

GOVERNMENT POLYTECHNIC FOR GIRLS

AHMEDABAD

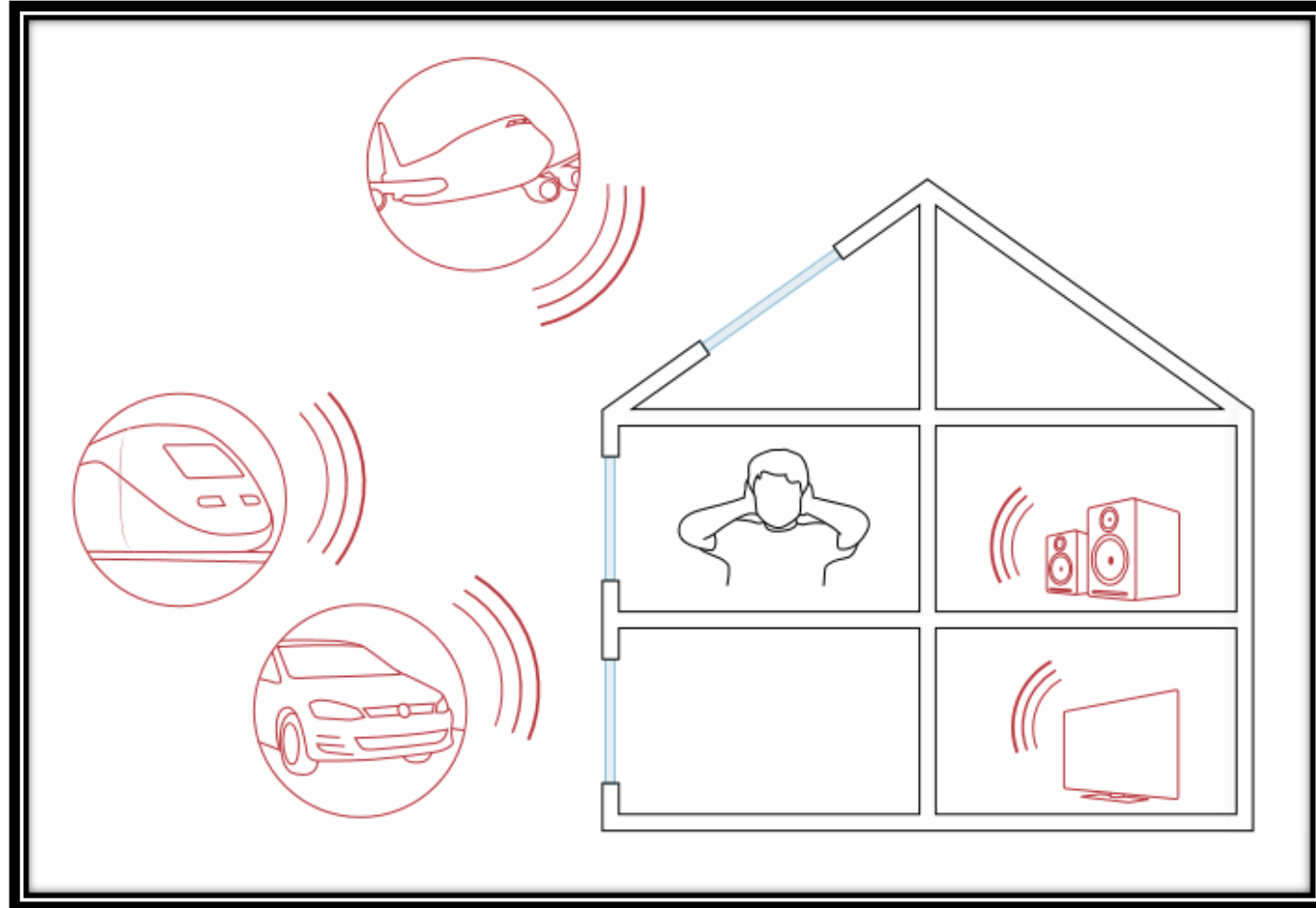
COURSE: BUILDING SERVICES

COURSE CODE : 3360604

TOPIC: NOISE ACOSTICS

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❖ TOPIC : Noise and SOUND insulation



❖ WHAT IS NOISE:

- Noise is the unpleasant and unwanted sound.
- The difference between noise and sound depends upon the listener and the circumstances.

