

California  
Highway  
Patrol

HPH 83.3

RECEIVED

SEP 29 1975

POLLUTION CONTROL BOARD

**SOUND  
MEASUREMENT  
PROCEDURES**



0000 0047

CALIFORNIA HIGHWAY PATROL

SOUND MEASUREMENT PROCEDURES HPH 83.3

REVISION RECORD

INSTRUCTIONS FOR USE: All revisions of the above Manual will be numbered to assure each manual holder that he has received all revisions. The date and initials of the person inserting revisions to the manual should be entered on this revision record opposite the appropriate revision number. If the sequence is broken, copies of the missing revisions may be requested from Office Services Section

<u>Rev. No.</u>	<u>Date Inserted</u>	<u>Initials</u>	<u>Rev. No.</u>	<u>Date Inserted</u>	<u>Initials</u>
1.	_____	_____	21.	_____	_____
2.	_____	_____	22.	_____	_____
3.	_____	_____	23.	_____	_____
4.	_____	_____	24.	_____	_____
5.	_____	_____	25.	_____	_____
6.	_____	_____	26.	_____	_____
7.	_____	_____	27.	_____	_____
8.	_____	_____	28.	_____	_____
9.	_____	_____	29.	_____	_____
10.	_____	_____	30.	_____	_____
11.	_____	_____	31.	_____	_____
12.	_____	_____	32.	_____	_____
13.	_____	_____	33.	_____	_____
14.	_____	_____	34.	_____	_____
15.	_____	_____	35.	_____	_____
16.	_____	_____	36.	_____	_____
17.	_____	_____	37.	_____	_____
18.	_____	_____	38.	_____	_____
19.	_____	_____	39.	_____	_____
20.	_____	_____	40.	_____	_____

DEPARTMENT OF CALIFORNIA HIGHWAY PATROL

SOUND MEASUREMENT PROCEDURES

THIS PUBLICATION MAY BE PURCHASED FOR \$2 EACH,  
PLUS CALIFORNIA STATE SALES TAX

MAY 1973

HPH 83.3

0000 0044

## FOREWORD

The purpose of the Sound Measurement Procedures Handbook is to describe equipment and procedures for measuring sound level produced by vehicles in operation on highways, by new vehicles operated under near maximum sound test conditions, and by emergency vehicle sirens.

The objective of the handbook is to provide standard sound measurement procedures which will yield accurate readings and result in uniform enforcement action.

This handbook contains adequate guidance on equipment, conditions and techniques for the measurement of sound in support of motor vehicle noise enforcement.

Comments or recommendations concerning the contents of this handbook should be addressed to Safety Services Division.

OFFICE OF THE COMMISSIONER

DISTRIBUTION: A E S (one to each Noise Team member)



## TABLE OF CONTENTS

	Paragraph
<b>CHAPTER 1 - INTRODUCTION</b>	
AUTHORITY	1.1
Location	1.1.1
Identification	1.1.2
NOISE ENFORCEMENT PROGRAM	1.2
Scope	1.2.1
Responsibilities	1.2.2
INSTRUMENTS AND TRAINING	1.3
Instruments	1.3.1
Training of Personnel	1.3.2
 <b>CHAPTER 2 - ON-HIGHWAY SOUND LEVEL MEASUREMENT</b>	
SCOPE	2.1
MEASUREMENT SITES	2.2
Types of Sites	2.2.1
Standard Measuring Site	2.2.2
Restricted Measuring Site	2.2.3
Measuring Distance	2.2.4
Sound-reflecting Surfaces	2.2.5
Surfaces Not Requiring Correction Factors	2.2.6
Correction Factors for Sound-reflecting Surfaces	2.2.7
Combination of Reflecting Surfaces and Non-Standard Measuring Distance	2.2.8
Selection of Sites	2.2.9
SOUND LEVEL MEASURING PRECAUTIONS	2.3
Identification	2.3.1
Intensity	2.3.2
Recording	2.3.3
EQUIPMENT SETUP AND USE	2.4
Microphone Location	2.4.1
Microphone Height	2.4.2
Windscreens	2.4.3
Sound Level Meter	2.4.4

## CHAPTER 3 - NEW VEHICLE SOUND LEVEL MEASUREMENT

NEW VEHICLE SOUND LEVEL MEASUREMENT	3.1
Scope	3.1.1
TEST AREA AND PERSONNEL	3.2
Test Area	3.2.1
Ground Condition	3.2.2
Roadway Surface	3.2.3
Wind	3.2.4
Personnel Location	3.2.5
EQUIPMENT SETUP AND PRECAUTIONS	3.3
Microphone Location	3.3.1
Power Supply	3.3.2
Recorder	3.3.3
Weather Measurement	3.3.4
Data Recording	3.3.5
Precautions	3.3.6
SOUND MEASURING EQUIPMENT	3.4
Sound Level Meter, Bruel & Kjaer Type 2203	3.4.1
Sound Level Meter, Frequency Analyzer Bruel & Kjaer Type 2113	3.4.2
Sound Level Meter, Graphic Level Recorder General Radio Type 1523/1523-PIA	3.4.3
Graphic Level Recorder, General Radio Type 1521A	3.4.4
Graphic Level Recorder, Bruel & Kjaer Type 2305	3.4.5
NEW VEHICLE TEST PROCEDURE	3.5
Vehicle Sound Levels	3.5.1
Definitions	3.5.2
Operation	3.5.3
Light Trucks, Truck Tractors, Buses and Passenger Cars	3.5.4
Heavy Trucks, Truck Tractors and Buses	3.5.5
Motorcycles	3.5.6
Snowmobiles	3.5.7

## CHAPTER 4 - SIREN TEST PROCEDURE

(To be printed later)

### ANNEXES

- A - EXCERPTS FROM CALIFORNIA VEHICLE CODE
- B - EXCERPTS FROM CALIFORNIA ADMINISTRATIVE CODE, TITLE 13

## CHAPTER 1

### INTRODUCTION

#### 1.1 AUTHORITY

1.1.1 Location. Statutory and administrative law governing authority for the guidance and direction contained in this handbook is quoted in Annexes A and B.

1.1.2 Identification. The sources of authority are:

- a. Vehicle Code Sections 23130, 23130.5, 27002, 27150, 27150.2, 27151, 27160 and 38280 (Annex A)
- b. California Administrative Code, Title 13, Chapter 2, Articles 8 and 10 of Subchapter 4 (Annex B)

#### 1.2 NOISE ENFORCEMENT PROGRAM

1.2.1 Scope. The Department, through the Safety Services Division, has established a sound measurement program to implement the laws and regulations applying to vehicle related noise. The program includes sound level measurements of vehicles on the highway, sound measurements of new vehicles, and sound level testing of sirens.

1.2.2 Responsibilities. Zone commands are responsible for the operation of the on-highway noise measurement. The Safety Services Division is responsible for the testing of new vehicles and for the testing of sirens.

#### 1.3 INSTRUMENTS AND TRAINING

1.3.1 Instruments. Sound measurement instruments described herein and used by the Department meet the requirements of the American National Standard S1.4-1971, Specification for Sound Level Meters. These instruments are high quality electronic devices which have been carefully calibrated by the

manufacturer within strict standards. Each sound level meter is supplied with a calibrator as a companion instrument. Use of this calibrator assures the operator that the sound level meter is consistently within the manufacturer's tolerances. Periodically, and at least annually, each set of sound measuring instruments is returned to the manufacturer for factory recalibration.

1.3.2 Training of Personnel. Each person selected to make sound level measurements for application of the vehicle noise levels shall have received a minimum of 8 hours of training in the use of the equipment, basic theory of noise, and measuring site selection.

## CHAPTER 2

### ON-HIGHWAY SOUND LEVEL MEASUREMENTS

- 2.1 SCOPE. This chapter describes the procedure for selecting sites and setting up equipment for measurement of noise from vehicles on the highway. Two types of measurement sites and three types of sound level meters are described.
- 2.2 MEASUREMENT SITES.
- 2.2.1 Types of Sites. Two types of sites are established for measuring vehicles in use on the highway. They are a standard measuring site requiring a large clear open area and a restricted measuring site in which sound-reflecting objects are permitted. When selecting measuring sites, care shall be taken to measure sites carefully and determine if a correction factor must be applied.
- 2.2.2 Standard Measuring Sites. Standard measuring sites are those where the microphone can be placed 50 ft. from the center of the vehicle path and where there are no sound-reflecting objects within a 100-foot radius of the microphone and a 100-foot radius of the microphone point (which is the point on the vehicle path that is closest to the microphone). (See Figure 2-1) When making measurements of vehicle sound levels in standard measuring sites, the instrument readings shall be recorded with no correction factor applied.
- 2.2.3 Restricted Measuring Sites. Restricted measuring sites are those where the distance from the center of the vehicle path to the microphone is other than 50 ft. or where there are sound-reflecting surfaces closer than 100 ft. from the microphone line or the vehicle path. Vehicle noise measurements may be made in such areas when the proper correction factors described in this chapter are applied to the recorded sound levels. (See Figure 2-2)

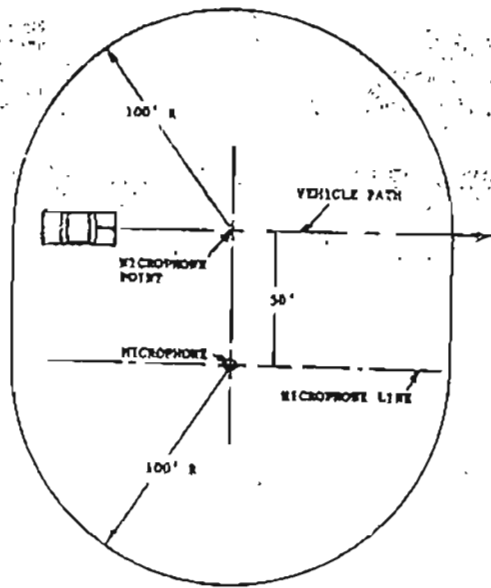


Fig. 2-1. Standard Measuring Site

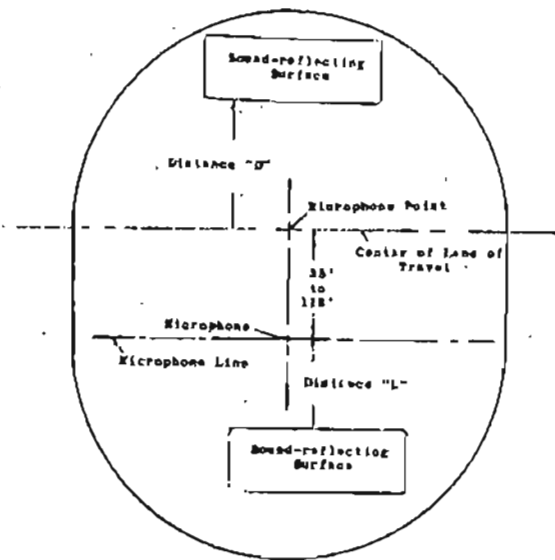


Fig. 2-2. Restricted Measuring Site

2.2.4 Measuring Distance. The actual distance from the microphone to the microphone point at the center of the vehicle path may range from 35 to 118 ft. when the factor obtained from Figure 2-3 is added to or subtracted from the sound level meter readings to correct the reading to what it would be at the standard measuring distance of 50 ft.

<u>Distance from Microphone to Roadway Centerline</u>	<u>dB(A) Correction Factor</u>
35 - 39 ft.....	-3
39 - 43 ft.....	-2
43 - 48 ft.....	-1
48 - 58 ft.....	0
58 - 70 ft.....	+1
70 - 83 ft.....	+2
83 - 99 ft.....	+3
99 - 118 ft.....	+4

Fig. 2-3. Measuring Distance Correction Factors

Example: If the distance between the microphone and the roadway centerline is 36 ft. instead of 50 ft. and a vehicle is measured at 90 dB(A), the recorded reading will be as follows:

90 dB(A)	Uncorrected reading
<u>-3 dB(A)</u>	Correction factor
87 dB(A)	Corrected reading



2.2.5 Sound-reflecting Surfaces. A "sound-reflecting surface" is any object or landscape surface in the immediate vicinity of a measurement site which reflects sufficient sound to require the application of a correction factor to the sound level meter reading.

- a. The correction factors obtained from the nomogram (Figure 2-6) may be applied only when sound-reflecting surfaces are basically parallel to the lane of travel.
- b. A basically parallel surface may have irregularities or projections of not more than 2 ft. measured perpendicular to the lane of travel, with the distance to the microphone line or vehicle path measured from the closest point of the projection.

2.2.6 Surfaces Not Requiring Correction Factors. Correction factors shall not be applied to the sound level reading when the following surfaces are within the measuring area defined by paragraph 2.2.2:

- a. Any surface that measures less than 8 ft. in length in a direction parallel to the vehicle path, regardless of height (such as a telephone booth or tree trunk) or less than 1 foot in height, regardless of length (such as a curb or guard rail).
- b. Any vertical surface, regardless of size (such as a billboard), with the lower edge more than 15 ft. above the roadway.
- c. Any uniformly smooth slanting surface with less than a 45-degree slope above horizontal.
- d. Any slanting surface with a 45- to 90-degree slope above horizontal where the line at which the slope begins to exceed 45 degrees is more than 15 ft. above the roadway.
- e. Any trees, bushes, shrubs, hedges, grass or other vegetation.

2.2.7

Correction Factors for Sound-reflecting Surfaces:

Correction factors to be applied to sound level meter readings when there are sound-reflecting surfaces within 100 ft. of either the microphone or microphone point are determined as follows:

a. Reflecting Surfaces. Sites where there are sound-reflecting surfaces basically parallel to the vehicle path within the clear area of the standard site may be used by measuring the distances shown in Figure 2-5 and applying the correction factor obtained from the nomogram in Figure 2-6.

b. Smooth Embankments. The point of measurement from smooth embankments shall be the place on the embankment where the slope begins to exceed 45 degrees above horizontal. (See Figure 2-4) The point of measurement from irregular embankments shall be the place on the embankment where the irregularity begins. A smooth embankment is one with vegetation, concrete, asphalt, dirt or other relatively smooth cover.

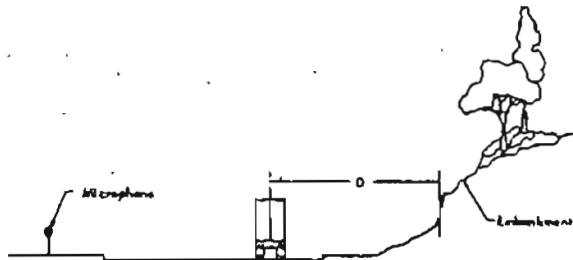


Fig. 2(b) Measurement of Distance to Embankment

- c. Taking Measurements. To determine the correction factor for sound-reflecting surfaces within the measuring site, measure the distances shown in Figure 2-5. Measurement "D" is the shortest distance between the sound-reflecting surface and the centerline of the lane of travel. Measurement "L" is the shortest distance between the sound-reflecting surface and a line parallel to the lane of travel that passes through the microphone (microphone line). (See Figure 2-5)

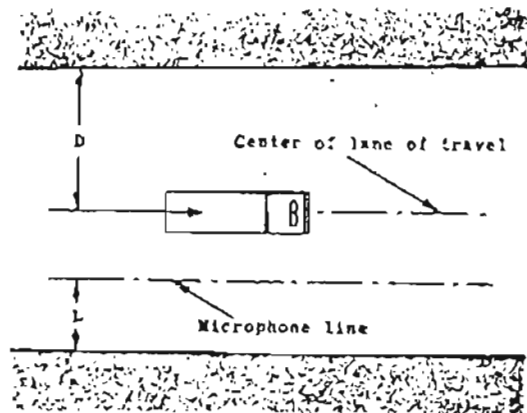
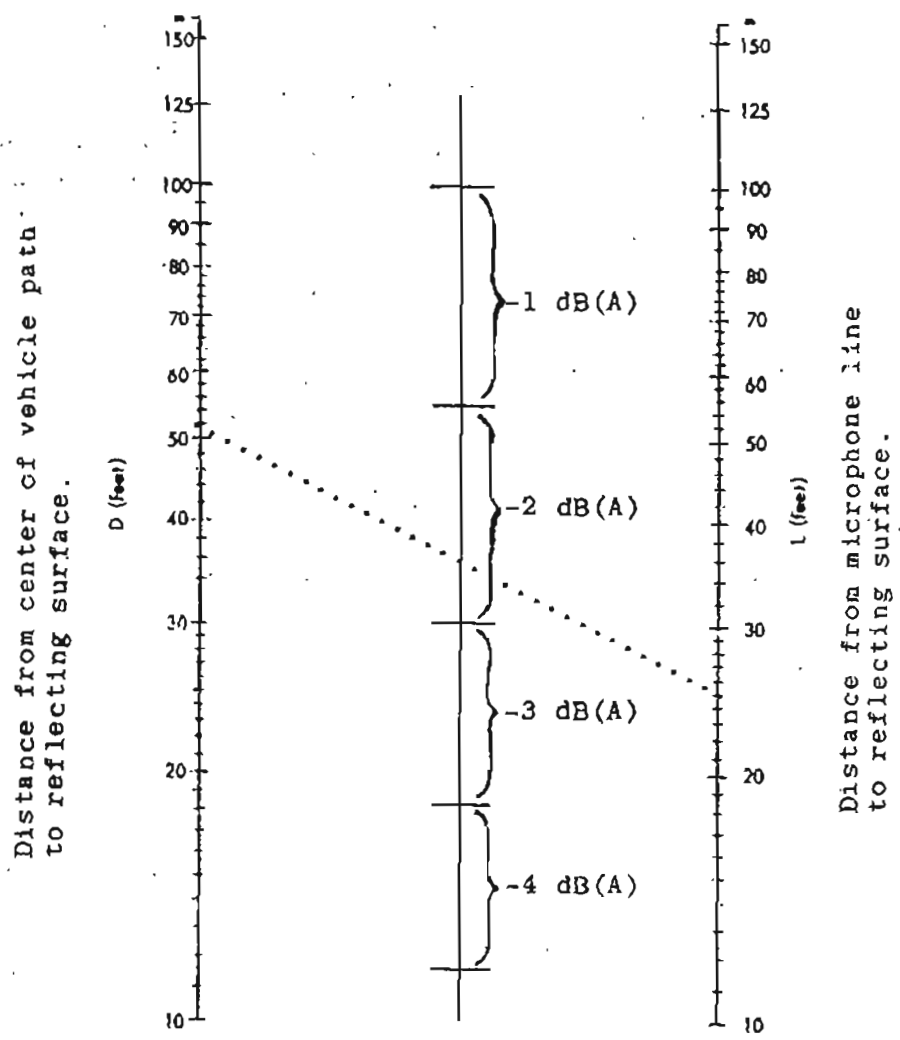


Fig. 2-5. Distances "D" and "L"

- d. Determining Correction Factor. Locate the points on the left and right scales of the nomogram (Figure 2-6) corresponding to the distances "D" and "L". Place a straight edge across the nomogram so that it connects the two points. The point where the straight edge intersects the center axis indicates the correction factor to be applied to the sound level meter reading.



On centerline read dB(A) correction to be subtracted from meter reading.

