

Glossary

Absorption

The properties of a material composition to convert sound energy into heat, thereby reducing the amount of energy that can be reflected.

Acoustical

The properties of a material that absorb or reflect sound.

Acoustical Analysis

A review of a space to determine the level of reverberation, or reflected sound, in the space (in seconds) as influenced by the building materials used to construct the space. Also, a study of the amount of acoustical absorption required to reduce reverberation and noise.

Acoustical Consultant

A professional, usually with an engineering degree, whose primary role is to provide advice on acoustical requirements and noise control in a variety of situations.

Acoustical Environment

The acoustical characteristics of a space or room influenced by the amount of acoustical absorption, or lack thereof, in the space.

Acoustics

The science or study of sound: its production, transmission and effects.

Architectural Acoustics

The control of noise in a building space to adequately support the communication functions within the space and its effect on the occupants. The qualities of the building materials used to determine its character with respect to distinct hearing.

Area Effect

Acoustical materials spaced apart can have greater absorption than the same amount of material pushed by soft exposed edges and also to diffraction of sound energy around panel perimeters.

Articulation Class (AC)

A single number rating used for comparing acoustical ceilings and acoustical screens for speech privacy purposes. AC values increase with increasing privacy and range from approximately 100 – 250. This classification supersedes the Speech Privacy Noise Isolation Class (NIC) rating method.

Articulation Index (AI)

A measure of speech intelligibility influenced by acoustical environment rated from 0.01 to 1.00. The higher the number, the higher the intelligibility of words and sentences understood from 0 – 100%.

Attenuation

The reduction of sound energy as a function of distance traveled.

Audiogram

A chart or table relating hearing level for pure tones to frequency.

Audiometer

An instrument for measuring hearing acuity.

A-Weighted Sound Level (Noise Level)

A measure of sound pressure level designed to reflect the response of the human ear, which does not respond equally to all frequencies. The ear is less efficient at low and high frequencies than at medium or speech-range frequencies. To describe sound in a manner representative of the human ear's response it is necessary to reduce the effects of the low and high frequencies with respect to the medium frequencies. The resulting sound level is said to be A-weighted, and the units are dBA. The A-weighted sound level is also called the noise level. Sound level meters have an A-weighting network for measuring A-weighted sound levels. Most levels of occupational, industrial and environmental noise are measured using A-weighting.

Baffle

A free hanging acoustical sound absorbing unit. Normally suspended vertically in a variety of patterns to absorb and therefore reduce reverberation and noise levels.

Barrier

A material that when placed around a source of noise inhibits the transmission of that noise beyond the barrier. Also, an environment or any physical thing that interferes with communication or listening. For example, a poor acoustical environment can be a barrier to good listening, especially for individuals with a hearing impairment.

Bel

A measurement of sound intensity, named in honor of Alexander Graham Bell, which equals 10 decibels. Initially used to relate intensity to a level corresponding to hearing sensation.

Boominess

Low-frequency reflection. In small rooms, acoustical panels with air space behind them can better help control low-frequency reflectivity.

Ceiling Attenuation Class (CAC)

A single number rating used to compare the efficiency of an acoustic ceiling as a barrier to sound transmitting between adjacent rooms sharing a common ceiling plenum.

Glossary

Cloud

An acoustical panel suspended in a parallel position, horizontal from ceiling/roof structure. Similar to a baffle, except positioned horizontally.

Cochlea

A snail-shaped mechanism in the inner ear that contains hair cells of basilar membrane that vibrate to aid in frequency recognition.

Cocktail Party Effect

Sound in a noisy crowded room generated mostly by conversation. Levels rise and fall as people compete with one another to be heard. Perception of speech can be nearly impossible in high levels of noise.

Cycle

In acoustics, the cycle refers to the complete oscillation of pressure above and below the atmospheric static pressure.

Cycles per Second

The number of oscillations that occur in the time frame of one second (see Frequency). Low-frequency sounds have fewer and longer oscillations.

Damping

The dissipation of energy with time or distance. The term is generally applied to the attenuation of sound in a structure owing to the internal sound-dissipative properties of the structure or to the addition of sound-dissipative materials.

Decibel (dB)

Sound level in Bels as a logarithmic ratio. Sound intensity is described in decibels. For example: breathing, 5 dB; office activity 50 dB; jet aircraft during takeoff at a distance of 300 feet, 130 dB.