❑ Effects of noise :

The major effects of noise pollution are:

- I. Physical (illustration- loss of hearing, total deafness, damage of eardrum)
- II. Physiological (headache, high rate of heart beat, blood pressure fluctuation)
- III. Psychological (mental stress, insomnia, annoyance, decrease in efficiency)

❖ WHAT IS A SOUND

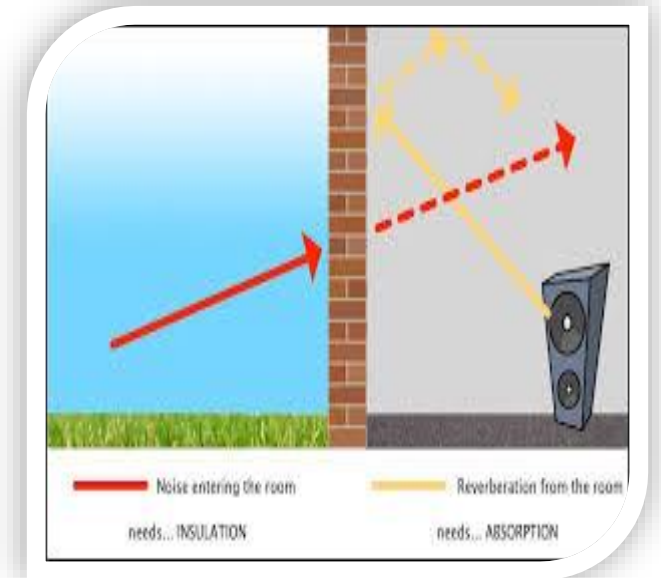
?

In the physical term, sound is the vibrations that travel through the air or another medium . It is a form of energy.

- It is generated in air when particles oscillate around their equilibrium position. It is the measure by which the transmission of sound or noise from one room to the other is prevented.
- It has different functions than **sound absorption**.
- The function of a sound absorption material is to absorb sound and thus reduce the sound reflected from a surface, while the function of **sound insulating materials** construction is to reduce sound passing through it.
- Sound absorbers, mostly of porous material , are poor sound insulators, while hard materials used for sound insulation are poor absorbers.

❖ What is sound insulation:

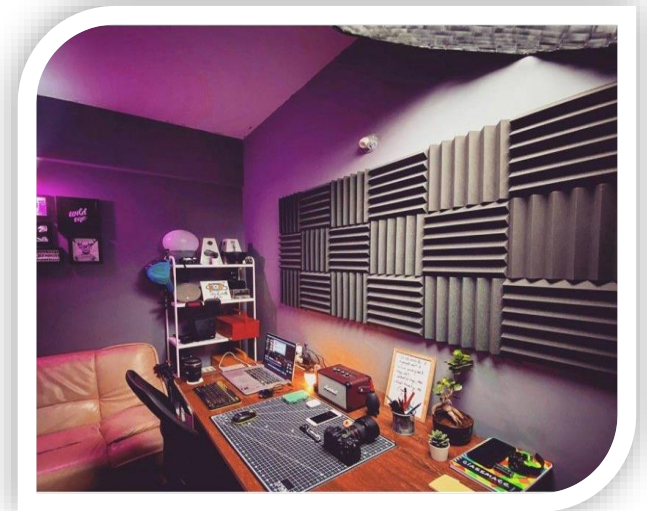
- It is the process of soundproofing an enclosed space , such as a room.
- This type of insulating activity is usually employed when there is a need to keep sound from filtering into or out of the space.
- Sound insulation techniques are often used in business settings, as well as in multi-family dwellings like duplexes and apartment buildings.



❖ Illustration:

▪ An good illustration of how sound insulation is used is found in a recording studio;

- In order to prevent background noise from interfering with the recording process, singers create their vocal and instrumental tracks in a soundproof recording booth.
- Because the booth prohibits the introduction of sounds from outside the space, there is nothing present to interfere with the quality of the recording.
- The audio tracks containing vocal performances and the various tracks are captured exactly as the performances hear them.



