)

(a) A person shall not drive on a highway, street or public

way in name of state, county or city and the owner or lessee shall not permit to be driven on a highway, street, or public way in name of state, county or city any motor vehicle or combination of motor vehicles of a type required to be registered under cite local statute in a manner that, at any time, at any speed, or under any condition of grade, load, acceleration, or deceleration, exceeds the sound level limits established under Section V.D.4. of this law or ordinance for the operation of that type of motor vehicle or combination of vehicles.

(b) If a police officer has reason to believe the exhaust noise of a vehicle registered in this state is exceeding the maximum sound level limits established under Section V.D.4. of this law or ordinance, the officer may stop the vehicle and issue to the driver a noise inspection order.

(c) This section does not limit or supercede any other provision of law concerning vehicle equipment, vehicle noise levels, or the means of enforcing the laws relating to the vehicle equipment or noise levels.

V.D.4. IN USE VEHICLE NOISE LEVEL LIMITS

(a) No person shall operate a motorcycle (motor vehicle) on a highway, street, or public way in a manner as to exceed the noise limits for the class of motor vehicle as set forth in Table I.

TABLE V.1  
ON-HIGHWAY MOTOR VEHICLES

Class of Vehicle	Posted or Advisory Speed		
	35 mph or less level road	45 mph or less	over 45 mph
Motorcycles	74	78	82
Passenger cars and trucks less than 10,000 lbs. GVW	70	72	78
Trucks and buses 10,000 lbs. and over GVW	Optional	Optional	Optional

(b) All noise limits set forth in Table I shall be based on a measurement distance at 50 feet from the center of the nearest lane of travel within the speed zone specified. Measurements may be taken at distances other than those specified in Table I and the distance correction factors set forth in Table II shall be applied.

TABLE V. 2.

Distance; D in Feet	Sound Level Limits in dBA					
	On-Highway Motorcycles			Autos and Light Trucks		
	Posted Speed Zone			Posted Speed Zone		
	≤ 35 mph Level Road	45 mph or Less	Greater than 45 mph	≤ 35 mph Level Road	45 mph or Less	Greater than 45 mph
21 - 29	81	85	89	77	79	85
29 - 32	80	84	88	76	78	84
32 - 35	79	83	87	75	77	83
35 - 39	77	81	85	73	75	81
39 - 43	76	80	84	72	74	80
43 - 48	75	79	83	71	73	79
48 - 58	74	78	82	70	72	78
58 - 70	73	77	81	69	71	77
70 - 83	72	76	80	68	70	76
83 - 99	71	75	79	67	69	75
99 - 118	70	74	78	66	68	74

V.D.5. STATIONARY VEHICLE NOISE LEVEL LIMITS

(a) A vehicle, when tested in a stationary mode, shall not exceed the following sound level limits:

Motorcycles-----95 dBA

Passenger cars and  
light trucks less  
than 10,000 pounds GVW

Front Engine-----90 dBA

Rear Engine-----92 dBA

(b) All stationary noise level limits shall be based on the microphone of a sound level meter located 20 inches (.5 meter) and within 45 degrees of the exhaust outlet. The test shall be performed with the transmission in neutral and the engine accelerated to 3,000 rpm for passenger cars and light trucks and 50 per cent of rated horsepower for motorcycles.

V.D.6. MOTORCYCLE (MOTOR VEHICLE) TO BE EQUIPPED WITH AN EXHAUST SYSTEM MAINTAINED IN GOOD WORKING ORDER.

(a) Every motorcycle (motor vehicle) operated on a highway, street, or public way shall, at all times, be equipped with an exhaust system free of defects and maintained in good working order to prevent excessive or unusual noise.

V.D.7. TAMPERING MODIFICATION TO EXHAUST SYSTEM AND NOISE ABATEMENT EQUIPMENT.

(a) No person shall modify any exhaust system or other noise abatement equipment in any manner which would amplify or increase the sound of the motorcycle (motor vehicle) above that as originally manufactured.

(b) No person shall remove or render inoperative or cause or permit to be removed or rendered inoperative any component, device or equipment which was installed by the manufacturer of the motorcycle (motor vehicle) for the purpose of noise control except for the purpose of maintenance, repair or replacement.

V.D.8. OPERATION OF MOTORCYCLE (MOTOR VEHICLE) WITH MODIFIED OR TAMPERED EXHAUST SYSTEM OR NOISE ABATEMENT EQUIPMENT.

(a) No person shall operate on a highway, street or public way or any restricted off-road operation a motorcycle (motor vehicle) with a modified or tampered exhaust system or noise abatement equipment if such modification or tampering amplifies or increases the sound of the motorcycle (motor vehicle) above that as originally manufactured.

V.D.9. (OPTIONAL) NEW MOTORCYCLE (MOTOR VEHICLE) SOUND LEVEL LIMITS.

(a) Every new motorcycle (motor vehicle) sold or offered for sale in this state, county or city and required to be registered shall meet the limits set forth in Table III.

TABLE V.3

New Motor Vehicle Sound Level Limits

Motorcycles	83 dBA
Passenger Cars and trucks less than 10,000 pounds GVW	80 dBA
Trucks and buses 10,000 pounds and over	83 dBA

(b) New motorcycle (motor vehicle) sound level limits shall be determined by application of the appropriate SAE test procedure for the class of vehicle being tested.

