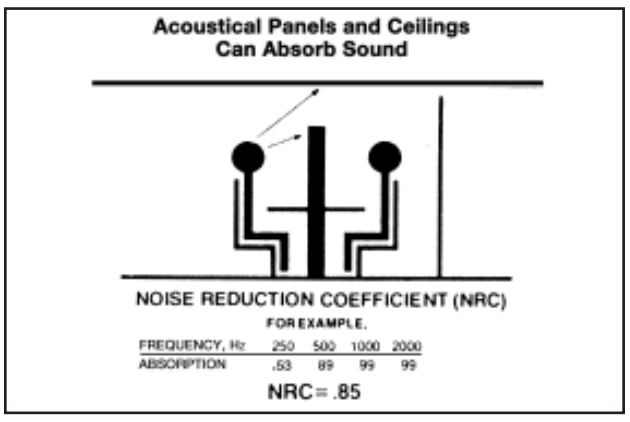
Evaluating Office Acoustics

To stop the direct path of sound, we erect barriers (walls and partitions) which stop sound from passing through. The STC, or Sound Transmission Class, is the ability of a barrier to stop sound from passing through it. A material with an STC of 21 will prevent 21 decibels of speech from passing through.

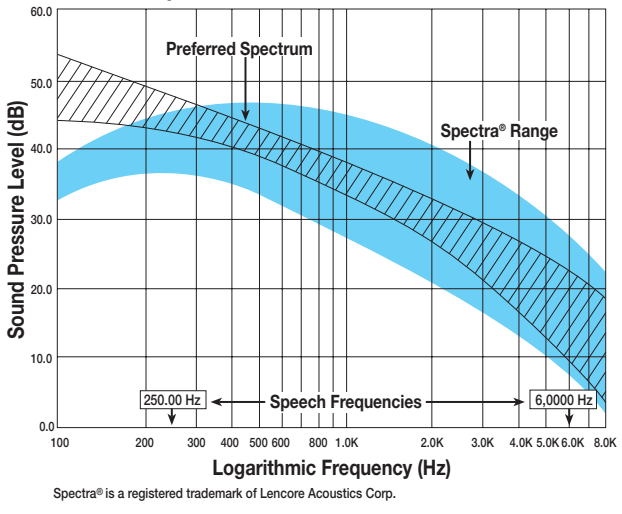
The most sound reduction that can be expected between work stations is 21 decibels, because sound will diffract, that is, bend over the top and around the side of partial height partitions.



SOUND IS ABSORBED AND/OR REFLECTED OFF SURFACES.

Acoustical panels absorb rather than reflect sound. The reflection of sound off a hard surface is called reverberation. The absorption of sound, on the other hand, actually refers to energy conversion.

Sound is a form of energy and energy cannot be destroyed. Acoustical panels convert sound energy into mechanical energy. As sound waves impact the acoustic panel, the panel material responds by vibrating. The ability of a material to convert sound energy to mechanical energy is measured in a test that provides the Noise Reduction Coefficient (NRC). An NRC of 70 means that the material absorbs 70 percent of the sound that hits that surface.



The ability of a material to absorb sound determines its acoustical capabilities. The most effective sound reduction in an office environment is achieved when the higher frequencies of human speech are absorbed (see Sound Masking Spectrum Graph).

The **NRC** is a simple average of the material's absorption of sound at frequencies of 250, 500, 1,000, and 2,000 Hertz (Hz). Hertz, cycles per second (CPS), and frequency all refer to the number of fluctuations per second, which determines the pitch of a sound.

Our ears are more sensitive to certain frequencies - it is no accident that these frequencies are the same as those of human speech. It is the higher frequencies of human speech (1,000 Hz through 3,000 Hz) that provide intelligibility. It is these frequencies which must be considered most closely in developing an acceptable open plan environment.

