

Simon Fraser University, Burnaby, British Columbia.

Sound Absorbers

The calculations involved with functional and spot sound absorbers aren't all that difficult

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Some interesting "selling aids" come to mind from questions asked by acoustical contractors.

A frequently asked question has been, "How many Noise Baffles or Geocoustic Units do I have to put into this or that space?"

First, for those of you who are not familiar with the so-called "Noise Baffle," let me list a few. The testing laboratory may call them "functional absorbers" which is a somewhat more generic term.

In the marketplace they may be known as Owens Corning Fiberglas Noise Stop Baffles, and Keene (now BLI) Sonosorbers. Several other small manufacturers have similar products, but these are probably the best known.

They are usually installed by hanging them from wires between

trusses of gyms, swimming pools and large arenas.

The OCF Noise Stop Baffle is a piece of plastic wrapped fiberglass 24" x 48" by 1½" thick with attached hooks for hanging purposes.

The Sonosorber is a 24" long cylinder, 12" in diameter also made of fiberglass and covered with a mesh. Hooks are provided so that they may be hung with the long dimension vertical or horizontal.

Geocoustic's Units are designed to be attached to walls on various spacings. Manufactured by Pittsburgh Corning and also sold by the Armstrong Cork Company, they are now 11½" x 16" x 2" thick. Similar "spot" absorbers are also made by the U.S. Gypsum Company and are called Acoustone

Space Units.

Most of the manufacturers provide procedures whereby the required number of their products can be determined by relatively simple calculations — providing drawings are available or dimensions of the space are known.

More accurate analysis can also be made using the Sabin Equation as outlined in all of the texts on acoustics. An experienced acoustical contractor, however, can make a very quick "on the job" calculation by just comparing the sound absorptive properties of the functional absorber or spot absorber or spot absorber with that of a conventional acoustical ceiling.

After all, the acoustical ceiling, functional sound absorber and spot sound absorber have but one main function, to reduce noise levels and shorten reverberation times in a room.

Q: How are sound absorption materials rated?

A: The testing laboratory rates a material at six frequencies: 125, 250, 500, 1000, 2000 and 4000 Hz in terms of the Sound Absorption Coefficient of the material. This term is a measure of the energy a sound wave loses when it impinges upon the surfaces of a material or object.

Q: Is it always necessary to use this rating at all six frequencies?

A: For most problems involving noise reduction, a single number rating, Noise Reduction Coefficient (NRC) can be used. The NRC of a material, functional or spot absorber is the arithmetic average of its Sound Absorption Coefficients at 250, 500, 1000 and 2000 Hz.

Q: What is a practical meaning of NRC?

A: Let's imagine we are in a room with all "hard," that is, sound reflective surfaces. The room has a large window with an area of 50 sq. ft. The glass in the window is also sound reflective. Now, let's open the large window. The sound that was reflecting from the glass back into the room now passes through the open window and the noise level in the room is reduced. The open window provides 50 sq. ft. of 100% sound absorptive surface — all of the sound impinging upon the open window leaves the room. In

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other words, an open window has unity, (1.00) absorption per square foot of window area. Unity absorption may also be called a Sabin in honor of Wallace Clement Sabine, the father of architectural acoustics.

Q: Where can I find the NRC ratings of acoustical tile, spot and functional absorbers?

A: The manufacturers' literature lists both Sound Absorption Coefficients and NRC of their products. The ratings of all of the products manufactured by members of the Acoustical and Board Products Association are listed in the Association's Bulletin which may be obtained by writing ABPA at 205 West Touhy Avenue, Park Ridge, Illinois 60068.

Q: What are typical NRC ratings?

A: A 3/4" thick fissured mineral acoustical tile has an NRC .75. All tile and acoustical lay-in panels will have NRC values of less than unity. Functional absorbers, because they are installed as in-space objects and not as a ceiling, and are exposed to sound on more than one square foot of surface, usually obtain test ratings in excess of unity. For example, a functional absorber may have an NRC of 7-1/2 Sabins (7-1/2 sq. ft. of open window). A spot absorber may have an NRC of 1.5 to 2 Sabins (1-1/2 to 2 open window units).

Q: If I know how many square feet of an acoustical ceiling is required for a space, how can I determine how many spot or functional absorbers I can install as a substitute for the acoustical ceiling?

A: For the purpose of making a quick and approximate estimate, we can assume that a functional absorber will provide 7.5 Sabins of absorption, a spot absorber about 2 Sabins of absorption, and a ceiling panel or tile about 3/4 Sabins (NRC .75) of absorption per square foot. The relationship that follows therefore is:

1 Functional Absorber = 10 Sq. Ft. of ceiling tile.

1 Spot Absorber = 2-2/3 Sq. Ft. of ceiling tile.

Q: Can you give me some examples?