Fig. 2-6. Nomogram for Reflecting Surfaces

- e. Example. The dotted line in Figure 2-6 illustrates the use of the nomogram for a reflecting surface 52 ft. from the center of the lane of travel (distance "D") and one 25 ft. from the microphone line (distance "L"). These measurements plotted on the nomogram result in a correction factor of -2 dB(A). With the microphone at the standard measuring distance of 50 ft. and a vehicle measured at 90 dB(A), the corrected reading would be recorded as follows:

90 dB(A)	Uncorrected reading
-2 dB(A)	Correction from Figure 2-6
<hr/>	
88 dB(A)	Corrected reading

- 2.2.8 Combination of Reflecting Surfaces and Non-standard Measuring Distance. If the distance between the microphone and microphone point is 74 ft. instead of the standard distance of 50 ft. and the sound-reflecting surfaces are the same distances as described in the example given above, two corrections are necessary:

90 dB(A)	Uncorrected reading
-2 dB(A)	Correction for sound-reflecting surfaces
<hr/>	
88 dB(A)	
+2 dB(A)	Correction for measuring distance
<hr/>	
90 dB(A)	Corrected reading

- 2.2.9 Selection of Sites. Selection of sites shall be subject to the following restrictions:

- a. Roadways. Roadways selected for sound level measuring sites shall be paved with relatively smooth concrete or asphalt.
- b. Tunnels and Overpasses. Sound measurements shall not be made within 100 ft. of a tunnel or overpass through which the roadway passes.

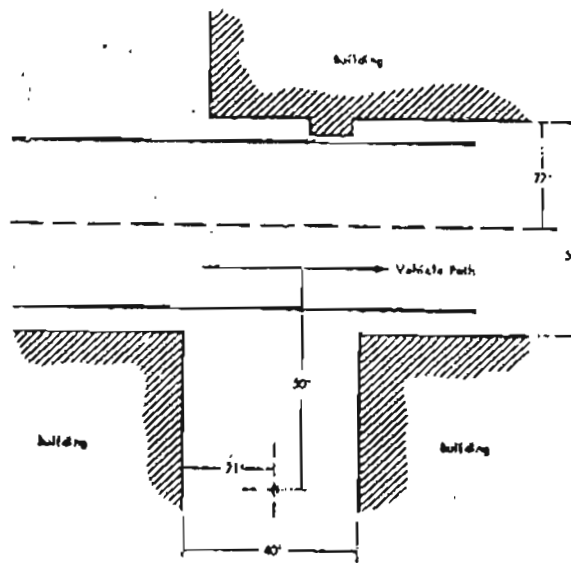


Fig. 2-7. Unacceptable Measuring Site

- d. Overhangs. The vehicle path and microphone shall not be within 50 ft. of overhangs on buildings which project more than 2 ft. from the wall of the building.
- e. Reflecting Surfaces Close to Microphone. Sound-reflecting surfaces, other than the ground, shall be no closer than 10 ft. from the microphone line.
- f. Reflecting Surfaces Close to Lane of Travel. Sound-reflecting surfaces shall be no closer than 10 ft. from the center of the lane of travel for a distance of 100 ft. parallel to the vehicle path on either side of the microphone point. (See Figure 2-8)
- g. Nonparallel Reflecting Surfaces. Large reflecting surfaces that are not basically parallel to the lane of travel shall be 100 ft. or more from the microphone or microphone point.

2.3 SOUND LEVEL MEASURING PRECAUTION.

- 2.3.1 Identification. It is most important that the noise recorded is actually from the vehicle being measured. Care must be taken to ensure that noise from another vehicle does not add to that from the one being measured.
- 2.3.2 Intensity. The sound level of the vehicle under scrutiny must rise at least 6 dB(A) before and fall at least 6 dB(A) after the maximum sound level occurs.
- 2.3.3 Recording. The sound level recorded shall be the highest level obtained as the vehicle passes by, disregarding unrelated peaks due to extraneous ambient noises.

2.4 EQUIPMENT SETUP AND USE.

- 2.4.1 Microphone Location. The distance from the center of the lane of travel (microphone point) to the Microphone can be determined after a suitable location has been established by adding one-half of the lane width to the distance measured from the outer edge of the traffic lane to the microphone. By measuring from the roadway edge, the danger of being struck by moving vehicles is decreased. On a roadway with 12-foot lanes, a measurement of 44 ft. from the microphone to the edge of the pavement will result in the microphone being located 50 ft. from the center of the lane of travel. If the lane is of a different width, the measurement shall be adjusted accordingly to obtain the correct distance.
- 2.4.2 Microphone Height. The microphone shall be placed on a tripod if an extension cable is used. If the cable is not used the sound level meter with the microphone attached may be handheld or placed on a tripod. The microphone shall be positioned at a height of  $4 \pm \frac{1}{2}$  ft. above the ground when the ground at the microphone location is at the same level as the roadway. If the ground at the microphone location slopes down from the roadway, the microphone shall be raised so as to be  $4 \pm \frac{1}{2}$  ft. above the level of the roadway. If the ground at



the microphone slopes up from the roadway, the microphone shall be placed  $4 \pm \frac{1}{2}$  ft. above the ground and shall not be more than 6 ft. above the level of the roadway. (See Figure 2-8)

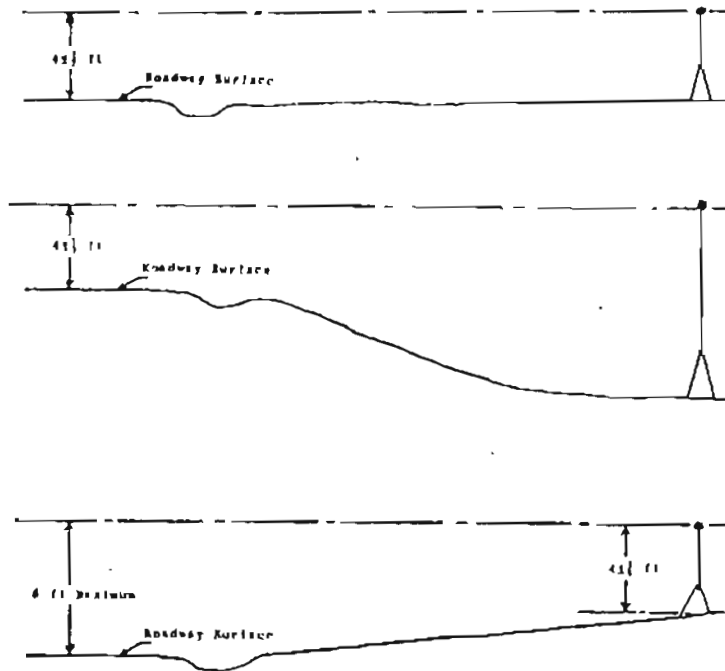
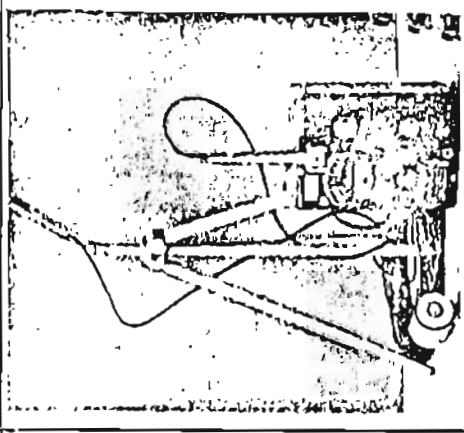
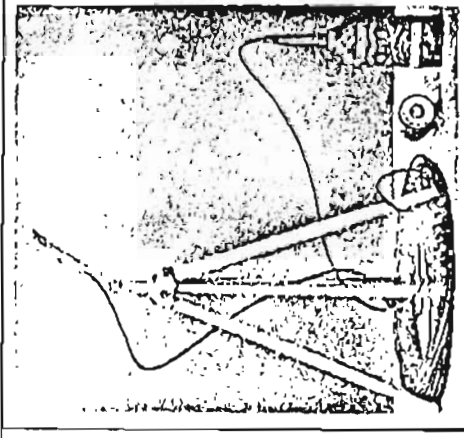
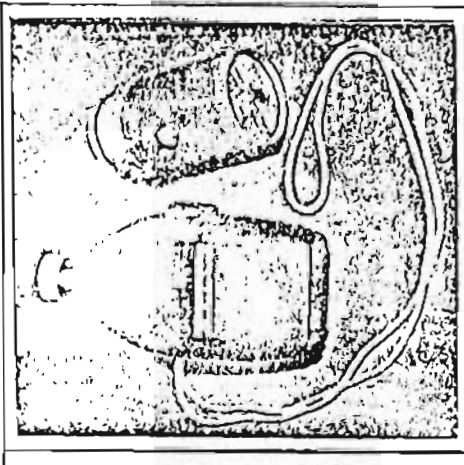


Fig. 2-8. Microphone Height

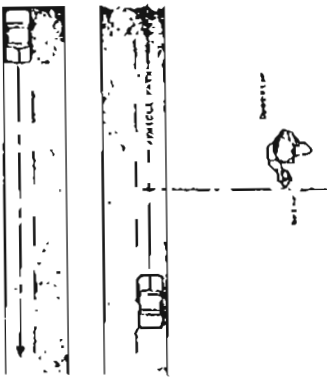
- 2.4.3 Windscreens. Windscreens made of open cell polyurethane foam furnished by the instrument manufacturer may be placed over the microphone after calibration and positioning. The windscreen reduces the effect of wind noise and protects the microphone diaphragm from dust or other airborne matter. The windscreen also reduces damage to the microphone in the event the tripod is pulled over or the microphone is dropped.
- 2.4.4 Sound Level Meter Setup and Use. Procedures for setup, calibration and use of three types of sound level meters used by the Department are contained in the following charts:

SOUND LEVEL METER SETUP AND USE

Equipment			
Meter	General Radio Type 1551C	General Radio Type 1565-9004	General Radio Type 1565B
Description	Sound level meter with 5-frequency calibrator, Type 1562-9000, and 100-foot extension cable.	Sound level meter with 5-frequency calibrator, Type 1562-9000, and 100-foot extension cable.	Sound level meter with single frequency calibrator, Type 1567, and without extension cable.
Setup	Turn sound level meter on by raising cable extension tube to "up" position. Connect extension cable between microphone and sound level meter. Attach microphone to tripod with microphone in vertical position. Allow approximately two minutes for meter warm up. Calibrate and operate only with the cable in the system.	Open sound level meter carrying case and remove sound level meter and microphone from carrying case. Connect extension cable between microphone and sound level meter. Attach microphone to the tripod with microphone in vertical position. Calibrate and operate only with the cable in the system.	Open carrying case and remove sound level meter and calibrator.

Meter	General Radio Type 1551C	General Radio Type 1565-9004	General Radio Type 1565B
Battery Check:	Turn "METER" "BATTERIES" knob to positions FL-1, FL-2 and PL, in that order. Observe meter needle deflection. If the needle falls to the left of the "B" in the "BAT" zone at any of the three positions, replace the batteries. First, turn instrument off; then, remove the two black screws on the back and separate the case. Replace the batteries and cover. Then repeat battery check.	Turn knob (on left) on "BAT". Needle should be within or to the right of the "BAT" zone. When needle falls to the left out of the "BAT" zone, replace the batteries. First, turn instrument off; then, remove the knurled sleeve below the cable connector and slide off the plastic cover and knurled sleeve. Replace the batteries and cover. Then repeat battery check.	Slide "ON-OFF" switch to "ON" position (red showing) and press "BAT CHECK" button. When the needle falls to the left out of the "BAT" zone, replace the batteries. First, turn meter off; then, with thumb and forefinger, grasp the knurled edges of the bottom cover, squeeze and remove cover. Replace the batteries and cover. Then repeat battery check.
a. Sound Level Meter	Remove calibrator from the carrying case and rotate the master control counterclockwise against the spring return and observe the small lamp behind the word "LIGHT" on the control. If the lamp does not come on, repeat a second time. If there still is no light, replace the batteries by removing the knurled knob on the side and sliding the shell off.	Remove calibrator from the case, and rotate the master control counterclockwise against the spring return and observe the small lamp behind the word "LIGHT" on the control. If the lamp does not come on, repeat a second time. If there still is no light, replace the batteries by removing the knurled knob on the side and sliding the shell off.	Turn instrument to "OK" with "ON-OFF" switch on back of calibrator. The "BATTERY" meter pointer must be within the green "OK" area. If the meter remains in the red "replace" area, replace the battery. To replace battery, turn the instrument off, remove knurled knob on the side and slide off the cover.
b. Calibrator	With the microphone on the tripod in a vertical position and the cable connecting the microphone and sound level meter, proceed as follows: a. Turn sound level meter on. (1) Set "METER" knob to "FAST" position. (2) Set "WEIGHTING" knob to "A" position. (3) Set decibel knob to read "90" in window.	With the microphone on the tripod in a vertical position and the cable connecting the microphone and sound level meter, proceed as follows: a. Turn sound level meter on. (1) Set sound level meter "WEIGHTING" knob (on left) to "AF" position. (2) Set sound level decibel knob (on right) to read "90" in window.	With the instrument either hand held or placed on a tripod with the microphone in a vertical position, proceed as follows: a. Turn sound level meter on. (1) Depress "A" switch (all other buttons are to be up). (2) Turn the attenuator knob on the right side of the sound level meter so "110" shows in the left window on the dial and "120" in the right window.
Instrument Calibration	With the microphone on the tripod in a vertical position and the cable connecting the microphone and sound level meter, proceed as follows: a. Turn sound level meter on. (1) Set "METER" knob to "FAST" position. (2) Set "WEIGHTING" knob to "A" position. (3) Set decibel knob to read "90" in window.	With the microphone on the tripod in a vertical position and the cable connecting the microphone and sound level meter, proceed as follows: a. Turn sound level meter on. (1) Set sound level meter "WEIGHTING" knob (on left) to "AF" position. (2) Set sound level decibel knob (on right) to read "90" in window.	With the instrument either hand held or placed on a tripod with the microphone in a vertical position, proceed as follows: a. Turn sound level meter on. (1) Depress "A" switch (all other buttons are to be up). (2) Turn the attenuator knob on the right side of the sound level meter so "110" shows in the left window on the dial and "120" in the right window.

Meter	General Radio Type 1551C	General Radio Type 1565-9004	General Radio Type 1565B
Instrument Calibration (Cont'd)	<p>b. Turn calibrator on.</p> <p>(1) Turn the master control on the calibrator counter-clockwise against the spring return (battery check), hold it for approximately one second, and turn the master control clockwise to 2,000 Hz position. If a clear tone is not audible at the open end of the instrument within a few seconds, repeat battery check. If instrument fails to operate, contact Passenger and Emergency Vehicle Section in Sacramento for repair instructions.</p> <p>(2) Place master control knob on calibrator to 500 Hz for calibration.</p> <p>(3) Place calibrator on microphone. Calibrator should rotate freely about microphone head. Sound level meter can be held near microphone.)</p> <p>c. With the instrument set as described above, the sound level meter needle should deflect to "0" (90 dB(A)). If not, adjust to "0" by using the calibrator button in center of the sound level meter. Observe sound level meter needle for approximately ten seconds to ensure that drift does not occur. If drift does occur, readjust to "0".</p>	<p>b. Turn calibrator on.</p> <p>(1) Turn master control on the calibrator counter-clockwise against the spring return (battery check), hold for approximately one second, and turn master control clockwise to 2,000 Hz position. If a clear tone is not audible at the open end of the instrument within a few seconds, repeat battery check. If instrument fails to operate, contact Passenger and Emergency Vehicle Section in Sacramento for repair instructions.</p> <p>(2) Place master control knob on calibrator to 500 Hz for calibration.</p> <p>(3) Place calibrator on microphone. Calibrator should rotate freely about microphone head. (Sound level meter can be held near microphone.)</p> <p>c. With the instrument set as described above, the sound level meter needle should deflect to "0" (90 dB(A)). If not, adjust to "0" by using the screw located between the two knobs. Observe sound level meter needle for approximately ten seconds to ensure that drift does not occur. If drift does occur, readjust to "0".</p>	<p>o. Turn calibrator on.</p> <p>(1) If a clear tone is not audible at the open end of the instrument within a few seconds, check the batteries. If the calibrator or the sound level meter fails to operate, contact Passenger and Emergency Vehicle Section in Sacramento for repair instructions.</p> <p>(2) Place calibrator on the microphone. The calibrator should rotate freely about the microphone.</p> <p>c. With the instrument set as described above, the sound level meter needle should deflect to "114". If not, adjust by using the small screw through the opening marked "CAL" located to the left of the white "A". Observe the sound level meter needle for approximately ten seconds to ensure that drift does not occur. If drift does occur, readjust to "114".</p>

Meter	General Radio Type 1551C	General Radio Type 1565-9004	General Radio Type 1565B
<p>Instrument Calibration (Cont'd)</p>	<p>d. After the instrument has been calibrated at 500 Hz, turn the master control knob on the calibrator to 2,000, 1,000, 500, 250, and 125 Hz and observe and compare each reading obtained to the calibration chart supplied with the instrument set. If the readings obtained vary more than <math>\pm 0.5</math> dB, rerun the battery check. If the batteries are all right, report the calibration. If the readings are still off, contact the Passenger and Emergency Vehicle Section in Sacramento for repair instructions.</p>	<p>d. After the instrument has been calibrated at 500 Hz, turn the master control knob on the calibrator to 2,000, 1,000, 500, 250, and 125 Hz and observe and compare each reading obtained to the calibration chart supplied with the instrument set. If the readings obtained vary more than <math>\pm 0.5</math> dB, rerun the battery check. If the batteries are all right, repeat the calibration. If the readings are still off, contact the Passenger and Emergency Vehicle Section in Sacramento for repair instructions.</p>	<p>d. After calibration, proceed as follows:</p> <ol style="list-style-type: none"> <li>(1) Remove calibrator from microphone, turn off and replace in carrying case.</li> <li>(2) Depress "A" button; all other buttons are to be up.</li> <li>(3) Set attenuator knob (on right side of instrument) to maximum anticipated noise in left window. With "90" in window, the instrument will now measure a range of sound from 85 to 100 dB(A).</li> </ol>
	<p>e. After calibration, proceed as follows:</p> <ol style="list-style-type: none"> <li>(1) Remove calibrator from microphone and turn off and replace in carrying case.</li> <li>(2) Set "METER" knob to "FAST" position.</li> <li>(3) Set "WEIGHTING" knob to "A" position.</li> <li>(4) Set attenuator knob to maximum anticipated noise in window, "90", etc. With "90" in window, the instrument will measure a range of sound from 84 to 100 dB(A).</li> <li>(5) Place the microphone on the tripod at a 70-degree angle to the horizontal plane (notch is provided on the tripod head) pointing in the direction of the microphone.</li> </ol>	<p>e. After calibration, proceed as follows:</p> <ol style="list-style-type: none"> <li>(1) Remove calibrator from microphone and turn off and replace in carrying case.</li> <li>(2) Set "WEIGHTING" knob (on left) to "AF" position.</li> <li>(3) Set the attenuator knob (on right) to maximum anticipated noise in window, "90", etc. With "90" in window, the instrument will now measure a range of sound from 80 to 100 dB(A).</li> <li>(4) Place the microphone on the tripod at a 70-degree angle to the horizontal plane (notch is provided on the tripod head) pointing in the direction microphone point.</li> </ol>	<p>e. Locate the sound level meter in front of the operator pointing in the direction from which traffic is coming.</p> 