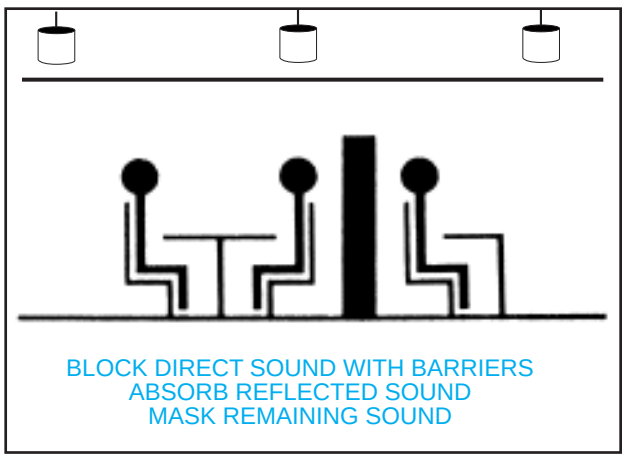
In evaluating an NRC rating for open plan acoustics, it is important that the higher absorption is at the higher frequencies (those of human speech). The **measure of sound** for open plan acoustics is adjusted to reflect the sensitivity of the human ear to various frequencies, particularly those in the human speech range. The lowest and highest frequencies of sound are inaudible to the

human ear, and do not need to be controlled in the office environment. Only the audible sound frequencies are considered when measuring the decibel level of sound in the open plan. Be aware that two different materials may have the same NRC, but the one which absorbs more of the intelligible (higher) speech frequencies will be a more effective material for controlling sound in the office environment.

"Mask those sounds which are not absorbed"

It is most important to have **background sound masking** to gently override the sounds that are not absorbed by acoustical panels. That sound, which is diffracted, reflected, and not blocked, can be masked with electronically-produced sound masking evenly distributed throughout a space through masking speakers above the ceiling. It cannot be masked with the sounds of music or heating, ventilating, and air conditioning equipment.

It is impossible to absorb or block all sound with partitions because some sound will diffract by bending over the top and around the sides of these partitions. Therefore, the remaining sound must be masked by an electronic sound masking



system. To be effective, the masking level should be 2 to 5 decibels louder than the level of incoming speech from adjacent work stations. In an open plan office, the STC and NRC must be balanced to achieve good speech privacy while the background sound levels are comfortable and uniformly maintained.

Psychological research on the effects of sound has shown that people are more comfortable with gentle sounds, such as leaves rustling, and most irritated by harsh sounds; so much in fact that productivity and creativity are greatly reduced. All alarm calls have **"spiky"** sound characteristics and are often fluctuating high frequency sounds.

They are deliberately intended to break your concentration, and put you mentally and physically into a state of alert. In the office environment, continuous interruptions of concentration (such as people talking in nearby work areas) have been shown to create fatigue and stress because they place individuals in a constant state of alert which they then have to suppress in order to concentrate.

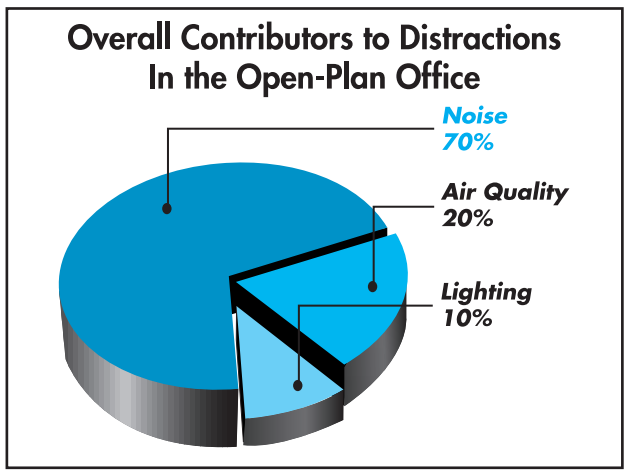
Sound masking provides a fixed and constant level of unobtrusive background sound, which is set to cover the speech levels as well as soften the other noises, so they appear as much smaller sound fluctuations. The result is that the unwanted noise does not register to the human ear as a distraction. The individual has no need to shout into the telephone and is more relaxed in his or her work.

The sound masking spectrum is complementary to the speech spectrum and effectively covers the speech levels, thus **reducing** both the distraction and the intelligibility of conversation.

The ideal formula to achieve acoustical comfort in the office environment incorporates the use of top-grade ceiling tile, line of sight partitions, commercial carpeting, acoustical wall panels, and, of course, sound masking. For a truly successful facility project, professionals must specify these products to ensure the overall "health" of the facility and its occupants.

