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100 Barr Harbor Dr., West Conshohocken, PA 19428
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Standard Guide for Measurement of Outdoor A-Weighted Sound Levels[1]

This standard is issued under the fixed designation E 1014; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

ϵ^1 NOTE—Keywords were added editorially in November 1995.

1. Scope

1.1 This guide covers the measurement of A-weighted sound levels outdoors at specified locations or along particular site boundaries, using a general purpose sound-level meter.

1.2 Three distinct types of measurement surveys are described:

1.2.1 Survey around a site boundary,

1.2.2 Survey at a specified location,

1.2.3 Survey to find the maximum sound level at a specified distance from a source.

1.3 Since outdoor sound levels almost always vary with time over a wide range, the data obtained using this guide may be presented in the form of a histogram of sound levels. The data obtained using this guide enables calculations of average or statistical sound levels for comparison with appropriate criteria.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

C 634 Terminology Relating to Environmental Acoustics[2]

2.2 *ANSI Standard:*

S1.4 Specification for Sound Level Meters[3]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this guide, see Terminology C 634.[4]

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *barrier*—any obstacle that blocks the line-of-sight between a source and a receiver or a measurement location.

3.2.2 *impulse noise*—a brief, intrusive sound, such as that associated with a tire blowout, operation of a power press, the discharge of a firearm, or a shout.

3.2.3 *measurement set*—the set of data obtained at a measurement location during a specific time period. For the types of measurements covered by this guide, evaluation of a site may require several measurement sets. The time period is flexible but should not extend beyond the time when the conditions influencing noise, or atmospheric conditions affecting noise propagation, are reasonably uniform. As an example, a significant change in traffic density or start-up of a machine indicate the beginning or end of a measurement set.

4. Significance and Use

4.1 There are numerous situations for which outdoor sound level data are required. These include, but are not limited to, the following:

4.1.1 Documentation of sound levels before the introduction of a new sound source (for example, assessment of the impact due to a proposed use).

4.1.2 Comparison of sound levels with and without a specific source (for example, assessment of the impact of an existing source).

4.1.3 Comparison of sound levels with criteria or regulatory limits (for example, indication of exceedence of criteria or non-compliance with laws).

4.2 This guide provides a means for selecting measurement locations, operating a sound level meter, documenting the conditions under which the measurements were performed, and recording the results.

4.3 This guide provides the user with information to (*1*) make and document the sound level measurements necessary to quantify relatively steady or slowly varying outdoor sound levels over a specific time period and at specific places and (*2*) make and document the physical observations necessary to qualify the measurements.

4.4 The user is cautioned that there are many nonacoustical factors that can strongly influence the measurement of outdoor sound levels and that this guide is not intended to supplant the experience and judgment of experts in the field of acoustics. The guide is not applicable when more sophisticated measurement methods or equipment are specified. This guide, depending as it does on simplified manual data acquisition, is necessarily more appropriate for the simpler types of environmental noise situations. As the number of sources and the range

[1] This guide is under the jurisdiction of ASTM Committee E-33 on Environmental Acoustics and is the direct responsibility of Subcommittee E33.09 on Community Noise.

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[2] *Annual Book of ASTM Standards,* Vol. 04.06.

[3] Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

[4] Terminology C 634 – 81a was used in the development of this guide.

of sound levels increase, the more likely experienced specialists with sophisticated instruments are needed.

4.5 This guide can be used by individuals, regulatory agencies, or others as a measurement method to collect acoustical data for many common situations. The data are obtained in the form of a histogram, a graph, or a table indicating the number of occurrences of each sound level observed during the measurement. Criteria for evaluating or analyzing the data obtained are beyond the scope of this guide.

4.6 Note that this guide is only a measurement procedure and, as such, does not address the methods of comparison of the acquired data with the specific criteria. No procedures are provided for estimating or separating the influences of two or more simultaneously measured sounds. This guide can be useful in establishing compliance when the measured data are below a specified limit.

4.7 Paragraph 8.2.1 outlines a procedure that can be used for a survey of the site boundary; paragraph 8.2.2 for a survey of specified monitoring points; and paragraph 8.2.3 for determining the location and magnitude of maximum sound level.

