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BRIEF TECHNICAL NOTES ON SOUND & NOISE CONTROL

An Informational Series

N9701

FUNDAMENTALS OF SOUND & NOISE CONTROL

Will the city ordinance for noise be satisfied? That's one of the questions often asked of us by architects and engineers. New buildings, additions and remodeling often involve more roof-top HVAC equipment adding to the current noise levels.

ESI Engineering, Inc. (ESI) offers the following consulting services in noise/sound control:

- Establishing Background Noise Criteria
- Measuring Ambient Noise Conditions
- Selecting Construction Materials

Architects, engineers and owners are concerned with many noise issues ranging all the way from satisfying city ordinances to just developing quiet interior spaces.

NOISE CRITERIA

Noise criteria are usually classified as

- occupational noise
- community noise
- building noise

Noise criteria reduce the risk of hearing loss, psychological annoyance or interference with speech communication. They are either stated on a weighted scale or on an octave-band sound pressure level.

For occupational noise, OSHA gives permissible exposure limits over time for steady state noise in overall dBA. They require employers to bring noise levels into compliance and if that is not possible, employers must develop a personal protection program for the workers affected. These standards are described in very objective measurements and enforceable by law.

Many local governments have adopted annoyance-type, community noise criteria which tend to be more subjective in nature because what annoys, disturbs or irritates one person may not cause the same to another person. Nevertheless, annoyance criteria are useful for describing the noise climate in a community.

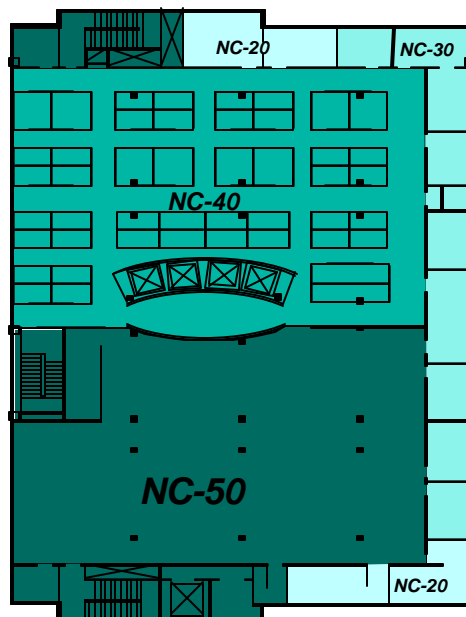
They are usually based on a statistical, time-weighted, noise level expressed in a single dBA number which is not to be exceeded for a certain percentage of time during the day.

Noise Criteria Curves (NC-Curves) developed by ASHRAE in 1957 are the most widely used values for gauging indoor building noise. The requirements are that the sound pressures measured at each octave band must be below the specified NC curve (within a 2dB tolerance) if they are to meet the NC rating.

NC criteria were developed from experience and are used in design of rooms and spaces to provide acceptable environments for occupants.

NC-levels refer to the constant, continuous background noise perceived inside the space as opposed to any intermittent noise from activities occurring within the space. Noise classifications and NC-levels are shown in the

following table for some typical spaces and functions.



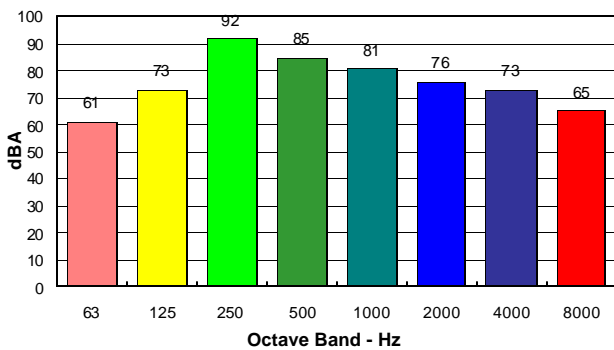
<i>Function/Space</i>	<i>Classification</i>	<i>NC-Level</i>
Recording Studios	Quiet	20-25
Lecture Hall	Critical Hearing	<30
Executive Offices	Normal	30
Production Shops	Very Noisy	50-65

MEASURING NOISE CONDITIONS

Noise control usually requires monitoring and measurement surveys for assessing a site or indoor space. The monitoring equipment may be a single hand-held sound meter or a combination of a sound meter and a computer for more detailed spectral analysis (by octave band) and data collection.

The physical quantity usually measured is the fluctuating pressure which propagates through the air as a sound wave. This quantity is the sound pressure level, L_p , expressed in decibels, dB.

Fluctuating pressures that are in the frequency range of 20-20,000 Hz can be classified as audible sound for the human ear. This frequency range is usually separated into eight unequal segments called octave bands, referring to the doubling of frequency, e.g., 63, 125, 250...8,000 Hz.



SOUND PRESSURE LEVELS BY OCTAVE BANDS

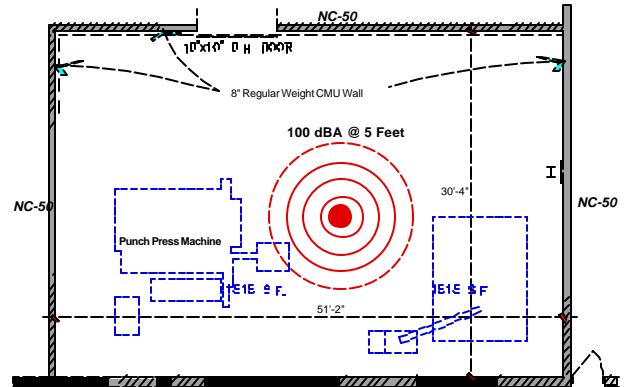
Most instruments can separate each band into three ranges called one-third-octave bands which are useful for measuring and identifying machine noise in a more discrete, narrow frequency range.

An indoor survey will include the background noise produced by the building HVAC equipment, electrical devices, other operating equipment and machines in the space. Any outdoor, audible sounds from wind and traffic which are transmitted through the building will be automatically included unless they are very sporadic in nature.

Sound power, L_w , is the total acoustical power that a given source radiates in a non-reflective environment. Sound pressure is the result of this power radiation. The use of sound power levels is the desirable method for equipment suppliers to furnish information because sound pressure levels can then be computed in octave bands for any desired reflective environment or space.

SELECTING CONSTRUCTION MATERIALS

Sound originates from some source, propagates over some path and affects a receiver or listener. To reduce unwanted noise to a listener, the source can be lowered, the path can be altered or the receiver can be protected.



Plan View - Machine Shop

The noise criteria sets the limit for the receiver and the noise measurement establishes the magnitude of the source. In building situations noise control is usually achieved by altering the path with sound transmission barriers or by using sound absorption.

Construction materials can be selected to provide the sound isolation barrier and absorption once the criteria and noise level are known. This is true for both interior and exterior walls, windows, doors, etc.

Performance of construction materials as barriers to airborne sound is best described with a number rating system called the Sound Transmission Class or STC-rating. All materials have such a rating.

Absorption data for acoustical ceiling materials, carpets and partitions can usually be obtained from directly from manufacturers catalogs.

ESI ENGINEERING, INC.

ESI Engineering, Inc. (ESI) offers consulting engineering services in noise and vibration. These services include:

- Establishing Permissible Criteria
- Measuring Actual Conditions
- Selecting Isolation Materials

ESI has experience in building construction and equipment installation in many industries.

**We would like to serve you. Please call us at:
(952) 831-4646**