

ACOUSTICS

LECTURE 5

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Sound Transmission Through Partition:

Consideration of the requirements for reduction of airborne sound between areas is important in building design, whether they be houses, offices, schools, studios or any other building requiring acoustic comfort or privacy.

Sound can be transmitted from one room to another by a number of methods:

- 1- Direct airborne transmitted across separating partition: the incident sound excites vibrations in the partition, and the vibrating partition then radiates sound into the receiving room.
- 2- Flanking transmission: airborne sound in the source room may excite flanking walls into vibration. The sound energy is then transmitted through the structure and re-radiated by some other partition in the receiving room.

Sound Reduction Index (R):

The fraction of the incident energy that is transmitted to the other side is called the transition coefficient (τ).

$$\tau = W_t/W_i$$

Where W_i is the incident sound energy on one side of the partition

W_t is the transmitted sound energy into the air on the other side of the partition.

The basic measure of the sound insulation of a partition is the sound reduction index, R or SRI.

$$R = 10 \log_{10} (1/\tau)$$

Sound reduction index is also called sound transmission loss (TL). If a wall has a high value for R then the sound energy transmitted through it is small.

Sound Insulation of Non-Homogeneous partitions: The overall sound reduction index (R) of a non-homogeneous partition, e.g. a wall with a door of lower sound reduction index as shown in figure (2.8) can be calculated using the following formula:

$$R_{av} = -10 \log_{10} (S_1 10^{-R_1/10} + S_2 10^{-R_2/10} / S_1 + S_2)$$

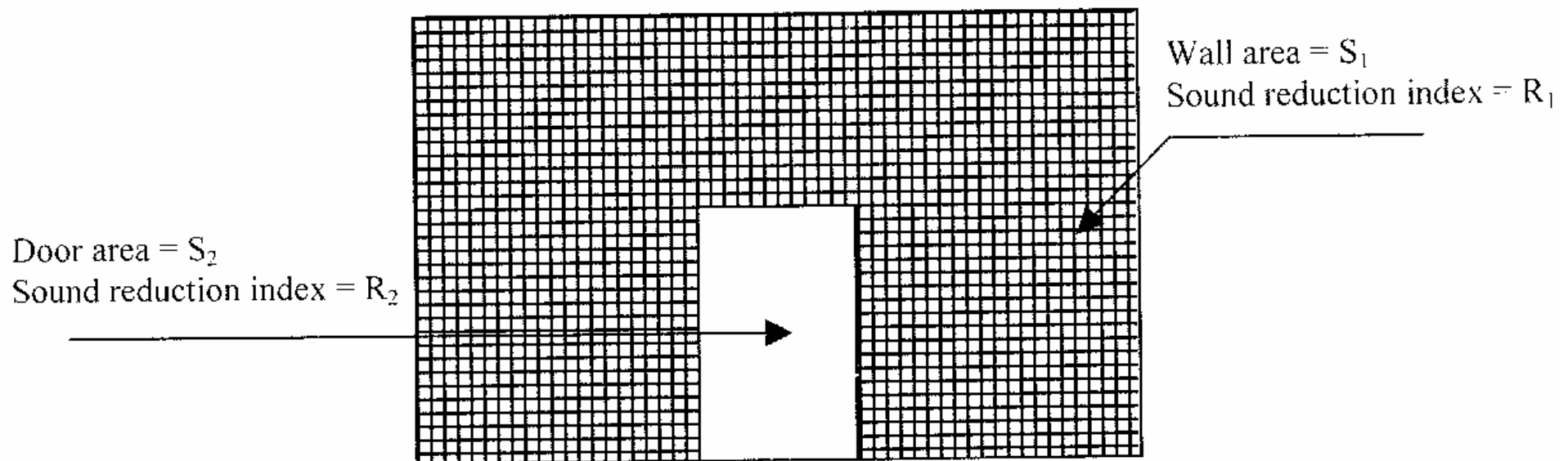


Figure (2.8): Sound reduction index of non-homogeneous partition.

Example 2.2: Suppose the area of the whole partition is 18 m². This partition was built by brickwork, which has SRI of 40 dB. A door has been fitted with an area of 1.8m², and has SRI of 16 dB. Calculate the average R of the non-homogeneous partition.

Solution:

$$S_1=18-1.8 = 16.2 \text{ m}^2 \quad R_1= 40\text{dB} \quad S_2=1.8 \text{ m}^2 \quad R_2=16\text{dB}$$

$$\begin{aligned} R_{av} &= -10\log_{10}\left(\frac{16.2 \times 10^{-40/10} + 1.8 \times 10^{-16/10}}{16.2 + 1.8} \right) \\ &= 25.8 \text{ dB} \end{aligned}$$

تمت بحمد الله