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STUDY OF NOISE CONTROL OF BUILDINGS

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Abstract

This study is aimed on the acoustical design issues for buildings. It also brings out the salient aspects of building noise control. The preventive majors taken for the control of noise i.e. unwanted sound are also discussed here. Noise control of buildings is a comprehensive set of strategy to decrease noise pollution. As public awareness of noise control grows and the public tolerance for noise diminishes, interest in building noise control is increasing. A comprehensive study on building noise and on acoustically divisible spaces has been made. The acoustics design issues for building involve the principal issues like site noise considerations, including the control of noise transfer to a project's neighbours, establishing noise standards for each use space, sound isolation between various use spaces, audio/visual system consideration. The most important segment of noise improvement is transportation noise control. The different noise control techniques insure proper acoustic balance in the building. The designers must use high quality materials which diminish acoustic effects coming from many audio or visual electronic devices. Therefore, it is the responsibility of the facility's planners, user groups, architects, engineers and others involved with the project to assure that the project acoustical needs are delineated.

Index Terms: *Acoustics, Soundproofing.*

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1. INTROUCTION

It is a noisy world. In our daily lives we continuously get exposed to the unwanted sound which we don't want, need, or benefit from. This is an introduction to noise control in buildings. It is not a deep study about the topic but it will introduce the designers to some important principles and terminology.

Acoustics of buildings that part of the science of physics which deals with the control of sound to create conditions by which people can hear with comfort, it is necessary to consider not only the principles of sound but to take into account also the phenomena of hearing. Acoustical analysis involves not only the sound source but also the listener and everything in between on the path of sound.

Noise from many outdoor sources assails our hearing as it invades our homes and work places: traffic, aircrafts, barking of dogs, neighbours voices. Social activities may generate noise levels that consistently affect the health of populations residing in or occupying areas, both indoor and outdoor, near entertainment venues that feature amplified sounds and music that present significant challenges for effective noise control strategies.

Acoustics as a modern science seems to have started in the 19th century, to serve social elites who wanted better auditoria for music. The subject attracted great experimentalists, most notably Hermann Helmholtz and the aristocrat Lord Rayleigh, and it was based on sound as a mechanical phenomenon; Wittje says music, science, and society were co-produced in this bourgeois world. For example, Helmholtz saw the experience of sound and the experience of music as interchangeable; C.V. Raman was another famous scientist whose caste-based elite training in classical music led to his contributing a chapter on musical instruments to the Handbuch der Physik in 1927. One of Rayleigh's major contributions was his disc suspended from a torsion thread; the apparatus summed sound pressure across frequencies and gave a first indication of the difference between perceived sound and independently measured intensity. Conceptions of acoustics also changed in response to developments in experimental psychology and ethnomusicology, while Helmholtz, for his part, moved from the physiology of sensations to electrodynamics.To help the developer community build quieter hardware, the Acoustics Office was established. Flight hardware noise is controlled through a comprehensive set of requirements where acoustic noise levels are limited based on the type and complexity of the hardware. Compliance to the requirements must be verified for the hardware to be approved for flight.

1. **CONSTRUCTION MATERIALS FOR SOUND CONTROL:**

For sound control number of speciality materials is available. They are design to provide strategic advantages over traditional materials, and are design to use in situations where controlling sound or noise levels is of great concern. Some common examples are listed here:

1. Mineral-fibre insulation is a special, denser type of insulation that can be used to improve a room's level of soundproofing.

2. Sheets of limp mass, dense vinyl sound barrier are available for covering flat surface. They are also available with an adhesive backing for even easier installation. These coverings are safe, inexpensive, and easy to work with they can be cut with a standard utility knife or scissors.

3. One side of the resilient channel is attached to the stud, and the drywall is attached to the other side. Drywall that is isolated from framing in this manner will transmit far less sound than drywall mounted directly to studs.

1.1 SOUND ABSORBTION

Sound absorption is the capability of surface to absorb sound instead of reflecting if the construction in reflective nature the sound will continuously move. The surface absorb the sound is the better option to control its movements rather than its reflection. Room acoustics describes how sound behaves in space. That means the listener and the sound source are in the same room. If the room has nearly no sound absorbing surfaces the sound will bounce between the surfaces and it takes a long time before the sound dies out. The listener in this kind of room will then have a problem registering the speaker because he hears both the direct sound and repeated reflected sound waves.

