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### Sound transmission loss of masonry walls: twelve-inch lightweight concrete blocks with various surface finishes

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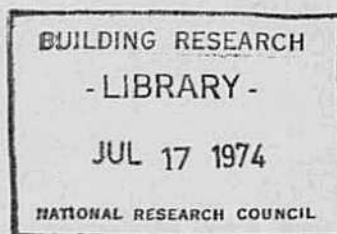
ANALYZED

SOUND TRANSMISSION LOSS OF MASONRY WALLS:  
Twelve-Inch Lightweight Concrete Blocks  
With Various Surface Finishes

by

T.D. Northwood and D.W. Monk

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SOUND TRANSMISSION LOSS OF MASONRY WALLS:  
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This is the first of a proposed series of notes reporting the laboratory measurements of sound transmission loss of masonry walls. The test program, which will extend over several years, will eventually include a range of block thicknesses and densities and will examine the effects of various surface finishes. This particular note considers six variations of a basic 12-in. lightweight block wall.

DESCRIPTION OF TEST SPECIMENS

The basic wall consisted of nominal 12-in. lightweight blocks, having actual dimensions of 7-5/8 in. high x 15-5/8 in. long x 11-5/8 in. thick with insets at each end and three cores. The centre core was approximately 8 x 2-5/8 in. and the two outer cores were 8-1/2 x 2-5/8 in. The walls between cores were 1-1/4 in. thick, minimum, and the outer walls were 1-5/8 in. thick, minimum. The average weight per block was 43 lb. After the test was completed a section of the wall, including mortar, was removed intact and found to weigh 53 lb per sq ft of wall surface. Figure 1, taken after the test, shows typical mortar joints.

The wall was built in a test opening 10 ft long x 8 ft high and consisted of twelve rows of blocks laid up with a Type N mortar (CSA - A179.1967) with 3/8-in. mortar joints tooled to a concave finish. It was allowed to cure for 28 days, after which a bead of caulking was applied around the perimeter on both sides of the wall as a precaution against possible shrinkage cracks. The following surface conditions were then tested:

Wall 1A - Basic wall as above, with no surface treatment.

Wall 1B - One side of the basic wall was painted with three coats of latex block filler applied with one-hour drying time between coats. Application was by brush and deep pile roller.

Wall 1C - On the unpainted side of Wall 1B a layer of 1/2-in. gypsum wallboard (Figure 2) was attached over resilient furring strips. The

furring strips also (Figure 2) were 24-gauge steel having a Z-shaped cross section, with one leg 1/2 in. wide and the other 1-1/4 in. wide and a connecting open web section 1/2 in. wide that provided a 1/2-in. offset between the outer legs. The narrow leg was fastened to the block wall using 1/2-in. concrete nails, and the wider leg then served as a mounting surface for the gypsum board, which was fastened on with 1-in. self-drilling screws. The furring strips were applied horizontally at 2-ft spacing. The weight of the furring added 0.2 lb per sq ft of wall and the gypsum board added 2.0 lb. Thus the weight per sq ft of finished wall was approximately 55 lb.

Wall 1D - The basic wall was painted on both sides with three coats of block sealer as described under Wall 1A.

Wall 1E - Wall 1D was modified on one side by the application of a 1-in. -thick blanket of low-density glass fibre and 1/2-in. gypsum board mounted on resilient furring as described under Wall 1C (Figures 2 and 3). The furring was mounted with 1-in. nails over the glass fibre blanket compressing it against the block wall over the area of contact under the furring strips. The weight per sq ft of glass fibre was 0.06 lb, and the weight per sq ft of finished wall was approximately 55 lb.

Wall 1F - Wall 1D was modified on one side by the application of 1/2-in. gypsum board mounted on resilient strips as described under Wall 1C. Weight per sq ft was approximately 55 lb.

## TEST PROCEDURE

Each test was done in accordance with ASTM E90-70-Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions. The results of the six tests are given in Table I.

## COMMENTS ON TEST RESULTS

### (1) Effect of Sealing Block Surface

In Figure 4 a comparison of Walls 1A, 1B and 1C shows the effect of sealing one or both surfaces of the wall with block filler. In the unsealed condition the wall performance is governed by porous transmission through the block material rather than by the mass of the wall. Note that once one side is effectively sealed, sealing the second side makes little additional change.

