

**Lead Industries Association, Inc.**

232 Madison Avenue • New York, N. Y. 10017 • Telephone: (212) 679-6036

July 6, 1973

SUBJECT: PRACTICAL APPLICATION  
OF SHEET LEAD FOR  
NOISE BARRIERS

-AND-

LEAD IN BUILDING

TO THE MEMBERS OF THE LEAD INDUSTRIES ASSOCIATION, INC.:

Enclosed are copies of two new booklets entitled:  
PRACTICAL APPLICATION OF SHEET LEAD FOR NOISE BARRIERS and  
LEAD IN BUILDING.

The first is aimed at the do-it-yourselfer as well as the professional faced with the problem of choosing a noise barrier within a budget figure to answer a particular acoustical problem. It includes no lessons in acoustics but gets down to business in clear and easily understood language with practical and useable information.

The second, from our Sweet's Catalog File, is a summary of four major uses for sheet lead in building construction, i.e., Waterproofing, Sound Barriers, Roofing and Flashing, and Vibration Control. Found in every architectural office in the country as a part of the Sweet's File it will also serve as an introduction to other potential users of lead in the construction field.

Additional copies are available upon request.

Sincerely,

EDM ip  
Encl. - 2

EDWIN D. MARTIN, AIA  
Manager Architectural Services



# LEAD IN BUILDING

## LEAD INDUSTRIES ASSOCIATION, INC.

WATERPROOFING • SOUND BARRIERS  
ROOFING AND FLASHING • ANTI-VIBRATION

### PERMANENT PROTECTION

For whatever use, lead is the most durable of the common metals. It has the greatest resistance to corrosion in Industrial, Urban, Rural or Seacoast atmospheres.

### NON-STAINING

Corrosive media form insoluble lead compounds on the surface so there is no staining of adjacent materials.

### FULL THICKNESS

Lead is an homogeneous material, full thick, not a coating to protect a more vulnerable material.

### EASILY INSTALLED

Extremely workable, lead can be made to conform to surfaces on which it is applied. Joining methods are standard sheet metal practice.

### COST

Directly competitive with other quality material, its ease of installation, freedom from callbacks, maintenance, repairs and replacement often make it the least expensive in the long run.

### SALVAGE

Salvage value is a function of cost which, with lead, often equals the total cost when installed.

## WATERPROOFING SHEET METAL WORK

roofing and flashing

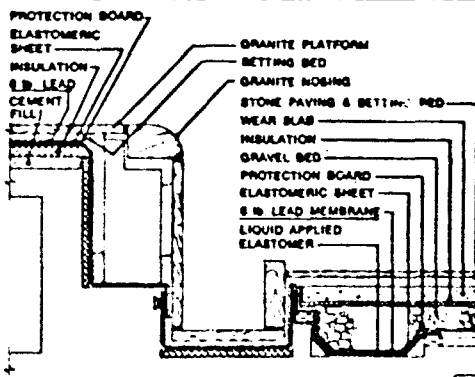
### WATERPROOFING

Lead membranes and pans, properly installed, provide an impermeable moisture barrier which will last as long as the most permanent building. As a lining for reflecting pools, plant boxes, fountains, shower stalls and shower rooms, commercial and institutional kitchen floors, soda fountains and bars, sheet lead provides waterproofing of the highest quality.

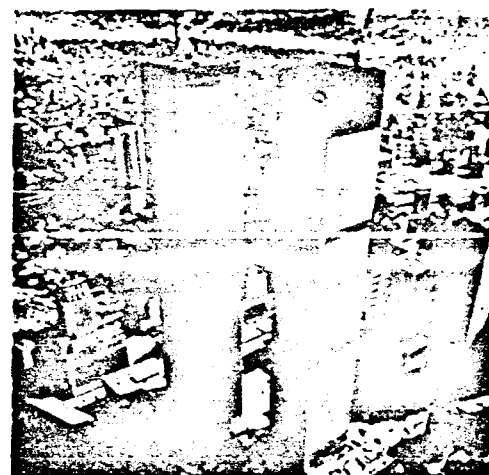
Generally speaking such installations should employ lead "burning" (welding) to join sheets as large as can be conveniently handled. Soldering is more rarely used for smaller installations.

Lead specified should be 4 lb., 6 lb., or 8 lb. per square foot weight equivalent to 1/16, 3/32, or 1/8 inch thicknesses. The lightest weight for small, less critical areas such as shower stalls; the heavier weights for larger areas such as reflecting pools where the safety factor required is of a higher degree.

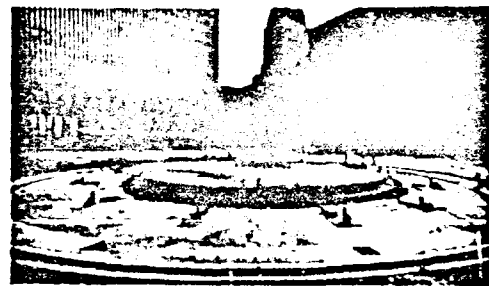
Complete specifications and free technical assistance are available on request.



SECTION OF PLAZA AT EDGE OF FOUNTAIN



AERIAL VIEW, WORLD TRADE CENTER, NEW YORK CITY



PLAZA POOL AND FOUNTAIN, WORLD TRADE CENTER, NEW YORK CITY  
Architects: Minoru Yamasaki & Associates; Emery Roth & Sons

# SOUND BARRIERS 9

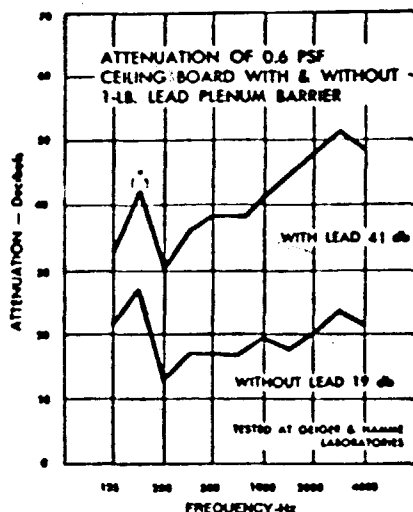
ACOUSTICAL TREATMENT

sound and vibration

## PLENUM BARRIERS

Lead is one of the oldest and most efficient of all common building materials used today for blocking sound. One of the most familiar uses is in thin sheet form as a plenum barrier. Modern office partitioning, brought only to the level of a hung ceiling, leaves an open space over the head of the partition, above the ceiling, for passage of sound from one room to another. Illustrations show how sheet lead, supported by battens of wood or metal attached to the slab above, draped over the head of the partition below and taped in place, will block that sound.

Material is 1/84th inch thick, weighs 1 lb. per square foot. It can be cut with a knife or scissors. It can be made to fit snugly around beams, pipes, ducts, wiring or other penetrating structures. It can be formed or shaped by hand, folded, taped, stapled or crimped. Sheet lead accepts adhesives readily and may be cemented or taped securely. All resulting in a first class job at lower cost and, most important, significantly better acoustically as indicated by the test curves below.



\*Actual value may be higher, datum approaches limit of test facility



This sheet of lead, bent over a light batten strip and stapled, ...



Can be lifted and nailed to blocking fastened to the slab overhead.



