

Acoustics of Buildings

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The science that deals with the design of a good auditorium and buildings so as to reduce the external & internal noise and maintains the conditions of sufficient loudness and clarity of the source of sound inside is called the "Acoustics of Buildings" or Architectural Acoustics.

In a building, specially an auditorium, to be able to enable speech & music to be heard clearly within it, there should be no undesirable echoes or reverberations and the reverberation time should be near the optimum for the hall.

The following conditions are to be secured in the construction of public halls and auditoriums:

1. Control of reverberation:

As reverberation is due to repeated reflections, the remedy lies in increased absorption which may be brought about by having

- (a) A few open windows, which by letting the entire sound energy out serve as perfect absorbers.
- (b) Walls covered with absorbent materials such as asbestos, coarse cloth, celotex, perforated card boards, maps and pictures, heavy curtains etc. or walls engraved and roughened with decorative porous bodies by providing small capillaries absorb a good amount of sound energy incident on them & serve very well as sound suppressors.
- (c) Upholstered seats which will be responsible for absorption and would avoid approximating the presence & absence of the audience.
- (d) A good audience. In this case one listener is equivalent to 4.7 sq. ft of an open window.

- ② Adequate loudness. - In a public hall the sounds which reach an audience must be sufficiently loud. This can be achieved by placing large wooden boards behind the speaker, hear only reflected from them. When the sound increase to see of the direct sound & confusion. A hard plane wall behind the speaker and facing the audience is also a very good reflecting surface. Low ceiling is also very useful in reflecting the sound towards the audience. Loudspeaker should be fitted above the heads of the listeners pointing slightly downwards.
3. Uniform distribution of intensity. The distribution of intensity throughout the hall should be uniform. The shape of the hall should be parabolic at the speaker's end and the position of the speaker should be at the focus of the parabola. In this condition, as the speaker speaks, sound is reflected from the back almost as a parallel beam. Thus there is a uniform distribution of sound intensity at all points of the hall.
4. Free from echelon effect: - When an observer walks towards a flight of steps, he finds that each foot step is followed by echoes giving a rolling sound. This arises from the regular train of sound reflected from the steps. This effect is known as "echelon effect". This can be freed by using a stair carpet.

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5. free from resonance. Sometime it is found that the window-panes and the wooden panels are thrown in resonant vibrations with the sounds produced in the hall. Such resonant vibrations should be suitably damped.

6. Freedom from spurious noise! -

The noise travelling through air come in from outside through open windows, doors, etc. This noise can be reduced by using double doors and double or triple windows in separate frames.

Noise is also produced inside the room by machinery, typewriters, etc. This may be reduced by proper lubrication of machines, by hanging curtains of absorbent material near the machines and by placing the type-writers on rubber pad.