

# SCOPE



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Pittsburgh, PA

## THE VALUE OF ACOUSTICAL PRIVACY IN THE OPEN OFFICE ENVIRONMENT

THE OPEN OFFICE plan offers numerous advantages for call center environments. Ease and speed of implementation, simplicity in mechanical systems and the desirability of natural light in interior office spaces are good reasons to consider such an approach. Flexibility is another — organizational changes can be easily implemented, typically at a lower cost, even though initial construction may not be less expensive than traditional office space. In particular, it is important to consider the subject of acoustical privacy for individuals. The same factors that render an open office plan so attractive for call centers can create difficulty from an acoustical standpoint for the people who must work there. Noise masking is a proven technology for achieving acoustical privacy in the open office.

### Acoustics Made Easy

It's easy for the layman to get lost in the field of acoustics. For example, the term "acoustical" is much misused, usually referring to an object able to absorb sound. But this simple explanation does not include any reference to test values. Other terms, like decibels, are difficult to grasp. Since it's useful to gain some measure of understanding when hiring an informed call center designer, let's review a brief glossary of common terms:

**ABSORPTION:** The reduction of sound energy. This may occur as sound passes through air, but is usually used in reference to sound waves striking a surface.

**DECIBEL (dB):** A unit used to measure or quantify the characteristic of sound usually referred to as "volume" or "loudness." The decibel is actually a ratio, or comparison, of two values. A change of less than 3 dB is usually not noticeable under daily office conditions, 3-4 dB is barely noticeable, 5-8 dB is clearly noticeable, and an increase or decrease of 10 dB is perceived as roughly twice or half as loud. Human speech and normal office activity is usually 60 to 70 dB. A sound at 70 dB is therefore perceived as twice as loud as a sound at 60 dB.

**NOISE CRITERION CURVES (NC):** A set of curves used to rate the relative acceptability or intrusiveness of continuous air conditioning-like sounds in buildings. Values below 25 are very quiet, 25 to 40 are normal and above 40 is generally too noisy for office environments.

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**SOUND TRANSMISSION CLASS (STC):** A single number rating of a construction's, or material's, ability to reduce transmitted sound. Typical measurements range from 20 to 70. The higher the value, the better the isolation; however, STC is frequency dependent. A high value does not necessarily indicate uniform isolation at all frequencies. For example, equivalent values may exhibit different degrees of bass frequency isolation.

## Theory

In theory, the open office will permit any call center representative to carry on his or her typical work assignment without undue interruption from noise. Thus, it's useful to view the open office as a

system comprised of man and machine.

Noise sources may be co-workers chatting, doing business on the tele-

phone or holding impromptu meetings.

Noise may emanate from the HVAC system, telephones ringing, and the whir

and whine of laser printers and copiers.

Transmission of all that noise is affected by the elements of the open office, such

as architecture, furnishings, partitions

and so on. Finally, there are noise receivers: the people who inhabit the space and are sensitive to the aural environment. This sensitivity may be manipulated by the introduction of masking sound.

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*The most common of these is a raised human voice. . .*

## Privacy

Early in the design process, it's necessary to establish the level of privacy required for each work function that will be present in the open office plan. Typically, managerial functions require a higher degree of privacy than representative or secretarial functions. As an example, confidential privacy is described as "zero phrase intelligibility with some remaining word intelligibility."<sup>1</sup> Privacy requirements should be imposed on the design criteria matrix when formulating the plan. It is also important to consider the primary sources of interfering sounds in the open office. The most common of these is a raised human voice, followed closely by office equipment.

Last on the list of interfering sounds is a poorly designed ventilating system. Note that an individual talker will modulate her voice to maintain an acceptable "signal-to-noise" ratio for the listener. Therefore, office equipment placement and HVAC system design will have a large influence on the ambient speech level. Office equipment should be strategically placed and/or enveloped to minimize impact on adjacent work areas, yet still provide easy access. The ventilation system should be designed to NC-35 or lower. Finally, other noise sources, such as telephone ringers, should be carefully selected for minimum noise impact. Some installations include low-level tones coupled with announce lights.

In a typical reverberant room, sound undergoes many reflections. At some point from the source, these reflections attain a uniform sound level that does not vary appreciably from one part of the room to another. In contrast, sound out-of-doors decreases in level at a predictable rate as the distance from the source increases. A properly designed open call center plan mimics the behavior of sound

outdoors by acoustically treating reflecting surfaces to reduce sound reflections in the range of the human voice. In a typical plan, the average distance between individuals is about 13 feet. This may be affected by the degree of privacy required, function and economics. Acoustic privacy may be attained by introducing partial height screens, highly absorptive ceilings and walls and background noise masking. Experience has shown that all three are required to achieve acceptable privacy.