Adjoining edges are folded together into a simple seam, ...



And taped in place for a tight, first class job.

## OTHER SOUND BARRIER APPLICATIONS

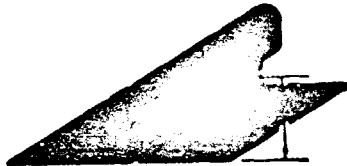
**LEADED VINYL SHEET**, consisting of lead powder loaded vinyl coated onto woven glass fiber, nylon or cotton, is often used where sheet lead or conventional constructions are ruled out. Although more expensive than sheet lead, its use is often the least expensive if not the only practical way to solve a problem. A wide variety of colors, embossed textures and printed surface patterns make it especially attractive to the architect or designer. Sheet lead is also effective as a **DUCT WRAP**, as a component in **DOORS, WALLS, PARTITIONS**, and remedial supple-

mentary **WALL PANELS**. When elastically laminated to thin panels of approximately equal square foot weight, acoustic performance of the composite panel will be far superior to that of an unleaded panel. **HIGH TRANSMISSION LOSS CEILINGS** between noisy machine rooms on upper floors and adjacent prime rental areas may be provided by laying 2 lb. sheet lead over ceiling construction with lapped joints, resilient hangers and absorptive materials on the slab. Additional application information is available upon request.

# ROOFING & FLASHING SHEET METAL WORK

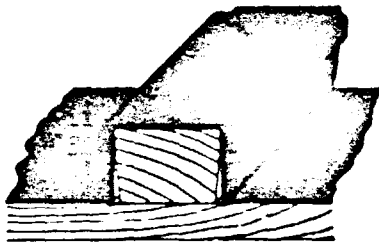
roofing and flashing

## ROOFING



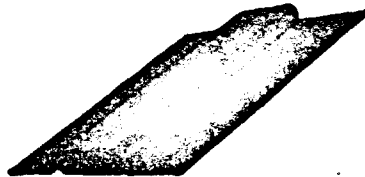
### STANDING SEAM

Standing seams are used to join long dimensions of sheet lead in the direction of roof slope. Sheets should be not more than 16 square feet in area and are usually 3 lb. (3/84 inch thick) in weight.



### BATTEN SEAM

Batten seams are generally used for large sloping areas and are applicable to the same type of roofing applications as standing seams. They may be used alone or combined with standing seams to create patterns for architectural effect.

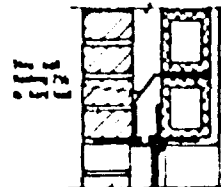


### FLAT SEAM

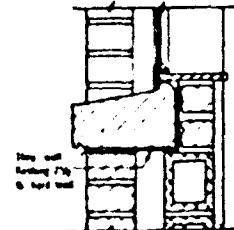
Flat seams are usually auxiliary seams used in conjunction with either standing or batten seams. Their function is to close the cross seams at right angles to the roof slope. They should always be formed in the direction of flow.

Write for complete specifications

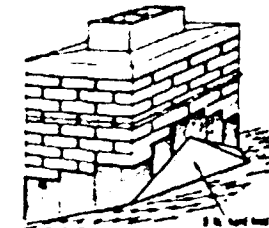
## FLASHING



WINDOW FLASH

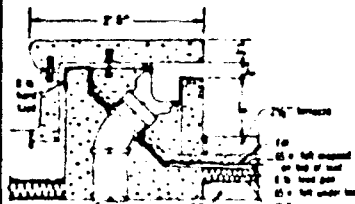
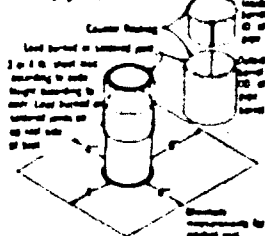


DOOR FLASH

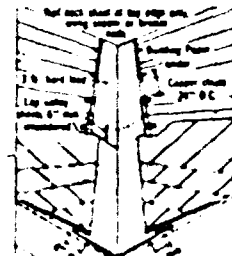


EXPRESS STEEPER CHIMNEY FLASHING AND SADDLE

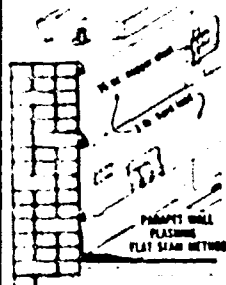
### SHEET LEAD VERT PIPE FLASHING FOR 3 INCH AND LARGER VERT PIPES



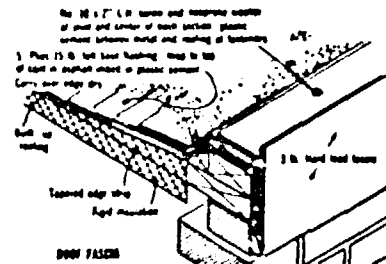
PIPE FLASHING AND PEN



ROOF VALLEY FLASHING



PROMPT WALL FLASHING FLAT SEAM METHOD



DOOR FLASH

LEAD INDUSTRIES ASSOCIATION, INC. 3

# ANTI-VIBRATION 13 ACOUSTICAL TREATMENT

sound and vibration

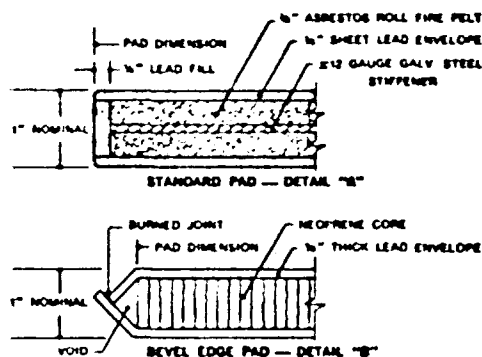
## ANTI-VIBRATION

Anti-vibration pads, sheathed with lead, are widely used under column bearing plates in heavy construction and as machinery mounts. The usual construction of these pads calls for a nominal overall thickness of 1 inch. This consists of a 1/8 inch thick (8 lb. per square foot) hermetically sealed sheet lead jacket, the interior of the pad being either asbestos roll fire felt in layers with one or more 12 gauge steel sheets as stiffeners or a single thickness of synthetic rubber for smaller pads and lighter loads.

Pads nominally 1 inch thick are standard but other sizes are also employed. Thus 3/4 inch, 1 inch or 1 1/2 inch thick pads may be specified provided the minimum plan dimension is at least ten times the thickness. When thicker pads are required, good practice calls for stacking of conventional thicknesses.

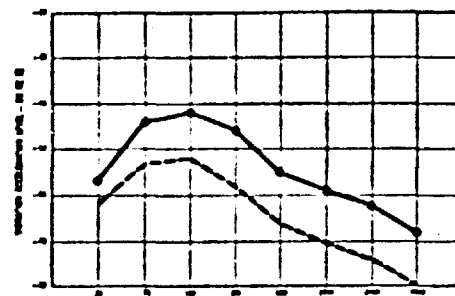
In all cases the lead protects the pad from environmental attack—by ground water in the case of foundations, by oil or corrosive fluids in machinery mounts. In addition the lead itself makes a definite contribution to the vibration isolating properties of the mount.