❖ What is the use of sound insulation:

A. Neighbor comfort.

- If you live in a bouse with very close neighbor , you will want comfort among them.
- Sound insulation prevents voice leaks , in which close houses trend to hear or feel sounds and voices from the neighbor house.

B. Human health and safety.

- Too much noise is not only bad for the environment but also for the humans.
- We are not designed for excessive noise.
- If the sound is too much high then it can cause deafness partially or in some cases permanently also.

❖ General consideration in sound insulation:

- The first is to isolate the source of noise. Air tight rooms for machinery would achieve this purpose.
- The orientation of residential buildings should be such that is oriented away from noisy surroundings. Doors and windows should not face the source of noise.
- Building units(rooms) should be properly planned so as to reduce the noise to minimum .
- The materials of furniture and lining of walls and ceilings should be of materials like wood, glass wool, help to reduce the noise to a greater extent.
- The transmission of noise by vibrations can be prevented by making walls, floors , partitions very rigid and massive or heavy.
- The control of Impact sound to some extent is possible by either providing resisting material like carpet etc.
- The personal protection devices like headphones, ear plugs etc. can be used to reduce the noise to a extent of 20 to 30 db.

❖ Where is sound insulation needed:

Museums.

Libraries.

Entertainment facilities .

Residentials.

Offices.

Apartments.

Recording studios.

Theaters.

restaurants.

Broadcast studios.

Music halls.

❖ Sound insulating materials:

❖ The sound insulating material can be broadly classified into three groups:

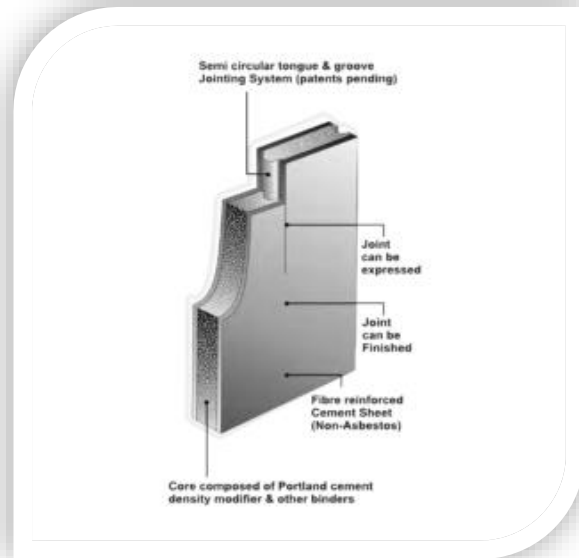
- A. Non-porous rigid materials
- B. Porous rigid materials
- C. Non-rigid (**FLEXIBLE**) Porous materials

1.) non-porous rigid materials:



- The sound insulation of non-porous, homogeneous, rigid construction, such as plastered solid brick masonry walls varies as the logarithms of the weight per unit area.
- The relation between the weight of a rigid partition and its sound insulation is approximately such that every time the weight is doubled there is an increase in sound insulation of about 4 to 5 db.

2.) Porous rigid materials:



- Porous materials may be rigid or non-rigid. Rigid porous materials (such as porous concrete masonry, cinder concrete etc.)
- The insulation increases about 10% higher than the non-porous rigid material.
- In order to secure the best insulation form the porous materials, it is recommended that porous partition should be plastered at least on one side and if possible on both sides.

3.) non-rigid
(flexible) porous
materials:

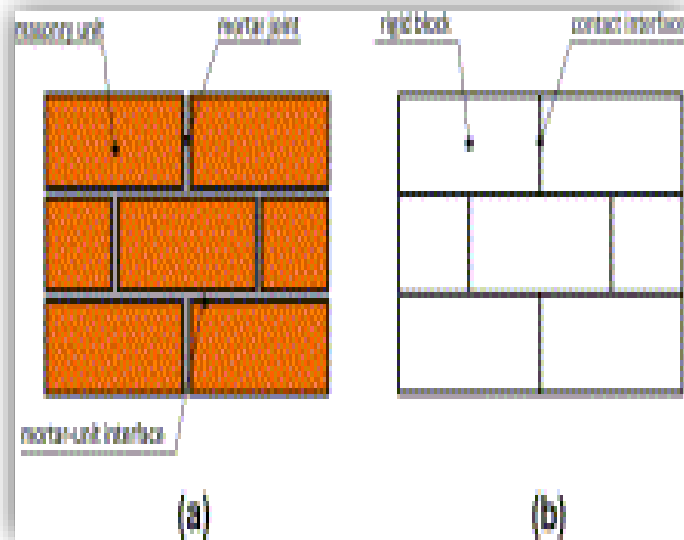


- These consists of felt, mineral wool, and quilt etc.
- They by themselves provide low **sound insulation** as compared to **rigid materials** and therefore they are **not** generally used for the purpose of **noise reduction** and **isolation**.
- However , a composite construction employing a combination of rigid materials and porous absorbers may be adopted where weight is an important factor.

❖ Wall insulation by vertical barriers:

- Walls and partitions are the vertical barriers to noise. Their proper design and construction may insulate the sound to the desired level. Wall construction, used for sound insulation, may be four types.
 - i. Rigid and Massive Homogeneous Walls.
 - ii. Partitions of Porous Materials.
 - iii. Double Wall Partition.
 - iv. Cavity Wall Type Construction.

1.) Rigid and Massive Homogeneous Walls



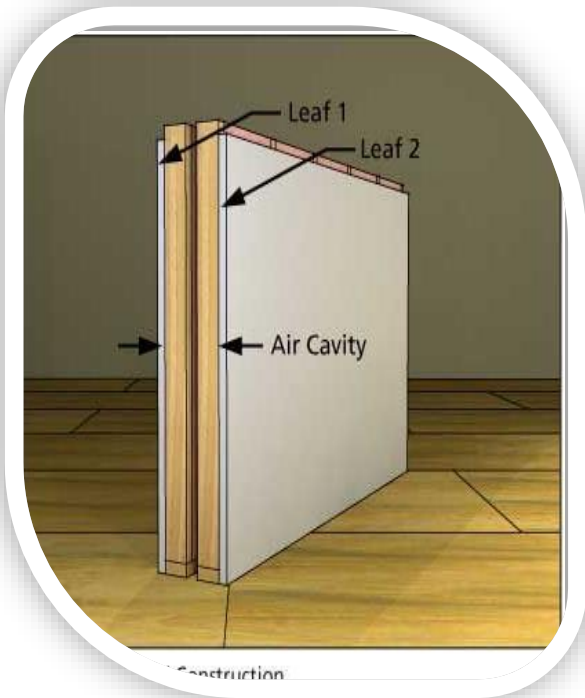
- A rigid wall consists of stone, brick or concrete masonry construction, well plastered on one or both the sides.
- The sound insulation offered by these rigid walls depends upon their weight per unit area.
- The sound insulation thus increases with the increase in the thickness of the wall.
- Because of the logarithmic variation between weight and transmission loss, such a construction (i.e. solid wall) becomes highly uneconomical and bulky after certain limit.

2.) Partition walls of Porous Materials



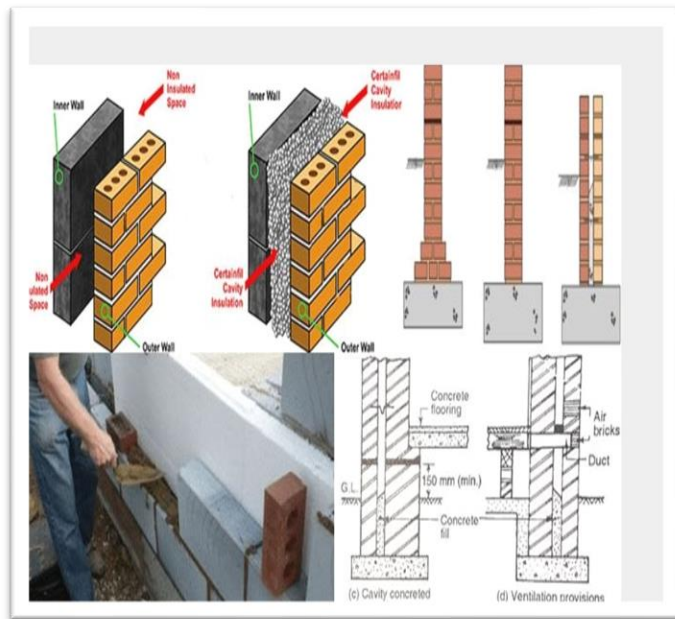
- Porous materials may be rigid or non-rigid. Rigid porous materials (such as porous concrete masonry cinder concrete etc.), the insulation increases about 10% higher than the non-porous rigid material. However, partition walls of non-rigid porous materials (such as felt, mineral wool etc.) offer very low sound insulation, though they can be used in combination with rigid materials with added advantage.