The importance of good acoustics in the workplace is growing with the ever-increasing use of systems furniture, teaming environments, speakerphones, cell phones, and voice-activated computer equipment. In addition, federal and state mandates for oral privacy have highlighted the importance of providing proper acoustics and speech privacy in office, healthcare, and financial settings. Recognizing this, professionals are eager to learn more about acoustics so that they may effectively *control sound* in the workplace.

We are surrounded by sound at all times. It affects the way we feel and behave. In the working environment, sound is particularly critical. In fact, the lack of speech privacy, and the presence of high noise levels and distracting conversations has been cited as the **#1 office concern.** These problems risk becoming more pronounced as traditional office walls are replaced by partial height panels that allow sound to circulate more freely throughout a space.



PROMOTING PRIVACY

Sound masking is extremely effective in providing industry-acceptable speech privacy levels. In quiet environments with a very low level of background noise, such as a library, people are very aware of the volume they are speaking at, and will speak in a whisper so as not to be overheard or distracting. In an office space, introducing sound masking into the environment will raise the background sound, and allow for conversations to remain at normal levels while giving employees back the speech privacy they need to remain productive.

LIFE SAFETY & PAGING ISSUES

All-call and emergency-paging systems are a critical part of office design. It is important that corporate America has communication contingency plans for dispersing emergency information. Lencore's masking speakers are designed for evenly-dispersed sound coverage, making the quality of voice paging vastly superior to that of conventional paging systems. Paging can be transmitted at lower-than-normal volumes and still be heard clearly. For virtually the cost of one system, the Lencore Sound Masking System can also provide quality paging and music.

RETURN ON INVESTMENT

Making your facility work for you is the key to profitability. The Lencore Sound Masking System has a 20+ year life expectancy, and once installed can be modified according to the needs of the changing floor plan. Productivity studies have shown increases of 3%-20% attributed to using sound masking along with other acoustical components within a space. Modeling productivity returns based on even a modest increase can quickly add up to bottom line savings.

In the open plan office, the acoustics of partitions, ceilings, floors, and walls must be evaluated. In order to achieve speech privacy, the overall sound pressure level must be measured and considered with the intended use of the space.

"Speech privacy in the office must be maintained."

In considering what is ***good*** and what is ***not good*** open plan acoustics, it is important to appreciate the difference between **"hearing"** and **"understanding"**. The muffled sounds from adjacent workstations are not distracting if they cannot be understood. This is an example of **confidential speech privacy**. In this case, the listener can *hear* that a conversation is taking place, but cannot *understand* the contents of that conversation and is therefore not distracted by it.

We create a quiet environment by dealing with the paths that sound takes between the sources (equipment and people talking) and the receivers (people listening). In the office, people and equipment are sound sources. People are also receivers of sound which is transmitted. The sound may be received directly from the source or as it is reflected, diffracted, and passed through various surfaces.

This brochure was designed by Lencore Acoustics Corp. to give you a basic understanding of sound, its measurements, and how to control sound in order to create the most functional and acoustically comfortable office environments.

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There are three paths by which sound travels: a direct path, which is one straight line between the source and receiver; a reflected path, which occurs as sound bounces off various surfaces; and a diffracted path, which involves sound bending over the top and around the sides of various surfaces. Controlling sound in an open office requires consideration of all three paths.

SOUND HAS A SOURCE, RECEIVER(S), AND A PATH. SOUND TRAVELS IN DIRECT, REFLECTED AND DIFFRACTED PATHS.

The acoustics of a space are determined by how much sound the ceiling, walls, and other surfaces absorb, block, or reflect, and how much sound may be transmitted through to adjacent areas. Almost all building materials can absorb, reflect, and dampen sound vibrations to some extent. But for critical surfaces like ceilings, panels made of material like mineral fiber or fiberglass are often chosen for their superior acoustical properties.

> *"We are surrounded by sound at all times...it affects the way we feel and behave."*

more

PRIMER

All you really need to know about office acoustics and sound masking for corporate interiors

Presented by Lencore Acoustics Corp.