Where light static loads are anticipated, a synthetic rubber core "bevel edge" pad is usually employed. Where conventional construction (Detail-A) calls for squared edges, the bevel edge is formed by bending the upper and lower edges toward each other at 45° angles (Detail-B). These are then burned together to form a watertight seam. The advantage of this construction, under light loads, is that the rubber core can bulge and the edge does not act as a vertical column to transmit vibration.



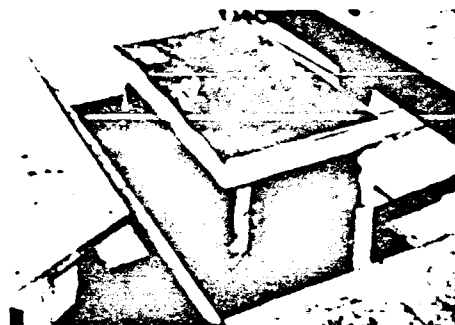
## A WORD ABOUT VIBRATION

Most vibration occurring in building structures is unpredictable and complex. It is almost impossible to predict what frequencies and intensities will be encountered. A typical railroad induced vibration curve is shown below. Note that the most intense vibration is in the 75 to 800 Hz frequencies.



REPRESENTATIVE PLOT OF INTENSITY VS. FREQUENCY OF VIBRATION CREATED BY A PASSING TRAIN MEASURED BY BOLT, BERANEK & NEWMAN

The railroad induced vibration is shown by the upper curve. The lower (dashed) curve shows the effect of the lead encased anti-vibration pads in a typical situation. Performance tests under laboratory conditions show a 5 decibel reduction at 40 Hz and 10-12 dB in the range from 100 to 1,000 Hz. Limited field testing has confirmed or bettered these predictions.



Close-up of a pad in place shows the resilient surround which will hold poured concrete away from the column and prevent creation of any by-pass path for vibration.

## OUTLINE SPECIFICATION

**Lead-asbestos:** Anti-vibration pads shall be made of five layers of material as follows:

- 1 Top layer 1/8 inch sheet lead.
- 2 Upper layer 3/8 inch asbestos roll fire felt—short fiber only, no binder asbestos.
- 3 Middle layer #12 Ga. galvanized steel stiffener.
- 4 Lower layer 3/8 inch asbestos roll fire felt.
- 5 Bottom layer 1/8 inch sheet lead.

**Lead-synthetic rubber:** Anti-vibration pads shall be made of three layers of material as follows:

- 1 Top layer 1/8 inch sheet lead.
- 2 Middle layer 1 inch Neoprene, or equal, of such durometer hardness as to limit vertical deflection to 15% or less of uncompressed thickness of pad.
- 3 Bottom layer 1/8 inch sheet lead.



# LEAD INDUSTRIES ASSOCIATION, INC.

WMA-4-73

232 MADISON AVENUE • NEW YORK, N.Y. 10017

TELEPHONE: (212) 679-6030

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**Practical  
application  
of  
sheet  
lead  
for  
noise  
barriers**



Lead Industries Association, Inc.  
202 Madison Ave., New York, N.Y. 10017

## HOW TO BUILD A GOOD ACOUSTICAL WALL

The problem of internal noise in buildings is not new. Nevertheless changing trends in building construction towards lighter and thinner walls, ceilings and partitions, coupled with increasing noise levels caused by growing numbers of telephones, typewriters and/or business or household machines have accentuated the problem.

The excellent soundstopping properties of sheet lead have made it possible to cope with these problems. Lead's contribution as the most effective noise control measure in well built acoustical walls makes them available for:

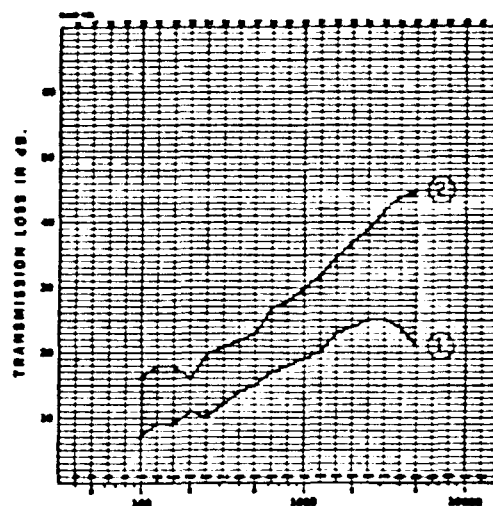
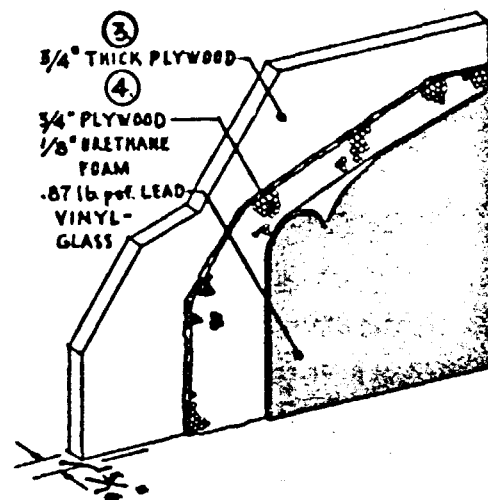
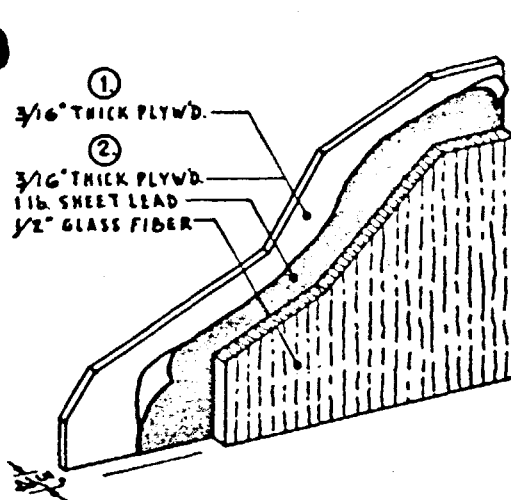
Privacy between adjacent rooms or offices.

Containment of noise sources such as office machines or household appliances.

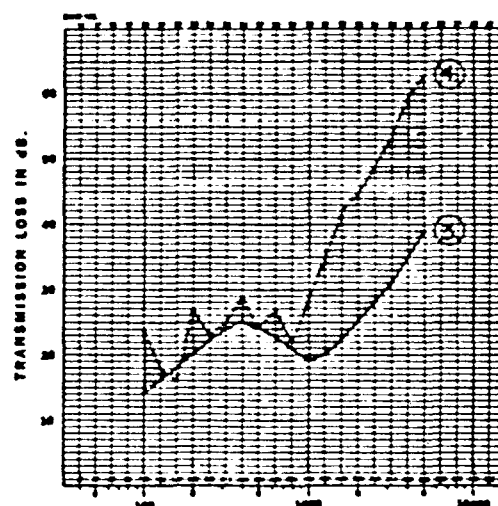
Isolation of noisy or quiet areas such as conference rooms or a furnace room near a family playroom.