0000 0064

Meter	General Radio Type 1551C	General Radio Type 1565-9004	General Radio Type 1565B
Instrument Calibration (Cont'd)	<p>f. Calibration checks shall be made before and after each period of use and at intervals not exceeding one-half hour when the instrument is in use longer than this time. Calibration will shift as the extension cable temperature changes. When a large change is anticipated, the first calibration should be checked in less than one-half hour.</p>	<p>f. Calibration checks shall be made before and after each period of use and at intervals not exceeding one-half hour when the instrument is in use longer than this time. Calibration will shift as the extension cable temperature changes. When a large change is anticipated, the first calibration should be checked in less than one-half hour.</p>	<p>f. Calibration checks shall be made before and after each period of use and at intervals not exceeding one-half hour when the instrument is in use longer than this time.</p>
CHP Form 94	<p>Review CHP Form 94, Instrument Setup Check-Off List, to assure that no calibration steps were omitted. This form is located in the carrying case of the sound level instrument and should remain with the instrument at all times. A new check-off list will be prepared by Engineering Section following instrument repair. CHP Form 94 is illustrated on Page 2-18.</p>	<p>Review CHP Form 94, Instrument Setup Check-Off List to assure that no calibration steps were omitted. This form is located in the carrying case of the sound level instrument and should remain with the instrument at all times. A new check-off list will be prepared by Engineering Section following instrument repair. CHP Form 94 is illustrated on Page 2-18.</p>	<p>Review CHP Form 94a, Instrument Setup Check-Off List, to assure that no calibration steps were omitted. This form is located in the carrying case of the sound level instrument and should remain with the instrument at all times. CHP Form 94a is illustrated on Page 2-18.</p>
Background Noise	<p>Measure and record the background noise level. The background noise level due to all sources other than the vehicle being measured, including wind effects, must be at least 10 dB(A) lower than the level of noise being measured; if not, move to a new location.</p>	<p>Measure and record the background noise level. The background noise level due to all sources other than the vehicle being measured, including wind effects, must be at least 10 dB(A) lower than the level of the noise being measured; if not, move to a new location.</p>	<p>Measure and record the background noise level. The background noise level due to all sources other than the vehicle being measured, including wind effects, must be at least 10 dB(A) lower than the level of the noise being measured; if not, move to a new location.</p>



Meter	General Radio Type 1531C	General Radio Type 1565-9004	General Radio Type 1565B
Sound Level Measurement	<p>a. With the sound level meter turned on, the microphone facing the highway and elevated 70 degrees, and with the meter in the window, the meter will measure a range of sound from 84 to 100 dB(A). Set the meter to the appropriate number to measure the anticipated sound level.</p> <p>b. The microphone on this instrument is designed to measure sound waves striking it at an angle of 70 to 90 degrees from the direction the microphone is pointed. This grazing incidence is attained by elevating the open end of the microphone to 70 degrees.</p>	<p>a. With the sound level meter turned on, the microphone facing the highway and elevated 70 degrees, and with the meter in the window, the meter will measure a range of sound from 80 to 100 dB(A). Set the meter to the appropriate number to measure the anticipated sound level.</p> <p>b. The microphone on this instrument is designed to measure sound waves striking it at an angle of 70 to 90 degrees from the direction the microphone is pointed. This grazing incidence is attained by elevating the open end of the microphone to 70 degrees.</p>	<p>a. With the sound level meter turned on ("A" button depressed and all other buttons up), stand with instrument held or placed on a tripod in front of the operator and pointing in the direction from which traffic is coming. With "90" in the left window the meter will measure a range of sound from 85 to 100 dB(A). Set the meter to the appropriate number to measure the anticipated sound level.</p> <p>b. The microphone on this instrument is designed to measure sound waves striking it at an angle of 70 to 90 degrees from the direction the microphone is pointed. This grazing incidence is attained by pointing the microphone in the direction from which traffic is coming.</p>
Sound Level Tolerance	<p>Allowances are necessary due to unavoidable variations in measuring sites, test equipment, temperature, and wind gradients. Vehicles specified in Sections 23130 and 23130.5 VC are not considered in violation unless they exceed the statutory limit by 2 dB(A) or more.</p>	<p>Allowances are necessary due to unavoidable variations in measuring sites, test equipment, temperature, and wind gradients. Vehicles specified in Section 23130 and 23130.5 VC are not considered in violation unless they exceed the statutory limit by 2 dB(A) or more.</p>	<p>Allowances are necessary due to unavoidable variations in measuring sites, test equipment, temperature, and wind gradients. Vehicles specified in Sections 23130 and 23130.5 VC are not considered in violation unless they exceed the statutory limit by 2 dB(A) or more.</p>

0000 0011



DEPT. OF CALIFORNIA HIGHWAY PATROL	
INSTRUMENT SETUP CHECK-OFF LIST	
SLM TYPE 1561-9001	
CALIBRATOR TYPE 1562-9000	
1. MICROPHONE POSITION	
30 FEET OR APPLY CORRECTION	
4 FEET HIGH	
2 FT. ABOVE ROADWAY	
2 FT. ABOVE LOCATION	
30° ANGLE FROM HORIZONTAL	
2. BATTERY CHECK	
SLM IN BAY ZONE	
CALIBRATOR LIGHT ON	
3. CALIBRATION ADJUSTMENT	
A FAST	
90 dB(A)	
500 Hz	
4. CALIBRATOR CHECK	
125 Hz	dB(A)
750 Hz	dB(A)
500 Hz	dB(A)
1000 Hz	dB(A)
2000 Hz	dB(A)
5. AREA	
DETERMINE IF CORRECTION IS NECESSARY	
SURFACE DRY	
BACKGROUND NOISE (dB(A))	
CHP FORM 54 (REV. 4-73)	

DEPT. OF CALIFORNIA HIGHWAY PATROL	
INSTRUMENT SETUP CHECK-OFF LIST	
SLM TYPE 1565B	
CALIBRATOR TYPE 1547	
1. MICROPHONE POSITION	
50 FEET OR APPLY CORRECTION	
4 FEET HIGH	
1 FT. ABOVE ROADWAY	
1 FT. ABOVE LOCATION	
WITH WALKER IN FRONT OF VOL. POINTER IN DIRECTION OF ONCOMING TRAFFIC AND PARALLEL TO ROADWAY	
2. BATTERY CHECK	
SLM IN BAY ZONE	
CALIBRATOR IN GREEN "OK" AREA	
3. CALIBRATION ADJUSTMENT	
A FAST	
110 IN LEFT WINDOW	
114 dB(A)	
4. AREA	
DETERMINE IF CORRECTION IS NECESSARY	
SURFACE DRY	
BACKGROUND NOISE (dB(A))	
CHP FORM 54 (REV. 4-73)	

Fig. 2-9. Instrument Setup and Check-Off List Forms

## CHAPTER 3

### NEW VEHICLE SOUND LEVEL MEASUREMENT

3.1 SCOPE. This Chapter establishes procedures for setting up and calibrating sound measuring equipment and conducting tests to determine vehicle sound level output.

#### 3.2 TEST AREA AND PERSONNEL

3.2.1 Test Area. The test area shall be a flat open space free of large upright sound-reflecting surfaces, such as parked vehicles, signboards, buildings, or hillsides, located within 100 ft. radius of the microphone and of the following unmarked points on the vehicle path as shown in Figure 3-1.

- a. The microphone point, which is the location on the vehicle path closest to the microphone.
- b. A point 50 ft. before the microphone point.
- c. A point 50 ft. beyond the microphone point.

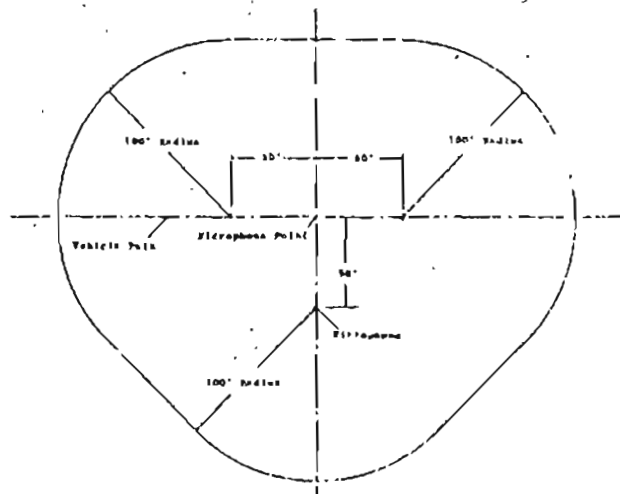


Fig. 3-1. Test Area Layout

- 3.2.2 Ground Condition. The surface of the ground within the measuring site for all vehicles except snowmobiles shall be smooth asphalt or concrete free of snow, soil or ashes in at least the triangular area formed by the microphone location and points on the vehicle path 50 ft. before and beyond the microphone point. The ground surface in the above area for snowmobiles shall be live vegetation (grass) no more than 4 in. in height.
- 3.2.3 Roadway Surface. The surface of the vehicle path shall be dry, smooth asphalt or concrete pavement free of extraneous material, except that the pathway for snowmobiles shall be covered with live vegetation (grass) no more than 4 in. in height.
- 3.2.4 Wind. Do not conduct sound measurements when wind velocity at the test area exceeds 12 miles per hour.
- 3.2.5 Personnel Location. Exercise care to prevent interference with sound level measurements caused by personnel in the measuring area.
- a. Bystander Location. Bystanders shall remain at least 50 ft. from the microphone and the vehicle being measured during sound level measurements.
- b. Technician Location. The technician making direct readings from the B & K 2203 sound level meter with microphone attached shall stand with the instrument between himself and the vehicle path with his body at least 20 in. from the instrument (when an extension microphone system is not used). Occupation of this location is permitted only while making comparisons between the readings of the sound level meter and recorder during the pretest vehicle warmup or in situations where the complete test is to be run without the use of the graphic level recorder.

### 3.3 EQUIPMENT SETUP AND PRECAUTIONS

- 3.3.1 Microphone Location. Attach the microphone or sound level meter to the tripod, extending the tripod legs so that the microphone, when aimed at the microphone

point, will be at a height of  $4 \pm \frac{1}{2}$  ft. above the plane of the roadway surface. Position the tripod so the microphone is at a distance of  $50 \pm 1$  ft. from the center of the lane of travel. Connect extension cable between instruments. Secure the cable to the foot of the tripod leg nearest the recorder location. This will help prevent the tripod from being pulled over by an accidental tug on the cable.

3.3.2 Power Supply. Position the vehicle providing instrument power supply approximately 100 ft. away from the microphone and test vehicle path. Connect inverter to power supply vehicle battery and operate the engine at fast idle.

3.3.3 Recorder. Set up the graphic level recorder in a convenient location near the power supply. Connect extension cable between sound level meter or microphone preamplifier and recorder.

3.3.4 Weather Measurement. Set up the anemometer on its stand near the power supply vehicle, place temperature and humidity gauges on the stand with the anemometer.

3.3.5 Data Recording. After all measuring equipment has been set up and before commencing the test series, record the following information:

- a. Record all required vehicle data, type of test equipment, names of individuals conducting the test, and weather information on the New Vehicle Test Form 061-4 (see page 3-26).
- b. Record all instrument settings, date, time, test run and operator's name on graphic level recording chart paper.

3.3.6 Precautions. The following precautions shall be observed before, during, and after each test series:

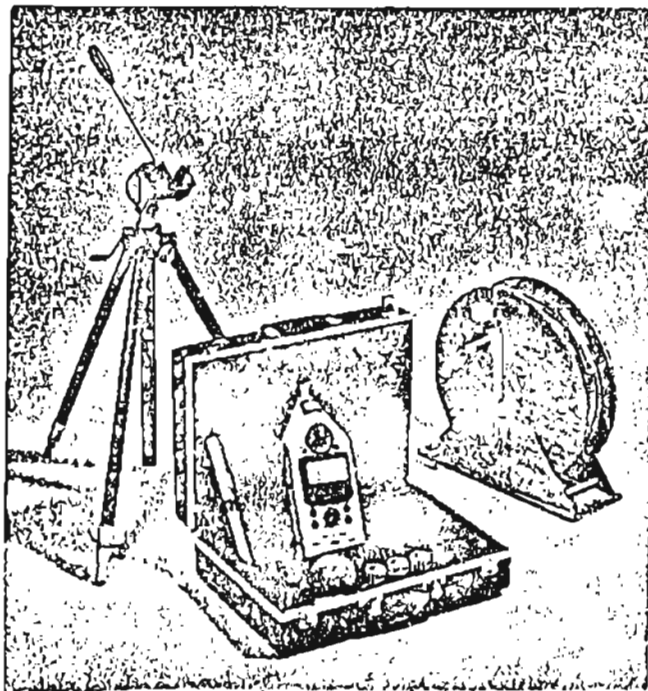
- a. Ensure that all knobs and switches on the equipment are turned to the proper function.
- b. Ensure that the graphic level recorder is recording the same sound level the sound level meter is indicating.

- c. The sound coming to the recorder should be monitored by the technician through the use of earphone to assure that the values recorded are the desired sounds and not from internal equipment noise.
- d. After each test series and before removing test equipment, or before starting a new test series, review the data to insure that all required information on the vehicle and all instrument settings have been recorded properly and the data is complete.

### 3.4 SOUND MEASURING EQUIPMENT.

The following sections apply to different types of sound measuring equipment. Refer to the specific type of equipment to be used and proceed with the equipment setup.

#### 3.4.1 Sound Level Meter, Bruel & Kjaer Type 2203.



a. Instrument Setup. Remove sound level meter from carrying case and install on tripod. Turn the sound level meter on by pulling center black knob to "up" position. Allow approximately two minutes for instrument warmup. If the pilot lamp marked "Amplifier On" does not flash, contact the instrument manufacturer's repair facility.

b. Battery Check:

(1) Sound Level Meter. Set knob with white dot to position marked "Batt". If the needle does not deflect to red battery range on the meter scale, replace the batteries.

(2) Calibrator. Remove pistonphone calibrator from carrying case. Set switch to "check" position and listen at the open end of the calibrator. Change the position of the switch from "check" to "measure". If there is no definite tone change, the batteries shall be replaced.

c. Calibration. The following calibration procedure shall be performed before and after each test series:

(1) Set sound level meter as follows:

(a) Point microphone up

(b) Center black knob to "Lin Fast"

(c) Rotate the black "db Range" selector until 120 appears opposite the black dot

(d) Rotate the transparent "db Range" selector until 120 appears within the red circle.

(2) Moisten seal in pistonphone open end and place on microphone.

(3) Turn pistonphone switch to "Measure".

(4) Observe needle on sound level meter decibel scale. It should deflect to "4". If needle



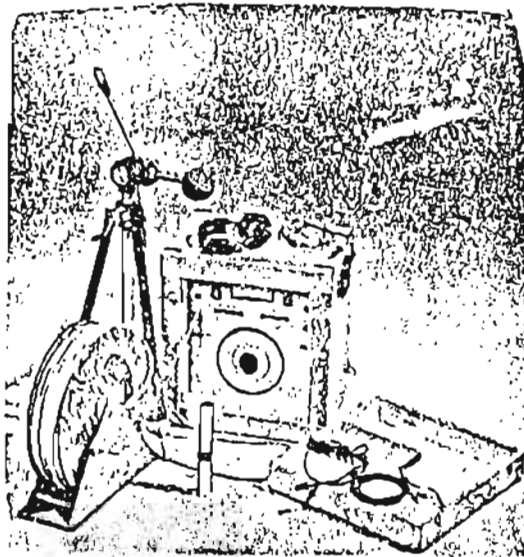
does not deflect to "4", turn the sensitivity adjustment screw marked "ADJ" with a screwdriver until it does.

d. After Calibration: After calibration, proceed as follows:

- (1) Remove pistonphone from microphone. Move switch to "off" position. Return to case.
- (2) Set center black knob on sound level meter to "A, Fast" position.
- (3) Place sponge windscreen on microphone to protect the microphone from possible damage.
- (4) Rotate "db Range" selectors to position the maximum anticipated sound level within red circle opposite black dot. With 90 in the red circle, the dial will measure a range of noise from 80 to 100 dB(A).
- (5) Place microphone in a horizontal position aimed at the microphone point on the vehicle path.
- (6) Sound measurements may now be resumed.

3.4.2

Sound Level Meter Frequency Analyzer Bruel and Kjaer Type 2113.





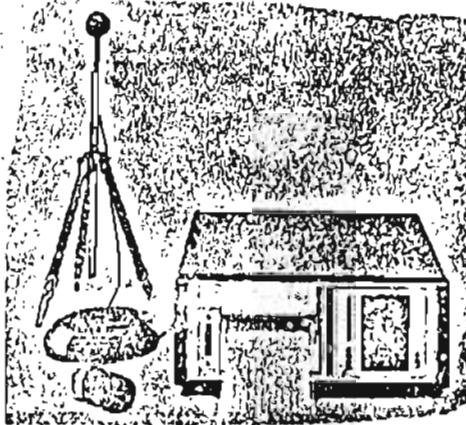
- a. Meter Setup. Open front and back of carrying case and set instrument where it will be used and proceed as follows:
- (1) String out extension cable from reel, being careful not to damage cable ends.
  - (2) Connect male end of cable to preamp input connector on left side of instrument.
  - (3) Remove preamplifier and microphone from instrument carrying case back and connect to extension cable.
  - (4) Place microphone in holder on tripod facing up and place wind screen over microphone.
  - (5) Secure extension cable to the foot of tripod leg nearest the meter. (This will help prevent the tripod from being pulled over.)
  - (6) Connect power supply to back of instrument and power source. Cable with cigarette lighter adaptor is for 12V DC field use and is to be plugged into vehicle lighter socket. Cable for 110 AC power is to be used in the laboratory only.
  - (7) Set instrument controls as follows:
    - (a) Gain control to "Cal"
    - (b) Input selection attenuator to "3V"
    - (c) Output selection attenuator to "X1"
    - (d) Master function to "RMS Fast"
    - (e) Input selector to "Prcamp"
    - (f) Ref. Insert Volt. Cal. buttons are all to be out
    - (g) Filters depress "Int., 22.4Hz, and 22.4kHz"
    - (h) Frequency selector red pointer to "LIN"

- (i) Scanning button to "Manual" (button out)
  - (j) Band width as desired
  - (k) Range switch to "I"
  - (l) Power switch to "On" and allow one minute for instrument to warm up.
- b. Instrument Calibration. Remove the pistonphone calibrator from the case, moisten the "O" ring in the open end of the calibrator and slide calibrator over microphone after removing wind-screen.
- (1) Turn calibrator switch to "Measure".
  - (2) The meter dial should read 124 dB; if it does not, adjust the sensitivity potentiometer beside the preamp input socket.
  - (3) Remove calibrator, turn off, and return to case. Replace windscreen on microphone and aim the microphone at the microphone point on the vehicle path.
- c. Measurement of Sound. After calibration, proceed as follows when making sound level measurements:
- (1) Position tripod with microphone as directed in paragraph 3.3.1.
  - (2) Place microphone in a horizontal position aimed at the microphone point.
  - (3) Set controls as follows:
    - (a) Input to "Preamp"
    - (b) Filter to "Int., 22.4Hz, and 22.4kHz"
    - (c) Power to "On"
    - (d) Range to "I"
    - (e) Band width to "1/3 Oct" or "1/1 Oct"
    - (f) Scanning to "Manual"
    - (g) Frequency selector red pointer to "A".

- (4) Keep the output selection attenuator in the "x1" position as much as possible. If the overload lamps flashes, turn the input selection attenuator up to the next step.
- (5) When the instrument is used with a graphic level recorder connect extension cable to the sockets on the sound level meter marked "Recorder" and to input fittings on recorder. Set recorder output switch to "DC". Calibrate sound level meter and graphic level recorder simultaneously.