Diffusion

The scattering or random reflection of a sound wave from a surface. The directions of reflected sound are changed so that listeners may have sensation of sound coming from all directions at equal levels.

Echo

Reflected sound producing a distinct repetition of the original sound. In mountains, echo is distinct because the sound waves travel after the original signal has ceased.

Echo Flutter

Short echoes in small reverberative spaces that produce a clicking, ringing or hissing sound after the original sound signal has ceased. Flutter echoes may be present in long, narrow spaces with parallel walls.

Equal Loudness Contours

Curves represented in graph form as a function of sound level and frequency, which listeners perceive as being equally loud. High-frequency sounds above 2,000 Hz are more annoying. Human hearing is less sensitive to low-frequency sound (also see Phon).

Free Field

Sound waves from an outdoor source where there are no obstructions.

Frequency

The number of oscillations, or cycles, per unit of time. Acoustical frequency is usually expressed in units of Hertz (Hz) where one Hz is equal to one cycle per second.

Frequency Analysis

An analysis to determine the character of a sound (e.g. high vs. low frequency) by measuring the amount of resonance at various frequencies that compose the overall sound spectrum.

Hearing Impairment

A degree of hearing loss, temporary or permanent, due to numerous causes, such as an illness, disease or exposure to excessively high noise levels. Affecting 20 – 50 million people of all ages in the United States, hearing impairment generally means a hearing loss, from a mild to severe degree. As opposed to “deafness,” which is generally described as little or no residual hearing with or without the aid of a listening device. Hearing-impaired persons are particularly adversely affected by long reverberation times.

Hearing Range

16 – 20000 Hz (speech intelligibility)
600 – 4800 Hz (speech privacy)
250 – 2500 Hz (typical small table radio)

Hertz (Hz)

Frequency of sound expressed by cycles per second (see Cycle).

Inverse Square Law

Newton’s mathematical equation, proving for every given distance traveled from the source, sound levels drop 6 dB.

Intensity/Loudness

A listener’s auditory impression of the strength of a sound. The average deviation above and below the static value due to a sound wave is called sound pressure. The energy expended during the sound wave vibration is called intensity and is measured in intensity units. Loudness is the physical resonance to sound pressure and intensity.

Glossary

Masking

The process by which the threshold of hearing of one sound is raised due to the presence of another sound.

Mounting

Standards established by ASTM to test the acoustics of materials by representing a typical installation. Type A Mounting—test specimen laid directly against the test surface. Type B Mounting—test specimen cemented to gypsum board and laid directly against the test surface. Type E Mounting—test specimen mounted with an air space behind it.

Noise

Unwanted sound that is obtrusive or interferes with listening. To qualify as interference, noise does not have to be excessively loud.

Noise Criteria (NC)

Noise criteria curves evaluate existing listening conditions by measuring sound levels (preferably at ear level) at the loudest locations in a room. Noise criteria may also be referred to as dBA levels.

Noise Isolation Class (NIC)

A single number rating of the degree of speech privacy achieved through the use of an acoustical ceiling and sound-absorbing screens in an open office. Articulation Class (AC) rating method has replaced NIC.

Noise Reduction (NR)

The amount of noise that is decreased through the introduction of sound-absorbing materials. The level (in decibels) of sound reduced on a logarithmic basis.

Noise Reduction Coefficient (NRC)

The NRC of an acoustical material is the mathematical average, to the nearest multiple of 0.05, of its sound absorption coefficients at center frequencies of 250, 500, 1000, 2000 Hz. (Also see Sound Absorption Coefficient.)

Octave

A pitch interval of 2 to 1. A tone whose frequency is twice that of a given tone.

Octave Bands

Sounds that contain energy over a wide range of frequencies are divided into sections called bands. A common standard division is in 10 octave bands identified by their center frequencies 31.5, 63, 250, 500, 1000, 2000 and 4000 Hz.

Phon

Loudness contours. A subjective impression of equal loudness by listeners as a function of frequency and sound level (dB). An increase in low frequency sound will be perceived as being much louder than an equivalent high-frequency increase.

Pitch

The perceived auditory sensation of sounds expressed in terms of high- or low-frequency stimulus of the sound.

Reflection

The amount of sound wave energy (sound) that is rebounded from a surface. Hard nonporous surfaces reflect more sound than soft porous surfaces. Some sound reflection can enhance the quality of the signal of speech and music.