With this in mind the following assemblies, partitions or laminates have been illustrated in sequence according to thickness to enable the user to pick a barrier with maximum capabilities within a minimum of space. All are given a single figure rating or Sound Transmission Class (STC) which will allow direct comparison for preliminary purposes. Final decision should always be based upon the entire transmission loss curve or values at all test frequencies. Following examples show the approximate effectiveness of walls with varying STC numbers:—

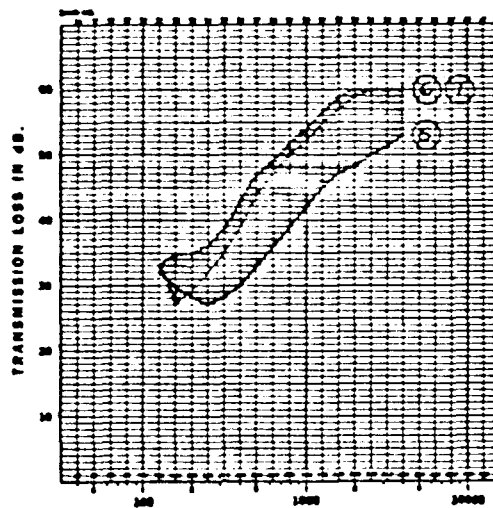
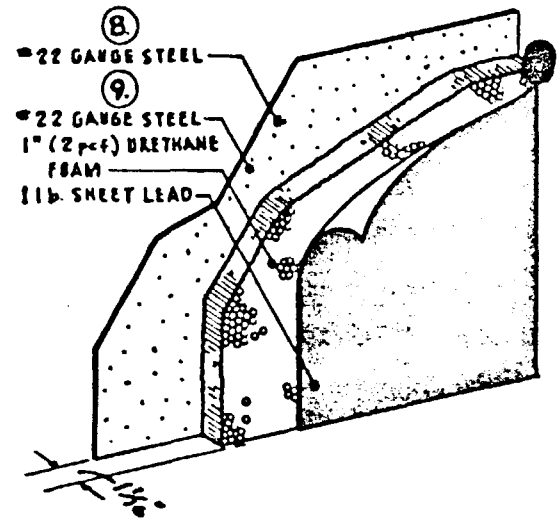
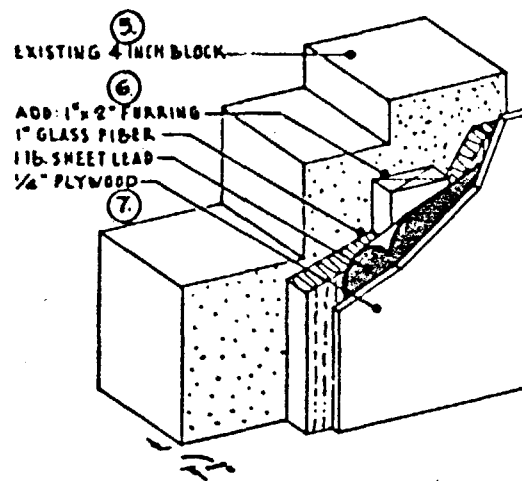
| STC NUMBER                | 25                                     | 30                                 | 35                                       | 42                              | 45                              | 48                              | 50                             |
|---------------------------|----------------------------------------|------------------------------------|------------------------------------------|---------------------------------|---------------------------------|---------------------------------|--------------------------------|
| APPROXIMATE EFFECTIVENESS | Normal speech can be easily understood | Loud speech can be understood well | Loud speech audible but not intelligible | Loud speech audible as a murmur | Must strain to hear loud speech | Some loud speech barely audible | Loud speech not at all audible |



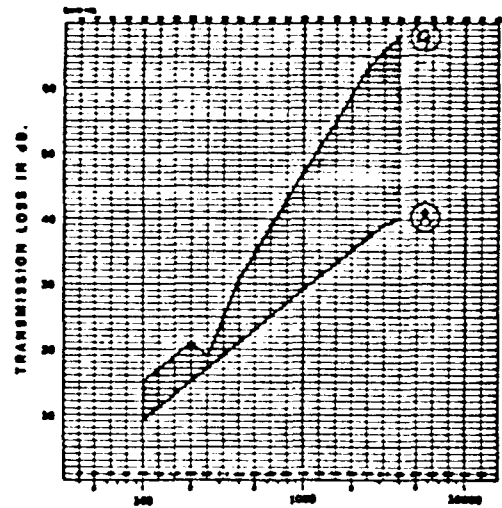
| CURVE NO. | CONSTRUCTION                                                                            | SPC |
|-----------|-----------------------------------------------------------------------------------------|-----|
| Curve #1  | 3/16 inch thick plywood alone                                                           | 20  |
| Curve #2  | 3/16 inch thick plywood, 1 lb sheet lead,<br>1/2 inch glass fiber, asbestos terminated. | 20  |



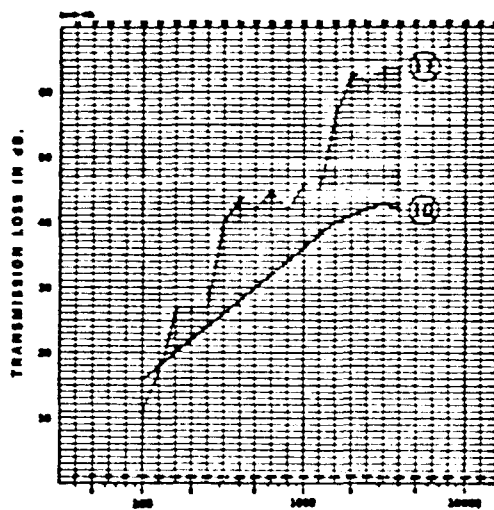
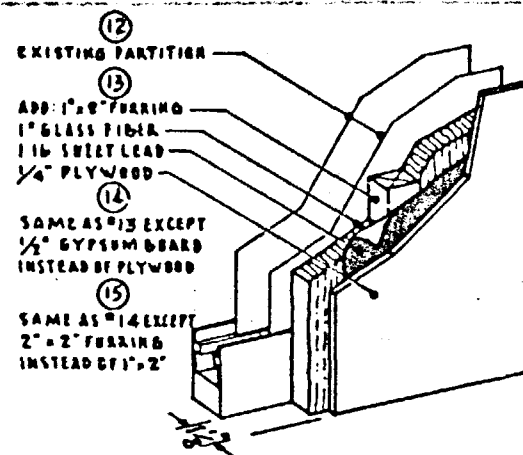
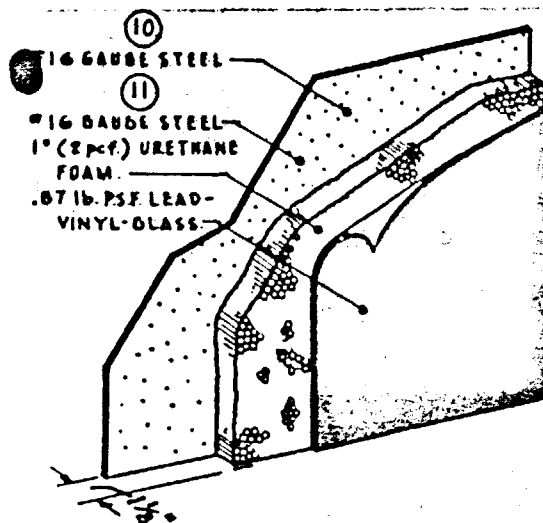
| CURVE NO. | CONSTRUCTION                                                                                       | SPC   |
|-----------|----------------------------------------------------------------------------------------------------|-------|
| Curve #3  | 3/4 inch thick plywood alone                                                                       | 22-24 |
| Curve #4  | 3/4 inch thick plywood, 1/8 inch thick<br>urethane foam, .07 lb per sq ft vinyl/glass<br>material. | 20    |