(c) Each manufacturer of a motorcycle (motor vehicle) of a type required to be registered in this state, county or city shall certify to the name of appropriate official, agency or department by specify time or dates in a manner prescribed by the name of appropriate official, agency or department the motorcycles (motor vehicles) which meet the sound level limits set forth in Table III and may be offered for sale in state, county or city.

(d) The manufacturer shall, upon request, provide either through factory outlets, dealers or other means, motorcycles (motor vehicles) for testing by the name of appropriate official, agency or department.

V.D.10. OFF-ROAD OPERATION - RESTRICTED AREAS

(a) No person shall operate any off-road motorcycle within the boundaries of       specify areas with jurisdiction       during       specify times      .

V.D.11. ENFORCEMENT

(a) The       name of appropriate official, agency or department       may specify the methods of enforcement, training and certification of enforcement personnel and those acts which constitute a violation of this       statute, law, ordinance, etc.       which includes but is not limited to       as specified by local authorities      .

V.D.12. SEVERABILITY

(a) Any provision or application of this       statute, law, section, etc.       is held to be invalid shall not cause the remainder of the       statute, law, section, etc.       to be invalid.



APPENDIX

Procedure to Enforce Section V.D.3.

(1) The noise inspection order shall direct the owner of the vehicle to have the vehicle tested at a designated site within 10 days.

(2) If after testing, it is determined the exhaust noise of the vehicle exceeds the sound levels established under Section V.D.4., a noise repair order shall be issued.

(3) The noise repair order shall direct the owner of the vehicle:

(i) To have the exhaust system corrected as necessary at a place of the owner's choice within 10 days from the issuance of the noise repair order.

(ii) To send to name of appropriate agency or department to a noise repair order certification dated subsequent to the issuance of the order.

(4) The name of appropriate department or agency shall prepare and provide the necessary forms for the enforcement and administration of this law, ordinance, or section.

(5) The name or appropriate department or agency may adopt rules and regulations to carry out the provisions of this section.

(OPTIONAL)

(i) THESE RULES AND REGULATIONS MAY INCLUDE THE SUSPENSION OF REGISTRATION IF PERMITTED BY LOCAL LAW AND/OR THE ISSUANCE OF A CITATION REQUIRING COURT ADJUDICATION.

(ii) IF SUSPENSION OF REGISTRATION IS PERMITTED, THE RULES AND REGULATIONS MUST ALSO INCLUDE PROVISIONS FOR THE REINSTATEMENT SUSPENDED REGISTRATION.

REGULATIONS  
GOVERNING THE MODEL ENFORCEMENT OF (MOTOR CYCLE) NOISE

A. (Cite local chapter, section or title)

.01 Promulgation of Regulations for Maximum Sound Level Limits

The following sections of the Motorcycle (Motor Vehicle) Noise Control Act authorize the (title of individual or name of department or agency) to adopt certain regulations:

- A. Section V-D.2 - establish maximum sound level limits for motorcycles (motor vehicles) operated on the (highways, streets or public ways) of this (state, county, city or town).
- B. Section V-D.4 - with the (name of police department), develop procedures for the administration and enforcement of the maximum sound level limits for motorcycles (motor vehicles) operated on the (highways, streets, or public ways) of this (state, county, city or town).
- C. Section V-D.6 - establish maximum sound level limits for new motorcycles (motor vehicles) sold, offered for sale, distributed or leased in this (state, county, city or town).
- D. Section V-D.8 - develop procedures for the administration and enforcement of the maximum sound level limits for new motorcycles (motor vehicles).
- E. Section V-D.9 - develop procedures for the certification of new motorcycles (motor vehicles) to be sold, offered for sale, distributed or leased in this (state, county, city or town).
- F. Section V-D.11 - develop procedures for the certification of exhaust muffler, intake mufflers and other noise abatement devices sold in this (state, county, city or town).

.02 Applicability

- A. Regulations .04 through .12 apply to the measurement of the sound level of:
1. Any motorcycle (motor vehicle) when in motion; or
  2. Any stationary motorcycle (motor vehicle) whether or not it is equipped with an engine speed governor.
- B. Regulations .04 through .12 do not apply to:
1. The sound generated by a horn or other warning device when used under the provisions of (cite local traffic or motor vehicle code); or
  2. The sound generated by an emergency motor vehicle when operating under the provisions of (cite local traffic or motor vehicle code).

.03 Definitions

- A. ANSI means the American National Standards Institute or its successor bodies.
- B. A-Weighted Sound Level means the sound pressure level in decibels as measured on a sound level meter using the A-weighted network.
- C. dBA means the accepted standard abbreviation for the A-weighted sound level in decibels.
- D. Decibel means a unit for measuring the volume of a sound equal to 20 times the logarithm to the base 10 or the ratio of pressure of sound measured to the reference pressure which is 20 micropascals (20 microneutons per square meter).
- E. GCWR means the value specified by the manufacturer as the loaded weight of a combination vehicle.
- F. GVWR means the value specified by the manufacturer as the loaded weight of a single vehicle.
- G. Ground Cover means any of various low dense growing plants such as ivy, myrtle, low weeds or brush.
- H. SAE means the Society of Automotive Engineers, Inc. or its successor bodies.

.03 Definitions - Continued

- I. Sound Level means the A-weighted sound level obtained by the use of a sound level meter set on the A-weighted network or characteristic as specified in American National Standard S1.4-1971, "Specifications for Sound Level Meters".
- J. Sound Level Meter means an instrument which includes a microphone, amplifier, RMS detector, integrator or time averager, output meter, and weighting networks used to measure sound pressure levels and designed to meet ANSI requirements.