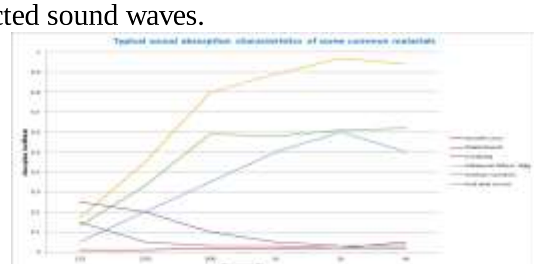

Fig. 1: Sound absorption characteristics of some materials

The property of sound absorption is in every material. Some of the material like carpet, foam, padding, and fiberglass insulation are the best sound absorbing materials. Sound absorption coefficient at a particular frequency range is described as a material property of sound absorption. In buildings sound absorbing materials used are rated using Noise Reduction Coefficient (NRC), which is basically a type of average of sound absorption coefficients from 250 Hz to 2 kHz, the primary speech frequency range. From perfectly absorptive (NRC = 1.0) to perfectly reflective (NRC=0.0) NRC theoretically ranges.

The sound absorbers can be divided into three main categories

- Porous absorbents
- Resonance absorbents
- Single absorbers

1.2SOUND INSULATION

To prevent you from being disturbed by the activity in the next room, whether the room is upstairs or in line, the construction has to prevent sound from being transmitted. This doesn't have to be a massive concrete slab or wall. To compare sound insulation properties you need to take into accounts the area of the dividing partition/wall, as well as the volume and sound absorption properties of the receiving room.

The principle of sound insulation is: The reduction of sound energy from one building area to another by absorbing it or reflecting it with an intervening solid panel of material is called sound transmission loss (TL).

Sound insulation construction: In the U.S., the standard way of describing sound insulation of constructions is a metric called STC, or Sound Transmission Class. The STC rating of wall, floor or ceiling is determined by the components of the construction and how they are assembles.

Two types of sound insulation are to be dealt with in building construction: -

(a)Airborne Sound Insulation

(b)Impact Sound Insulation

1.2.1 AIRBORNE SOUND INSULATION

Airborne sound can be transmitted in a receiving room via same or all of the paths (A) to (D) as shown in fig 1. Path (A) is called the direct path.

All transmissions paths other than path (A) are together termed the indirect or flanking transmission. This direct transmission becomes increasingly important when the insulation requirement of the separating partition is about 35 dB upwards.

The ideal material for good sound insulation has a very high mass and low stiffness but some of the most convenient building material has low mass and relatively high stiffness.

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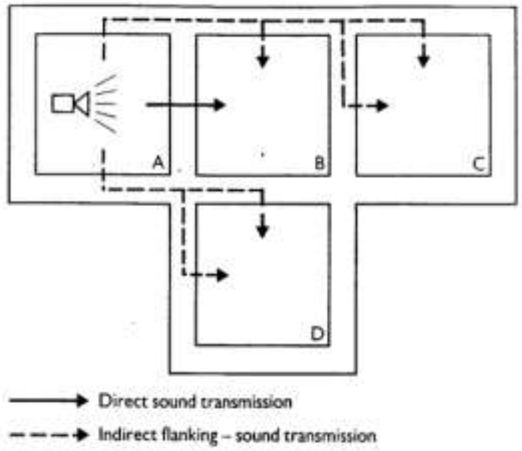

Fig. 2: Paths for Sound Transmission between Adjacent Rooms

1.2.2 IMPACT SOUND INSULATION

Insulation against structure-borne (or impact) noise can be achieved by the use of:

(a) Soft floor finish (carpet, cork, vinyl, rubber, etc.),
(b) Resiliently suspended solid ceiling,
(c) Resilient (anti vibration) mounts, and
(d) Floating floor.

2. NOISE ACOUSTICS

Acoustic noise is any sound in the acoustic domain, either deliberate (e.g., music or speech) or unintended. In contrast, noise in electronics may not be audible to the human ear and may require instruments for detection. Room acoustics pertains to the physical characteristics of a space for the hearing of direct and reflected sound. In libraries, the principal issue for room acoustics is speech intelligibility and control of background noise levels. Multi-purpose rooms require special room acoustics design since these spaces often must accommodate speech and musical activities at different times. For speech activities, the reverberation time should be low enough to allow syllables of parts of speech to be readily understood.

Industrial and manufacturing plant noise causes lower employee productivity, less safety communication, worker fatigue, and higher absenteeism. A quieter work environment (84 dB (A) and below for an 8 hour shift) is the basic level OSHA requires for safety in the workplace. With proper sound treatments, you can engineer the noise out of a plant by using enclosures to encapsulate noise, acoustical blanket walls to block off noisy areas, or baffles and wall panels to reduce the overall ambient noise in the plant.

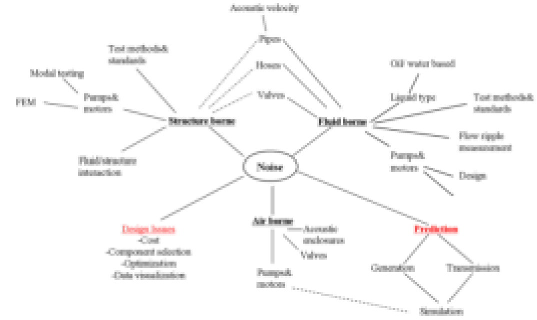

Fig. 3: Noise acoustics in hydraulic system.