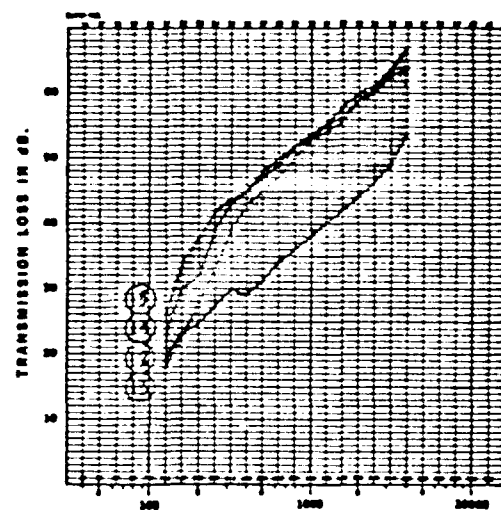
| CURVE NO. | CONSTRUCTION                                                                   | STC |
|-----------|--------------------------------------------------------------------------------|-----|
| Curve #5  | Existing 4 inch thick solid block wall                                         | 36  |
| Curve #6  | Add 1" x 2" furring, lightweight glass fiber in cavity, 1/4 inch thick plywood | 46  |
| Curve #7  | Same as #6 except 2" x 2" furring instead of 1" x 2" furring                   | 46  |



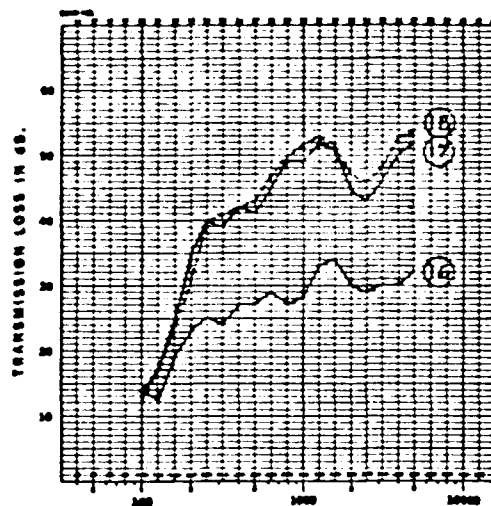
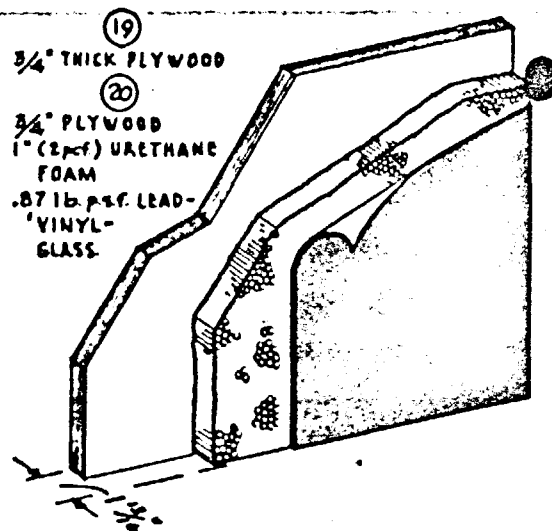
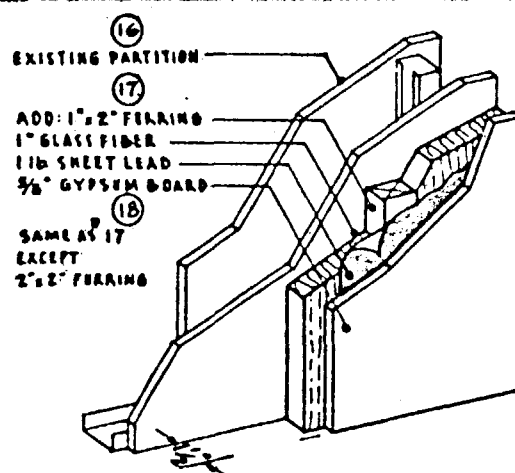
| CURVE NO. | CONSTRUCTION                                                               | STC |
|-----------|----------------------------------------------------------------------------|-----|
| Curve #8  | 22 Gauge Steel Sheet alone                                                 | 27  |
| Curve #9  | 22 Gauge Steel Sheet, 1 inch thick (2 pol.) urethane foam, 1 lb sheet lead | 36  |



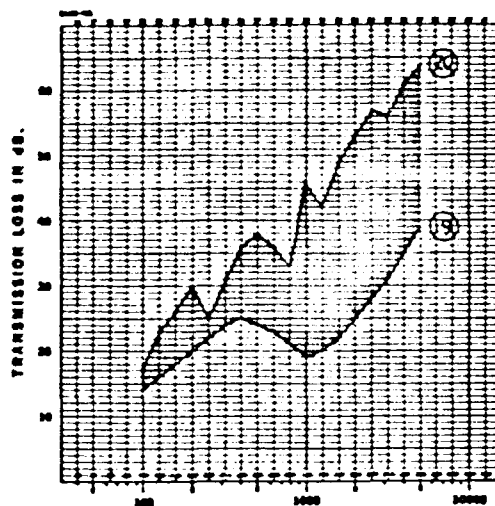
| CURVE NO.  | CONSTRUCTION                                                                                            | SPS |
|------------|---------------------------------------------------------------------------------------------------------|-----|
| Curve @ 10 | @ 16 Gauge Steel Sheet alone                                                                            | 34  |
| Curve @ 11 | @ 16 Gauge Steel Sheet alone 1 inch thick (2 pcf.)<br>Urethane foam, .07 pcf. Lead-Vinyl-Glass material | 41  |