3.) Double wall partition



- A double wall partition shown in Figure, consists of plaster boards on fiber boards or plaster on laths on both the faces, with sound absorbing blanket in between staggered wooden studs are provided as support, though their number should be a minimum.
- A double wall construction is thus a partition wall of rigid and non-rigid porous materials.

4.) Cavity wall construction:



- In case of cavity wall, the gap between the walls are kept air filled or else filled with some resilient material.
- The two faces of the wall may be fixed with insulating board. The width of the cavity should be at least 5cm and two wall leaves should be tied by use of only light butterfly wall ties.

Horizontal barriers by:

Floors and ceilings insulation

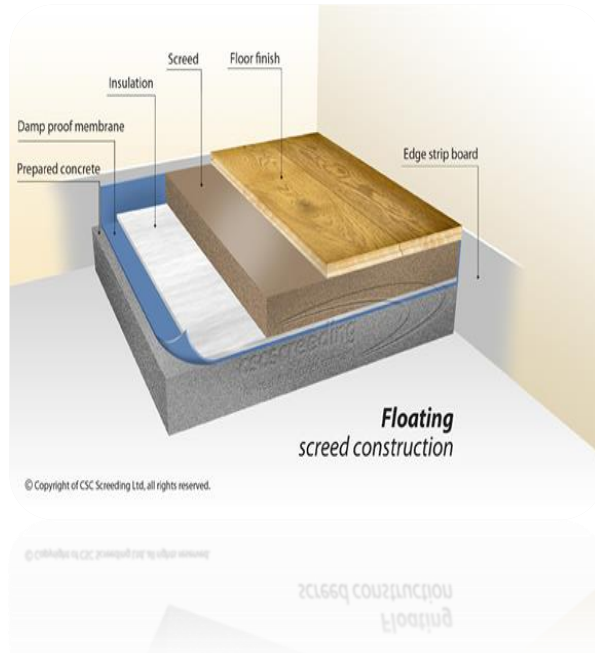
- Floors and ceilings insulation act as horizontal barriers to the noise. It can be achieved by the following constructional features :
 - I. use of resilient surface materials on floor.
 - II. Concrete floor floating construction.
 - III. Timber floor floating construction.
 - IV. Timber floor with suspended ceiling and air space.
 - V. Skirting.

1.) use of Resilient material on floor.



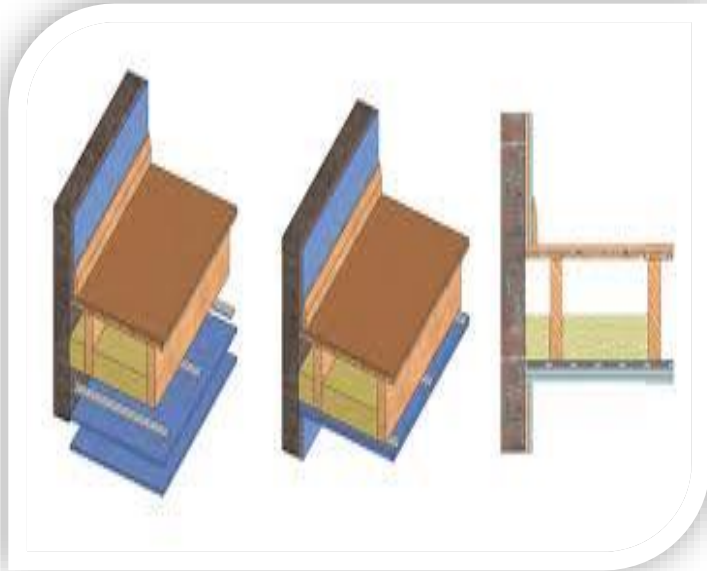
- **Resilient flooring:** is defined as the floors made up of materials like PVC, rubber, linoleum etc.
- Different types of **resilient flooring used** in building construction is discussed.
- **Resilient flooring** system is denser and non-absorbent in nature.
- They assure a flexible **surface** which makes comfortable walking.