.04 Maximum sound level limits for in-use motorcycles (motor vehicles)

- A. A motorcycle (motor vehicle) shall not be operated or permitted to be operated at any time, speed, or under any conditions of grade, load, acceleration or deceleration or in any manner which would cause the sound level of the motorcycle (motor vehicle) to exceed the limits specified in Tables 1 or 3 for the type of vehicle and posted or advisory speed.
  - 1. All sound level limits for (highway, street or public way) operation shall be based on a distance of 50 feet between the microphone location and the center of the lane of travel of the vehicle and using the A-weighted network and fast meter response mode of the sound level meter.
    - a. Measurements made at other distances shall be adjusted by the factors specified in Table 2.
  - 2. All sound level limits for stationary vehicle measurements shall be:
    - a. Motorcycles (Motor Vehicles) with engine speed governors ---- based on a 50 feet distance between the microphone location and the longitudinal centerline of the vehicle and using the A-weighted network and slow meter response mode of the sound level meter.
    - b. Motorcycles (Motor Vehicles) without engine speed governors ---- based on a 20 inches distance between the microphone location and the exhaust outlet of the vehicle using the A-weighted

.04 Maximum Sound Level Limits for In-Use Motorcycles (Motor Vehicles) - Continued

2.

- b. network and slow response mode of the sound level meter.

TABLE 1

MAXIMUM SOUND LEVELS - (HIGHWAY, STREET OR PUBLIC WAY OPERATION)

<u>Type of vehicle</u>	<u>Posted or advisory speed limit</u>	
	<u>45 mph or less</u>	<u>Over 45 mph</u>
Any motorcycle	82 dBA	86 dBA
<u>After (Date of further reduction)</u>	<u>(Further reduced limits)</u>	
Passenger cars and light trucks less than 10,000 pounds GVWR	76 dBA	82 dBA
<u>After (Date of further reduction)</u>	<u>(Further reduced limits)</u>	
Trucks, buses and combination vehicles over 10,000 pounds GVWR or GCWR	35 mph or less 86 dBA	Over 35 mph 90 dBA

(Any further reductions or dates would have to affect intrastate vehicles only because EPA and BMCS limits are preemptive of local requirements for regulated carriers)

TABLE 2

DISTANCE CORRECTION FACTORS

<u>Distance in feet between microphone location and center of lane of travel</u>	<u>dBa correction factor added to or subtracted from limit</u>
21-29	+ 7
29-32	+ 6

TABLE 2  
DISTANCE CORRECTION FACTORS - Continued

32-35	+ 5
35-39	+ 3
39-43	+ 2
43-48	+ 1
48-58	+ 0
58-70	- 1
70-83	- 2
83-99	- 3
99-118	- 4

.05 Maximum Sound Level Limits for Stationary Motorcycles  
(Motor Vehicles)

A. A vehicle when tested in a stationary mode, shall not exceed the limits specified in Table 3.

TABLE 3  
MAXIMUM SOUND LEVELS - STATIONARY MODE

<u>Type of vehicle</u>	<u>Maximum level in dBA</u>
Any motorcycle	95
After <u>(Date of further reduction)</u>	<u>(Further reduced limit)</u>
Passenger cars and light trucks less than 10,000 pounds GVWR	
Front engine	90
Rear engine	92
After <u>(Date of further reduction)</u>	<u>(Further reduced limit)</u>

Trucks, buses and combination  
vehicles over 10,000 pounds  
GVWR or GCWR

\* Stationary test is applicable to motor vehicles equipped with an engine speed governor and is based on a 50 feet distance between the microphone location point and the longitudinal centerline of the motor vehicle.

.06 Standard Measurement Site For (Highway, Street or Public Way) Operation of All Motorcycles (Motor Vehicles) and Stationary Measurements of Motor Vehicles over 10,000 pounds GVWR and GCWR Equipped With an Engine Speed Governor.

A. Moving Motorcycle (Motor Vehicle) Measurement Procedures. (See Figure 1)

1. Measurements shall be made at a measurement site which is adjacent to and includes a portion of a traveled lane of a (highway, street or public way). A microphone target point shall be established on the centerline of the traveled lane of the (highway, street or public way) and a microphone location point shall be established on the ground surface 50 feet from the microphone target point and on a line that is perpendicular to the centerline of the traveled lane of the (highway, street or public way) and passes through the microphone target point.
2. The measurement site shall have a clear area with a radius of 50 feet around both the microphone location and target points. There shall be no sound reflecting surfaces within the clear areas.
3. Within the measurement site is a triangular area which is determined by connecting the microphone location point and the points where the centerline of the lane of travel intersects the outer edges of the clear area around the microphone target point. There shall be no other vehicles within the triangular area when a vehicle is within the measurement site.
4. The sound level of the motorcycle (motor vehicle) is the highest reading observed on the sound level meter as it passes through the measurement site.
5. The sound level of the motorcycle (motor vehicle) being measured must be observed to rise and fall at least 6 dBA before and after the maximum sound level occurs.

