Measurement Procedure for Determining a Representative Sound Level at a Construction Site Boundary Location – SAE J1075

SAE Recommended Practice
Approved April 1978

THIS IS A PREPRINT WHICH IS SUBJECT TO REVISIONS AND CORRECTIONS. THE FINAL VERSION WILL APPEAR IN THE 1979 EDITION OF THE SAE HANDBOOK.

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LAND SEA AIR SPACE

PREPRINT

MEASUREMENT PROCEDURE FOR DETERMINING A REPRESENTATIVE SOUND LEVEL AT A CONSTRUCTION SITE BOUNDARY LOCATION—SAE J1075

SAE Recommended Practice

Report of Construction, Agricultural and Off-Road Machinery Sound Level Technical Committee approved April 1978. Rationale statement available.

1. Scope—This SAE Recommended Practice sets forth 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. It concerns the community adjacent to the construction site, and it is not intended for use in determining occupational hearing damage risk.

2. Introduction—The procedure set forth in this document 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. As is demonstrated in the rationale statement (Ref. 1) to this recommended practice, the representative sound level obtained using this procedure approximates the *energy* equivalent sound level, L_{eq}, obtained from more sophisticated data acquisition and analysis techniques. Use of this recommended practice provides sound level data representative of the complex time-varying sounds emitted by construction activities which may be applied using various methods (Ref. 1) to estimate community reaction to the construction activity.

3. Definitions

3.1 Construction Site—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 Boundaries of the Construction Site—The outermost limit lines of the construction site.

3.3 Noise Sensitive Area—Inhabited property such as that used for public, commercial, religious, or educational purposes, or home dwellings, parks, and other special purpose areas where the background ambient sound is less than the construction site sound level.

3.4 Background Ambient Sound—The all encompassing sound associated with the given environment, when the construction site is inactive, being usually a composite of sounds from many sources far and near.

3.5 Representative Sound Level, $\overline{L}_A$—It is the average of sound level samples accomplished in accordance with procedures outlined in paragraphs 6.1.1 –6.1.5.

3.6 Equivalent Sound Level, L_{eq}—It is the *energy average* sound level, the steady level consisting of the same acoustic energy as the time varying sound.

4. Instrumentation

4.1 A sound level meter which meets Type 1 requirements of American National Standard Specification for Sound Level Meters, S1.4-1971 (Ref. 2).

4.2 As an alternative to making direct measurements with the sound level meter, a microphone or sound level meter may be used with a magnetic tape recorder and/or graphic level recorder or data analysis instrumentation (either analog or digital) providing the system meets the requirements of SAE J184, Qualifying a Sound Data Acquisition System (Ref. 3).

4.3 An acoustic calibrator with an accuracy of ±0.5 dB (see paragraph 7.3.4).

4.4 A windscreen recommended by the sound level meter manufacturer (see paragraph 7.4).

4.5 An anemometer with an accuracy of ±10% of full scale wind speed.

5. Site Determination

5.1 Obtain specific drawings, survey stake locations, and other pertinent information in order to sketch the boundaries of the construction site and noise sensitive areas on a facsimile of Fig. 1. If applicable, the distance between the boundaries and the noise sensitive land use should be noted.

5.2 Obtain information in sufficient detail necessary to determine location and activity pattern of the construction site during the period used for measurement, as well as the locations of noise sensitive areas, in order to aid in the selection of sound level measurement locations.

6. Measurement

6.1 Sound level measurements at construction site boundary adjacent to noise sensitive areas shall be taken in the following manner:

6.1.1 Calibrate the sound level meter before and after each measurement period, using an acoustic calibrator.

6.1.2 Locate the microphone at 1.5 m (4.9 ft) above the ground and, if practical, at least 3 m (9.8 ft) from walls, buildings, or other sound reflecting structures when they appear at the construction site boundary. When circumstances dictate, measurements may be made at greater distances and heights and closer to walls, providing these facts are noted.