## (2) Effect of Extra Leaf of Gypsum Wallboard

Figure 5 shows the improvement to be achieved when an additional leaf of gypsum wallboard is resiliently applied to one side. Note that in this instance the extra leaf is applied on the unsealed side of the block wall. The substantial improvement is due in part to the absorption provided by the unsealed porous block wall.

Figure 6 shows a similar result when both sides have been sealed; here the improvement is much less and is, in fact, and impairment at the low frequencies. Addition of a glass fibre blanket in the space between the block wall and the gypsum wallboard largely restores the effectiveness of the extra leaf except at the lowest frequencies where a significant gain can be achieved only by increasing the spacing of the added leaf or by increasing the low-frequency absorption. Leaving the block wall unsealed under the added leaf is a useful and inexpensive way of achieving better low frequency absorption and avoids the reduction in transmission loss at the lowest frequencies that may otherwise result with the added leaf.

## ACKNOWLEDGEMENT

The tests reported here were done as a cooperative project with the National Concrete Producers' Association, who furnished the materials and constructed the test specimens.

TABLE I  
TRANSMISSION LOSS IN DECIBELS

Centre Band Frequency Hz.	1A	1B	Wall No.		1E	1F
			1C	1D		
125	29	35	37	34	26	30
160	30	35	37	38	33	32
200	31	40	41	41	39	34
250	31	43	46	42	45	36
315	34	43	49	43	54	40
400	34	44	52	44	55	42
500	35	45	55	44	51	46
630	35	48	59	46	55	50
800	33	50	62	49	63	55
1000	35	51	66	51	65	59
1250	41	54	69	54	67	62
1600	45	56	72	57	71	65
2000	48	57	72	58	71	66
2500	50	56	69	61	69	65
3150	52	58	68	62	68	64
4000	54	60	70	60	70	63
Sound Transmission Class (S. T. C.)	39	51	57	50	50	49

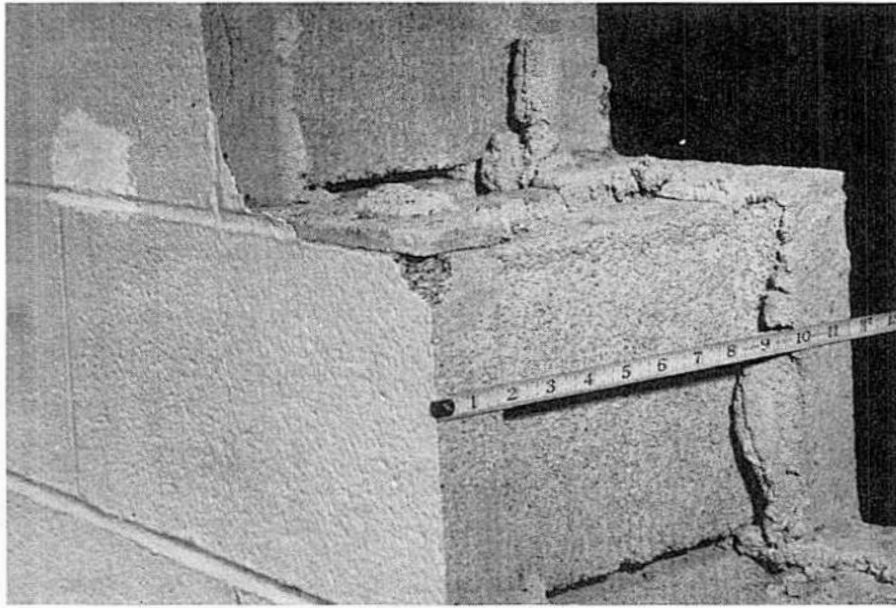


Figure 1 Block wall section after test, showing extent of mortar coverage on horizontal and vertical joints.