2.) Concrete floor floating construction.



- **Floating floors** are one of the most effective constructions used for impact **sound insulation** assurance in dwellings.
- Resilient material between upper layer and the base of the **floor** are the main element reducing transmission of vibrations through the **floor** to the adjacent room.

3.) Timber floor flooring construction.



- In case of floors constructed of wooden joints, the problem of sound insulation becomes more difficult. The figure shows the insulation of new timber floor, using mineral or glass wool sheet for insulation.
- The further improvement in insulation of such floors is achieved by employing plugging or deadening material in the air space between the wood joints.

4.) timber floor with suspended ceiling and air space



- This type of construction helps to improve the insulation of both air-borne and structural bone sounds.
- For solid floors like R.C.C, slab metal hangers of acoustic clips may be used to support the ceiling below as shown in image.

5.) skirting



- A skirting is fixed to the wall .
- The type of skirting fixed will affect the insulation of the floor a great.
- The large the contact area it provides between the floor and the wall, the lower would be the insulation.
- The air gape or resilient material the skirting and the floor is provided.

❖ Noise control in residential buildings :

- The most desirable method is to locate the residential buildings in a quiet area away from the noisy source like the industrial areas, rail tracks, road carrying heavy traffic.
- The dwellings should be surrounded by the maximum amount of planting and grassed area.
- Avoiding hard surfacing around the buildings.
- Roads within the residential area should be kept to a minimum both in width and length.
- Roads with through traffic should be excluded from residential areas.
- Playground for children should be sited as far as possible.
- The orientation of buildings in a locality should be planned in such a way as to reduce the noise disturbance from neighborhood areas.

- The non critical areas ,such as corridors , bathrooms , kitchen , elevators and service spaces may be located on noisy side and the critical areas such as bedrooms and living rooms on the quite side.
- Doors and window should be located away from the noise side of the buildings.
- The building should be located at a distance of about 30m from the road, but a distance of 45m or more is desirable
- When the window are at right angles to the directions of the noise , the distance from the road should be arranged to about 15 to 25 m .
- It is desirable that rooms on party walls and above /below party floors should be of similar type. By this means, bedrooms are not exposed to noise from adjoining living rooms , and there is less risk of disturbance of sleep.

- Bedrooms should not be planned along side access balconies , and preferably not underneath them .
- Water closets should be planned over living rooms and bed rooms and bed rooms. Soil pipes should not be carried in ducts which adjoin living rooms or bed rooms.
- All items of equipment's that are potentially noisy should be selected with care w.c cistern should not be fixed on partition next to bed rooms or living rooms.
- Plumbing pipes should be isolated from the structure .
- Lift motors should be mounted on resilient supports.
- Provide false ceiling.

- To minimize structure borne noise use of discontinuous or non homogeneous material in the construction of the structure is recommended . An expansion joint may be proper location.
- Th e floor of a room immediately above the bedroom or living room shall be provided with 12mm thick carpet.
- Reduction of air borne noise requires the use of rigid and massive walls without any openings .openings are the major cause of penetration of noise through a barrier. All doors and windows should be properly gasketed where a high degree of sound insulation is desired.

- Use personal protection devices like earphones, ear plug etc.
- Cover walls , ceiling and floor with sound absorbent material.
- Reduce number of opening in a wall.
- Cover all walls with non-porous material.
- Construct floating floor over the existing floor.

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