B. Stationary Motor Vehicle Measurement Procedures for Motor Vehicles Over 10,000 pounds GVWR and GCWR and equipped With an Engine Speed Governor. (See Figure 2)

11.14.05 Noise Abatement Program

.05 Standard Test Site Highway Operations All Vehicles

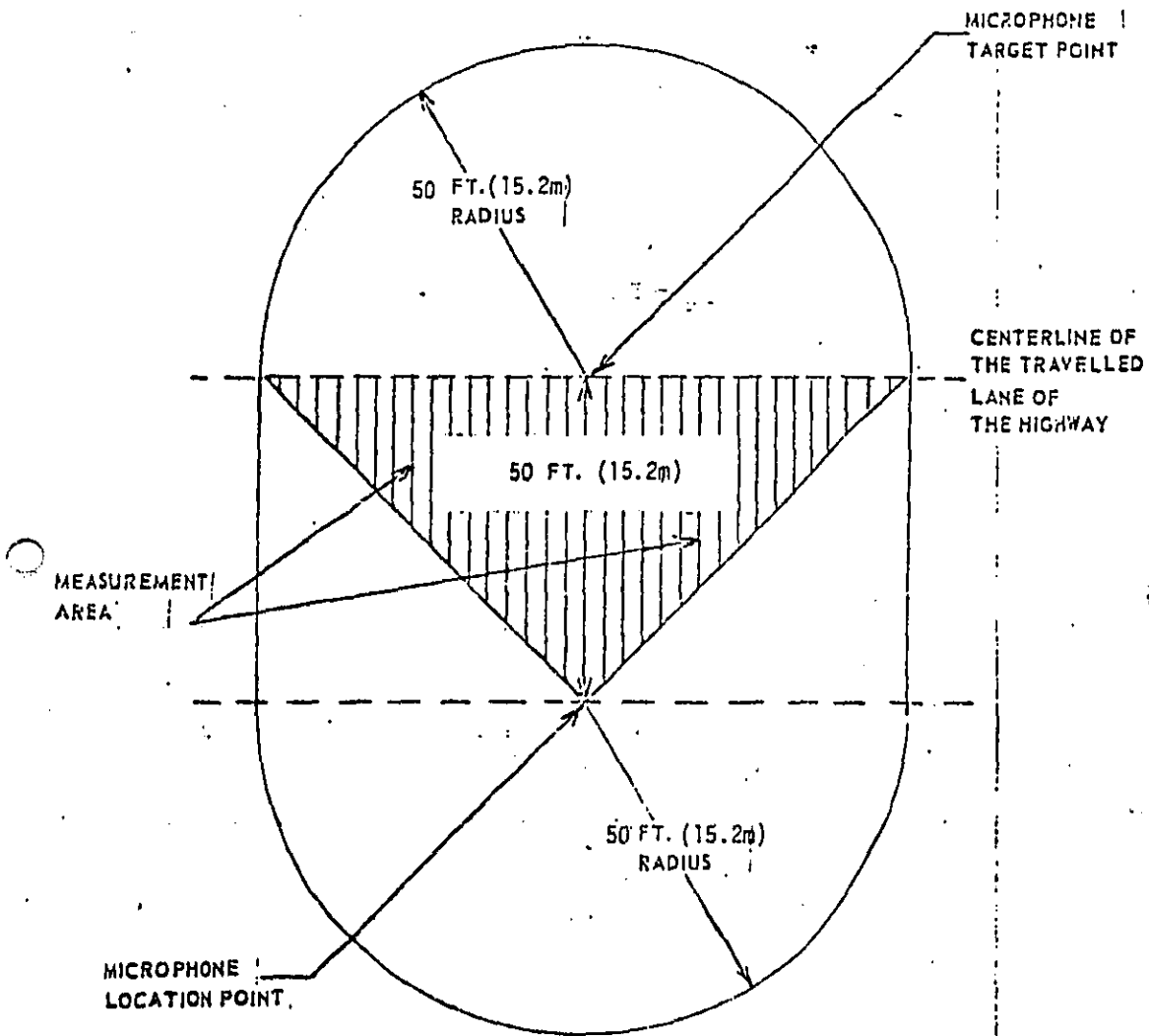


FIGURE 1

STANDARD TEST SITE  
HIGHWAY OPERATIONS



11.14.05 Noise Abatement Program

.05 Stationary Operation Vehicles Over 10,000 Lbs. GCWR and GVWR

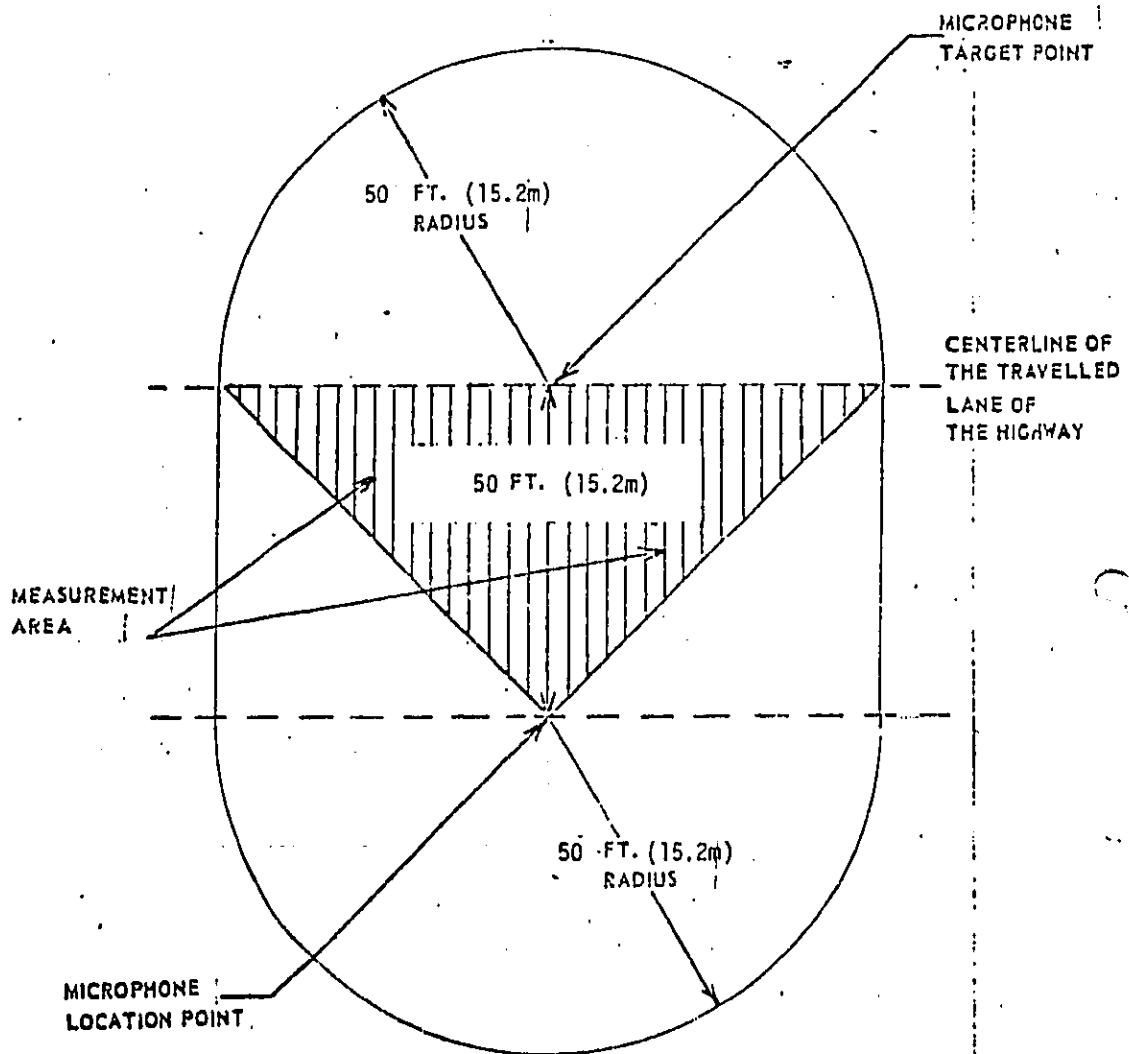


FIGURE 2

STANDARD TEST SITE  
STATIONARY OPERATIONS

.06 B Stationary Motor Vehicle Measurement Procedures Cont'd

1. The motor vehicle to be tested shall be parked within the measurement site. A microphone target point shall be established on the ground surface of the site on the centerline of the lane in which the motor vehicle is parked at a point that is within 3 feet of the longitudinal position of the vehicle exhaust outlet or outlets.
  - a. If the motor vehicle is a combination vehicle, they shall be parked so the longitudinal centerlines of all vehicles are in substantial alignment.
2. A microphone location point shall be established on the ground surface 50 feet from the microphone target point and on a line that is perpendicular to the centerline of the lane where the vehicle is parked and passes through the microphone target point.
3. The measurement site shall have a clear area with a radius of 50 feet around both the microphone location and target points. There shall be no sound reflecting surfaces within the clear areas.
4. All auxiliary equipment such as cranes, asphalt spreaders, liquid or slurry pumps, auxiliary air compressors, welders or trash compactors which are installed on the motor vehicle and which are designed to operate under normal conditions only when the vehicle is operating at a speed of 5 miles per hour or less shall be turned off.