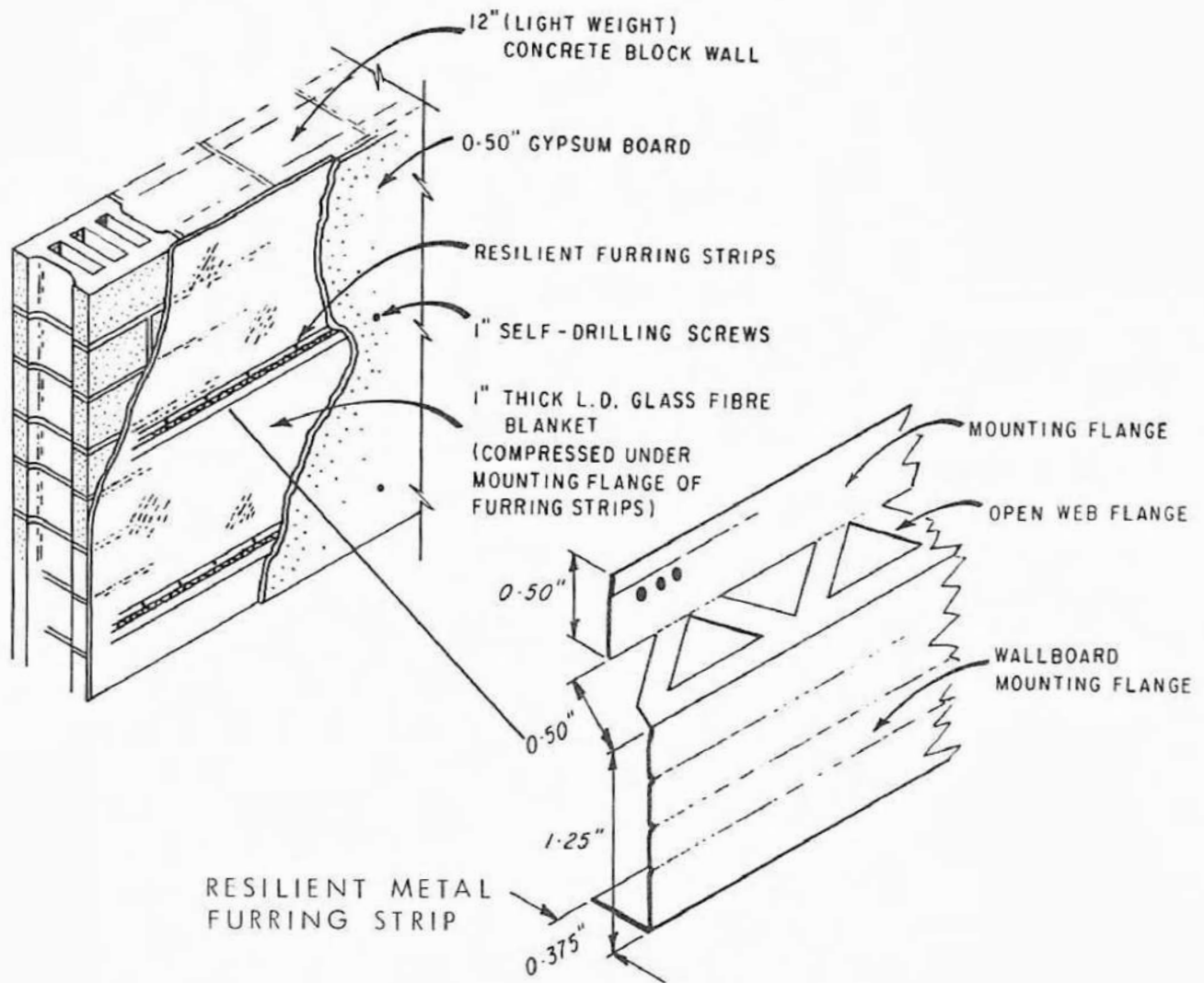


FIGURE 2

SECTIONS OF WALLS IC AND IE SHOWING MOUNTING OF GYPSUM BOARD LEAF AND DETAIL OF RESILIENT FURRING STRIP

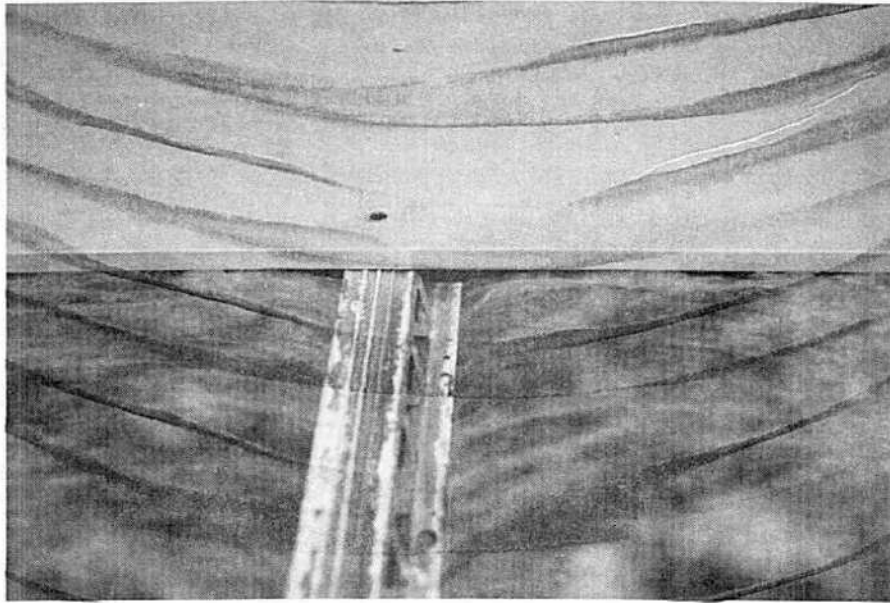


Figure 3 Wall E showing mounting of gypsum board over resilient furring strips and glass fibre blanket.

