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A Study on Noise Control in Buildings

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Abstract

The world is a noisy place. Seven days a week we are open to sounds we don't need. There are very few places on earth where we do not get exposed to sounds or we are free from unwanted sounds. Outdoor sources of noise attack our hearing as it raids our homes and workplaces like aircraft passing over our buildings, traffic. There are also noises from within the workplace like machines running in the office, ventilation systems, conversations happening in the next cubicle. Noise in the classrooms obstruct the learning process and ruins the educational experience. It can also result as a health hazard and can cause permanent hearing loss. In order to control noise problems in our built environment, we need to understand, learn the basics of noise control and know how to apply solutions to new or remodeled building.

Keywords: *noise control, background sound, airborne, structureborne*

1. INTRODUCTION

Subjectively, sound results from vibrations in the air and we can hear these changes in vibrations occurring near us. These vibrations yield pressure fluctuations which can be measured on a device called the sound level meter. Vibrations in the air are usually linked as a mechanical device such a mass moving up and down on a spring. As sound travels through air, this air is locally compressed and expanded as the air resists compression just like pneumatic tyres of a car. A region of compressed air will try to regain its equilibrium by expanding making the adjacent region to compress so the sound wave can propagate.

There is also another mechanism to understand the concept of sound. For example, the sound is generated when the wind is blowing through open spaces in a building or air flowing through an air conditioner blades. The blades accelerate and change the direction of the air flow, whilst it is the sudden drop in pressure expedite air escaping from a compressed air line which results in sound. The sound which is caused by these mechanical devices is frequently classified as Noise, noise is generally described as the "unwanted sound".

This paper mainly focused on the various means to control these unwanted sounds coming from different sources around us.

2. HOW MUCH BACKGROUND SOUND IS ACCEPTABLE?

Whether we are in our homes, outdoors, or workplaces, we will certainly be exposed to a certain level of background sound which is also known as ambient sound. Before beginning to solve a noise control problem, it is important to determine how much background sound is acceptable. As humans, we can never create, nor do we really want a completely sound free environment.

Background sound can be divided into mainly three types. When having a private conversation in the home or office we need a moderate level of background sound which can be instrumental in preventing the conversation to be overheard by nearby listeners, yet not make it difficult for those conversing to be heard by each other. Low background sound can contribute to rest or sleep when it is not interrupted with sudden loud noises. Higher background sound can somewhat be acceptable in some public places. There is a particular need for sound control in places like auditorium or concert halls where a very low background sound is needed.

For human ears, Noise Criteria (NC) curves system is used to establish allowable sound levels for various interior spaces. NC curves are built to compensate for the human ears' response to loudness and the speech interference properties of noise.

Table 1. Shows the recommended noise criteria range for various interior spaces.

Table 1: Recommended noise criteria range for various interior spaces.

Types of spaces	Acoustical considerations	NC values
Concert halls	Listening to both faint and loud sounds	10-20
Recording Studios	Close microphone pick ups	20-25
Large theaters	Listening to speech and music	20-25
Conference rooms, classrooms	Clear speech communication	25-30
Private rooms	Clear communication with speech privacy	30-35
Retail shops	Clear speech communication	35-50

3. SOUND PATHS

The sound has a tendency to travel through any media—air, wood, water, metal. The sound is either structure-borne or airborne. It generally depends on the media through which it travels.

4. AIRBORNE SOUND

Airborne sounds travel through the air and radiate directly from the source—. For example, the sound of dogs barking in the street, sound from the aircraft's jet engine, loud music playing in an open ground—all travel to our ears as airborne sound.

5. STRUCTUREBORNE SOUND

Structureborne sounds can travel through rigid materials which are in direct contact with the source of the sound. For example, knocking at the door, vibrations from the motorized machine in contact with the surface. Eventually, all structureborne sounds will become airborne before reaching our ears. During the noise control in residential buildings, both the airborne and structureborne sounds must be considered.

6. NOISE CONTROLLING AT THE SOURCE

We can lower the noise level from any mechanical device by mounting it on a relatively softer ground which can considerably isolate the vibrations and thus diminishing the structureborne sound. Calibrating the mechanical device to operate on a lower speed can also help lower the noise levels. Regular service of the noise source, tightening screws, lubricating belts etc. Moving the device to a distant place away from the listeners can. Enclosing the device in a housing creating a noise block can help isolate the noise. It should be accentuated that controlling noise at the source is much less costly than to modify after the building is built.

7. NOISE CONTROLLING ALONG ITS PATH

Noise originating from the source produces sound waves which can vibrate the structures in contact, this vibrating motion can travel through structures creating noise after re-radiating. In order to reduce the noise along its path vibration, barriers must be installed in the structure. It was noticed that preventing the noise from entering a building is more economical than constructing noise barriers after the building is constructed, treatment, after the building is built, is much more expensive.

8. NOISE CONTROLLING AT THE RECIEVER

As noted earlier, the most practical and economical way to noise control is at the source. There are other solutions to control the noise levels involving effective treatments along its path like flanking. Also, there are other temporary means to control the noise from reaching the listeners' ears. Including features like ventilation, doors, windows we can effectively solve noise control problems ate receiver's end.

CONCLUSIONS

To conclude, it is very essential to understand the various aspects of effective noise control from inside and from outside any building. Also, this paper emphasizes what should be the recommended background sound which can create a balance of acoustics around a listener. Due to the increase in construction noises around us in this developing nation, noise control has become an important building service. Although noise control needs a very engineered approach, one can easily use the basics means to reduce the effects of noise in our day to day life

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