SAE International

SURFACE VEHICLE STANDARD

SAE J1075 MAR2013

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Superseding J1075 NOV2007

Sound Measurement - Construction Site

RATIONALE

SAE J1075 is being reaffirmed due to its continued value as a standardized test method for measuring the non-specific noise levels around the perimeter of a work site. The methods and technology used within this test standard are unchanged and are not anticipated to change in the near future.

1. SCOPE

This SAE Standard sets forth measurement procedures and instrumentation to be used for determining a "representative" sound level during a representative time period at selected measurement locations on a construction site boundary. The document is not intended for use in determining occupational hearing damage risk. Determination of a representative time period is left to the judgment of the user.

1.1 Purpose

The purpose of this SAE document is to set forth procedures that may be used by construction site management for self-regulation and construction site planning or by state and local officials for the enforcement of construction site noise regulations. Two measurement methods are provided to obtain the time-integrated equivalent sound level, L_{eq}, emitted by construction site activity. First, a sampling procedure is recommended for use with a sound level meter. Second, a measurement procedure using an integrating sound level meter is presented. The latter procedure is generally preferred. Use of this document provides sound level data representative of the complex time-varying sounds emitted by construction activities, which may be used to estimate community reaction to the construction activity.

2. REFERENCES

2.1 Applicable Publications

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publication

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J184 Qualifying a Sound Data Acquisition System

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
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2.1.2 ANSI Publications

Available from ANSI, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ANSI S1.4 Specification for Sound Level Meters

ANSI S1.40 Specification for Acoustical Calibrators

ANSI S12.9/3 Quantities and Procedures for Description and Measurement of Environmental Sound, Part 3: Short-Term Measurement with an Observer Present

2.1.3 IEC Publications

Available from International Electrotechnical Commission, 3, rue de Verambe, P.O. Box 131, 1211 Geneva 20, Switzerland, Tel: +41-22-919-02-11, www.iec.ch.

IEC 60942 Sound Calibrators

IEC 61672-1 Electroacoustics—Sound Level Meters—Part 1: Specifications

3. DEFINITIONS

3.1 Construction Site

The construction site is that area within the defined boundaries of the project. This includes defined boundary lines of the project itself, plus any staging area outside those defined boundary lines used expressly for construction or demolition.

3.2 Construction Site Boundaries

The outermost limit lines of the construction site.

3.3 Noise Sensitive Area

Property such as that used for public, commercial, religious, or educational purposes, or home dwellings, parks, and other special-purpose areas in the vicinity of a construction site where the ambient noise is less than the construction site sound level.

3.4 Instrument Noise Floor

The instrument noise floor is the total acoustical and electrical noise from all sources in a system that interferes with the production, transmission, detection, measurement, or recording of a signal. The sound level meter range setting must be selected so that the Instrument noise floor is 10 dB below measured ambient sound.

3.5 Ambient Sound

The all-encompassing sound typically associated with the environment in a given area, being composed of sounds from many sources far and near, when the construction site is inactive.

3.6 Representative Sound Level, L_A

The average of sound level samples obtained in accordance with the procedures.

3.7 Equivalent (or Time-Average) Sound Level, L_{eq}

Equivalent or time-average sound is the square root of the time-average of instantaneous sound pressure squared. It is also termed the root-mean-square sound. Equivalent sound level is 10 times the common logarithm of the square of the ratio of the equivalent or time-average sound to the reference sound, p_o, of 20 μPa.

4. INSTRUMENTATION

4.1 Sound Level Measurement Instrument

4.1.1 If 6.1 is to be followed, a sound level meter meeting Type 1 or Type 2 requirements of ANSI S1.4-1983 (R1997) or IEC 61672-1 shall be used.

4.1.2 If 6.2 is to be followed, an integrating sound level meter that provides the equivalent sound level for a measurement period of at least 30 min shall be used. The integrating-averaging sound level meter meeting Type 1 or Type 2 requirements of IEC 61672-1 should be used. The integrating sound level meter shall have a "pause" or "standby" capability that inhibits data collection. The dynamic range of the instrument should be at least 80 dB, including crest factor.