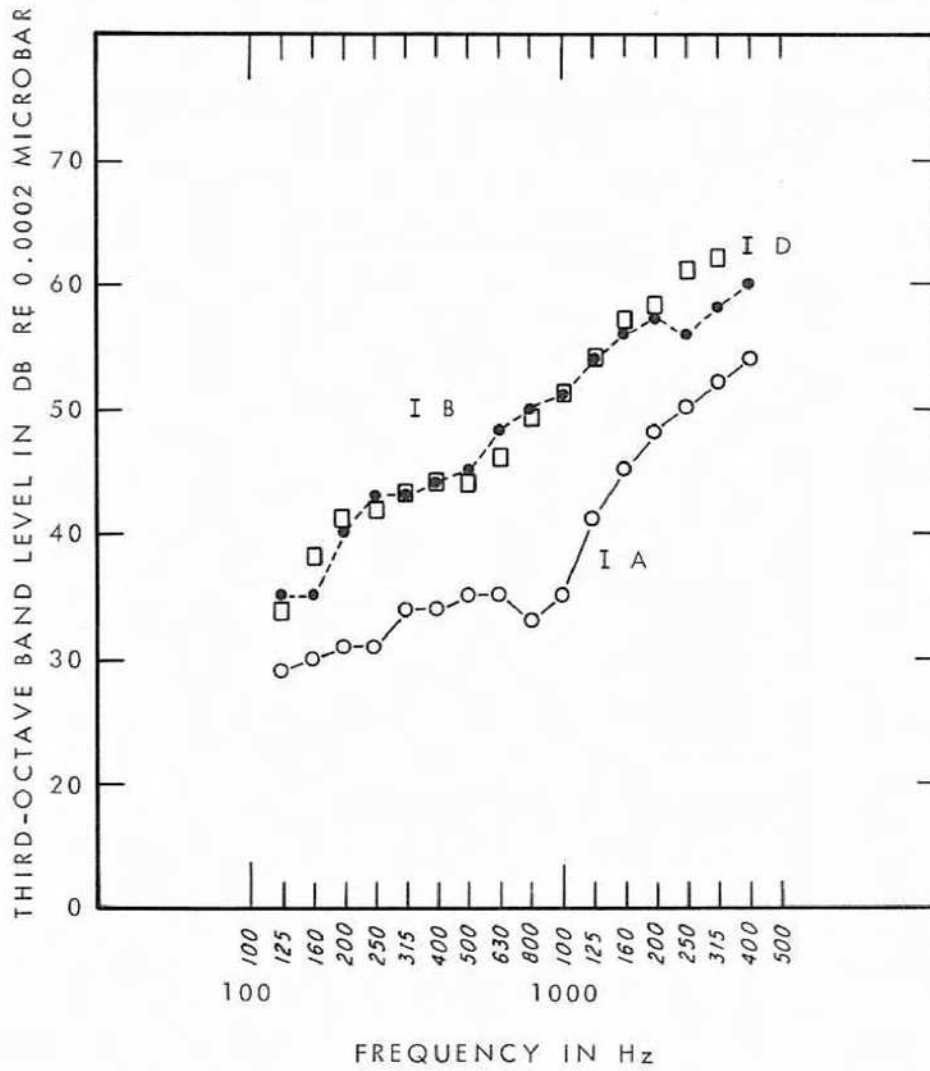


FIGURE 4

COMPARISON OF WALLS IA, IB AND ID SHOWING EFFECT OF SEALING ONE AND BOTH SIDES OF WALL WITH BLOCK