### 3.4.3

#### Sound Level Meter Graphic Level Recorder General Radio Type 1523/1523-PIA.



- a. System Setup. Set up system as follows:
  - (1) Remove microphone from storage case and install on the remote preamplifier.
  - (2) Set switches on remote preamplifier as follows:
    - (a) GAIN to "X10"
    - (b) 200V to "Off"
  - (3) Place windscreen on microphone.

- (4) Install remote preamplifier and microphone on tripod positioned near where the recorder will be set up.
  - (5) Connect extension cable between remote preamplifier and "SIGNAL INPUT" connector located at the rear of the recorder.
- b. Recorder Setup. Connect recorder to inverter by cable extension. Set up recorder as follows:
- (1) Depress the PLA preamplifier right side unit to disengage it from the case (this unit shall hereafter be referred to as the PLA plug-in). Slide the unit out and set the following switches:
    - (a) "WEIGHTING" switch on the right side to "A".
    - (b) Internal slide switches:
      - 1 "LINE FREQ" to "60 Hz"
      - 2 "INPUT" to "REAR"
      - 3 "INPUT" to "BUFFERED"
  - (2) Replace PLA plug-in in the case and set knobs and switches on the front panel as follows:
    - (a) "CHART SPEED" left knob to "10", right knob to "SEC per in"
    - (b) "AVERAGE TIME seconds" knob to "0.05" (This setting corresponds to the sound level meter fast response)
    - (c) "RESET MODE" switch to "NEW CHART"
    - (d) "SENSITIVITY dB" knob to "30"
    - (e) Depress the following pushbuttons:
      - 1 "RECORD"
      - 2 "STOP"
      - 3 "PEN UP"
    - (f) All other pushbuttons shall be out.

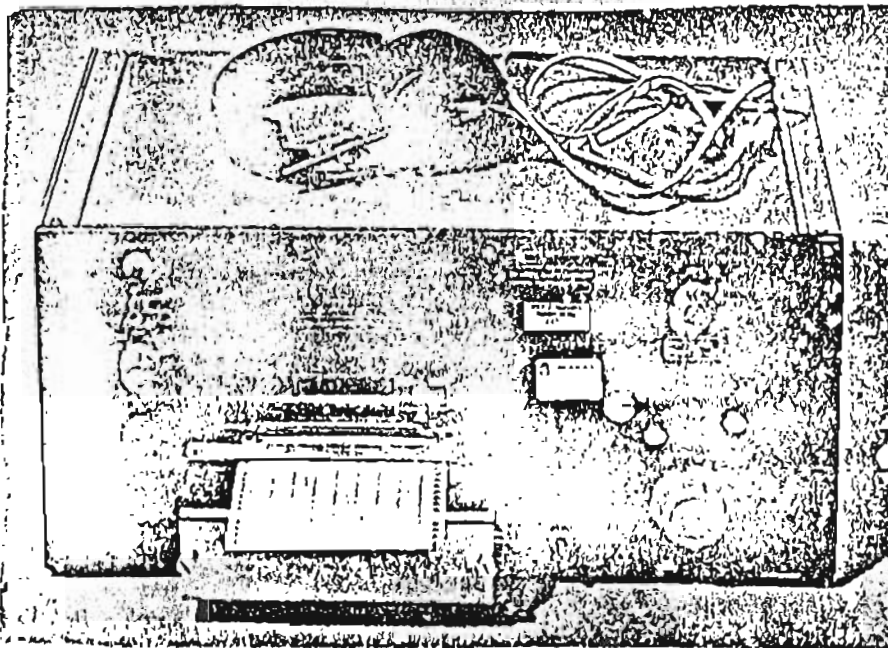
- (3) Depress the recorder, left unit, to disengage it from the case, and partially slide it out.
    - (a) Install paper.
    - (b) Set "PAPER TAKE UP" switch, located just forward of paper spool, to "OFF".
  - (4) Press recorder back into case.
    - (a) Install pen in pen holder.
    - (b) Turn recorder on by depressing "POWER" pushbutton on front of PIA plug-in.
- c. Calibration. The following calibration procedure shall be performed before and after each test:
- (1) Remove calibrator from carrying case. Turn on and verify that "BATTERY" meter pointer is within the green "OK" area. The 1-kHz tone should be audible from the open end of the device.
  - (2) Snap microphone adaptor into calibrator cavity, remove windscreen, and place the calibrator over the microphone.
  - (3) Depress "PEN DOWN" pushbutton.
  - (4) Depress "FORWARD" pushbutton.
  - (5) Adjust "SENSITIVITY CAL" knob on front of PIA plug-in until the pen is drawing a line on the 7th line from the left of the chart which represents 114 dB(A). On the chart the far left line represents 120 dB(A) and the far right line represents 70 dB(A).
  - (6) Remove calibrator from microphone, turn off calibrator, and replace in case.
  - (7) Place windscreen on microphone.
  - (8) Depress "STOP" pushbutton on PIA Plug-in.
  - (9) The equipment is now set up to measure sound levels from 70 to 120 dB(A).



- d. Measurement of Sound. After calibration, proceed as follows:
- (1) Position tripod with microphone in proper location.
  - (2) Point microphone at a 70-degree elevation from the horizontal plane facing the vehicle path.
  - (3) Depress "PEN AUTO" pushbutton.
  - (4) Depress "FORWARD" pushbutton when ready to record.
  - (5) Chart speed may be changed as need for more compact or expanded data arises.
- e. Recording. Sound measurement recordings may be made by depressing "FORWARD" pushbutton. The recorder is calibrated to record 70 dB(A) at the right line of the chart and 120 dB(A) at the left line of the chart.

3.4.4

Graphic Level Recorder, General Radio Type 1521A.





- a. Recorder Setup. Connect recorder to inverter by cable extension. Set controls as follows:
- (1) "INPUT ATTENUATION" to "40"
  - (2) "WRITING SPEED" to "10"
  - (3) "CHART DRIVE" to "FWD"
  - (4) Left gear lever to "30"
  - (5) Right gear lever to "N"
  - (6) Power switch to "POWER"
  - (7) Connect extension cable between sound level meter and recorder "INPUT"
  - (8) Remove cap from special felt pen
  - (9) Switch right gear to "X1" and calibrate.
- b. Instrument Calibration. With the B & K Type 2203 sound level meter being calibrated and reading 124, the recorder pen should be marking on the sixth line from the left on the chart. If not, adjust recorder with "CAL" button.
- c. Measurement of Sound. After calibration, proceed as follows:
- (1) Switch the right gear to "N".
  - (2) Proceed with sound level meter setup.
  - (3) Set sound level meter to indicate the maximum anticipated sound level. With the sound level meter set to 90, the instrument set will record a range of sound from 70 to 110 dB.
- d. Chart Centerline. The center line of the chart corresponds with the decibel number shown in the window of the B & K Type 2203 sound level meter when the recorder input attenuator selector is set at 40. This point can be shifted from the center to the left or right in steps of 10 by shifting the attenuator knob on the recorder.

- e. Chart Speed. Record chart speed on each chart at the beginning of the measurement and at each change in recorder speed. Chart speed is determined by the following gear selections:

<u>Left Gear</u>	<u>Right Gear</u>	<u>Inches per Minute</u>
10	X1	2.5
30	X1	7.5
10	X10	25.0
30	X10	75.0

3.5 NEW VEHICLE TEST PROCEDURE

3.5.1 Vehicle Sound Level. The sound levels for new motor vehicles shall be determined by tests performed according to procedures established for each particular class of vehicle.

3.5.2 Definitions. For the purpose of these procedures, the following terms have the meanings indicated:

- a. First Gear. "First gear" means the highest numerical gear ratio of the transmission, commonly referred to as low gear.
- b. Maximum RPM. "Maximum rpm" means the maximum governed engine speed, or if uncontrolled, the rpm at maximum engine horsepower as determined by the engine manufacturer in accordance with the procedures in SAE J245, April 1971.
- c. Microphone Point. "Microphone point" means the unmarked location on the center of the lane of travel that is closest to the microphone.
- d. Vehicle Reference Point. "Vehicle reference point" means the location on the vehicle used to determine when the vehicle is at any of the points on the vehicle path. The primary vehicle reference point is the front of the vehicle. For vehicles with a gross vehicle rating of 6,000 lbs. or more where the distance from the front of the vehicle to the exhaust outlet exceeds 16 ft., the secondary vehicle reference point is the exhaust outlet.

3.5.3 Operation. New motor vehicles shall be tested both with and without auxiliary equipment that may be in use while the vehicle is in operation on the highway. Auxiliary equipment includes but is not limited to cement mixers, refrigeration units, air conditioners, and garbage compactors. The following general procedures shall apply to all classes of vehicles:

- a. Preliminary Runs. Sufficient preliminary runs shall be made to enable the test driver to become familiar with the operation of the vehicle and to stabilize engine operating conditions.

- b. Test Runs. At least four test runs shall be made for each side of the vehicle. When the exhaust outlet is more than 16 ft. from the front of the vehicle, at least two runs shall be made for each side of the vehicle using both the primary and secondary reference points. At least two additional runs shall be made from the reference point that gives the highest readings.
- c. Reported Noise Level. The reported sound level for each side of the vehicle shall be the average of the two highest readings on that side which are within 2 dB(A) of each other. The sound level reported for the vehicle shall be the sound level of the loudest side.
- d. Visual Readings. When sound level instruments have been turned on and calibrated, the graphic level recorder shall be put in operation. Visual readings shall be taken from the sound level meter during preliminary test runs and recorded. The readings from the sound level meter shall be compared with those of the recorder and there shall be no more than  $\pm 0.5$  dB(A) variation between the readings. When the variation is greater, the equipment shall be checked and recalibrated. If the variation still exists, the test shall be conducted using only direct readings from the sound level meter. This procedure does not apply to the General Radio Type 1523-PLA sound measuring set because the recorder is the meter.

3.5.4 Light Trucks, Truck Tractors, Buses and Passenger Cars. Trucks, truck tractors and buses with a manufacturer's gross vehicle weight rating of less than 6,000 lbs., and passenger cars shall be tested as follows:

- a. Vehicle Path. The test area shall include a vehicle path of sufficient length for safe acceleration, deceleration, and stopping of the vehicle.
- b. Test Area Layout. The following points and zones shown in Figure 3-2, where only one directional approach is illustrated for purposes of clarity, shall be established on the vehicle path so that measurements can be made on both sides of the vehicle:

- (1) Microphone point
- (2) Acceleration point - a location 25 ft. before the microphone point
- (3) End point - a location 100 ft. beyond the microphone point
- (4) End zone - the last 75-ft. distance between the microphone point and the end zone.

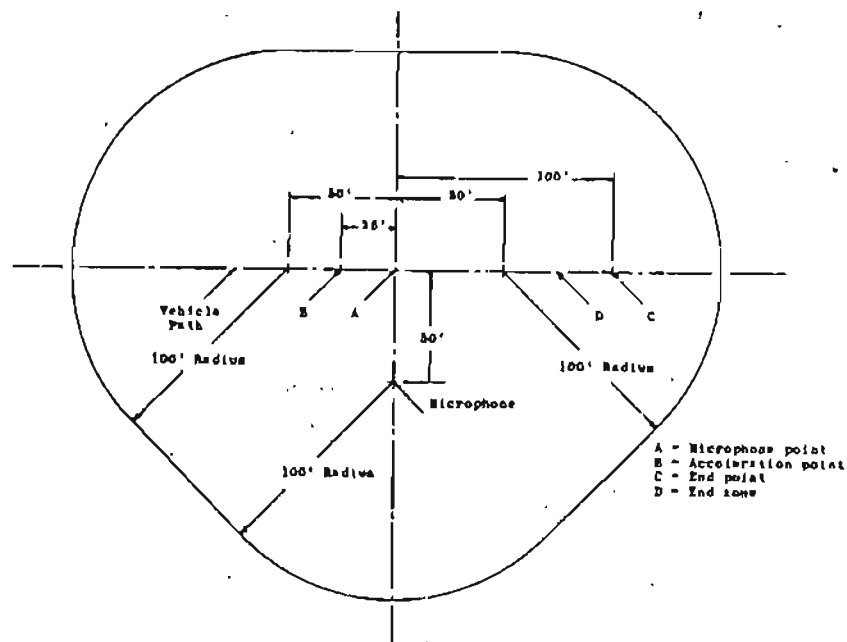


Fig. 3-2. Test Area Layout  
for Light Trucks, Buses, and Passenger Cars

c. Test Procedures. Vehicles shall be tested according to the following procedures:

- (1) Gear Selection. Motor vehicles equipped with three-speed manual transmissions and with automatic transmissions shall be operated in the first gear. Vehicles

equipped with manual transmissions of four or more speeds shall be operated in first gear and in second gear. Vehicles which reach maximum rpm at less than 30 mph or before reaching the end zone shall be operated in the next higher gear. Auxiliary step-up ratios (overdrive) shall not be engaged on vehicles so equipped.

- (2) Acceleration. The vehicle shall proceed along the vehicle path at a constant speed of 30 mph in the selected gear for at least 50 ft. before reaching the acceleration point. When the vehicle reference point reaches the acceleration point, the throttle shall be rapidly and fully opened. The throttle shall be held open until the vehicle reference point reaches the end point or until maximum rpm is reached within the end zone. At maximum rpm, the throttle shall be closed sufficiently to keep the engine just under maximum rpm until the end point, at which time the throttle shall be closed.
- (3) Deceleration. Tests during deceleration shall be conducted when deceleration noise appears excessive. The vehicle shall proceed along the vehicle path at maximum rpm in the same gear selected for the tests during acceleration. When the reference point on the vehicle reaches the acceleration point, the throttle shall be rapidly closed and the vehicle allowed to decelerate to less than 1/2 of maximum rpm.
- (4) Engine Temperature. The engine temperature shall be within normal operating range throughout each test run. The engine shall be idled in neutral for at least one minute between runs.

3.5.5 Heavy Trucks, Truck Tractors, and Buses. Vehicles with a manufacturer's gross vehicle weight rating of 6,000 lbs. or more shall be tested as follows:

- a. Vehicle Path. The test area shall include a vehicle path of sufficient length for safe



acceleration, deceleration, and stopping of the vehicle.

b. Test Area Layout. The following points and zones shown in Figure 3-3, where only one directional approach is illustrated for purposes of clarity, shall be established on the vehicle path so that measurements can be made on both sides of the vehicle:

- (1) Microphone point
- (2) Acceleration point - a location 50 ft. before the microphone point
- (3) End point - a location 50 ft. beyond the microphone point
- (4) End zone - the last 40-ft. distance between the microphone point and the end point.

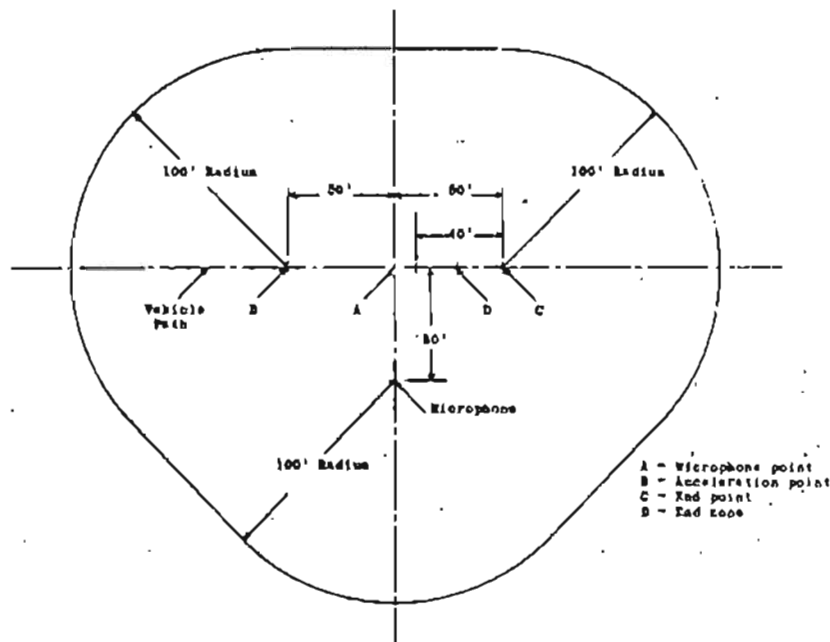


Fig. 3-3. Test Area Layout  
for Heavy Trucks and Buses

c. Test Procedures. Vehicles shall be tested according to the following procedures:

- (1) Gear Selection. A gear shall be selected which will result in the vehicle beginning at an approach rpm of no more than  $\frac{2}{3}$  maximum rpm at the acceleration point and reaching maximum rpm within the end zone without exceeding 35 mph.
  - (a) When maximum rpm is attained before reaching the end zone, the next higher gear shall be selected, up to the gear where maximum rpm produces over 35 mph.
  - (b) When maximum rpm still occurs before reaching the end zone, the approach rpm shall be decreased in 100 rpm increments until maximum rpm is attained within the end zone.
  - (c) When maximum rpm is not attained until beyond the end zone, the next lower gear shall be selected until maximum rpm is attained within the end zone.
  - (d) When the lowest gear still results in reaching maximum rpm beyond the end zone, the approach rpm shall be increased in 100 rpm increments above  $\frac{2}{3}$  maximum rpm until the maximum rpm is reached within the end zone.
- (2) Acceleration. The vehicle shall proceed along the vehicle path maintaining the approach engine rpm in the selected gear for at least 50 ft. before reaching the acceleration point. When the reference point on the vehicle reaches the acceleration point, the throttle shall be rapidly and fully opened and held open until maximum rpm is attained within the end zone, at which point the throttle shall be closed.

- (3) Deceleration. Tests during deceleration shall be conducted when deceleration noise appears excessive. The vehicle shall proceed along the vehicle path at maximum rpm in the same gear selected for the tests during acceleration. When the reference point on the vehicle reaches the microphone point, the throttle shall be rapidly closed and the vehicle allowed to decelerate to less than 1/2 maximum rpm. Vehicles equipped with exhaust brakes shall also be tested with the brake full on immediately following closing of the throttle.

3.5.6 Motorcycles. Motorcycles shall be tested as follows:

- a. Vehicle Path. The test area shall include a vehicle path of sufficient length for safe acceleration, deceleration, and stopping of the vehicle.
- b. Test Area Layout. The following points and zones shown in Figure 3-4, where only one directional approach is illustrated for purposes of clarity, shall be established on the vehicle path so that measurements can be made on both sides of the vehicle:
- (1) Microphone point
  - (2) Acceleration point - a location 25 ft. before the microphone point
  - (3) End point - a location 100 ft. beyond the microphone point
  - (4) End zone - the last 75-ft. distance between the microphone point and the end point.