5. If the motor vehicle engine fan is equipped with a clutch or similar device that automatically either reduces or disengages the rotational speed of the fan from its power source in response to reduced engine cooling loads, park the vehicle before testing, with the engine running at high idle speed or any other speed the operator may choose, for sufficient time but not more than 10 minutes, to permit the radiator fan to automatically disengage.
6. The motor vehicle transmission shall be in neutral and the clutch engaged.
7. Rapidly accelerate the engine from idle to maximum governed speed with wide open throttle and return to idle speed and observe the maximum reading on the sound level meter. Repeat these procedures until the first two maximum sound level readings observed are within 2 dBA of each other. Numerically average the readings to obtain the maximum sound level of the motor vehicle.

.06 B. Stationary Motor Vehicle Measurement Procedures Cont'd

- a. If the motor vehicle is equipped with dual exhausts, these procedures will be applied to both sides of the motor vehicle and the numerical averages for each side will be numerically averaged to obtain the maximum sound level generated by the motor vehicle.

.07 Measurement Site for Stationary Measurements for Motorcycles (and Motor Vehicles Less than 10,000 pounds GVWR).

- A. Measurements shall be made at a site that contains 10 feet radius around the centerline of the vehicle of clear area free of reflecting surfaces.
- B. The microphone shall be located 20 inches away from the exhaust outlet; 8 inches above the ground level on which the vehicle stands; and within a 45 degree angle of the exhaust outlet.
- C. The transmission of the motorcycle (motor vehicle) shall be placed in neutral and the engine speed gradually increased to:
  1. Motorcycle, 50 percent of rated horsepower;
  2. Motor vehicles less than 10,000 pounds GVWR, 3,000 revolutions per minute.
- D. The sound level of the motorcycle (motor vehicle) shall be the maximum level observed on the sound level meter when the engine speed of the motorcycle (motor vehicle) listed in Section .07 C is attained.