FILLER. WALL IB IS SEALED ON ONE SIDE; ID IS SEALED ON BOTH SIDES

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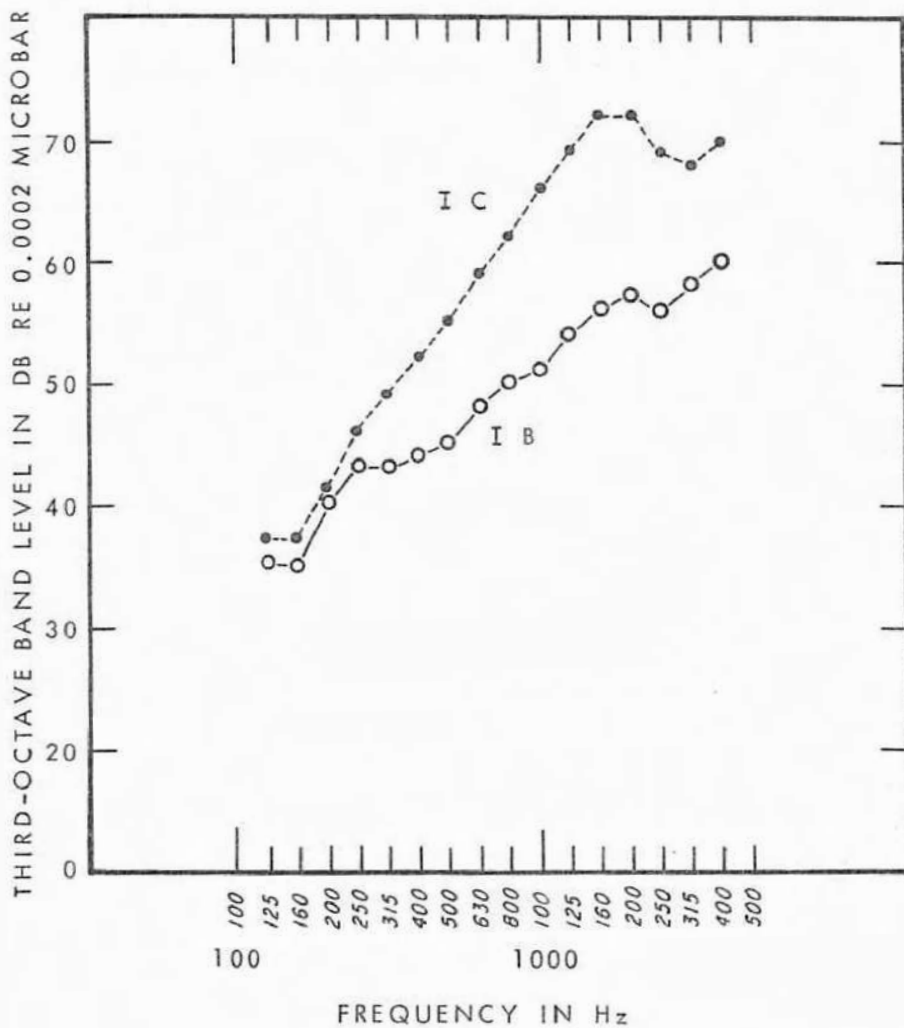