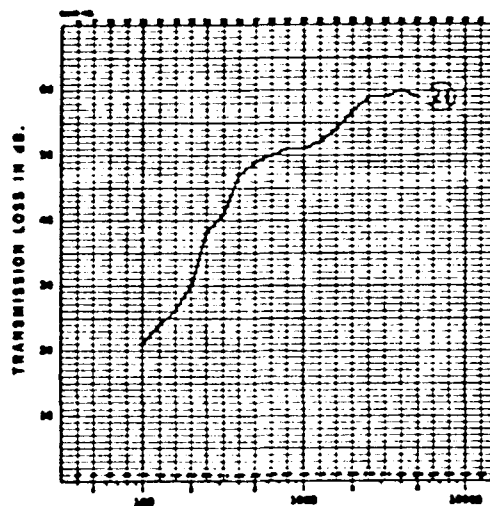
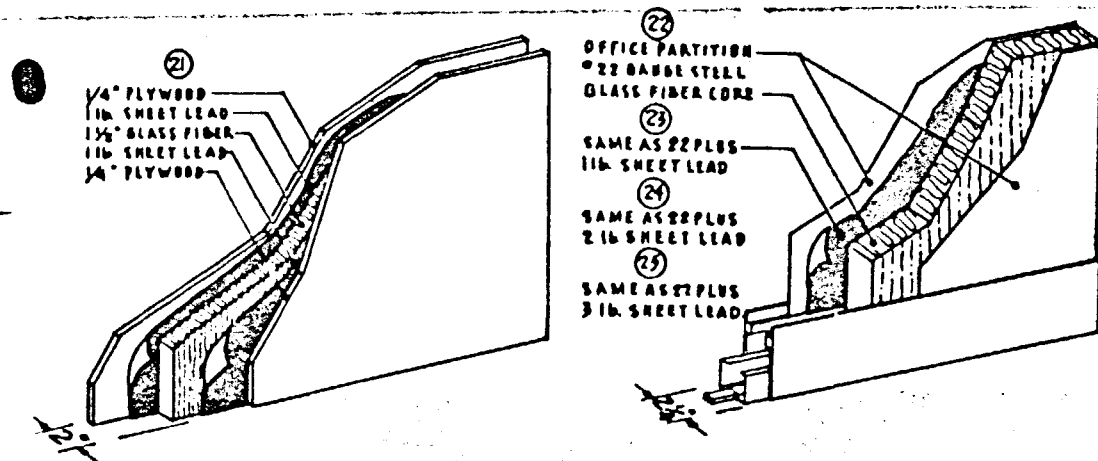
| CURVE NO.  | CONSTRUCTION                                                                               | SPS |
|------------|--------------------------------------------------------------------------------------------|-----|
| Curve @ 12 | Existing Standard Steel Office Partition                                                   | 36  |
| Curve @ 13 | Add 1" x 2" furring, 1 inch thick glass fiber,<br>1 lb. sheet lead, 1/4 inch thick plywood | 48  |
| Curve @ 14 | Same as @ 13 except 1/2 inch thick gypsum board<br>instead of 1/4 inch thick plywood       | 47  |
| Curve @ 15 | Same as @ 14 except 2" x 2" furring instead of<br>1" x 2" furring                          | 50  |



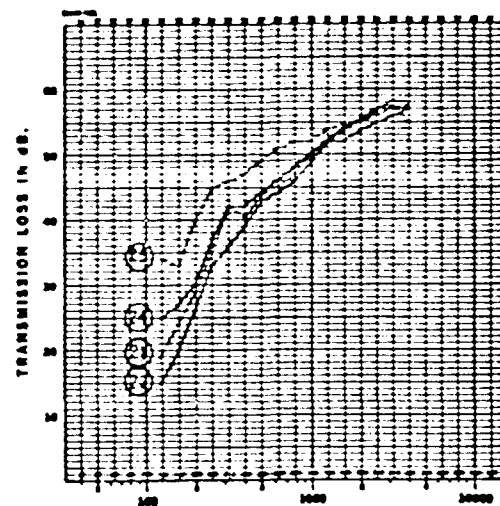
| CURVE NO. | CONSTRUCTION                                                                                                                        | STC |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------|-----|
| Curve #16 | Standard steel stud and gypsum board construction (not caulked).                                                                    | 29  |
| Curve #17 | Add 1" x 2" furring 24" on center, bedded on corking beads, 1 inch thick glass fiber, 1 lb sheet lead, 1/2 inch thick gypsum board. | 39  |
| Curve #18 | Same as #17 except 2" x 2" furring instead of 1" x 2" furring.                                                                      | 41  |



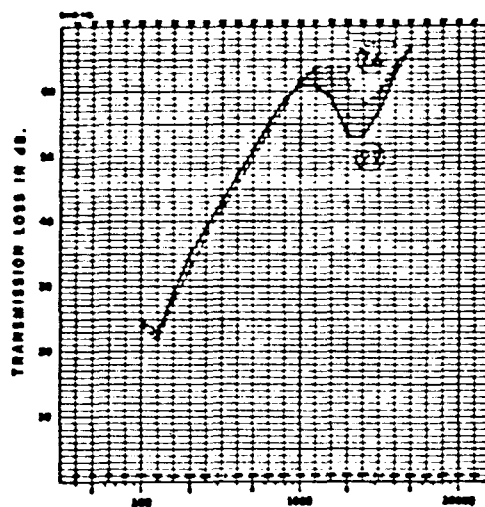
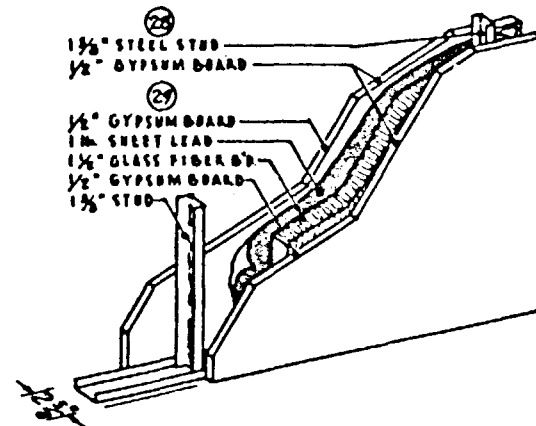
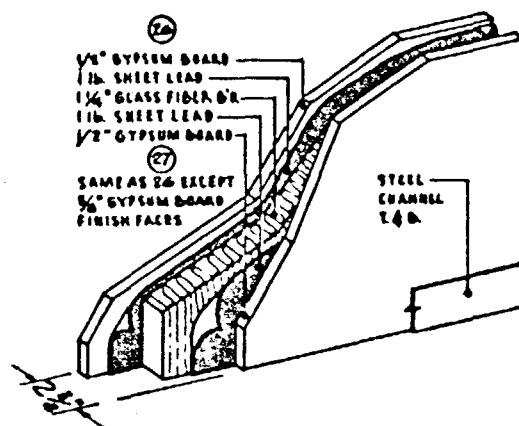
| CURVE NO. | CONSTRUCTION                                                                                   | STC          |
|-----------|------------------------------------------------------------------------------------------------|--------------|
| Curve #19 | 3/4 inch thick plywood alone                                                                   | 22-24 (Est.) |
| Curve #20 | 3/4 inch thick plywood, 1 inch thick (2 part) urethane foam, .87 pcf lead-vinyl-glass material | 40           |



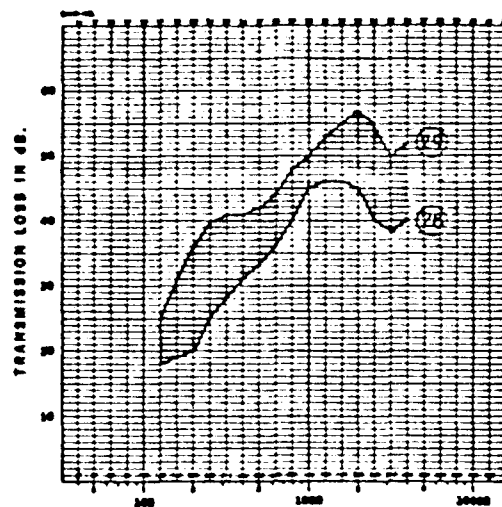
| CURVE NO. | CONSTRUCTION                                                                                                                                         | STC |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Curve 21  | 1/4 inch thick plywood, 1 lb. sheet lead, 1 1/2 inch (2 part) glass fiber, 1 lb. sheet lead, 1/4 inch thick plywood, 1 1/2 inch wood perimeter frame | 47  |