.08 Non-Standard Measurement Site For (Highway, Street or Public Way) Operation of All Motorcycles (Motor Vehicles).

See Figure 3

- A. Measurements may be made at a site that meets all the requirements of Section .06 A except the distance between the microphone location and target points.
  1. If the distance between the microphone location and target points is less than 50 feet, the clear area around the microphone location and target points shall have a radius equal to the distance between the microphone location and target points.
    - a. If the distance between the microphone location and target points is less than 50 feet, the sound level limits shall be adjusted as specified in Table 2.

11.14.05 Noise Abatement Program

.05 Non-standard Test Site Highway Operations All Vehicles

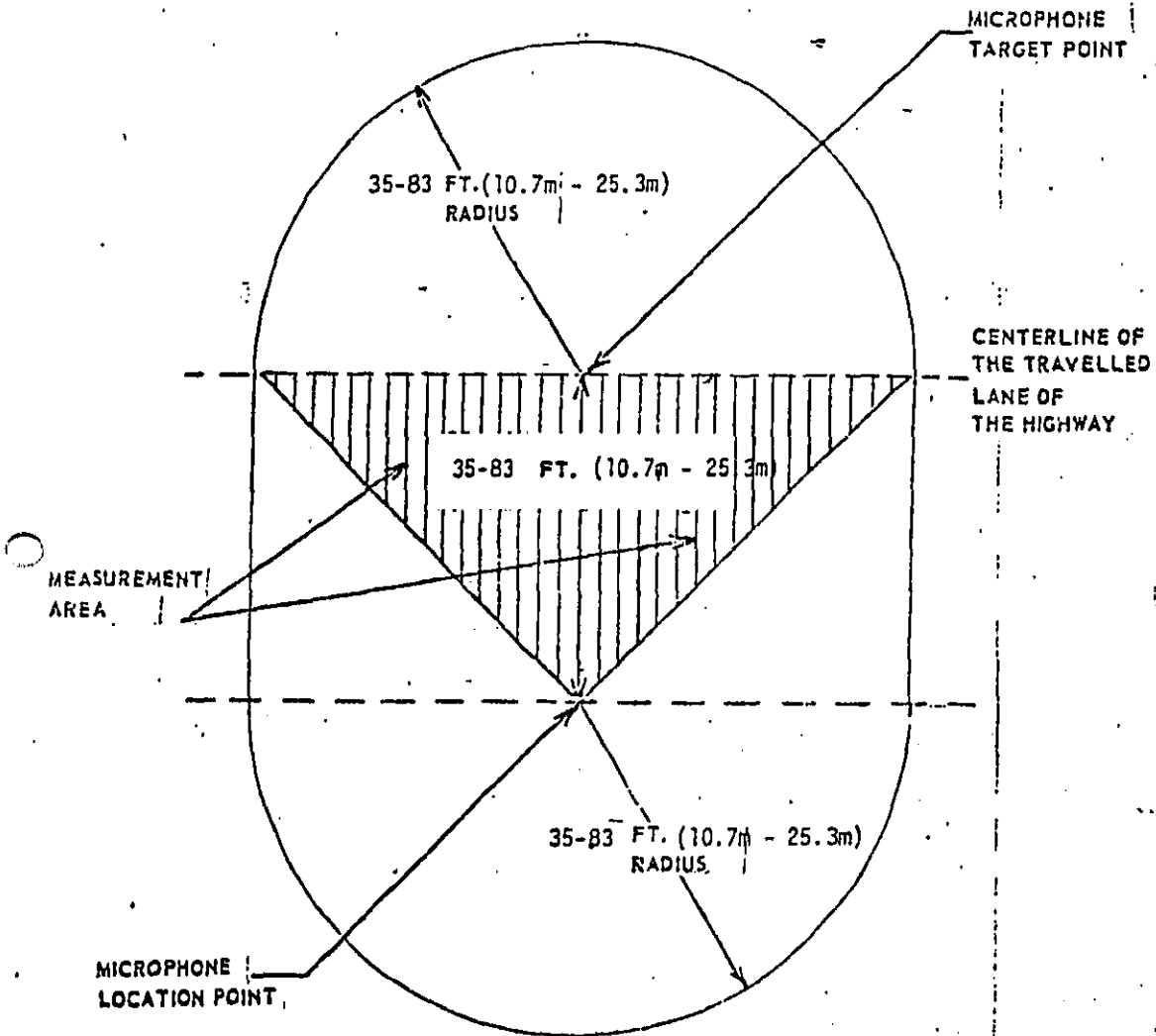


FIGURE 3  
NON STANDARD TEST SITE  
STATIONARY OR HIGHWAY OPERATIONS

.08 Non-Standard Measurement Site Cont'd

A.

2. If the distance between the microphone location and target points is greater than 50 feet, the clear area around the microphone location and target points shall have a radius of 50 feet.
  - a. If the distance between the microphone location and target points is greater than 50 feet, the sound level limits shall be adjusted as specified in Table 2.

.09 Site Requirements For (Highway, Street or Public Way)  
Operation of Motorcycles (All Motor Vehicles) and Stationary Testing of Motor Vehicles Over 10,000 Pounds GVWR and GCWR Equipped With an Engine Speed Governor.