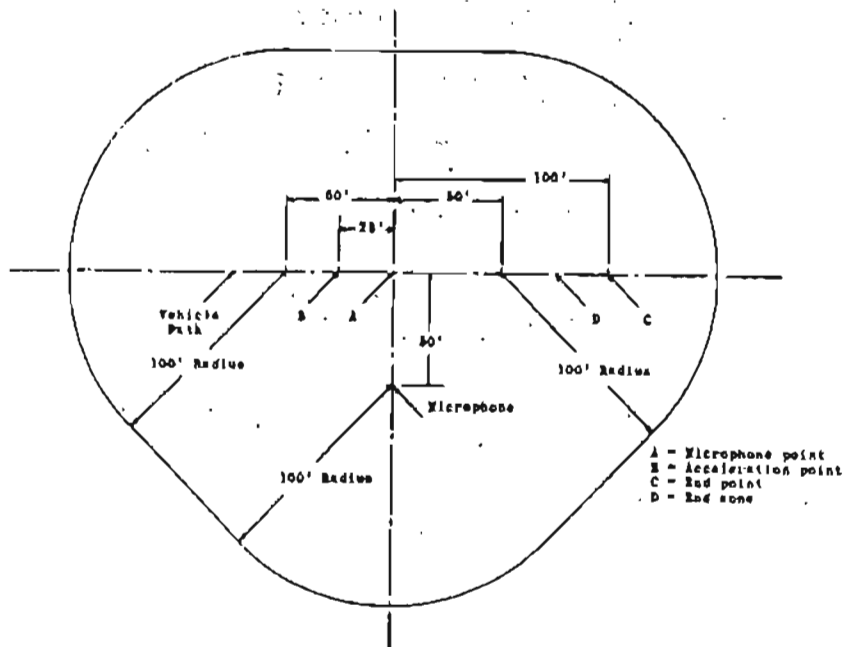


Fig. 3-4. Test Area Layout for Motorcycles

c. Test Procedures. Vehicles shall be tested according to the following procedures:

- (1) Gear Selection. Motorcycles shall be operated in second gear. Vehicles which reach maximum rpm at less than 30 mph or before a point 25 ft. beyond the microphone point shall be operated in the next higher gear.
- (2) Acceleration. The vehicle shall proceed along the vehicle path at a constant approach speed which corresponds either to an engine speed of 60 percent of maximum rpm or to 30 mph, whichever is lower. When the reference point on the vehicle

reaches the acceleration point, the throttle shall be rapidly and fully opened and held open until the vehicle reference point reaches the end point, or until the maximum rpm is reached within the end zone, at which point the throttle shall be closed. Wheel slip shall be avoided. When this procedure results in a dangerous operating condition, the next higher gear shall be selected for the test.

- (3) Deceleration. Tests during deceleration shall be conducted when deceleration noise appears excessive. The vehicle shall proceed along the vehicle path at maximum rpm in the same gear selected for the tests during acceleration. When the reference point on the vehicle reaches the acceleration point, the throttle shall be rapidly closed and the vehicle shall be allowed to decelerate to less than 1/2 of maximum rpm.
- (4) Engine Temperature. The engine temperature shall be within normal operating range before each test run.
- (5) Test Weight. The total weight of test driver and test equipment shall be 165 lbs. For small drivers, additional weights shall be used to bring the total to 165 lbs.

3.5.7 Snowmobiles. Snowmobiles shall be tested as follows:

- a. Vehicle Path. The test area shall include a vehicle path of sufficient length for safe acceleration, deceleration, and stopping of the vehicle.
- b. Test Area Layout. The following points and zones shown in Figure 3-5, where only one directional approach is illustrated for the purposes of clarity, shall be established on the vehicle path so that measurements can be made on both sides of the vehicle:

- (1) Microphone point
- (2) End point - a location 50 ft. beyond the microphone point
- (3) Acceleration point - a location on the vehicle path established as follows: Position the vehicle headed away from the microphone point with the vehicle reference point at 25 ft. from the microphone point. From a standing start with transmission in low gear, rapidly apply wide-open throttle, accelerating until maximum rpm is attained. The location on the vehicle path where maximum rpm was attained is the acceleration point for tests run in the opposite direction
- (4) Maximum rpm zone...

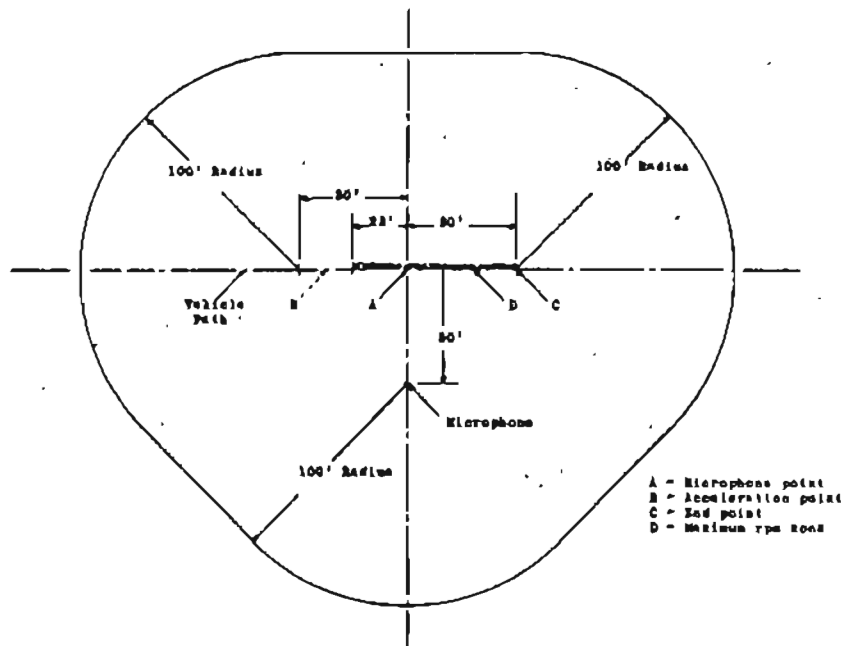


Fig. 3-5. Test Area Layout for Snowmobiles



c. Test Procedures. From a standing start, with transmission in low gear and the vehicle reference point positioned at the acceleration point, the throttle shall be rapidly and fully opened and held through the maximum rpm zone until the reference point on the vehicle reaches the end point after which the throttle shall be closed.



CHAPTER 4  
SIREN TEST PROCEDURE

To be printed later

ANNEX A

EXCERPTS FROM CALIFORNIA VEHICLE CODE

23130. (a) No person shall operate either a motor vehicle or combination of vehicles of a type subject to registration at any time or under any condition of grade, load, acceleration or deceleration in such a manner as to exceed the following noise limit for the category of motor vehicle within the speed limits specified in this section:

	Speed Limit of 35 mph or less	Speed limit of more than 35 mph
(1) Any motor vehicle with a manufacturer's gross vehicle weight rating of 6,000 pounds or more and any combination of vehicles towed by such motor vehicle:		
(A) Before January 1, 1973----	88 dB(A)	90 dB(A)
(B) On and after January 1, 1973-----	86 dB(A)	90 dB(A)
(2) Any motorcycle other than a motor-driven cycle-----	82 dB(A)	86 dB(A)
(3) Any other motor vehicle and any combination of vehicles towed by such motor vehicle-----	76 dB(A)	82 dB(A)

(b) The noise limits established by this section shall be based on a distance of 50 feet from the center of the lane of travel within the speed limit specified in this section. The Department of the California Highway Patrol may provide for measuring at a distance closer than 50 feet from the center of the lane of travel. In such a case, the measuring devices shall be so calibrated as to provide for measurements equivalent to the noise limit established by this section measured at 50 feet.

(c) The department shall adopt regulations establishing the test procedures and instrumentation to be utilized.

These procedures shall allow, to the extent feasible, noise measurement and enforcement action to be accomplished in reasonably confined areas such as residential areas of urban cities.

(d) This section applies to the total noise from a vehicle or combination of vehicles and shall not be construed as limiting or precluding the enforcement of any other provisions of this code relating to motor vehicle exhaust noise.

(e) For the purpose of this section, a motor truck, truck tractor, or bus that is not equipped with an identification plate or marking bearing the manufacturer's name and manufacturer's gross vehicle weight rating shall be considered as having a manufacturer's gross vehicle weight rating of 6,000 pounds or more if the unladen weight is more than 5,000 pounds.

(f) No person shall have a cause of action relating to the provisions of this section against a manufacturer of a vehicle or a component part thereof on a theory based upon breach of express or implied warranty unless it is alleged and proved that such manufacturer did not comply with noise limit standards of the Vehicle Code applicable to manufacturers and in effect at the time such vehicle or component part was first sold for purposes other than resale.

23130.5. (a) Notwithstanding the provisions of subdivision (a) of Section 23130, the noise limits, within a speed zone of 35 miles per hour or less on level streets, or streets with a grade not exceeding plus or minus 1 percent, for the following categories of motor vehicles, or combinations of vehicles, which are subject to registration, shall be:

- (1) Any motor vehicle with a manufacturer's gross vehicle weight rating of 6,000 pounds or more and any combination of vehicles towed by such motor vehicle ----- 82 dB(A)
- (2) Any motorcycle other than a motor-driven cycle----- 77 dB(A)
- (3) Any other motor vehicle and any combination of vehicles towed by such motor vehicle----- 74 dB(A)

No person shall operate such a motor vehicle or combination of vehicles in such a manner as to exceed the noise limits specified in this section.

The provisions of subdivisions (c), (d), (e), and (f) of Section 23130 shall apply to this section.

(b) Measurements shall not be made within 200 feet of any intersection controlled by an official traffic control device, or within 200 feet of the beginning or end of any grade in excess of plus or minus 1 percent. Measurements shall be made when it is reasonable to assume that the vehicle flow is at a constant rate of speed, and measurement shall not be made under congested traffic conditions which require noticeable acceleration or deceleration.

(c) Test procedures and instrumentation to be utilized shall be in accordance with regulations of the Department of the California Highway Patrol, except that measurement shall not be conducted within 200 feet of any intersection controlled by an official traffic control device, or within 200 feet of the beginning or end of a grade.

(d) The noise limits established by this section shall be based on a distance of 50 feet from the center of the lane of travel within the speed limit specified in this section. The Department of the California Highway Patrol may provide for measuring at distances closer than 50 feet from the center of the lane of travel. In such a case, the measuring devices shall be so calibrated as to provide for measurements equivalent to the noise limit established by this section measured at 50 feet.

Vehicles equipped with at least two snowtread tires are exempt from this section.

The provisions of this section shall become operative on January 1, 1972.

27150. (a) Every motor vehicle subject to registration shall at all times be equipped with an adequate muffler in constant operation and properly maintained to prevent any excessive or unusual noise, and no muffler or exhaust system shall be equipped with a cutout, bypass, or similar device.

(b) Every passenger vehicle, except an off-highway motor vehicle subject to identification as defined in Section 38012, operated off the highways shall at all times be equipped with an adequate muffler in constant operation and properly maintained so as to meet the requirements of Section 27160, and no muffler or exhaust system shall be equipped with a cutout, bypass, or similar device.



(c) The provisions of subdivision (b) shall not be applicable to passenger vehicles being operated off the highways in an organized racing or competitive event conducted under the auspices of a recognized sanctioning body or by permit issued by the local governmental authority having jurisdiction.

27150.1. On and after the effective date of regulations and standards adopted by the commissioner pursuant to Section 27150.2, no person shall offer for sale, sell, or install, a motor vehicle exhaust system, or part thereof, including, but not limited to, a muffler, unless it meets such regulations and standards.

27150.2. The commissioner shall, after the study required by Section 27150.3, and after public hearings, adopt regulations setting standards for the certification of vehicular exhaust systems based solely upon noise standards consistent with the total vehicle noise levels set by Sections 23130 and 23130.5. Such regulations shall include, but need not be limited to:

(a) Provisions for standards for vehicular exhaust systems, based on manufacturers' data and subject to such inspections and other verification as the commissioner may prescribe.

(b) Provisions for the licensing of stations to implement the provisions of this section, and Section 27150.1, and for the denial, revocation, or suspension of any license for failure to comply with the provisions of this section or any regulation adopted thereunder.

The regulations may provide for the exemption of vehicular exhaust systems where compliance with the regulations would cause an unreasonable hardship without resulting in a sufficient corresponding benefit with respect to noise level control.

The regulations adopted pursuant to this section shall become effective one year after the regulations are filed with the Legislature pursuant to Section 27150.4.

27150.3. The commissioner shall conduct a study to determine the best means of implementing the requirements of Section 27150.1. The results of such study shall be filed with the Legislature and made available to the public as soon as practicable but not later than January 5, 1973.

27150.4. The commissioner shall file the regulations adopted pursuant to Section 27150.2 with both houses of the Legislature not later than six months after the study is filed as specified in Section 27150.3.

27150.5. Any person holding a retail seller's permit who sells or installs an exhaust system, or part thereof, including, but not limited to, a muffler, in violation of Section 27150.1 or 27150.2 or the regulations adopted pursuant thereto, shall thereafter be required to install an exhaust system, or part thereof, including, but not limited to a muffler, which is in compliance with such regulations upon demand of the purchaser or registered owner of the vehicle concerned, or to reimburse the purchaser or registered owner for the expense of replacement and installation of an exhaust system, or part thereof, including, but not limited to, a muffler, which is in compliance, at the election of such purchaser or registered owner.

27150.6 The department shall make every effort to obtain federal assistance to carry out the provisions of Sections 27150.1, 27150.2, 27150.3, 27150.4, and 27150.5.

27150.7. A court may dismiss any action in which a person is prosecuted for operating a vehicle in violation of Sections 23130 or 23130.5 if it is found that the vehicle was equipped with an exhaust system certified pursuant to Section 27150.2 and that the defendant had reasonable grounds to believe that the exhaust system was in good working order and had reasonable grounds to believe that the vehicle was not operated in violation of Sections 23130 or 23130.5.

27151. No person shall modify the exhaust system of a motor vehicle in a manner which will amplify or increase the noise emitted by the motor of such vehicle, above that emitted by the muffler originally installed on the vehicle and the original muffler shall comply with all of the requirements of this chapter. No person shall operate a motor vehicle with an exhaust system so modified.

27160. (a) No person shall sell or offer for sale, a new motor vehicle which produces a maximum noise exceeding the following noise limit at a distance of 50 feet from the centerline of travel under test procedures established by the department:

- (1) Any motorcycle manufactured before 1970-- 92 dB(A)
- (2) Any motorcycle; other than a motor-driven cycle, manufactured after 1969, and before 1973----- 88 dB(A)
- (3) Any motorcycle, other than a motor-driven cycle, manufactured after 1972, and before 1975----- 86 dB(A)
- (4) Any motorcycle, other than a motor-driven cycle, manufactured after 1974, and before 1978----- 80 dB(A)
- (5) Any motorcycle, other than a motor-driven cycle, manufactured after 1977, and before 1988----- 75 dB(A)
- (6) Any motorcycle, other than a motor-driven cycle, manufactured after 1987----- 70 dB(A)
- (7) Any snowmobile manufactured after 1972--- 82 dB(A)
- (8) Any motor vehicle with a gross vehicle weight rating of 6,000 pounds or more manufactured after 1967, and before 1973- 88 dB(A)
- (9) Any motor vehicle with a gross vehicle weight rating of 6,000 pounds or more manufactured after 1972 and before 1975-- 86 dB(A)

- (10) Any motor vehicle with a gross vehicle weight rating of 6,000 pounds or more manufactured after 1974, and before 1978----- 83 dB(A)
- (11) Any motor vehicle with a gross vehicle weight rating of 6,000 pounds or more manufactured after 1977, and before 1988----- 80 dB(A)
- (12) Any motor vehicle with a gross vehicle weight rating of 6,000 pounds or more manufactured after 1987----- 70 dB(A)
- (13) Any other motor vehicle manufactured after 1967, and before 1973----- 86 dB(A)
- (14) Any other motor vehicle manufactured after 1972, and before 1975----- 84 dB(A)
- (15) Any other motor vehicle manufactured after 1974, and before 1978----- 80 dB(A)
- (16) Any other motor vehicle manufactured after 1977, and before 1988----- 75 dB(A)
- (17) Any other motor vehicle manufactured after 1987----- 70 dB(A)

(b) Test procedures for compliance with this section shall be established by the department, taking into consideration the test procedures of the Society of Automotive Engineers.

38280. (a) No person shall sell or offer for sale a new off-highway motor vehicle subject to identification which produces a maximum noise exceeding the following noise limit at a distance of 50 feet from the centerline of travel under test procedures established by the Department of the California Highway Patrol:

- (1) Any such vehicle manufactured on or after January 1, 1972, and before January 1, 1973 - 92 dbA
- (2) Any such vehicle manufactured on or after January 1, 1973, and before January 1, 1975 - 88 dbA
- (3) Any such vehicle manufactured on or after January 1, 1975 - 86 dbA

(b) Test procedures for compliance with this section shall be established by the Department of the California Highway Patrol, taking into consideration the test procedures of the Society of Automotive Engineers.

ANNEX A  
HPH 83.3

A-8

0000 0101

ANNEX B

EXCERPTS FROM CALIFORNIA ADMINISTRATIVE CODE  
TITLE 13, CHAPTER 2, SUBCHAPTER 4

Article 8. Sirens

1020. Scope of Regulations. This article shall apply to sirens required on authorized emergency vehicles in accordance with Section 27002 of the Vehicle Code.

1021. Definitions. The following definitions shall apply wherever the terms are used in this article:

(a) Electromechanical Siren. An electromechanical siren is a siren incorporating a stator and rotor driven by an electric motor.

(b) Electronic Siren. An electronic siren is a siren incorporating an oscillator, amplifier, driver, and speaker.

(c) Mechanical Siren. A mechanical siren is a siren incorporating a stator and rotor driven by a mechanical connection to a rotating part of the vehicle or engine.

(d) Siren. A siren is a device which produces the readily recognizable sound of an electromechanical siren authorized for use on and identified with emergency vehicles in California.

1022. Submission Instructions. Sirens shall be submitted for testing and approval in accordance with the following procedures:

(a) Application for Approval. Requests for approval of sirens shall be submitted on forms furnished by the department and shall be sent with the required test fees to the following address:

California Highway Patrol  
Engineering Section  
P. O. Box 898  
Sacramento, California 95804

(b) Test Fees. Test fees shall be payable to the Department of the California Highway Patrol as follows:

(1) Electromechanical siren	\$ 100.00
(2) Mechanical siren	\$ 100.00



- (3) Electronic siren with one speaker  
\$ 100.00
- (4) Electronic siren with two speakers  
\$ 100.00

Fees for testing additional models at the same time are as follows:

- (1) Each additional siren \$ 30.00
- (2) Each additional speaker model \$ 30.00
- (3) Each additional speaker of same model  
\$ 30.00

Fees for comparison are as follows:

- (1) Electromechanical siren \$ 30.00
- (2) Mechanical siren \$ 30.00
- (3) Electronic siren with one speaker  
\$ 30.00
- (4) Electronic siren with two speakers  
\$ 30.00

(c) Test Samples. One properly marked sample of each model shall be submitted with the following additional material:

- (1) Lightweight test stand on which siren is mounted, suitable for setting on a test bench 12 inches square.
- (2) Switch, connectors, and cables at least 10 inches in length. Cables shall be marked positive (+) and negative (-) for applying power to the siren. Cables shall be equipped with appropriate plugs and alligator type clips for easy attachment to the siren and to the battery terminals.

(3) Installation, operating, and wiring instructions representative of those to be furnished with each device sold.

(d) Siren Shipments. Sirens shall be shipped prepaid to the following address:

California Highway Patrol  
Engineering Section  
2811 26th Street  
Sacramento, California 95818

(e) Return of Samples. At the completion of tests, sirens will be returned railway express collect unless otherwise claimed by the applicant.

1023. Approval of Sirens. Sirens shall be approved or disapproved as follows:

(a) Test Reports. Test reports will be prepared by the Department of the California Highway Patrol, a copy of which will be furnished the applicant. If the siren is unsatisfactory, reasons for rejection will be furnished. If the device meets all test requirements, a certificate of approval will be issued to the applicant.