4.1.3 As an alternative to making direct measurements with a sound level meter or integrating sound level meter, a microphone or sound level meter may be used with a magnetic tape recorder or graphic level recorder and data analysis instrumentation providing the system meets the requirements of SAE J184.

4.2 Calibrator

An acoustic calibrator with an accuracy within ±0.5 dB meeting the requirements of IEC 60942.

4.3 Windscreen

A microphone windscreen shall be used except when the user is certain that the wind-induced noise is more than 15 dB below the sound level of the source being measured. A windscreen may be used at all times. When a windscreen is used, it shall be of a type recommended by the microphone manufacturer, and it shall not affect the A-weighted sound level of the source being measured by more than ±0.5 dB in a calm (no wind) situation.

4.4 Anemometer

An anemometer or other device for use in measurement of wind speed and direction with an accuracy within ±10% at 20 km/h.

5. SITE CHARACTERIZATION

5.1 Obtain specific drawings, survey stake locations, or other pertinent information and sketch the boundaries of the construction site and noise sensitive areas; a facsimile of Figure 1 may be used. Note the distance between the noise sensitive area(s) and the nearest boundaries.

5.2 Obtain information to determine location and activity pattern of equipment on the construction site during the planned measurement period.

5.3 Based on 5.1 and 5.2, select the sound level measurement location(s).

6. MEASUREMENTS

Two sound level measurement procedures are presented. A manual sampling procedure using a sound level meter is given in 6.1. Paragraph 6.2 describes the procedure for using an integrating-averaging sound level meter.

NOTE: ANSI S12.9/3 meets the requirements of this document and provides a more detailed method to measure L_{eq} corrected for ambient noise.

6.1 Manual Sampling with Sound Level Meter

Sound level measurements at construction site boundary adjacent to noise sensitive areas shall be taken with a sound level meter in the following manner for any representative 30 min period of construction activity:

6.1.1 Calibrate the sound level meter before and after each measurement period using an acoustic calibrator, per manufacturer's instructions. If calibration shifts by more than 0.5 dB, the measurements shall be repeated after correction of the shift problem.

6.1.2 Locate the microphone at the location selected in 5.3 at approximately 1.5 m above the ground and, if practical, at least 3 m from sound reflecting structures. If circumstances dictate, measurements may be made at other heights and closer to sound reflecting structures providing these facts are noted on a data sheet similar to Figure 1.

6.1.3 Set the sound level meter to the A-weighting network and slow response. Observe the sound level meter during a 10 s ± 2 s sampling period at the start of each consecutive 30 s period. Record the maximum value observed during each sample period, L_A, on a data sheet such as shown in Figure 2. Take 60 valid readings where a valid reading is one in which the measurements are not affected by intrusive noise sources external to the construction site, such as aircraft, emergency signals, and surface transportation; make a note on the data sheet for each invalid reading.

6.1.4 On/off-highway vehicles, such as dump trucks, truck/mixers, etc., which occasionally enter, operate on, and leave the site, shall be considered as part of the construction activity while within the site boundaries. However, off-site pass-by of such vehicles in the area of measurement location shall be considered as intrusions, and handled as outlined in 6.1.3.

6.1.5 Determine the representative sound level, L_A, using:

$$\overline{L}_A = \sum_{i=1}^{n} (L_A)_i / n \qquad \text{(Eq. 1)}$$

where:

L_A = The arithmetic average of the $(L_A)_i$
n = The number of $(L_A)_i$ values used for computing the arithmetic average

$(L_A)_i$ includes those sound level samples that fall within a range from the maximum sample level to 6 dB below the maximum sample level. For example, if the maximum sample level was 70 dB, all sound level samples between 64 and 70 dB would be valid $(L_A)_i$.