- A. The measurement site shall be an open site, essentially free of large sound reflecting objects or surfaces and no closer than 200 feet between the microphone target point and a tunnel or overpass. However, the following objects may be within the measurement site, including the triangular measurement area but not between the microphone location and target points:
1. Small cylindrical or vertical objects less than 14 inches in diameter regardless of length, such as fire hydrants, lampposts or utility poles.
  2. Guardrails or traffic railings less than 14 inches in height regardless of length except solid concrete barriers commonly referred to as "Jersey Barriers".
  3. Rural mailboxes.
  4. One or more curbs or surfaces having a vertical height or 1 foot or less
- B. The following objects may be within the measurement site if they are outside the triangular measurement area of the site:
1. Any vertical surface, such as billboards or traffic signs, regardless of size, having a lower edge more than 15 feet higher than the surface of the lane of travel of the (highway, street or public way) provided the face of the object is angled upward from the lane of travel.
  2. Any uniformly sloping surface sloping upward from from the lane of travel, such as a rise in grade

## .09 Site Requirements Cont'd

## B.

2. alongside a (highway, street or public way) with a slope that is less than 45 degrees above the horizontal plane of the lane of travel. See Figure 4
3. Any surface sloping downward from the lane of travel that is more than 45 degrees but not more than 90 degrees provided the surface on which the microphone stands is not more than 10 feet below the plane of the lane of travel. See Figure 5
4. Any standing water.
5. The operator, a witness or trainee. The operator, witness or trainee must be positioned behind the microphone but no closer than 2 feet from the microphone.

## C. (Highway, Street or Public Way) Surface Requirements.

1. The traveled lane of the (highway, street or public way) shall be dry, paved with relatively smooth concrete or asphalt and substantially free from:
  - a. Holes or other defects which would cause a vehicle to emit irregular tire, body or chassis impact noise; and
  - b. Loose material such as gravel or sand.

## D. Ambient Conditions.

1. Sound - The ambient A-weighted sound level at the microphone shall be measured, in the absence of motorcycle (motor vehicle) sound emanating from within the clear zone, with fast meter response selection on a sound level meter which conforms to Section 11.
  - a. The measured ambient sound level shall be at least 10 dBA below the maximum levels to be enforced.
2. Wind - The wind speed at the microphone location point shall be measured at the beginning of each series of sound measurements and at intervals of 5 to 15 minutes thereafter until it has been established the wind speed is essentially constant. After it has been determined the wind speed is constant, future wind speed measurements may be made at intervals of once each hour or whenever wind speed increases. Sound measurements may

11.14.05 Noise Abatement Program

.05 Standard Measurement Site for Vehicles Over 10,000 GVWR or GCWR

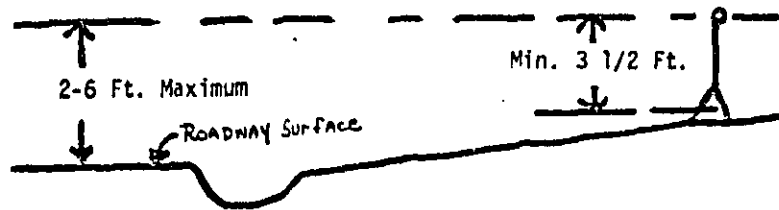


FIGURE 4

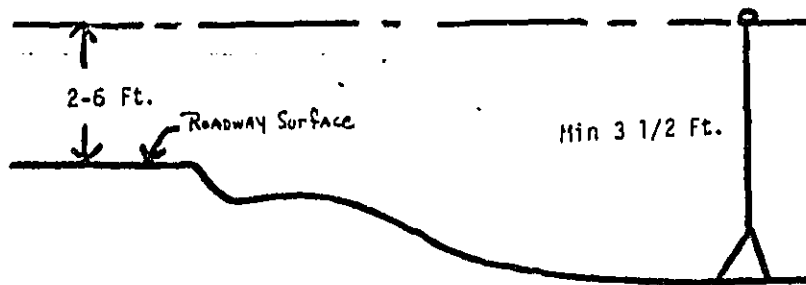


FIGURE 5

## .09 Site Requirements Cont'd

## D.

2. only be made if the measured wind speed is 12 miles per hour or less. Occasional wind speed gusts up to 20 miles per hour are permitted.
3. Precipitation - Measurements are prohibited under any condition of precipitation, however, measurements may be made with snow on the ground. The ground surface within the measurement area shall be free from standing water.

## E. Reflecting Surfaces Within Measurement Sites for Motorcycles (and Motor Vehicles Less Than 10,000 pounds GVWR).

1. Measurements made in sites with sound reflecting surfaces behind the microphone location point or beyond the vehicle fore and aft centerline and outside the triangular measurement area shall be adjusted by the factors in Table 4. If the reflecting surface are behind the microphone location point and beyond the vehicle fore and aft centerline, they are additive. Measurements shall not be made when a sound reflecting surface is less than 25 feet from the microphone location point or the fore and aft centerline of the vehicle or when there are more than two reflecting surfaces within a site.