(b) Comparison Reports. Comparisons for approval of sirens which are identical, except for marks of identification, will be made under the following conditions:

(1) A siren submitted by a manufacturer for comparison with another siren manufactured by him shall be compared only after the original device has been approved.

(2) A siren produced by one manufacturer and sold to another for marketing under a different name and model number shall be compared after the original manufacturer has received approval for the siren and has submitted an affidavit to the department authorizing comparison.

(c) Preproduction Samples. Preproduction samples identified as such and mounted and wired as specified in Section 1022(c) may be submitted for preliminary sound level tests. Certificates of approval will not be issued on the basis of such tests. Fees for testing a preproduction sample are the same as those in Section 1022(b).

(d) Certificates of Approval. Certificates of approval for sirens issued between January 1 and June 30, inclusive, shall expire on July 1, five years after the date of issuance; and certificates issued between July 1 and December 31, inclusive, shall expire on January 1, five years after the date of issuance except as follows:

(1) Certificates of approval issued on the basis of a comparison report with another siren shall expire on the same date as the certificate of approval issued for the original device.

(2) Certificates of approval issued for sirens approved for a limited term of less than five years shall expire on the expiration date shown on the certificate.

(3) A siren installed on a vehicle prior to the expiration date of the certificate of approval may continue to be used on that vehicle by any owner even though the certificate of approval has expired. The owner of a siren for which the approval has expired may transfer it between vehicles owned by him but shall not sell it for use on an authorized emergency vehicle.

(e) Submission of Sirens for Reapproval. Samples shall be submitted for test and reapproval at least one month and not more than six months prior to the expiration date if the continued sale of the siren is desired. The new certificate shall expire five years from the expiration date of the previous certificate.

(f) Modifications. The department shall be notified by the manufacturer of any changes in marks of identification and any modification or change in design, mechanical construction, or function which might affect the performance of an approved siren. Tests of the modified device may be required at the discretion of the department.

1024. Identification Markings. Sirens shall be marked as follows:

(a) Electromechanical, mechanical and electronic sirens, amplifier boxes, drivers, and speakers shall be permanently marked with the manufacturer's name, initial, or lettered trademark and the model designation in letters and numerals at least 1/8 inch in height.

(b) Drivers for electronic sirens shall be marked to denote the wattage rating in letters and numerals at least 1/8 inch in height.

(c) Markings shall be so located as to be clearly visible when the siren is installed on a vehicle.

1025. Test Procedure. Sirens shall be tested in accordance with the following procedure:

(a) Test Equipment. The sound level output of a siren shall be measured with a sound level meter meeting the standards of International Electrotechnical Publication 179, Precision Sound Level Meter. A graphic level recorder shall be used to record the results.

(b) Test Conditions. The sound level meter shall be set to A-weighting network, fast response. The siren and meter microphone shall be positioned 100 feet apart at 4 feet above ground level over a grassy area with grass no more than 6 inches in height and having no obstructions except a passenger vehicle to the rear of the microphone or siren within a 500 foot radius of both the microphone and siren. Due consideration shall be given to background noise, wind, atmospheric conditions, and reflections.

(c) Sound Level Determination. The measured sound level value shall be recorded as the level reached or exceeded during one-half of the recorded time when steady or under manual control. On automatic control, the recorded value shall be the level reached by one-half of the major peaks. These values shall be determined from the graphic level recorder charts.

1026. Test Requirements. Sirens shall comply with the following test requirements:

(a) Sound Level Output. Two classes of sirens are established as follows:

(1) Class A. Class A sirens shall meet the following sound level output at 100 feet when tested in accordance with Section 1025:

On the axis . . . . . 100 dB(A)

45° from the axis . . . . . 95 dB(A)

(2) Class B. Class B sirens shall meet the following sound level output at 100 feet when tested in accordance with Section 1025:

On the axis . . . . . 90 dB(A)

45° from the axis . . . . . 85 dB(A)

(b) Sound Level Classification. Sirens shall be classified in accordance with the lowest performing function. The recorded sound level values of both automatic and manual functions shall comply with the following requirements:

(1) Pitch Variation Rate. Any automatic function of a siren shall have an undulating pitch rate not less than 8 nor more than 30 oscillations per minute.

(2) Rapidly Undulating Function. Certain electronic sirens are equipped with an additional rapidly undulating function commonly referred to as "yelp", "wail", or "alert". This function does not meet requirements for an emergency vehicle siren, but it may be included in conjunction with the normal siren function.

1027. Mounting Requirements. Sirens installed on authorized emergency vehicles shall be mounted as follows:

(a) Class A. Class A sirens shall be mounted outside, behind the grille, or under the hood. The siren horn opening shall face forward, parallel to the road and vehicle centerline, except that electromechanical sirens mounted behind the grille or under the hood may face in any direction.

(b) Class B. Class B sirens shall be mounted outside or between the grille and the radiator with the horn opening facing forward, parallel to the road and vehicle centerline. Direction of horn opening requirement does not apply to mechanical motorcycle sirens.

(c) Electronic Sirens with Dual Speakers. Dual speakers for electronic sirens may be mounted at a maximum angle of 10° (20° included angle) from the vehicle centerline to provide greater noise dispersion. Speakers shall be connected in phase to prevent noise cancellation.

## Article 10. Vehicle Noise Measurement

1040. Scope of Regulations. This article contains procedures implementing Section 23130 of the Vehicle Code which applies to the measurement of noise from motor vehicles and combinations of vehicles subject to registration when operated on a highway, and Section 27160 of the Vehicle Code which applies to the measurement of noise from new motor vehicles offered for sale.

1041. Definitions. The following definitions shall apply wherever the terms are used in this article:

(a) First Gear. The "first gear" is the highest numerical gear ratio of the transmission which is commonly referred to as low gear.

(b) Maximum RPM. The "maximum rpm" is the maximum governed engine speed, or if uncontrolled, the rpm at maximum engine horsepower as determined by the engine manufacturer in accordance with the procedures in SAE J245, April 1971.

(c) Vehicle Reference Point. The "vehicle reference point" is the location on the vehicle used to determine when the vehicle is at any of the points on the vehicle path. The vehicle reference point shall be the front of the vehicle unless such position is more than 16 ft from the exhaust outlet, in which case both the front of the vehicle and the exhaust outlet shall be used as reference points.

1042. Personnel. Persons selected to conduct noise measurement testing or to measure noise level of vehicles operated on a highway shall have been trained and qualified in the techniques of sound measurement and the operation of sound measuring instruments.

1043. Instrumentation. Equipment used in making vehicle noise measurements shall be selected by technically trained personnel and shall meet the following requirements:

(a) Sound Level Meter. The sound level meter shall meet the requirements of ANSI Standard S1.4-1971 for Types 1, 2, or S2A.

(b) Sound Level Calibrator. The sound level calibrator shall calibrate the entire sound level meter with an acoustic calibrator of the coupler-type.



(c) Tachometer. A calibrated engine speed tachometer shall be used to determine when maximum rated rpm is attained in conducting the tests specified in Section 1046 of this code.

(d) Anemometer. An anemometer shall be used to measure the wind speed at the test site when conducting tests specified in Section 1046 of this code.

1044. Noise Measurement Sites. Noise measurement sites shall be selected to meet location, ground condition, and roadway surface requirements in the following subsections (a) and (b):

(a) Measurement Sites for Vehicles on the Highway. Sites for measuring noise from vehicles on the highway under Section 23130 of the Vehicle Code shall meet the following conditions:

(1) Location. The location shall be open and free of large vertical sound-reflecting surfaces such as parked vehicles, signboards, buildings, bridges, or hillsides within either of the following areas shown in Figure 1:

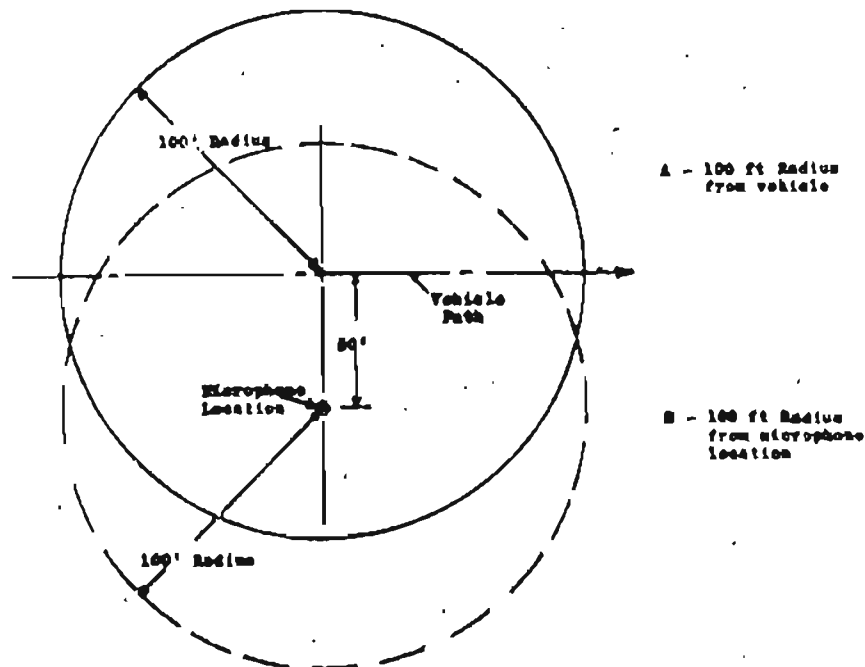


Figure 1

(A) A 100-ft radius of the point on the centerline of the path of the vehicle nearest the microphone; or

(B) A 100-ft radius of the microphone.

(2) Ground Condition. The surface of the ground between the microphone and the path of the vehicle shall be free of any vegetation more than 3 ft in height.

(3) Roadway Surface. The surface over which the vehicle travels shall be dry and relatively smooth concrete or asphalt pavement.

(b) Measurement Sites for New Motor Vehicles. Sites for measuring noise from new motor vehicles to determine compliance with Section 27180 of the Vehicle Code shall meet the following conditions:

(1) Location. The location shall be a flat open space free of large vertical sound-reflecting surfaces such as signboards, buildings, hillsides, or trees within 100 ft of the microphone and within 100 ft of the centerline of the path of the vehicle from the point where the throttle is opened to the point where the throttle is closed.

(2) Ground Condition. The ground surface between the microphone and the path of the vehicle shall be asphalt or concrete free of powdery snow, loose soil, or ashes.

(3) Roadway Surface. The surface over which the vehicle travels shall be dry and relatively smooth concrete or asphalt pavement free of extraneous material.

1045. Microphone and Personnel Positions. The microphone for the sound level meter and the personnel involved in all types of vehicle noise measurements shall be positioned as follows:

(a) Microphone Location. The microphone shall be located  $50 \pm 1$  ft from the centerline of the lane of travel of the vehicle at a height of  $4 \pm 1/2$  ft above the plane of the roadway surface.

(b) Microphone Orientation. The microphone shall be oriented in relation to the source of the sound in accordance with the instrument manufacturer's instructions. Where the instruction manual is vague or does not include adequate information, a specific recommendation shall be obtained from the manufacturer.

(c) Technician Location. The technician making direct readings of the meter shall be positioned in relation to the microphone in accordance with the instrument manufacturer's instructions. Where the instruction manual is vague or does not include adequate information, a specific recommendation shall be obtained from the manufacturer.

(d) Bystander Location. During noise measurements, bystanders shall remain at least 50 ft from the microphone and the vehicle being measured, except for a witness or trainee, who may be positioned beyond the technician on a line with the technician and the microphone.

1046. Operation of New Motor Vehicles. New motor vehicles tested to determine compliance with Section 27160 of the Vehicle Code shall be operated in conjunction with any auxiliary equipment that would be in use while the vehicle is operated on the highway, including but not limited to cement mixers, refrigerator units, and garbage compactors.

(a) Heavy Trucks, Truck Tractors, and Buses. The test procedure for vehicles with a manufacturer's gross vehicle weight rating of 6,000 lbs or more shall be as follows:

(1) Test Area Layout. The test area shall include a vehicle path of sufficient length for safe acceleration, deceleration, and stopping of the vehicle. The vehicle path (shown with only one directional approach in Figure 2 for purposes of clarification) shall be marked with the following zone and points:

(A) Microphone point - the unmarked location on the centerline of the vehicle path that is closest to the microphone.

(B) Acceleration point - a location 50 ft before the microphone point.

(C) End point - a location 50 ft beyond the microphone point.

(D) End zone - the last 40-ft distance between the microphone point and the end point.

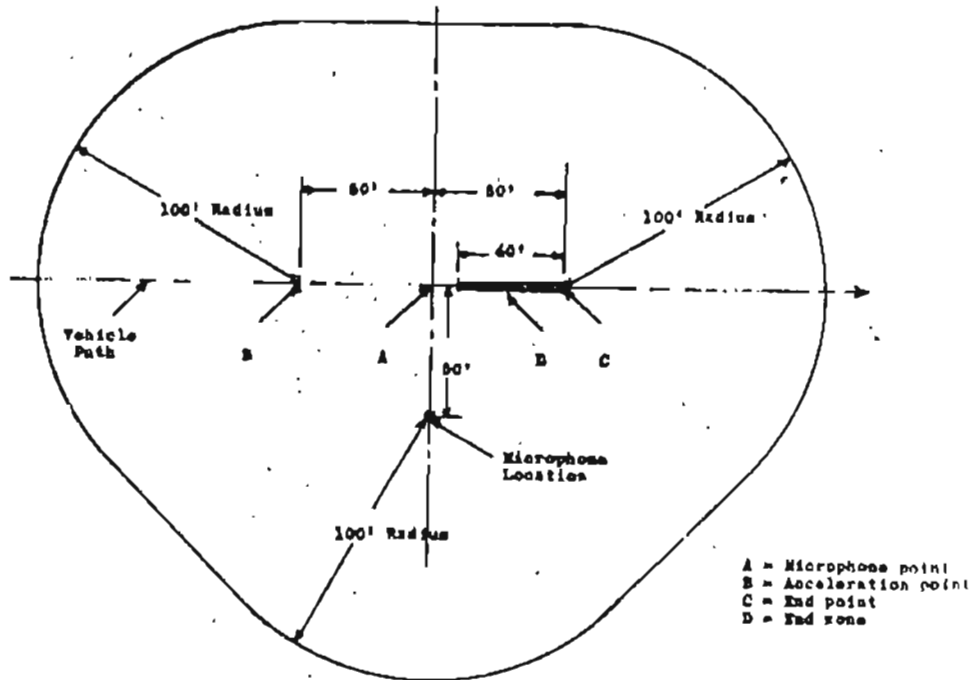


Figure 2

(2) Gear Selection. A gear shall be selected which will result in the vehicle beginning at an approach rpm of no more than  $\frac{2}{3}$  maximum rpm at the acceleration point and reaching maximum rpm within the end zone without exceeding 35 mph.

(A) When maximum rpm is attained before reaching the end zone, the next higher gear shall be selected, up to the gear where maximum rpm produces over 35 mph.

(B) When maximum rpm still occurs before reaching the end zone, the approach rpm shall be decreased in 100 rpm increments until maximum rpm is attained.

(C) When maximum rpm is not attained until beyond the end zone, the next lower gear shall be selected until maximum rpm is attained within the end zone.

(D) When the lowest gear still results in reaching maximum rpm beyond the end zone, the approach rpm shall be increased in 100 rpm increments until the maximum rpm is reached within the end zone.

(3) Acceleration. The vehicle shall proceed along the vehicle path and shall maintain the approach engine speed in the gear selected for at least 30 ft before reaching the acceleration point. When the vehicle reference point reaches the acceleration point, the throttle shall be rapidly and fully opened and held open until maximum rpm is attained within the end zone.

(4) Exhaust Brake. Vehicles with exhaust brakes shall be tested under deceleration as specified in the following subsection (d) with the exhaust brake immediately applied at the same time the throttle is closed.

(5) Engine Temperature. The engine temperature shall be within normal operating range throughout each test run.

(b) Light Trucks, Truck Tractors, Buses, and Passenger Cars. Trucks, truck tractors, and buses with a manufacturer's gross vehicle weight rating of less than 6,000 lbs, and all passenger cars shall be operated as follows:

(1) Test Area Layout. The test area shall include a vehicle path of sufficient length for safe acceleration, deceleration, and stopping of the vehicle. The vehicle path (shown with only one directional approach in Figure 3 for purposes of clarification) shall be marked with the following zone and points:

(A) Microphone point - the location on the centerline of the vehicle path that is closest to the microphone.

(B) Acceleration point - a location 25 ft. before the microphone point.

(C) End point - a location 100 ft beyond the microphone point.

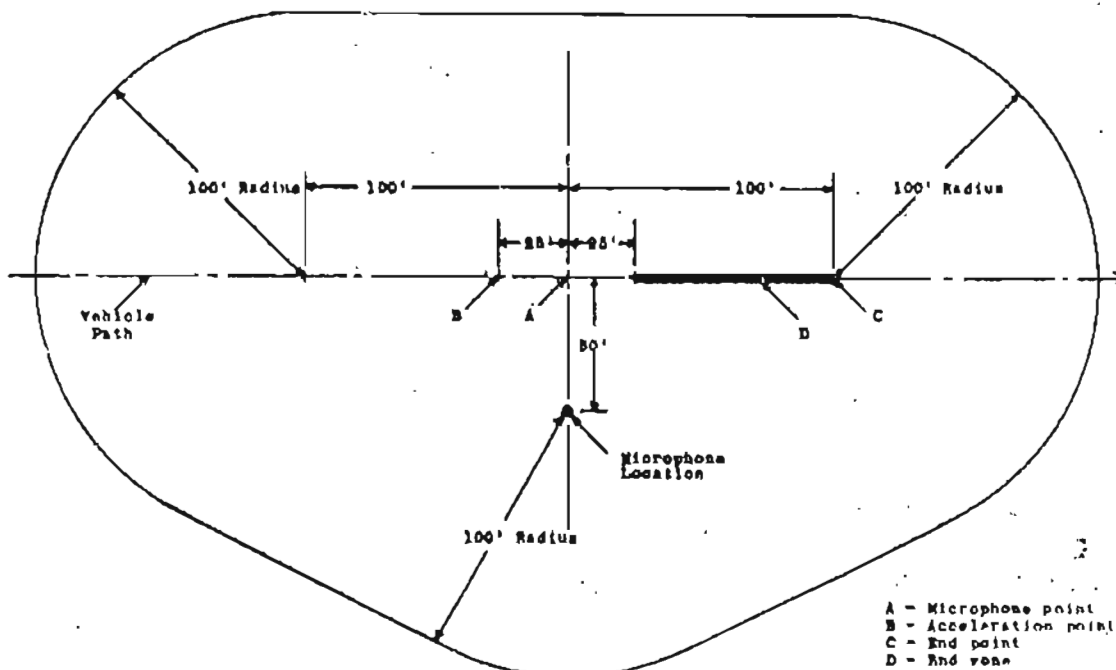


Figure 3



(2) Gear Selection. Motor vehicles equipped with three-speed manual transmissions shall be operated in first gear. Vehicles equipped with four-speed manual transmissions shall be operated in first gear and in second gear. Vehicles equipped with five-speed manual transmissions shall be operated in second gear. Vehicles equipped with automatic transmissions shall be operated with transmissions engaged in first gear. Vehicles which reach maximum rpm at less than 30 mph or before reaching the end zone shall be operated in the next higher gear. Auxiliary step-up ratios (overdrive) shall not be engaged on vehicles so equipped.