CONSTRUCTION SITE SKETCH FORM

1. Measurer _____

2. Date _____ Temperature _____ Wind Velocity _____

3. Construction Site: Location _____

   Description _____

4. Sound Level Meter: Mfr. _____ Model _____ S/N _____

5. Remarks: _____

   _____

6. Site sketch showing site boundaries, noise sensitive areas, measurement locations, and major pieces of construction equipment in operation, with distances between the above items; also show wind direction:

FIGURE 1 - SAMPLE SITE SKETCH DATA SHEET

Measurer: _____ Date: _____ Time: _____
Construction Site: _____ Measurement Point: _____
Remarks: _____
_____

Instructions:
1. Select A-weighting network and "slow" response on meter.
2. Calibrate meter using acoustic calibrator and install windscreen.
3. Observe for 10 s ± 2 s at the start of each minute and each one-half minute for 30 min, and record maximum level for each observation period.

	L_A	Remarks		L_A	Remarks
1.			31.		
2.			32.		
3.			33.		
4.			34.		
5.			35.		
6.			36.		
7.			37.		
8.			38.		
9.			39.		
10.			40.		
11.			41.		
12.			42.		
13.			43.		
14.			44.		
15.			45.		
16.			46.		
17.			47.		
18.			48.		
19.			49.		
20.			50.		
21.			51.		
22.			52.		
23.			53.		
24.			54.		
25.			55.		
26.			56.		
27.			57.		
28.			58.		
29.			59.		
30.			60.		

4. Determine $\overline{L_A}$: Circle L_A values within 6 dB of maximum value.
   $\overline{L_A}$ = number of circled values/sum of circled values = n/sum = ___/___ = ___
5. Determine L_{eq}:
   n/60 = ___ Correction (Table 1) = ___ L_{eq} = $\overline{L_A}$ - Correction = ___

FIGURE 2 - MANUAL SAMPLING DATA SHEET

6.1.6 Determine a correction to be applied to L_A to approximate L_{eq} for the measurement period: divide n by 60, read the corresponding correction from Table 1, and subtract this value from L_A.

Then,

$$L_{eq} = L_A - \text{Correction} \quad \text{(Eq. 2)}$$

TABLE 1 - CORRECTIONS TO L_A TO OBTAIN L_{eq}

n/60[1] greater than	n/60[1] less than or equal to	Correction, dB[2]
0.8	1.0	0
0.7	0.8	1
0.6	0.7	2
0.5	0.6	3
0.4	0.5	4
0.3	0.4	5
0.2	0.3	7
0	0.2	10

1. n is the number of samples used in the calculation of L_A.
2. Subtract L_A to obtain L_{eq}.

6.2 Sampling with an Integrating Sound Level Meter

Equivalent sound level measurements at the construction site boundary adjacent to noise sensitive areas shall be taken with an integrating sound level meter in the following manner:

6.2.1 Calibrate the integrating sound level meter before and after each measurement period, using an acoustic calibrator. Equivalent sound level measurements at the construction site boundary adjacent to noise sensitive areas shall be taken with an integrating sound level meter in the following manner:

6.2.2 Locate the microphone at approximately 1.5 m above the ground and, if practical, at least 3 m from sound reflecting structures. When circumstances dictate, measurements may be made at other heights and closer to sound reflecting structures, providing these facts are noted on a data sheet similar to Figure 1.

6.2.3 Set the integrating sound level meter to the A-weighting network and slow response (if no slow response switch is present, note that fact in the reporting described in 6.3.1). Estimate what the anticipated maximum and minimum levels will be during the measurement period and set the range of the meter to include these extremes (for example, 40 to 120 dB is a typical range for construction site activity).

6.2.4 Start the integrating sound level meter and maintain it in a data collection state for 30 min, exclusive of periods deleted due to intrusions per 6.2.5.

6.2.5 If during the measurement period the levels are affected by intrusive noise sources external to the construction site, such as aircraft, emergency signals, and surface transportation, activate the pause or standby switch to inhibit data collection until the intrusion is over.

6.2.6 Record the L_{eq} value at the conclusion of the 30 min measurement period (exclusive of deleted time periods).

6.3 Information to be Reported

6.3.1 Name of measurer, date, time, construction site, location, type of construction, wind velocity and direction, ambient temperature, sound level meter manufacturer, model, and serial number shall be reported.