TABLE 4

Distance between reflecting surface and microphone location or target point...	dBa adjustment added to limit
More than 25 feet but not more than 35 feet	1 dBA

## .10 Site Requirements for Stationary Testing of Motorcycles (Motor Vehicles Over 10,000 Pounds GVWR.

- A. The measurement site shall have a relatively hard smooth concrete or saphalt surface free of loose materials.
- B. There shall be no reflecting surfaces within the 10 feet radius of the motorcycle (motor vehicle) being tested.
- C. The measurement site shall be free of standing water



## .10 Site Requirements, Stationary Testing Cont'd

- C. however the measurement site does not have to be completely dry

## .11 Sound Level Measurement Equipment.

## A. Sound level meter

1. A (Type 1 or Type 2) sound level meter meeting the requirements of American National Standards Specification for Sound Level Meters ANSI 1.4-1971 or ANSI S1.4-1971 or later revision shall be used.
  - a. The sound level meter shall be calibrated and certified (specify time interval) with a method traceable to the U.S. National Bureau of Standards to verify its performance within design tolerances.
2. Auxiliary Equipment - (Specify any additional equipment such as tripod, cable etc. which may be necessary for use and enforcement).

## B. Acoustical Calibrator.

1. An acoustical calibrator of the microphone coupler type shall be used for calibration of the sound level meter during field operation and use. The frequency of the calibration signal shall be 1000 Hz,  $\pm 5$  percent
  - a. The calibrator shall be calibrated and certified annually with a method traceable to the U.S. National Bureau of Standards to verify its performance within design tolerances.

## C. Microphone Windscreen.

1. A windscreen shall be used for all measurements to protect the microphone from wind noise. Installation of the windscreen may not cause a change in the sensitivity or more than  $\pm 5$  dB in the frequency range from 50 Hz to 5 kHz or more than  $\pm 2$  dB in the frequency range from 5 KHz. It is sufficient that this compliance be demonstrated only at the required sound level meter calibration and certification.

## D. Anemometer

1. Specify the type required for local enforcement purposes. (Usually a hand held type would be sufficient)

.11 Sound Level Measurement Equipment Cont'd

D. Anemometer

1. (If new vehicle testing or certification is a part of the noise program, the anemometer should be a remote operation type with a steady-state accuracy of  $\pm 10$  percent of any reading above 10 miles per hour.

E. Tachometer

1. The tachometer shall be solid state with an inductive pick up and be capable of measuring engine speed of ignition spark engines of 2 or 4 stroke cycle or rotary design. It shall also have the capabilities of being used on 2,4,6, or 8 cylinder engines. The tachometer shall have a solid-state accuracy of  $\pm 100$  revolutions per minute readings throughout a range of 2,000 through 12,000 revolutions per minute.

.12 Sound Level Equipment Operation for Measuring Motorcycle (Motor Vehicle) Sound.

A. Microphone Location.

1. All moving motorcycle (motor vehicle) and stationary measurements for vehicles over 10,000 pounds GVWR and GCWR equipped with an engine speed governor.
  - a. The microphone shall be located at a height of not less than 2 feet or more than 6 feet above the plane of the lane of travel or the surface on which the vehicle is parked. The microphone shall not be less than  $3\frac{1}{2}$  feet above the surface on which it stands. The preferred microphone height is 4 feet above the surface on which it stands.
2. Stationary measurements for motorcycle and other vehicles with less than 10,000 pounds GVWR.
  - a. The microphone shall be located at a height of 8 inches above the surface on which the microphone and vehicle stand. It shall be 20 inches from the exhaust outlet of the vehicle and within 45 degrees of the exhaust outlet.

B. Microphone Orientation

1. Unless specified otherwise by the manufacturer, the

.12 Sound Level Equipment Operation Cont'd

B. Microphone Orientation

microphone shall be approximately, but not more than 70 degrees from being perpendicular to the (highway, street or public way) so the sound from the vehicle reaching the microphone from any point in the measurement site strikes the microphone at a grazing incidence (parallel to the microphone diaphragm).

C. Meter Operation

1. The sound level meter shall be operated in accordance with the manufacturer's instructions and as follows:
  - a. The meter shall be set for the A-weighting network and fast response.
    - (1) For stationary vehicle measurements, the meter shall be set on the slow response.
2. The sound level meter shall be calibrated with the acoustic calibrator immediately before and after a period of use, and at approximately  $\frac{1}{2}$  to 1 hour intervals when in use.
  - a. When the meter is initially calibrated, it shall be checked at 15 minute intervals until it has stabilized (less than .5 dB drift).
3. The operator may not stand at any point in the measurement site that lies on a line passing through the microphone location and target points. An operator, witness or trainee may be positioned behind the microphone but no closer than 2 feet of the microphone.
4. The ambient (background) sound level, including that of other vehicles, wind effects and all other sources except the sound of the vehicles being measured, shall be at least 10 dBA less than the maximum sound level of the vehicle being measured.
5. The sound level reading of a moving vehicle or stationary vehicle shall be the highest reading observed as the vehicle passes through the site or the engine speed is attained when the requirements of Sections .06 and .07 are met.

.13 Records.

- A. The operator shall keep written and signed records, on prescribed forms, which shall include at least the following:
1. Location of measurement site and posted or advisory speed, if applicable.
  2. Date and times of measurements.
  3. A sketch of the site, noting the location of any sound reflecting surfaces if any are present.
  4. Name of operator making the measurements.
  5. Identifying numbers of sound measurement equipment.
  6. Site correction factors, if any.
  7. Distance correction factors for the different lanes of travel to be used.
  8. Distance correction factor, if any, for the distance between the microphone and fore and aft centerline of the stationary vehicle being measured.
  9. For each violation observed, a description of the vehicle, lane of operation (except for stationary vehicle measurements), the sound level reading as set forth in Sections .06 and .07, the maximum permitted sound level, the time, enforcement action taken, if any, wind speed, calibration times, calibration adjustments if made, and any other information deemed necessary.