(3) Acceleration. The vehicle shall proceed along the vehicle path at a constant approach speed of 30 mph in the selected gear. When the vehicle reference point reaches the acceleration point, the throttle shall be rapidly and fully opened. When maximum rpm is reached, which must be within the end zone, the throttle shall be closed sufficiently to prevent excessive engine speed and shall be held until the vehicle reference point reaches the end point, at which time the throttle shall be completely closed.

(4) Engine Temperature. The engine temperature shall be within normal operating range throughout each test run. The engine shall be idled in neutral for at least one minute between runs.

(c) Motorcycles. The test procedure for motorcycles shall be as follows:

(1) Test Area Layout. The test area layout for motorcycles shall be the same as specified in subsection (b) (1) and Figure 3 for light trucks, truck tractors, buses, and passenger cars.

(2) Gear Selection. Motorcycles shall be operated in second gear. Vehicles which reach maximum rpm at less than 30 mph or before a point 25 ft beyond the microphone point shall be operated in the next higher gear.

(3) Acceleration. The vehicle shall proceed along the test path at a constant approach speed which corresponds either to an engine speed of 60% of maximum rpm or to 30 mph, whichever is lower. When the vehicle reference point reaches the acceleration point, the throttle shall be fully opened. The throttle shall be held open until the rear of the vehicle is approximately 100 ft beyond the microphone or until the maximum rpm is obtained, at which point the throttle shall be gradually closed. Wheel slip shall be avoided during this test.

(4) Engine Temperature. The engine temperature shall be within normal operating range before each test run.

(d) Deceleration. Tests during deceleration shall be conducted when deceleration noise appears excessive. The vehicle shall approach the end point from the reverse direction at maximum rpm in the same gear selected for the tests during acceleration. At the end point, the throttle shall be closed and the vehicle shall be allowed to decelerate to 1/2 of maximum rpm.

1047. Meter Operation. The sound level meter shall be operated in accordance with the instrument manufacturer's instructions and as follows:

(a) Meter Setting. The A-weighting network and the fast meter response shall be used.

(b) Calibration Check. An external calibration check shall be made before and after each period of use and at intervals not exceeding 2 hr when the instrument is used longer than a 2-hr period.

(c) Meter Reading. The reading recorded shall be the highest sound level obtained as the vehicle passes by, disregarding unrelated peaks due to extraneous ambient noises.

(d) Ambient Sound. Measurements shall be made only when the A-weighted ambient sound level, including wind effects, due to all sources other than the vehicle being measured, is at least 10 dB(A) lower than the sound level of the vehicle.

(e) Wind. Measurements shall be made only when the wind velocity is less than 12 mph.

1048. Vehicle Noise Level. The measured noise level of a vehicle shall be reported as follows:

(a) Vehicles on the Highway. The sound level reading for determining compliance with Section 23130 of the Vehicle Code shall be the highest reading obtained as the vehicle or combination of vehicles passes through the measuring site on the highway. Sound level readings shall be recorded for vehicles which are in lanes of travel with centerlines at or beyond 50 ft and which produce noise levels exceeding the statutory limits.

(b) New Motor Vehicles. The sound level readings for determining compliance of new motor vehicles with Section 27160 of the Vehicle Code shall be obtained after sufficient preliminary runs to enable the test driver to become familiar with the operation of the vehicle and to stabilize engine operating conditions.

(1) At least four measurements shall be made from each side of the vehicle. When the exhaust outlet is more than 16 ft from the driver's position, at least two runs in each direction shall be performed with each of the reference points described in Section 1041 (c) of this code.

(2) The A-weighted sound level for each side of the vehicle shall be the average of the two highest readings on that side which are within 2 dB(A) of each other. The noise level reported for the vehicle shall be the sound level of the loudest side.

This order shall take effect on January 15, 1972, as provided in Section 11422(d) of the Government Code.

The following pages contain the proposed amendments to the Vehicle Sound Measurement Regulations which were published on March 29, 1972. The final date for submitting comments was May 10, 1973.

Comments received will be considered in the final regulations which should be adopted prior to October, 1973.

P  
R  
O  
P  
O  
S  
E  
D

After proceedings had in accordance with the provisions of the Administrative Procedure Act (Gov. Code, Title 2, Div. 3, Part 1, Chapter 4.5) and pursuant to the authority vested by Section 2402 of the Vehicle Code, and to implement, interpret, or make specific Sections 23130, 23130.5, 27160 and 38280 of the Vehicle Code, the Department of the California Highway Patrol hereby adopts, amends, or repeals regulations in Chapter 2, Title 13, California Administrative Code, as follows:

- (1) Repeals Article 10, Subchapter 4
- (2) Adopts new Article 10, Subchapter 4 to read:

Article 10. Vehicle Sound Measurement

1040. Scope of Regulations. This article shall apply to procedures for measuring motor vehicle sound in accordance with limits specified by Vehicle Code Sections 23130 and 23130.5 for vehicles currently in use; and by Sections 27160 and 38280, respectively, for testing new on-highway and new off-highway vehicles offered for sale.

1041. Definitions. The following definitions shall apply wherever the terms are used in this article:

(a) First Gear. The "first gear" is the highest numerical gear ratio of the transmission, commonly referred to as low gear.

(b) Maximum RPM. The "maximum rpm" is the maximum governed engine speed, or if uncontrolled, the rpm at maximum engine horsepower as determined by the engine manufacturer in accordance with the procedures in SAE J245, April 1971.

DO NOT WRITE IN THIS SPACE

CONTINUATION SHEET  
FOR FILING ADMINISTRATIVE REGULATIONS  
WITH THE SECRETARY OF STATE

(Pursuant to Government Code Section 11380.1)

(c) Microphone Point. The "microphone point" is the unmarked location on the center of the lane of travel that is closest to the microphone.

(d) Vehicle Categories. The terms "new vehicle", "used vehicle", and "off-highway vehicle" are defined, respectively, in Sections 430, 665, and 38012 of the Vehicle Code.

(e) Vehicle Reference Point. The "vehicle reference point" is the location on the vehicle used to determine when the vehicle is at any of the points on the vehicle path. The primary vehicle reference point is the front of the vehicle. For vehicles with a gross vehicle rating of 6,000 lbs or more where the distance from the front of the vehicle to the exhaust outlet is more than 16 ft, the secondary vehicle reference point is the exhaust outlet.

1042. Instrumentation. Equipment used in making vehicle sound measurements shall meet the following requirements:

(a) Sound Level Meter. The sound level meter shall meet the requirements for Types 1, 2, or S2A in the American National Standard Specification for Sound Level Meters S1.4-1971; or the requirements of International Electrotechnical Commission Publication 179, "Precision Sound Level Meters."

(b) Sound Level Calibrator. The sound level calibrator shall calibrate the entire sound level meter with an acoustic calibrator of the coupler type.

(c) Tachometer. A calibrated engine speed tachometer shall be used to determine when maximum rated rpm is attained in conducting tests for new vehicles specified in Section 1048 of this code.

(d) Anemometer. An anemometer shall be used to measure the wind speed at the test site when conducting tests for new vehicles specified in Section 1048 of this code.

1043. Personnel. Persons selected to conduct sound measurement testing or to measure sound level of vehicles operated on a highway shall have received a minimum of 8 hours of training in the techniques of sound measurement and the operation of sound measuring instruments. Personnel making measurements shall be positioned as follows:

P  
R  
O  
P  
O  
S  
E  
D

DO NOT WRITE IN THIS SPACE

CONTINUATION SHEET  
FOR FILING ADMINISTRATIVE REGULATIONS  
WITH THE SECRETARY OF STATE  
(Pursuant to Government Code Section 11380.1)

(a) Technician Location. The technician making direct readings of the meter shall be positioned in relation to the microphone in accordance with the instrument manufacturer's instructions. Where the instruction manual is vague or does not include adequate information, a specific recommendation shall be obtained from the manufacturer.

(b) Bystander Location. During sound measurements, bystanders shall remain at least 50 ft from the microphone and the vehicle being measured, except for a witness or trainee, who may be positioned beyond the technician on a line with the technician and the microphone.

1044. Location of Microphone. The microphone for sound level meters used in all vehicle sound measurements shall be located as follows:

(a) New Motor Vehicles. The microphone shall be located at a height of  $4\pm\frac{1}{2}$  ft above the plane of the roadway surface and at a distance of  $50\pm 1$  ft from the center of the lane of travel for tests on new vehicles.

(b) Vehicles on the Highway. The microphone shall be located at a height of  $4\pm 2$  ft above the plane of the roadway surface and at  $4\pm\frac{1}{2}$  ft above the surface upon which the microphone stands. The standard distance from the microphone to the center of the lane of travel of vehicles measured on the highway shall be 50 ft. The actual distance may range from 31 to 118 ft based on the factor shown in Table I to be added to or subtracted from the sound level meter reading to correct the reading to the standard distance.

DO NOT WRITE IN THIS SPACE

P  
R  
O  
P  
O  
S  
E  
D



CONTINUATION SHEET  
FOR FILING ADMINISTRATIVE REGULATIONS  
WITH THE SECRETARY OF STATE  
(Pursuant to Government Code Section 11380.1)

TABLE I

<u>Distance from microphone to roadway centerline</u>	<u>dB(A) Correction factor</u>
35 - 39 ft .....	-3
39 - 43 ft .....	-2
43 - 48 ft .....	-1
48 - 58 ft .....	0
58 - 70 ft .....	+1
70 - 83 ft .....	+2
83 - 99 ft .....	+3
99 - 118 ft .....	+4

1045. Meter Operation. The sound level meter shall be operated in accordance with the instrument manufacturer's instructions and as follows:

(a) Microphone Orientation. The microphone shall be oriented in relation to the source of the sound in accordance with the instrument manufacturer's instructions. Where the instruction manual is vague or does not include adequate information, a specific recommendation shall be obtained from the manufacturer.

(b) Meter Setting. The A-weighting network and the fast meter response mode shall be used.

(c) Calibration Check. An external calibration check shall be made before and after each period of use and at intervals not exceeding 2 hr when the instrument is used longer than for a 2-hr period.

(d) Meter Reading. The recorded reading shall be the highest sound level obtained as the vehicle passes by, disregarding unrelated peaks due to extraneous ambient noises.

DO NOT WRITE IN THIS SPACE

P  
R  
O  
P  
O  
S  
E  
D

0000 0727

CONTINUATION SHEET  
FOR FILING ADMINISTRATIVE REGULATIONS  
WITH THE SECRETARY OF STATE

(Pursuant to Government Code Section 11380.1)

(e) Ambient Sound. Measurements shall be made only when the A-weighted ambient sound level, including wind effects, due to all sources other than the vehicle being measured, is at least 10 dB(A) lower than the sound level of the vehicle.

(f) Wind. Measurements shall be made only when the wind velocity is less than 12 mph.

1046. Highway Measurement Sites. Sites for measuring sound from vehicles operated on highways shall meet the following requirements:

(a) Standard Sites. Standard measuring sites shall be open and free of sound-reflecting surfaces within a 100-ft radius of the microphone and a 100-ft radius of the microphone point as shown in Figure 1.

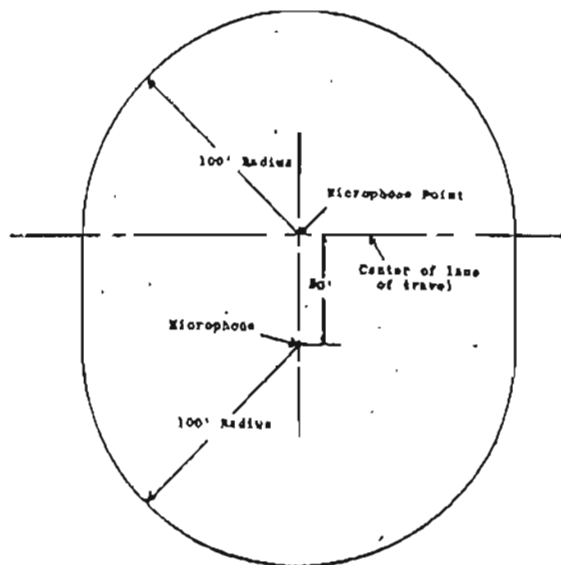


Figure 1

(b) Restricted Sites. A restricted measuring site is one that does not meet the requirements for a standard site because of large sound-reflecting surfaces within the clear area defined by Figure 1. Certain restricted measuring sites may be used by applying a correction factor determined from the following procedure.

DO NOT WRITE IN THIS SPACE

D  
M  
S  
O  
P  
R  
O  
P  
O  
S  
I  
T  
I  
O  
N

CONTINUATION SHEET  
FOR FILING ADMINISTRATIVE REGULATIONS  
WITH THE SECRETARY OF STATE  
(Pursuant to Government Code Section 11380.1)

(1) Distance from Sound-reflecting Surfaces  
The distance from the microphone to its nearest sound-reflecting surface and the distance from the microphone point to its nearest sound-reflecting surface shall be measured as shown in Figure 2. These distances shall be located on the nomogram in Figure 3 on their respective axes. A straight line shall be placed so as to connect the two marks. The point on the central axis that is crossed by the straight line indicates the dB(A) correction factor that shall be subtracted from the sound level reading. (The dotted line in Figure 3 illustrates a -2dB(A) correction for sound-reflecting surfaces at 52 ft from the microphone point and 25 ft from the microphone.)

(A) The correction factors determined by the nomogram in Figure 3 shall be used only for sound-reflecting surfaces that are parallel to the lane of travel.

(B) A basically parallel surface may have irregularities or projections not more than 2 ft, measured perpendicular to the lane of travel, with the distance shown in Figure 2 measured from the closest point of the projection.

(C) Sound-reflecting surfaces that are not basically parallel to the lane of travel shall be 100 ft or more from the microphone or microphone point.

DO NOT WRITE IN THIS SPACE

P  
R  
O  
P  
O  
S  
E  
D

CONTINUATION SHEET  
FOR FILING ADMINISTRATIVE REGULATIONS  
WITH THE SECRETARY OF STATE  
(Pursuant to Government Code Section 11380.1)

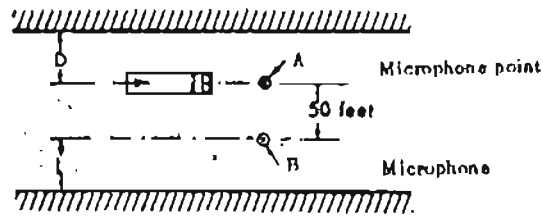
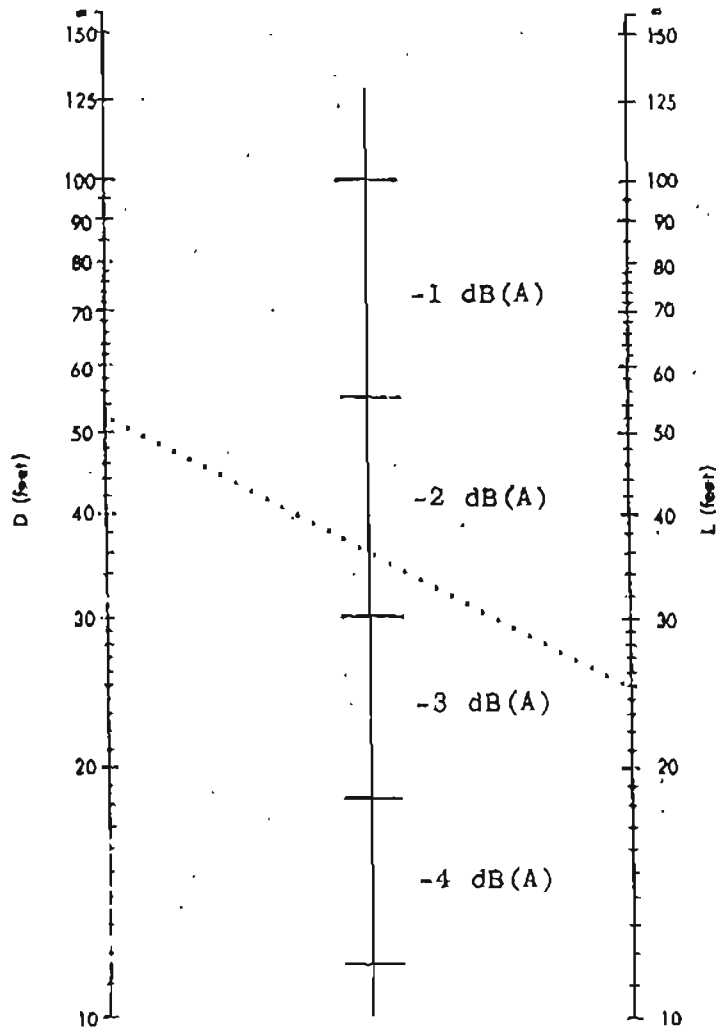


Figure 2

Distance "D" from microphone point "A" to reflecting surface.



Distance "L" from microphone "B" to reflecting surface.

On centerline read dB(A) correction to be subtracted from meter reading.

Figure 3

D  
M  
S  
O  
P  
O  
R  
P

Form 400A  
CONTINUATION SHEET  
FOR FILING ADMINISTRATIVE REGULATIONS  
WITH THE SECRETARY OF STATE  
(Pursuant to Government Code Section 11380.1)

(2) Distance from Embankments. The point of measurement from smooth embankments shall be the place on the embankment where the slope begins to exceed 45 deg above horizontal. The point of measurement from irregular embankments shall be the place on the embankment where the irregularity begins. A smooth embankment is one with vegetation, concrete, asphalt, dirt, or other relatively smooth cover.

(3) Restrictions. Selection of sites shall be subject to the following restrictions.

(A) Sound measurements shall not be made within 100 ft of a tunnel or overpass through which the roadway passes.

(B) The microphone shall not be placed between parallel surfaces which are less than 50 ft apart measured in the direction of the lane of travel (such as in an alley intersecting the roadway).

(C) The microphone and microphone point shall not be within 50 ft of overhangs that exceed 2 ft on buildings.

(D) Sound measurements shall not be made with the microphone or the center of the lane of travel within 10 ft of any sound-reflecting surface for a distance of 50 ft parallel to the vehicle path on either side of the microphone point.

(4) Change in Sound Measuring Distance. When the distance from the microphone to the center of the lane of travel differs from the standard 50 ft at a restricted measuring site (see Table 1) the dB(A) correction for distance shall be algebraically added to the correction for reflections.

(c) Nonreflecting Surfaces. The following objects shall not be considered sound-reflecting surfaces.

(1) Any surface that measures less than 8 ft in length in a direction parallel to the vehicle path, regardless of height (such as a telephone booth or a tree trunk), or less than 1 ft in height, regardless of length (such as a curb or guard rail)

P  
R  
O  
P  
O  
S  
E  
D

DO NOT WRITE IN THIS SPACE

CONTINUATION SHEET  
FOR FILING ADMINISTRATIVE REGULATIONS  
WITH THE SECRETARY OF STATE  
(Pursuant to Government Code Section 11380.1)

(2) Any vertical surface (such as a billboard) with the lower edge more than 15 ft above the roadway

(3) Any uniformly smooth slanting surface with less than a 45 deg slope above horizontal

(4) Any slanting surface with a 45- to 90- deg slope above horizontal where the line at which the slope begins to exceed 45 deg is more than 15 ft above the roadway

(5) Trees, bushes, shrubs, hedges and tall grass.

(d) Roadway Surface. The surface over which the vehicle travels shall be dry and relatively smooth concrete or asphalt pavement.