Here's how it works:

An individual talker in an open-office will modulate her voice so that the listener will enjoy a 20dB signal-to-noise ratio at a typical listening distance of 4 feet. By providing a screen, speech levels intruding on adjacent work stations will be much reduced. Nevertheless, sound will want to travel over, around and under the screen. A highly absorbent ceiling will reduce sound reflections over the screen, while carpeted floors and absorptive walls do the same for other signal paths. Typically, these two steps will result in a very quiet environment so that normal speech levels appear to be far in excess of the environmental noise. By introducing controlled masking noise into the call center plan, this spill-over speech will be unnoticed, or at least unintelligible.

### Noise Masking — What Is It?

Research has shown that it is possible for one slightly louder sound to mask another slightly softer sound, provided the frequency content of the sounds is similar. Noise masking employs a carefully defined spectrum of sound shaped to mask human speech. Typically, the sound is provided by a specially designed random noise generator and a series of loudspeakers installed in the ceiling plenum. Noise masking has been proven more effective than music alone, although music is an effective supplement.

To be effective, the masking field must be uniform in space and time. This is primarily influenced by careful spacing and orientation of loudspeakers, transmission characteristics of the ceiling system, reflective properties of the plenum materials and openings in the ceiling, such

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as return air ducts and light fixtures. It is best not to have other areas of the building quieter than the open call center or the masking noise may have the opposite effect and become intrusive. When this is unavoidable, the solution is to provide gradual transition zones between areas.

It must be stressed that the system must never be turned off while the room is occupied, or its masking effect will be

lost. It becomes a permanent part of the office environment. It is possible to program the noise masking level to compensate for population swings.

For example, the noise may be gradually reduced from 5 P.M. to 7 P.M. so that a noise-sensing security system will be effective during the evening hours and then increased to normal operating levels in the morning as the workforce returns. A typical noise masking system may add as much \$1 per square foot to the construction cost. However, a side benefit is that the noise masking system can also be used for public address or emergency announcements.

## Case Study

AT&T's Customer Care Center in Pittsburgh, PA presents a textbook example of a noise-masking system implementation. With approximately 28,000 square feet of open office space, the Center consists primarily of online customer service representatives. Divided into two primary spaces, the open areas are separated by the building's central core and other AT&T support facilities, such as meeting and storage rooms. As a visitor approaches from either the central elevator bank or from one of the adjacent support facilities, the noise masking signal is ramped up in level. The result is an imperceptible aural transition to the noise-masked areas.

Due to the computer-intensive nature of the work performed by Customer Care Center personnel, the lighting in the space is primarily indirect (refer to the November 1996 edition of *Scope* for more details), provided by fixtures mounted on the workstation partitions and focused to reflect off the ceiling. The ceiling remains a relatively unbroken expanse of acoustical tile and creates an ideal environment for noise-masking. The tile was specially selected for its high and uniform absorptive properties across a broad frequency spectrum.

Above the tile, speakers were placed at a high density to provide a uniform sound field in the plenum cavity. It's interesting to note that the speakers, when installed, are not facing down toward the floor, but actually point toward the underside of the deck above. This causes the sound to be more uniform in the plenum space. Finally, care was taken to insure that specific speakers were arranged to avoid direct radiation through HVAC grill openings so as to avoid "hot spots" in the work areas.

The result at AT&T is a comfortable workspace that is surprisingly active, once the observer learns to look as well as listen, because the first (aural) impression is one of subdued quiet.

## Conclusion

To review, the acoustical components of the open call center plan are 1) noise sources, such as people and machines, 2) architecture, including screens, walls, ceiling, floor and furnishings and 3) electronic masking. A design integrating all three components in a cohesive system will create a superior acoustical environment, resulting in enhanced aesthetics, increased productivity and higher employee morale. Noise masking is a proven technology enhancing the acoustical environment by providing a higher degree of privacy at nominal cost. ①

*Editor's Note: This article was authored by Mark Valenti, principal of The Sextant Group, Pittsburgh, PA, a full-service consulting and design firm specializing in integrated communications solutions. The Sextant Group is focused on the application of new media technologies, advanced network architectures and telecommunications systems to create innovative, value-oriented solutions. The firm often serves as an acoustics consultant to KSBA Architects on call center projects, such as the one described above at AT&T.*

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