5. Apparatus

5.1 *Acoustical Measurements*:

5.1.1 *Sound Level Meter* (required), Type 2, as defined by ANSI S1.4–1971 preferably with an a-c output port to permit the use of headphones.

5.1.2 *Microphone Windscreen* (required), recommended by the sound level meter manufacturer.

5.1.3 *Acoustical Calibrator* (required), with adaptors necessary to fit the microphone.

5.1.4 *Set of Headphones* (desirable), compatible with and electrically connected to the a-c output of the sound level meter. Monitoring the output of the sound level meter with headphones may enable the operator to detect equipment malfunctions or anomalies in the data caused by wind, humidity, and electrical interference.

5.1.5 *Tripod* (desirable), to ensure a steady and repeatable microphone position.

5.2 *Physical Measurements*:

5.2.1 To assure an accuracy of 1 dB in values derived from these measurements, the accuracy of distance measurements must be within 5 %. Any instrument that provides this degree of accuracy is satisfactory.

5.2.2 *Pocket Compass* (desirable), used for site layout work and for determination of wind direction.

5.2.3 *Site Map* (optional).

5.3 *Meteorological Measurements*—Any of the many available general-accuracy meteorological instruments may be used in order to enable the measurement of:

5.3.1 Wind speed (5-km/h or 2.5-mph increments),

5.3.2 Wind direction (in octants),

5.3.3 Relative humidity (in 10 % increments),

5.3.4 Dry bulb temperature (in 2°C or 5°F increments).

6. Calibration

6.1 The calibration of the sound level meter shall be checked using an acoustical calibrator immediately before and after each measurement set, in a manner prescribed by the manufacturer. Adjustments, if required, shall be made at this time. Calibration shall also be verified if the sound level meter is abused (dropped, etc.). If the change in the calibration reading, as shown on the sound level meter, is 1 dB or greater, the data gathered since the preceding calibration are considered invalid and should be discarded.

6.2 The sound level meter and the acoustical calibrator shall have been thoroughly calibrated with equipment traceable to the National Institute of Standards and Technology within 1 year before the survey. Included in this calibration shall be checks of frequency response, amplifier sensitivity, internal noise, and verification of correct operation of meter circuits and microphone.

7. Interference

7.1 Wind may influence sound level measurements, even with a windscreen in place, particularly at wind speeds above 20 km/h (12 mph). Manufacturers' instructions shall be followed with respect to meter limitations under windy conditions. When wind speeds approach or exceed 20 km/h, headphones shall be used to monitor the sound level meter output or the sound level meter indicator shall be carefully observed to determine if fluctuations correspond to wind speed or actual sound sources. Data obtained during intervals when wind is influencing the measurements shall not be used. No measurements shall be made when steady wind speeds exceed 20 km/h.

7.2 Measurable precipitation almost always influences outdoor sound levels. For example, tires rolling on a paved surface result in higher sound levels when the pavement is wet. Also, fallen snow may affect the propagation of sound so that sound levels may be different with and without fallen snow. For these reasons, making measurements during precipitation or when pavement is wet or snow covered is discouraged. If it is necessary to obtain data when ground surfaces are wet or snow covered, the conditions shall be carefully described in the report. High humidity can influence certain microphones; manufacturers' instructions should be closely followed under these conditions.

7.3 This guide is not intended to evaluate impulse noise because Type 2 sound level meters operating in "fast" or "slow" modes do not accurately or precisely measure impulse noise. If occasional impulses occur during the survey, estimation of their magnitude may be attempted using the fastest available meter response, either "fast," "peak," or "impulse." The maximum meter reading, the meter response setting, and the repetition rate within the measurement set shall be reported. Whenever most of the sound level meter readings in any measurement set are influenced by impulse noise, this guide shall not be used.

7.4 Occasionally it is necessary to measure sources of pure tone noise perceived as a "buzz," "hum," or "whistle." Since both the operator's body and reflections can significantly influence the sound level meter indication when tones are present, the report must include observations of tonal noise when present.

7.5 Electromagnetic radiation from high voltage transmission lines, or strong television or radio signals may affect the sound level meter indication. The operator should use caution when these are nearby. Such electrical interference problems, when they occur, might result in wild and unexpected swings