1047. Measurement Sites for New Motor Vehicles. Sites for measuring sound from new motor vehicles shall meet the following requirements:

(a) Location. The location shall be a flat open space free of large vertical sound-reflecting surfaces (such as signboards, buildings, hillsides, or trees) within 100 ft of the microphone and within 100 ft of the following points on the vehicle path:

- (1) The microphone point
- (2) A point 50 ft before the microphone point
- (3) A point 50 ft beyond the microphone point

(b) Ground Condition. The ground surface of the measuring site for all vehicles except snowmobiles shall be smooth asphalt or concrete free of powdered snow, loose soil or ashes in at least the triangular area formed by the microphone location, acceleration point, and end point. For snowmobiles, the ground surface shall be covered with live vegetation no more than 4 in. in height.

(c) Roadway Surface. The surface over which the vehicle travels shall be dry, smooth, asphalt or concrete pavement free of extraneous material, except that the pathway for snowmobiles shall be covered with vegetation no more than 4 in. in height.

1048. New Motor Vehicles Tests. New motor vehicles shall be tested both with and without auxiliary equipment that may be in use while the vehicle is operated on the highway. Auxiliary equipment includes but is not limited to cement mixers, refrigeration units, air conditioners and garbage compactors.

D E M S O P R P

DO NOT WRITE IN THIS SPACE

0000 0132



CONTINUATION SHEET  
FOR FILING ADMINISTRATIVE REGULATIONS  
WITH THE SECRETARY OF STATE  
(Pursuant to Government Code Section 11330.1)

(a) Heavy Trucks, Truck Tractors, and Buses. The test procedure for vehicles with a manufacturer's gross vehicle weight rating of 6,000 lbs or more shall be as follows:

(1) Test Area Layout. The test area shall include a vehicle path of sufficient length for safe acceleration, deceleration, and stopping of the vehicle. The following points and zones shall be established on the vehicle path as shown in Figure 4, where only one directional approach is illustrated for purposes of clarity.

(A) Microphone point

(B) Acceleration point - a location 50 ft before the microphone point

(C) End point - a location 50 ft beyond the microphone point

(D) End zone - the last 40-ft distance between the microphone point and the end point.

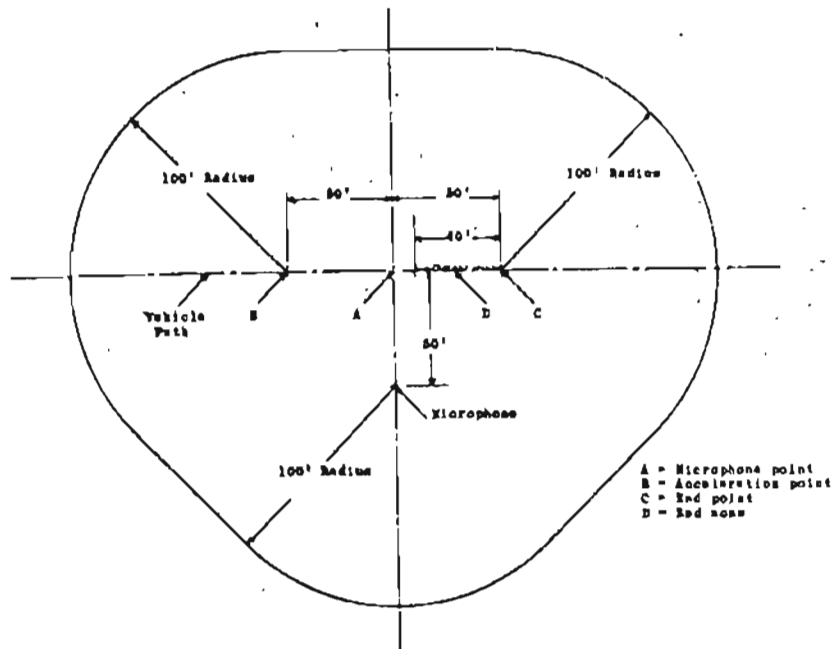


Figure 4

P  
R  
O  
P  
O  
S  
E  
D

DO NOT WRITE IN THIS SPACE

CONTINUATION SHEET  
FOR FILING ADMINISTRATIVE REGULATIONS  
WITH THE SECRETARY OF STATE  
(Pursuant to Government Code Section 11380.1)

(2) Gear Selection. A gear shall be selected (manual or automatic transmission) which will result in the vehicle beginning at an approach rpm of no more than 2/3 maximum rpm at the acceleration point and reaching maximum rpm within the end zone without exceeding 35 mph.

(A) When maximum rpm is attained before reaching the end zone, the next higher gear shall be selected, up to the gear where maximum rpm produces over 35 mph.

(B) When maximum rpm still occurs before reaching the end zone, the approach rpm shall be decreased in 100 rpm increments until maximum rpm is attained within the end zone.

(C) When maximum rpm is not attained until beyond the end zone, the next lower gear shall be selected until maximum rpm is attained within the end zone.

(D) When the lowest gear still results in reaching maximum rpm beyond the end zone, the approach rpm shall be increased in 100 rpm increments above 2/3 maximum rpm until the maximum rpm is reached within the end zone.

(3) Acceleration. The vehicle shall proceed along the vehicle path maintaining the approach engine rpm in the gear selected for at least 50 ft before reaching the acceleration point. When the vehicle reference point reaches the acceleration point, the throttle shall be rapidly and fully opened and held open until maximum rpm is attained within the end zone, at which point the throttle shall be closed.

(4) Deceleration. Tests during deceleration shall be conducted when deceleration noise appears excessive. The vehicle shall proceed along the vehicle path at maximum rpm in the same gear selected for the tests during acceleration. When the vehicle reference point reaches the microphone point, the throttle shall be rapidly closed and the vehicle allowed to decelerate to less than 1/2 maximum rpm. Vehicles equipped with exhaust brakes shall also be tested with the brake full on immediately following closing of the throttle.

DO NOT WRITE IN THIS SPACE

P  
R  
O  
P  
O  
S  
E  
D

CONTINUATION SHEET  
FOR FILING ADMINISTRATIVE REGULATIONS  
WITH THE SECRETARY OF STATE  
(Pursuant to Government Code Section 11380.1)

(5) Engine Temperature. The engine temperature shall be within normal operating range throughout each test run.

(b) Light Trucks, Truck Tractors, Buses, and Passenger Cars. The test procedure for trucks, truck tractors, and buses with a manufacturer's gross vehicle weight rating of less than 6,000 lbs, and all passenger cars shall be as follows:

(1) Test Area Layout. The test area shall include a vehicle path of sufficient length for safe acceleration, deceleration, and stopping of the vehicle. The following points and zones shall be established on the vehicle path as shown in Figure 5, where only one directional approach is illustrated for purposes of clarity:

- (A) Microphone point
- (B) Acceleration point - a location 25 ft before the microphone point
- (C) End point - a location 100 ft beyond the microphone point
- (D) End zone - the last 75-ft distance between the microphone point and the end point.

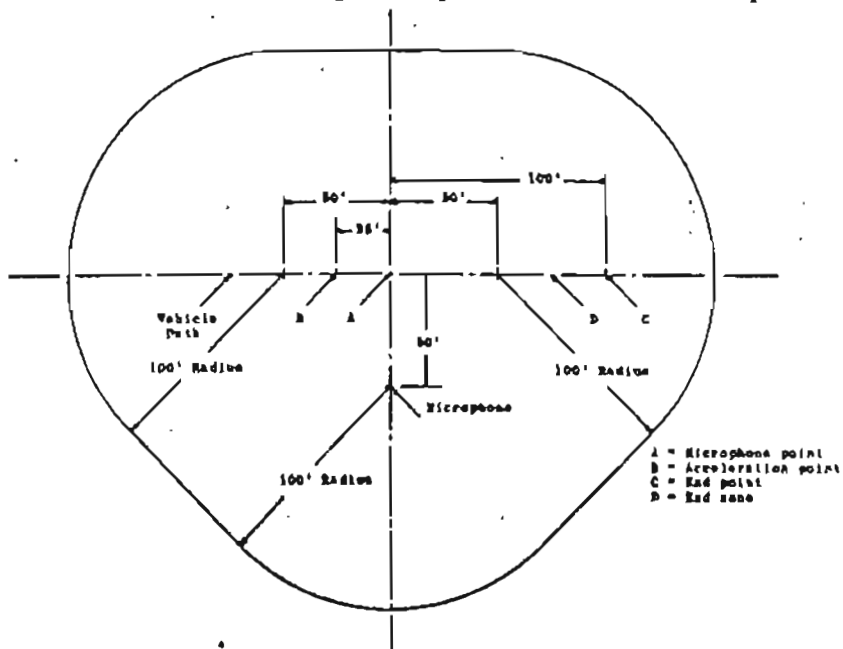


Figure 5

PROPOSED

DO NOT WRITE IN THIS SPACE

CONTINUATION SHEET  
FOR FILING ADMINISTRATIVE REGULATIONS  
WITH THE SECRETARY OF STATE  
(Pursuant to Government Code Section 11380.1)

(2) Gear Selection. Motor vehicles equipped with three-speed manual transmissions and with automatic transmissions shall be operated in first gear. Vehicles equipped with manual transmissions of four or more speeds shall be operated in first gear and in second gear. Vehicles which reach maximum rpm at less than 30 mph or before reaching the end zone shall be operated in the next higher gear. Auxiliary step-up ratios (overdrive) shall not be engaged on vehicles so equipped.

(3) Acceleration. The vehicle shall proceed along the vehicle path at a constant speed of 30 mph in the selected gear for at least 50 ft before reaching the acceleration point. When the vehicle reference point reaches the acceleration point, the throttle shall be rapidly and fully opened. The throttle shall be held open until the vehicle reference point reaches the end point, or until maximum rpm is reached within the end zone. At maximum rpm, the throttle shall be closed sufficiently to keep the engine just under maximum rpm until the end point, at which time the throttle shall be closed.

(4) Deceleration. Tests during deceleration shall be conducted when deceleration noise appears excessive. The vehicle shall proceed along the vehicle path at maximum rpm in the same gear selected for the tests during acceleration. When the vehicle reference point reaches the acceleration point, the throttle shall rapidly be closed and the vehicle allowed to decelerate to less than 1/2 of maximum rpm.

(5) Engine Temperature. The engine temperature shall be within normal operating range throughout each test run. The engine shall be idled in neutral for at least one minute between runs.

(c) Motorcycles. The test procedure for motorcycles shall be as follows:

(1) Test Area Layout. The test area layout for motorcycles shall be the same as specified in preceding subsection (b)(1) and Figure 5 for light trucks, truck tractors, buses, and passenger cars.

P  
R  
O  
P  
O  
S  
E  
D

DO NOT WRITE IN THIS SPACE

CONTINUATION SHEET  
FOR FILING ADMINISTRATIVE REGULATIONS  
WITH THE SECRETARY OF STATE  
(Pursuant to Government Code Section 11380.1)

(2) Gear Selection. Motorcycles shall be operated in second gear. Vehicles which reach maximum rpm at less than 30 mph or before a point 25 ft beyond the microphone point shall be operated in the next higher gear.

(3) Acceleration. The vehicle shall proceed along the test path at a constant approach speed which corresponds either to an engine speed of 60 percent of maximum rpm or to 30 mph, whichever is lower. When the vehicle reference point reaches the acceleration point, the throttle shall be rapidly and fully opened. The throttle shall be held open until the vehicle reference point reaches the end point or until the maximum rpm is reached within the end zone, at which point the throttle shall be closed. Wheel slip shall be avoided.

(4) Deceleration. Tests during deceleration shall be conducted when deceleration noise appears excessive. The vehicle shall proceed along the vehicle path at maximum rpm in the same gear selected for the tests during acceleration. When the vehicle reference point reaches the acceleration point, the throttle shall be rapidly closed and the vehicle shall be allowed to decelerate to less than 1/2 of maximum rpm.

(5) Engine Temperature. The engine temperature shall be within normal operating range before each test run.

(6) Weight. For testing purposes, the combined weight of the driver and any test equipment he carries shall be not more than 165 nor less than 155 lbs. Weights shall be used to compensate for any difference between the actual driver/equipment load and the required 155 lb minimum.

(d) Snowmobiles. The test procedure for new snowmobiles shall be as follows:

(1) Test Area Layout. The test area shall include a vehicle path of sufficient length for safe acceleration, deceleration, and stopping of the vehicle. The following points and zones shall be established on the vehicle path as shown in Figure 6, where only one directional approach is illustrated for purposes of clarity:

P  
R  
O  
P  
O  
S  
E  
D

DO NOT WRITE IN THIS SPACE

0000 0138



CONTINUATION SHEET  
FOR FILING ADMINISTRATIVE REGULATIONS  
WITH THE SECRETARY OF STATE  
(Pursuant to Government Code Section 11360.1)

(A) Microphone point

(B) End point - a location 50 ft beyond the microphone point

(C) Acceleration point - a location on the vehicle path established as follows: Position the vehicle reference point at 25 ft from the microphone point. From a standing start with transmission in low gear, rapidly apply wide open throttle, accelerating until maximum rpm is attained. The location on the vehicle path where maximum rpm was attained is the acceleration point for tests run in the opposite direction.

(D) Maximum rpm zone.

(2) Acceleration. From a standing start, with transmission in low gear and the vehicle reference point positioned at the acceleration point, the throttle shall be rapidly and fully opened and held through the maximum rpm zone until the vehicle reference point reaches the end point after which the throttle shall be closed.

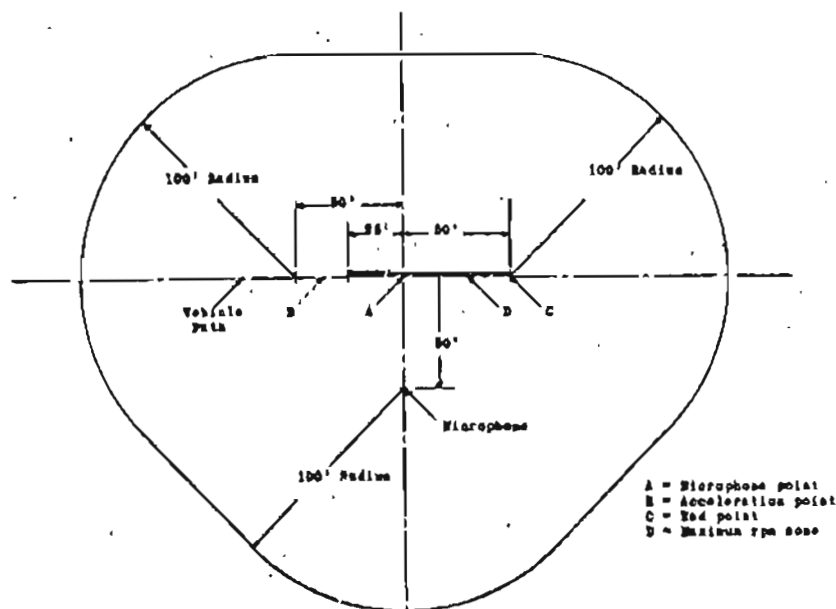


Figure 6

DO NOT WRITE IN THIS SPACE

P  
R  
O  
P  
O  
S  
E  
D



CONTINUATION SHEET  
FOR FILING ADMINISTRATIVE REGULATIONS  
WITH THE SECRETARY OF STATE

(Pursuant to Government Code Section 11380.1)

1049. Vehicle Sound Level. The measured sound level of a vehicle shall be reported as follows:

(a) Vehicles on the Highway. The sound level reading for vehicles in use on the highway shall be the highest reading observed as the vehicle or combination of vehicles passes through the measuring site.

(b) New Motor Vehicles. The sound level reading for a new motor vehicle shall be obtained as follows:

(1) Preliminary Runs. Sufficient preliminary runs shall be made to enable the test driver to become familiar with the operation of the vehicle and to stabilize engine operating conditions.

(2) Test Runs. At least four test runs shall be made for each side of the vehicle. When the exhaust outlet is more than 16 ft from the front of the vehicle, at least two runs shall be made for each side of the vehicle using both the primary and secondary reference points defined in Section 1041(e) of this code. At least two additional runs shall be made from the reference point that gives the highest readings.

(3) Reported Sound Level. The reported A-weighted sound level for each side of the vehicle shall be the average of the two highest readings on that side which are within 2 dB(A) of each other. The sound level reported for the vehicle shall be the sound level of the loudest side.

DO NOT WRITE IN THIS SPACE

P  
R  
O  
P  
O  
S  
E  
D



R74-10

34. 9/29/75 Chrysler Corporation by James H. Kilroy  
(Mailgram)
35. 9/29/75 Illinois Bus Association by B.L. Peyton
36. 9/29/75 Mr. John Fanzino
37. 9/29/75 California Highway Patrol "Sound Measurement  
Procedures" (HPH 83.3) submitted by Illinois  
EPA, John S. Moore
38. 9/29/75 Illinois State Chamber of Commerce by Raymond  
J. Bodnar w/attachments
39. 9/29/75 General Motors Corporation by Martin B. Buckner  
w/attachments
40. 9/29/75 Institute for Environmental Quality by Samuel  
G. Booras, Director w/attachment
41. 9/30/75 Illinois Department of Transportation by  
Larry F. Wort
42. 9/30/75 Memo to Board from Roy Harsch re: Telephone  
Conversations pertaining to R74-10
43. 10/6/75 City of Chicago by Commissioner H.W. Poston
44. 10/8/75 Chicago Automobile Trade Association by Ross E. Kelsoy
45. 10/8/75 Walter E. Quinby w/attachment
46. 10/30/75 J.I. Case Co. by Lawrence H. Hodges
47. 1/13/76 William J. Bergmann
48. 1/21/76 Ron Thornton
49. 9/8/76 University of Illinois at Urbana-Champaign by  
Sheldon J. Plager
50. 9/28/76 Charles & Sylvia Smz
51. 10/15/76 Illinois EPA proposed amendments to final draft  
by James M. Bumgarner
52. 10/25/76 Motor Vehicle Laws Commission(Illinois) by Frank  
Gioglio, Acting Chairman
53. 11/3/76 Illinois Task Force on Noise by Sheldon Plager
54. 11/3/76 Illinois Task Force on Noise (Special Statement)  
by Sheldon Plager

PAGES 66-68  
MILROFICHE

Illinois

Richard H. Briceland, Director



Environmental Protection Agency



Mailing address:

2200 Churchill Road, Springfield, Illinois 62706

Office location: 4500 S. 6th St. Rd., Springfield, Illinois 62706

Telephone: 217-786-6758

P.C.# 37

September 26, 1975

RECEIVED

SEP 29 1975

POLLUTION CONTROL BOARD

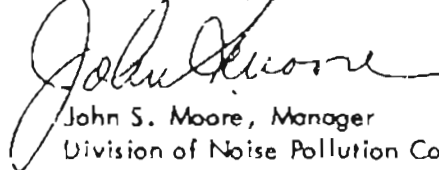
Mr. Jacob Dumelle  
Chairman  
Illinois Pollution Control Board  
Suite 300, 309 West Washington  
Chicago, Illinois 60606

Re: R74-10  
(Proposed Motor Vehicle Noise Regulations)

Dear Chairman Dumelle:

Enclosed herein please find two copies of the current California Highway Patrol "Sound Measurement Procedures" (HPH 83.3). This letter and enclosures are formally being submitted in order that they be entered into the record of the above captioned proceedings.

Yours very truly,

  
John S. Moore, Manager  
Division of Noise Pollution Control

JSM:js  
Encs.