Resonance

The emphasis of sound at a particular frequency.

Reverberation

Sound after its source has ended will continue to reflect off surfaces until the sound waves lose energy by absorption and eventually die out. Reverberation has an important impact on speech intelligibility.

Reverberation Time (RT60 or T60)

The time taken for sound to decay 60 dB to 1/1,000,000 of its original sound level after the sound source has stopped. Sound after its source has ended will continue to reflect off surfaces until the wave loses enough energy by absorption to eventually die out. Reverberation time is the basic acoustical property of a room, which depends only on its dimensions and the absorptive properties of its surfaces and content.

Sabin

A unit of sound absorption based on one square foot of material. Baffles are frequently described as providing X number of sabins of absorption based on the size of the baffle tested through the standard range of 125 – 4000 Hz. The amount of sabins developed by other acoustical materials is determined by the amount of material used and its absorption coefficients.

Sabine Formula

A formula, developed by Wallace Clement Sabine, that allows designers to plan reverberation time in a room in advance of construction and occupancy. Defined and improved empirically, the Sabine Formula is $T=0.049(V/A)$ where T=reverberation time (time required for sound to decay 60 dB after source has stopped) in seconds. V=volume of room in cubic feet. A=total square footage of absorption in sabins.

Septum

A thin layer of material, such as foil, lead, steel, etc., between two layers of absorptive materials, that prevents sound waves from passing through the absorptive material.

Glossary

Signal to Noise (S/N) Ratio

The sound level of a speaker above background noise, at the listener's ear level. The inverse square law affects the S/N ratio.

Sound

Sound is an oscillation of pressure, stress particle displacement and particle velocity in a medium. Sound produces an auditory sensation caused by oscillation.

Sound Absorption

The property possessed by materials, objects and air to convert sound energy into heat. Sound waves reflected by a surface cause a loss of energy. The energy not reflected is referred to as the sound absorption coefficient.

Sound Absorption Coefficient

The fraction of sound energy, striking a material or object that is not reflected. For instance, if a material reflects 70% of the sound energy incident upon its surface, then its Sound Absorption Coefficient is 0.30. SAC = absorption/area in sabins per square foot.

Sound Level

A subjective measure of sound expressed in decibels as a comparison corresponding to familiar sounds experienced in a variety of situations.

Sound Level Meter

A device that converts sound pressure variations in the air into corresponding electronic signals. The signals are filtered to exclude sound waves outside the desired frequencies.

Sound Pressure Level (SPL)

An important measure of sound loudness, the level is calculated in decibels by 20 times the logarithm to the base 10 of the ratio of the measured sound pressure level and the reference point.

Sound Transmission Class (STC)

A single-number system used to rate the sound transmission performance of a wall, panel, ceiling, etc. The higher the ranking, the better the ability to obstruct sound transmission.

Spectrum

The description of sound waves' components of frequency and amplitude.

Speech Intelligibility

The ability of a listener to hear and correctly interpret verbal messages. In a classroom with high ceilings and hard parallel surfaces such as glass and tile, speech intelligibility is a particular problem. Sound bounces off walls, ceilings and floors, distorting the teacher's instructions and interfering with students' ability to comprehend.

Speech Privacy

Degree to which speech is unintelligible between rooms. Three ratings are used: confidential, normal (unobtrusive) and minimal.

Time Weighted Average (TWA)

The measure used by the Occupational Safety and Health Administration (OSHA) to measure noise levels in the workplace. It is equal to a constant sound level lasting eight hours that would cause the same hearing damage as the variable noises that a worker is actually exposed to. (This hearing loss, of course, occurs over long-term exposure.) Same as LOSHA.

Ultrasounds

Sounds of a frequency higher than 20000 Hz. The frequency region containing these frequencies is called the ultrasonic region.

Volume

The cubic space of a room bounded by walls, floors and ceilings determined by the mathematical equation [volume = length x width x height]. Volume influences reverberation time.

Wavelength

Sound that passes through air produces a wavelike motion of compression and refraction. Wavelength is the distance between two identical positions in the cycle or wave. Similar to ripples (waves) produced by dropping a stone into water. Length of sound wave varies with frequency: low frequency is created by longer wavelengths, whereas high frequency is produced by shorter wavelengths.