that will give any more isolation than that indicated by the mass law curve shown in Figure 18. A double wall, when properly constructed, will overcome this difficulty. However, the two portions of the wall must be completely isolated from each other. It is necessary that no appreciable vibration travel from the wall facing the sound source through any path whatsoever to the second wall. Methods for accomplishing the necessary vibration isolation are described in other texts and will not be reviewed here.[5,9]

I. TRANSMISSION OF SOUND THROUGH COMPOSITE STRUCTURES

When the partition separating a noisy area from another area is made up of two or more materials, each having a different surface density in pounds per square foot, an effective transmission loss for the entire partition can be computed. This is done by finding the power transmitted through each portion of the partition, adding these figures, and dividing by the total area of the partition. This gives the average intensity transmitted through the composite wall structure. The difference from the intensity on the source side is the transmission loss.

The effective transmission loss of a partition composed of two different materials is shown in Figure 19. Along the horizontal axis is the difference in transmission loss of the two portions of the partition. The several curves correspond to the area of the portion with the smaller transmission loss expressed as a fraction of the total area. The point on the vertical axis that corresponds to the intersection of the correct difference in transmission loss and the correct fractional area curve gives the number of decibels that must be subtracted from the larger transmission loss in order to get the effective value for the composite structure. The curves of Figure 19 may also be used if the wall in question is constructed of more than two different materials. In this case, one should find the combined transmission loss for any two portions of the wall. Then proceed by combining this effective value with the transmission loss of another portion, and so on.

The curves of Figure 19 emphasize a very important point in connection with the design of an isolating wall. A tiny portion of a wall constructed of material of low transmission loss tends to nullify the effect of the remainder of the wall. In order to clarify this point, consider the transmission loss of a concrete block partition 10 feet high. Figure 18 and Table 4 show that this structure should yield a transmission loss of 48 db at about 600 c.p.s. Suppose that the mason did not realize the importance of small cracks in a noise control structure, and carelessly left on opening just $^1/_8$ inch wide along the top of the wall. The area ratio between this small opening and the rest of the wall is about 0.001, but the difference in the transmission loss between the two is, of course, 48 db. Figure 19 shows that 18 db must be subtracted and that the effective transmission loss will be 30 db, substantially less than would be expected for the concrete wall.

[9] R. H. Bolt, L. L. Beranek, and R. B. Newman, Handbook of acoustic noise control, Physical Acoustics, *Wright Air Development Center Tech. Rept.* **52-204**, Wright-Patterson Air Force Base, Ohio, 1, 1952.

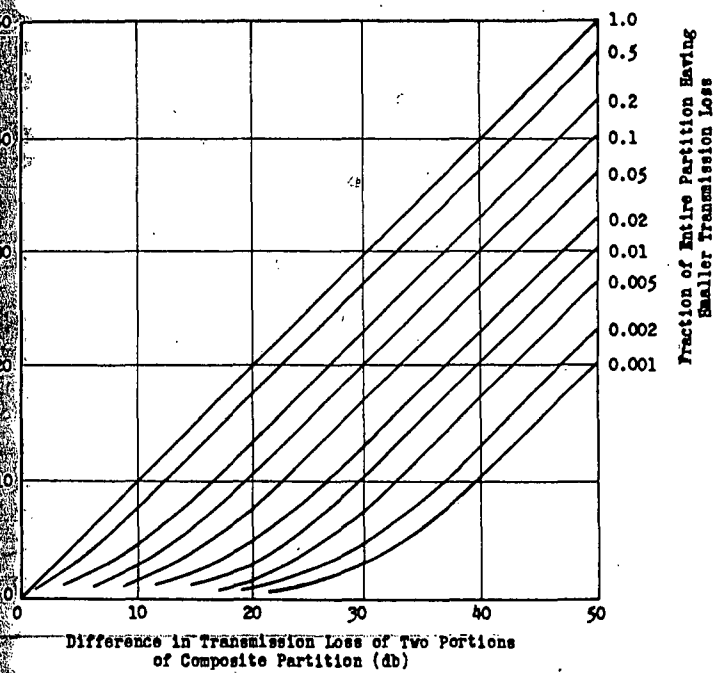


Figure 19. Curves for the calculation of the transmission loss of composite partitions.

One must always be on the alert for similar situations in construction for the purpose of noise control. Leaks around doors are extremely hard to eliminate unless great care is exercised. Poorly fitting panels and joints also are frequent sources of trouble.

J. TRANSMISSION OF SOUND FROM ONE ROOM TO ANOTHER

The curves shown in Figure 18 give the transmission loss in decibels from one side of a partition to the other. It is assumed that reflected sound is of negligible importance on the secondary side of the partition. This is not the case when the secondary side of the wall faces into a room of fairly small size with imperfectly absorbing walls. The increase in level in the secondary room resulting from reverberant sound must then be computed.

The total power radiated into the secondary room by the vibrating partition will be equal to the intensity transmitted through the wall times the surface area of the wall, S_w. In order that the sound energy in the room neither increase nor decrease, the sound power absorbed by the walls, ceiling, and floor must be