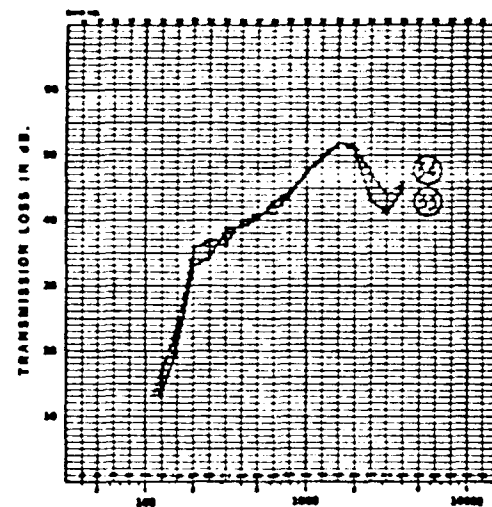
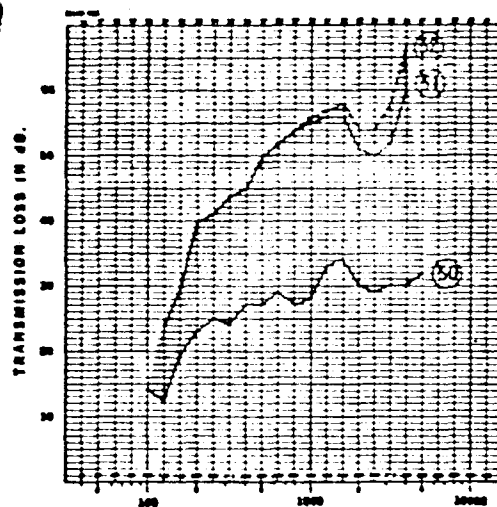
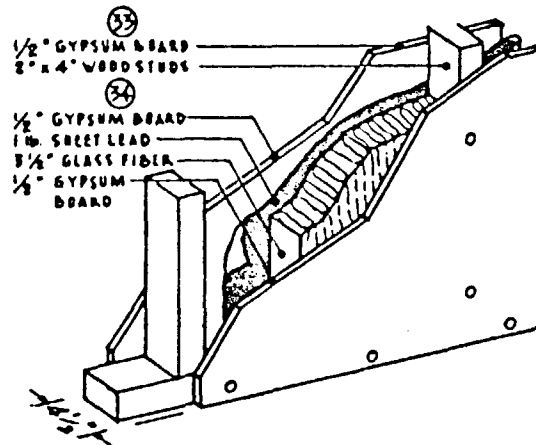
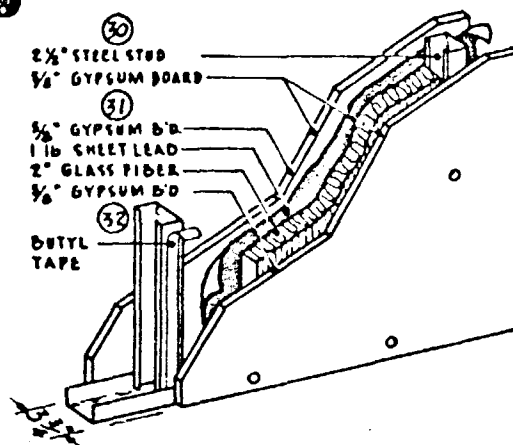
| CURVE NO. | CONSTRUCTION                                                      | STC |
|-----------|-------------------------------------------------------------------|-----|
| Curve 22  | Standard Sheet Office Partition, 22 gauge steel, glass fiber core | 38  |
| Curve 23  | Same as 22 except add 1 lb. sheet lead to one finish face         | 40  |
| Curve 24  | Same as 22 except add 2 lb. sheet lead to one finish face         | 46  |
| Curve 25  | Same as 22 except add 3 lb. sheet lead to one finish face         | 50  |



| CURVE NO. | CONSTRUCTION                                                                                                                                       | STC |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Curve #26 | 1/2 inch thick gypsum board, 1 lb. sheet lead, 1 1/4 inch thick (6 pcf) glass fiber board, 1 lb. sheet lead, steel channel runners top and bottom. | 46  |
| Curve #27 | Same as #26 except 1/2 inch thick gypsum board instead of 1 1/2 inch thick gypsum board.                                                           | 42  |

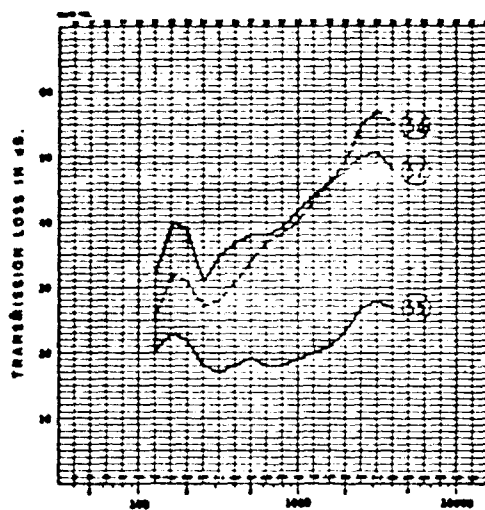
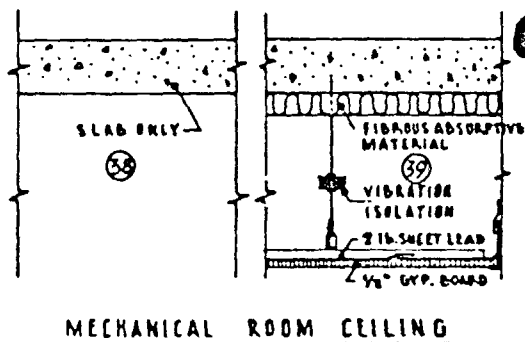
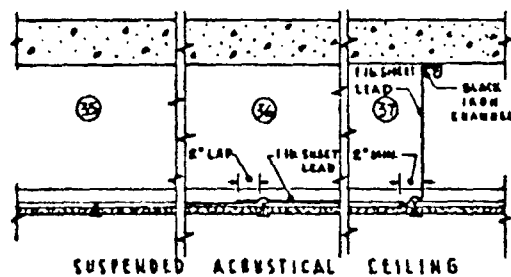


| CURVE NO. | CONSTRUCTION                                                                                                                            | STC |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------|-----|
| Curve #28 | 1 1/2 inch thick gypsum board, 1 1/2 inch steel studs, 1/2 inch thick gypsum board.                                                     | 36  |
| Curve #29 | 1/2 inch thick gypsum board, 1 lb. sheet lead, 1 1/4 inch thick glass fiber board, 1/2 inch thick gypsum board, 1 1/2 inch steel studs. | 47  |