6.1.3 Set the sound level meter to the A-weighting network and slow response. Observe the sound level meter (for maximum values) during a 10±2 s sampling period at the *start* of each minute and one-half minute for any representative 30-min period of construction activity. If during any of these observations, the measurements are affected by any intrusive noise sources outside the construction site, such as aircraft, emergency

(Construction Site)

1. Sketch Appropriate Site Boundaries, Adjacent Communities, and Measurement Locations

2. Construction Site _____ Type _____

3. Sound-Level Meter: Manuf. _____ Model _____ S/N _____

4. Weather Conditions _____

5. Remarks _____

FIG. 1—SAMPLE SKETCH FORMAT

The ϕ symbol is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. If the symbol is next to the report title, it indicates a complete revision of the report.

signals, and surface transportation, measurements made during these periods should not be considered, but the number of one-half minute observation periods should be extended until 60 valid measurements are obtained.

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, pass-by of such vehicles, in the area of the measurement location causing difficulty in obtaining valid measurements, shall be considered as intrusions, and handled as in the preceding paragraph. An alternative measurement system, paragraph 4.1, may be required to augment the direct measurements for these construction site conditions.

6.1.4 Tabulate the maximum values, L_A, observed during the sample period, using a data sheet such as shown in Fig. 2.

6.1.5 Determine the representative sound level, $\overline{L}_A$, using:

$$\overline{L}_A = \left(\sum_{1}^{n} L_A\right)/n$$

Arithmetic average of L_A values.

Instructions:

1. Calibrate sound level meter using acoustic calibrator.
2. Install windscreen, select A-weighting network, select "slow" response.
3. Observe for 10 ±2 s at the start of each minute and one-half minute for 30 min.
4. Tabulate maximum reading L_A.

Determine Arithmetic Average $\overline{L}_A$

	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.		

Sum: _____ (See paragraph 6.1.5.)

Note: Consider for the sum only those values within 6 dB of the maximum value observed.

$\overline{L}_A$ = Sum/n n is the number of L_A values used in computing Sum.

Location _____ Date _____ Time _____

Wind Velocity _____ km/h Temperature _____ °C Observer _____

Remarks _____

FIG. 2–CONSTRUCTION SITE NOISE MEASUREMENT DATA SHEET

L_A values: those sound levels which fall within a range of from 6 dB less than the maximum level to and including the maximum level (L_{max}, L_{max-1}, L_{max-2}, L_{max-3}, L_{max-4}, L_{max-5}, L_{max-6}).

n: the number of L_A values used for computing the arithmetic average.

The use of this technique provides a result which is comparable to *energy averaging* all of the observed values. Corrections may be applied (see Table 1) which result in a computation of L_{eq} for the representative measurement period.

7. General Comments

7.1 It is often desirable to obtain the background ambient sound level on the same day as the sound survey to obtain representative construction site sound levels. It is suggested that this be accomplished when the construction site is inactive, such as before start-up, during the luncheon break, or after shut-down. The above procedure (paragraphs 6.1.1–6.1.5) should be used. Include all intrusive, non-construction related noise sources.

7.2 It is recommended that persons technically trained and experienced in the current techniques of sound measurements select the equipment and conduct the tests.

7.3 Proper usage of all test instrumentation is essential to obtain valid measurements. Operating manuals or other literature furnished by the instrument manufacturer should be referred to for both the recommended operation of the instrument and precautions to be observed. Specific items to be considered are:

7.3.1 The type of microphone, its directional response characteristics, and its orientation relative to the ground plane and source of noise.

7.3.2 The effects of ambient weather conditions on the performance of all instruments (for example: temperature, humidity, and barometric pressure). Instrumentation can be influenced by low temperature and caution should be exercised.

7.3.3 Proper signal levels, terminating impedances, and cable lengths on multi-instrument measurement systems.

7.3.4 Proper acoustical calibration procedure, to include the influence of extension cables, etc. Field calibration with an acoustic calibrator shall be made immediately before and after each test sequence. Internal calibration means is acceptable for field use, provided that external calibration is accomplished immediately before or after field use.

7.4 A microphone windscreen recommended by the manufacturer shall be used provided that the noise due to the wind is at least 15 dB (A-weighted) below that of the construction site noise or the background ambient sound levels. It is recommended that measurements be made only when wind velocity is below 20 km/h (12.4 mph).

7.5 Measurements should not be made if significant changes in extraneous and non-construction related noise-making activities or pat-

TABLE 1

Corrections to $\overline{L}_A$ to Obtain L_{eq}

n/60	Correction–dB
0.8–1	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
<0.2	10

where n is the number of samples used in the calculation of $\overline{L}_A$.

Note: $L_{eq} = \overline{L}_A$ –Correction