A: Suppose we wish to install functional or spot absorbers in a swimming pool area because the acoustical tile specified for the space may be damaged by the high humidity. The space is 100 ft. x 200 ft. x 30 ft. high to the underside of the roof deck. Normally you would hang a suspended acoustical ceiling over the entire area, 20,000 sq. ft. The equivalent acoustical results may be obtained by hanging 2000 functional absorbers between the trusses (20,000 divided by 10 = 2000) or by installing 7500 spot absorbers on the underside of the roof or on upper wall surfaces (20,000 divided by 2-2/3 = 7500).

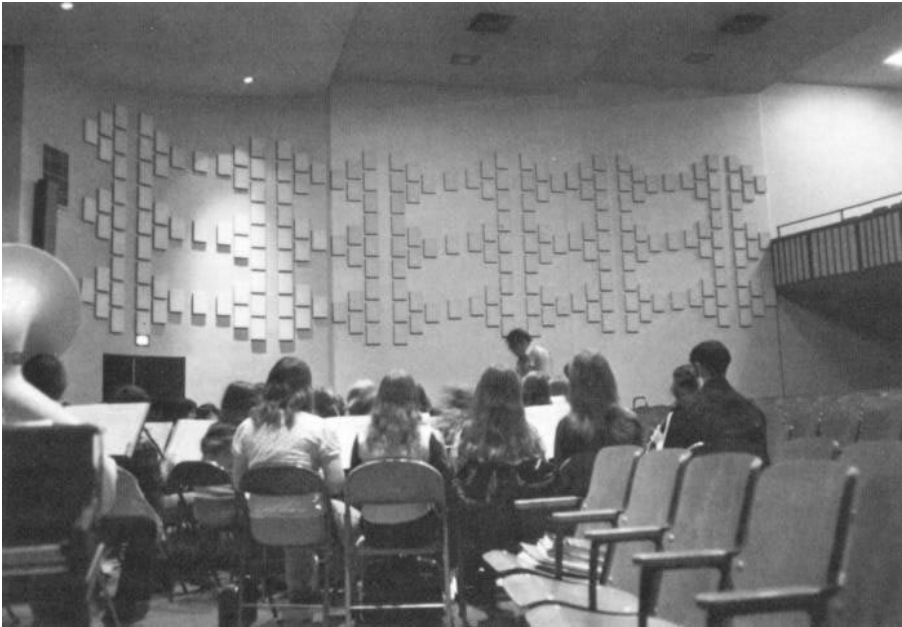
Q: How can I check my quick calculation?

A: The conversion from square feet of tile to units of spot or functional absorbers can be checked by first looking up the manufacturer's literature to make sure the NRC ratings assumed above are valid. If they differ, small variations in the number of units needed may take place. For example, if the acoustical ceiling material has an NRC of .90, one Functional Absorber will equal 8-1/3 sq. ft. and one Spot Absorber will equal about 2-1/4 sq. ft. of ceiling material.

Q: Are there any other precautions I should take?

A: Always check the manufacturer's literature to determine whether the product is recommended for the use of the space. Some functional or spot absorbers may not be recommended for swimming pools or gymnasiums. Also, bear in mind that when working with the single number rating, NRC, you are using a limited average of the absorption coefficients. This may not be important in noise reduction installations, however, in auditoriums, lecture halls, area where the criterion is an optimum reverberation time, an analysis should be made at six frequencies to determine the shape of the resulting reverberation time curve.

Generally speaking, the absorption vs. frequency curve of spot absorbers will resemble that of



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acoustical tile cemented to a surface (No. 1 Mounting), however, the frequency curve of a suspended acoustical ceiling will usually be flatter than both spot and functional absorbers.

Spot and functional absorbers are useful products, especially in

correcting acoustical problems in existing buildings, however, they are frequently specified at the planning stage in spaces that do not lend themselves to acoustical tile ceilings — swimming pools, and gyms.

The following companies manu-

facture functional and spot sound absorbing units:

Pittsburgh Corning Corporation
Three Gateway Center
Pittsburgh, PA 15222

Owens-Corning Fiberglas Corp.
Fiberglas Tower
Toledo, OH 43659

BLI, Inc.
179 Main Street
West Orange, NJ 07052

Birma/Insulcoustic Corp.
Jernee Mill Road
Sayreville, NJ 08872

United States Gypsum Company
101 S. Wacker Drive
Chicago, IL 60606

Armstrong Cork Company
W. Liberty Street
Lancaster, PA 17540

Noise Measurement and
Control Corp.
322 E. Lancaster Avenue
Wayne, PA 19087