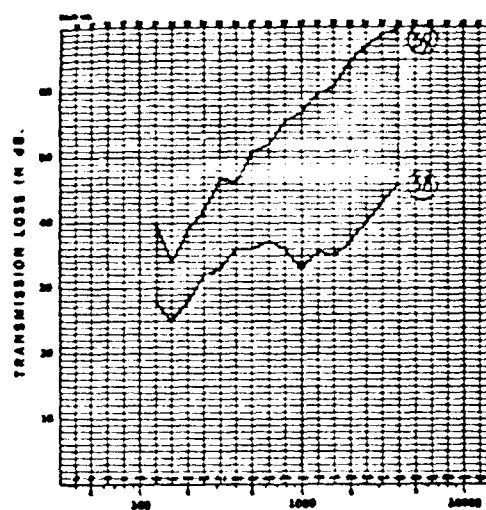


| CURVE NO. | CONSTRUCTION                                                                                                          | STC      |
|-----------|-----------------------------------------------------------------------------------------------------------------------|----------|
| Curve #30 | 1/2 inch thick gypsum board, 2 1/2 inch steel studs, 1/2 inch thick gypsum board, (not caulked)                       | 29       |
| Curve #31 | 1/2 inch thick gypsum board, 1 lb sheet lead, 2 inch thick (2 per 1) glass fiber blanket, 1/2 inch thick gypsum board | 48       |
| Curve #32 | Same as #31 except butyl tape (1/4" x 1/30") used between studs and finish materials.                                 | 48 (est) |

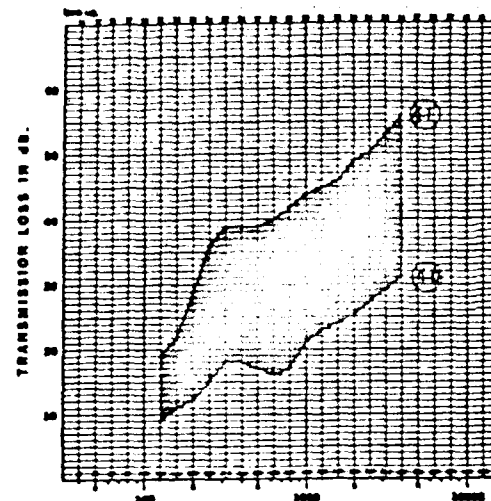
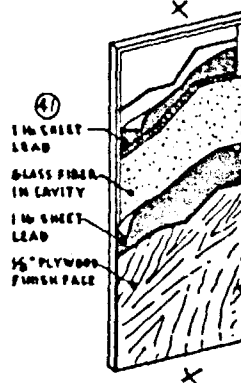
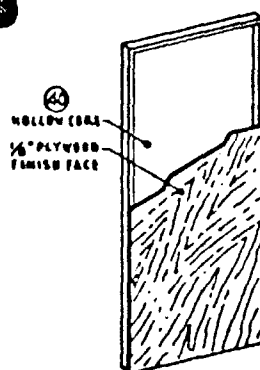
| CURVE NO. | CONSTRUCTION                                                                                          | STC |
|-----------|-------------------------------------------------------------------------------------------------------|-----|
| Curve #33 | 1/2 inch thick gypsum board, 2" x 4" wood studs                                                       | 27  |
| Curve #34 | 1/2 inch thick gypsum board, 1 lb sheet lead, 3/4 inch thick glass fiber, 1/2 inch thick gypsum board | 41  |



| CURVE NO. | CONSTRUCTION                                                                            | STC |
|-----------|-----------------------------------------------------------------------------------------|-----|
| Curve #35 | Standard suspended ceiling construction, T-bar grid, less densely ceiling panels        | 21  |
| Curve #36 | Same as #35 except add 1 lb. sheet lead blanket lapped 2 inches.                        | 26  |
| Curve #37 | Same as #35 except add 1 lb. sheet lead vertical barrier hung from slab over partition. | 41  |



| CURVE NO. | CONSTRUCTION                                                                                                                                                                | STC |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Curve #38 | Typical concrete slab.                                                                                                                                                      | 34  |
| Curve #39 | 1/4 inch thick gypsum board ceiling hung on vibration isolators, absorptive material adhered to slab, 2 lb. sheet lead blanket, lapped 2 inches, over ceiling construction. | 38  |



| CURVE NO.  | CONSTRUCTION                                                                                      | STC |
|------------|---------------------------------------------------------------------------------------------------|-----|
| Curve g-40 | Standard hollow core plywood door.                                                                | 21  |
| Curve g-41 | Same as g-40 except 1 lb. sheet lead laminated to both inner finish faces, glass fiber in cavity. | 42  |

### PITFALLS TO BE AVOIDED AND PRACTICAL TIPS FOR BETTER SOUND BARRIERS

Acoustical theory shows the importance of MASS, LIMPNESS, and internal DAMPING — qualities which lead possesses to a greater degree than any other common building material. The following practical tips are listed therefore to make sure these qualities are fully utilized since no material, no matter how efficient, can surmount careless or uninformed installation.

Lead's MASS can be maintained by:

Keeping the weight of lead in a composite skin nearly equal, or in excess, of the weight of the laminating material.

Lead's LIMPNESS can be preserved by:

Avoiding rigid fastening to stiffer surface skins.

Using viscoelastic adhesives, or intermittent rather than continuous fastenings when laminating leaded panels.

Resilient mounting of surface skins.

Employing leaded panel skins in double walls rather than single even when the total weight is the same for both.

Sound will go wherever air will. Therefore do not fail to eliminate sound leaks in seams, doors, and perimeter joints by caulking or gasketing. Make sure paths through which sound can circumvent the barrier wall are thoroughly blocked. These may be windows, back-to-back panel or electric outlet boxes, medicine cabinets, convector panels, door louvers, heating ducts, an open plenum above a hung ceiling, even hairline cracks can spoil a barrier's effectiveness. In the latter case a heavy coat of paint could be helpful but, in general, the best remedy is caulking, taping, speckling, or plugging with an appropriate material.

## ADDITIONAL INFORMATION AVAILABLE

For further details or engineering assistance with a noise problem contact Lead Industries Association.

### J-4

#### "DIRECTORY OF ACOUSTIC SPECIALTIES"

A 26-page brochure including descriptions of various lead bearing elements in sheet, laminated, powder, or bulk form for acoustical purposes and including lists of manufacturers.

### J-8

#### "INDUSTRIAL NOISE — HOW TO CONTROL IT"

Technical data on the causes of industrial noise and information on methods of controlling it. List of control materials available. Graphs.

### J-9

#### "LEAD A MAJOR FACTOR IN NEW MACHINERY NOISE SUPPRESSION SYSTEMS"

Description of techniques used to lower machinery noise levels with lead and lead composites. Lists machines that normally exceed noise level allowed by the Occupational Safety and Health Administration. Two pages.

### J-10

#### "SHEET LEAD PLENUM BARRIERS"

Detailed description of acoustical plenum barriers and how to install them. Materials and installation procedures described and illustrated. Eight pages.

### J-12

#### "CONTROLLING SOUND WITH LEAD"

Reprint from Building Operating Management covers the applications of lead in reducing vibration and airborne noise. Case studies on three new structures are discussed. Illustrated. Four pages.

### J-13

#### "LEAD KEEPS CLASSROOMS QUIET"

Reprint from Better Schools describes the application of lead for noise insulation in a large elementary school. Details of installation. Illustrated. Two pages.



Lead Industries Association, Inc.

282 Madison Avenue

New York, N.Y. 10017