Industry Development Committee's
Subcommittee on Sound and Vibration
Minutes

EXHIBIT "A"

August 28, 1964

THIN LEAD SHEET SOUND BARRIERS

THIN LEAD SHEET IS A GOOD BARRIER MATERIAL for reducing the transmission of air borne sound.

LEAD IS TECHNICALLY GOOD because it combines high density, natural limpness and good damping capacity.

LEAD IS MECHANICALLY GOOD because it is easily formed or fitted, requires no special tools, can be readily adhered or fastened to other materials and provides a non porous membrane.

LEAD IS ACOUSTICALLY GOOD because pound for pound it is a better sound barrier than any other conventional building material.

LEAD IS ECONOMICALLY GOOD because it is reasonable in cost, takes less space, often saves weight, is easy to install and is salvageable.

This pamphlet contains additional information on:

The nature of sound.
What constitutes a good barrier.
What are the pitfalls to be avoided.
Examples of effective barriers containing lead.
Miscellaneous information helpful in working with sound.

NATURE OF SOUND

The sounds we hear are the result of air pressure waves impinging upon our ultra sensitive ears. The frequency pitch of audible pressure waves can vary from 20-20,000 cycles per second. The intensity of these pressure waves and the physical energy involved varies over a fantastic range and accordingly it is expressed logarithmically in units known as decibels.

Sound can be pleasant, acceptable, tolerable, objectionable or injurious. Noise is unwanted sound and in today's society the control of noise is fast becoming a problem of major proportions involving petty annoyances, loss of privacy, lowered working efficiency, higher accident rates and physical impairment of hearing.

The information presented here is concerned with air-borne noise rather than impact or structural borne noise. This includes familiar sources such as the crying baby, TV & HiFi sets, loud conversation, office machines, motors, pumps, manufacturing operations, etc. It does not include noise from articles dropped or foot traffic on bare floors above, water hammer in pipes, vibration from heavy machinery or the rumble of a subway train, which is transmitted primarily through the ground or the structure involved.

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RENITA JACKSON, ET AL. V. THE GLIDDEN COMPANY ET AL.

Air-borne sound is a series of air pressure waves radiating in all directions from a source much like the ripples in a pool from dropping stones. These pressure waves will readily penetrate porous materials but will set rigid barriers into vibration which, in turn, generates new sound of lower intensity on the opposite side of the barrier.

WHAT CONSTITUTES A GOOD SOUND BARRIER

A good sound barrier wall is one which will reduce offending noise from adjacent areas to the level of the background noise normally present and accepted in the desired quiet area or to some slightly higher level which is still deemed acceptable to the occupant of the quiet area and will provide speech privacy or freedom from annoyance or distraction. For example, an 80 db (decibel) noise impinging on a 30 db wall will generate a 50 db noise on the other side. If the normal and accepted level of background noise in the quiet area is 50 db, no annoyance will be experienced. If, however, the normal background noise level is 40 db, it will now increase to 50 db indicating that the barrier is inadequate.

The physical properties of a material or a composite wall that go to make up a good sound barrier are high density, freedom from stiffness and good damping capacity. Lead has all of these desired properties to a greater extent than any other common building material. The proper use of lead in combination with other materials will compensate for their deficiencies and will improve the acoustical performance of the composite barrier.

To select or design a barrier one must have a measure of its effectiveness. This is known as its Transmission Loss (TL) and represents the reduction in the level of air-borne sound that will pass through a given barrier. The TL is expressed in decibels as a single figure which, in turn, represents the arithmetic average of nine separate TL measurements taken at specified frequency ranges between 125-4000 cycles per second. This portion of the sound spectrum encompasses the frequencies of most of the sound waves to which we are subjected. Transmission Loss is a fixed property of a barrier but varies with the frequency of the sound. Thus, in appraising the capacity of a barrier one should consider both the stated TL figure and the frequency plotting of the separate values that make up the figure.

A more recent means of expressing the sound attenuation capacity of a barrier is known as the Sound Transmission Class (STC) number. This method has gained acceptance because it gives a more reliable measure of barriers which have sharp dips in TL at certain frequencies.

There is a further improved method of expressing the attenuation capacity, known as the Speech Privacy Index which narrows the field of attention to the 200-4000 cps range and takes into account the factors of intelligibility and background conditions. In ranking tests of various materials or panels for barrier performance, an arithmetic average of the noise reduction in the speech range from 200-4000 cps provides a useful single figure rating.

The TL of all materials and barriers increases with frequency but at some point in the curve a plateau or dip will occur with most materials where the barrier developes travelling waves (like microscopic versions of the waves in a shaken rug) in sympathy with the disturbing sound waves. When this coincidence occurs, the amplitude of vibration in the barrier increases and more sound is transmitted. Lead as a material does not have this detrimental property in the frequency ranges with which we are concerned. Thus, when combined with other materials, it will improve their weak spots.

The required TL for a barrier in any given situation will depend upon the amount of background noise present, the degree of quiet desired, the amount of absorptive material present and the character and intensity of the offending noise.

For example in a typical office without air conditioning and where reasonable quiet is desired, the partition barrier or wall should usually have a minimum average TL of 40 db. Recently revised F.H.A. minimum Standard Requirements for Apartment House construction call for partition walls with substantially higher STC ratings. See table.

PITFALLS TO BE AVOIDED

The installed barrier when tested in place will frequently fall short of the TL test rating for the barrier. This can be due to a highly absorptive receiving room but more frequently can result from faulty installation in failing to eliminate sound leaks in seams, doors and perimeter joints. In many cases this lowered performance stems from the existence of numerous flanking paths via which the sound waves can circumvent the barrier wall. Common flanking paths include windows, back to back electrical fixtures, medicine cabinets or wall joints; door louvres, heating ducts; open plenum above hung ceiling; low TL doors in a high TL wall etc. Failure to apply relatively simple corrective measures to these common defects can seriously jeopardize the performance of an otherwise good barrier.

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