2.1 PHYSICAL TECHNIQUES TO REDUCE NOISE IMPACTS:

This section describes some of the physical methods which architects, developers and builders can employ to reduce noise impacts. There are four major actions which can be taken to improve noise compatibility for any type of land use or activity. These are site planning, architectural design, construction methods, and barrier construction.

Noise barriers can be erected between noise sources and noise-sensitive areas. Barrier types include berms made of sloping mounds of earth, walls and fences constructed of a variety of materials, thick plantings of trees and shrubs, and combinations of these materials.

Acoustical construction involves the use of building materials and techniques to reduce noise transmission through walls, windows, doors, ceilings, and floors. This area includes many of the new and traditional "soundproofing" concepts.

Acoustical site design uses the arrangement of buildings on a tract of land to minimize noise impacts by capitalizing on the site's natural shape and contours. Open space, nonresidential land uses, and barrier buildings can be arranged to shield residential areas or other noise sensitive activities from noise, and residence can be orients away from noise.

2.2 THE ADVANTAGES OF HAVING ACOUSTIC CEILINGS INSTALLED:

If you have been considering adding an acoustic ceiling to a room in your home, office, or anywhere else, consider the following benefits of doing so:

1. A good drop ceiling or suspended ceiling will dampen ambient noise, and it will help the noise within the room to seem fuller and richer. This can be great for spaces such as a theatre room in your home, where you want to be able to experience every last bit of sound that is coming from the system.

2.The labour costs for this kind of installation are lower than other construction jobs, and the materials are relatively inexpensive as well. If you are looking for an option that isn't going to break the bank but will still give you the fresh look that you desire, an acoustic ceiling is likely to meet most or all of your criteria for the job.

3.Because of the way these ceilings are installed – they are made up of tiles that are placed within a metal framework hung from the ceiling – you can quickly and easily customize the look of any space without doing major renovations.

4. Most of these ceilings to a great job of reflecting light back into the room, meaning you should have to less light in order to set a comfortable environment. This could save you down the line on utility costs, and it could prevent you from having to install more lighting into a large space.

3. SOUNDPROOFING:

Soundproofing is any means of reducing the sound pressure with respect to a specified sound source and receptor. There are several basic approaches to reducing sound: increasing the distance between source and receiver, using noise barriers to reflect or absorb the energy of the sound waves, using damping structures such as sound baffles, or using active antinoise sound generators. Two distinct soundproofing problems may need to be considered when designing acoustic treatments - to improve the sound within a room (See anechoic chamber), and reduce sound leakage to/from adjacent rooms or outdoors. Soundproofing can reduce the transmission of unwanted direct sound waves from the source to an involuntary listener through the use of distance and intervening objects in the sound path.**Soundproofing** is any means of reducing the sound pressure with respect to a specified sound source and receptor. There are several basic approaches to reducing sound: increasing the distance between source and receiver, using noise barriers to reflect or absorb the energy of the sound waves, using damping structures such as sound baffles, or using active antinoise sound generators.

Two distinct soundproofing problems may need to be considered when designing acoustic treatments - to improve the sound within a room (See anechoic chamber), and reduce sound leakage to/from adjacent rooms or outdoors. Acoustic quieting, noise mitigation, and noise control can be used to limit unwanted noise. Soundproofing can suppress unwanted indirect sound waves such as reflections that cause echoes and resonances that cause reverberation.Soundproofing can reduce the transmission of unwanted direct sound waves from the source to an involuntary listener through the use of distance and intervening objects in the sound path.

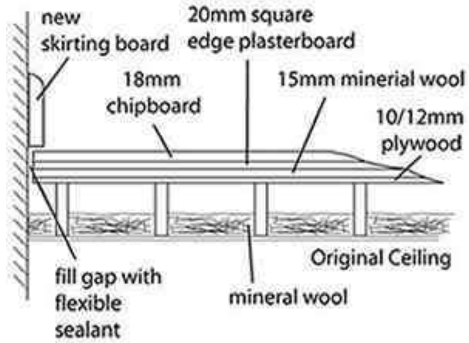

Fig. 4: SOUNDPROOFING ABOVE THE FLOOR

4. CONCLUSION

As the architectural and engineering design of the project evolves, the design should be reviewed in light of the agreed upon acoustical programmatic requirements for the building

project. Since acoustics is typically not a code requirement, a city or state building official cannot be expected to comment on the correctness of the acoustical design in the contract documents.Acoustical sustainable materials, either natural or made from recycled materials, are quite often a valid alternative to traditional synthetic materials.

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