FIGURE 5

EFFECT OF ADDING EXTRA LEAF OF GYPSUM BOARD  
 OVER UNSEALED SIDE OF BLOCK WALL I B WALL  
 SEALED ON ONE SIDE WITH BLOCK FILLER I C -  
 RESILIENTLY MOUNTED GYPSUM BOARD ON UNSEALED  
 SIDE OF WALL

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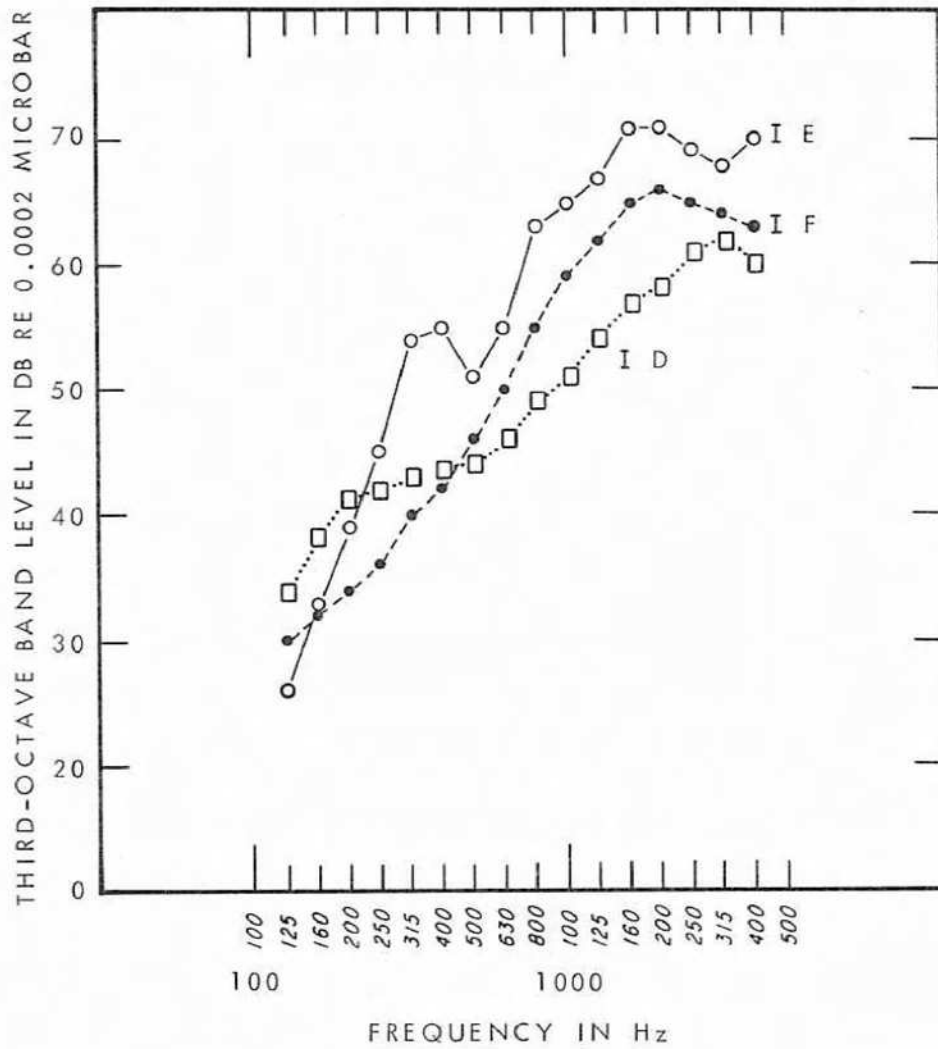


FIGURE 6

EFFECT OF ADDING EXTRA LEAF OVER SEALED SURFACE OF BLOCK WALL, WALL I D IS THE BASIC WALL; I F IS THE WALL PLUS RESILIENTLY MOUNTED GYPSUM BOARD; I E IS THE WALL PLUS GLASS FIBRE BLANKET PLUS RESILIENTLY MOUNTED GYPSUM BOARD

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