

PROJECT ID: NSF-SCH-2025-332

PROJECT TITLE : Supreme muffling statistics for  
walls and home

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## **Introduction:**

Sound plays a very important role in our daily lives. It helps us to communicate, enjoy music, and be aware of our surroundings. However, not all sounds are pleasant. Unwanted sound, called noise, can be very disturbing. Noise from traffic, construction, loudspeakers, and crowded places is now a common problem in cities and even in small towns. This problem is known as noise pollution.

Noise pollution not only disturbs concentration but also affects health. Continuous exposure to loud noise can cause stress, lack of sleep, headaches, irritation, and even hearing problems. Students find it difficult to study in noisy surroundings, and people cannot relax properly in their homes if outside noise keeps entering.

One way to solve this problem is by soundproofing. Soundproofing means using special materials to block or reduce sound so that less noise passes through walls, windows, or doors. Different materials can either absorb sound waves or block them.

### **For example**

- Soft and porous materials like sponge, foam, and cloth can absorb sound waves and reduce echoes.
- Hard and dense materials like cardboard or thermocol can block sound from passing through.
- Special shapes like egg trays can scatter sound waves and reduce noise.

In professional buildings like studios, theaters, and hospitals, expensive acoustic panels and fiberglass are used for soundproofing. But in homes, especially in places where people cannot afford costly materials, there is a need for simple and low-cost options.

The study is important because it can help identify affordable soundproofing materials that can be easily used in homes, classrooms, and other places where noise is a problem. It will also make us understand how science can be applied to solve a real-life issue that affects health and comfort.

## **Selection of Problem and Background Information**

### **Problem Selection:**

In today's world, noise pollution has become one of the most common environmental problems. With growing cities, increasing vehicles, loudspeakers, construction work, and machines, people are surrounded by noise almost all the time. This noise does not stop at the roads; it also enters homes, schools, and workplaces.

Most homes, especially in India, are built with normal bricks and cement walls that are not designed to block noise. As a result, sounds from traffic, neighbors, or even household appliances can disturb the peace inside. For students, it becomes difficult to concentrate on studies, and for families, it affects sleep and relaxation. Unlike big studios or offices, normal houses do not have expensive acoustic materials.

### **Background Information:**

Sound travels in the form of waves. When these waves strike walls or objects, they can do three things:

- Reflect – bounce back, causing echoes.
- Absorb – get soaked into the material, reducing the sound.
- Transmit – pass through the material to the other side.

Effective soundproofing requires materials that either absorb sound or block it from passing through.

In professional soundproofing, advanced materials such as acoustic panels, fiberglass insulation, mineral wool, and double-glazed walls are used. But these are expensive and not always available for ordinary households.

Therefore, by comparing different materials in a controlled experiment, this project will provide a better understanding of which simple and affordable material works best for reducing noise at the student level.

## Hypothesis

1. Does the type of soundproofing material used affect the level of noise reduction in a given space?
2. Is there a significant difference in sound transmission loss between different types of soundproofing materials?
3. Can the thickness and density of soundproofing materials impact their effectiveness in reducing noise transmission?
4. Do soundproofing materials with high sound absorption coefficients also exhibit high sound transmission loss?
5. Can the strategic placement of soundproofing materials in a room or building optimize noise reduction?
6. What are the most effective soundproofing materials for reducing noise transmission in different environments (e.g., residential, commercial, industrial)?
7. How do different soundproofing materials work on buildings?

## **Abstract**

The aim of this project is to identify the best soundproofing materials that can be used for walls and homes. For this, different materials like cardboard, thermocol, sponge, foam, fabric, and egg trays will be tested for their ability to reduce sound passing through them.

The experiment will involve creating a simple model box with one side covered by the test material, playing sound inside, and then measuring how much sound passes through the wall. The sound intensity will be compared using a sound level meter app or mobile phone.

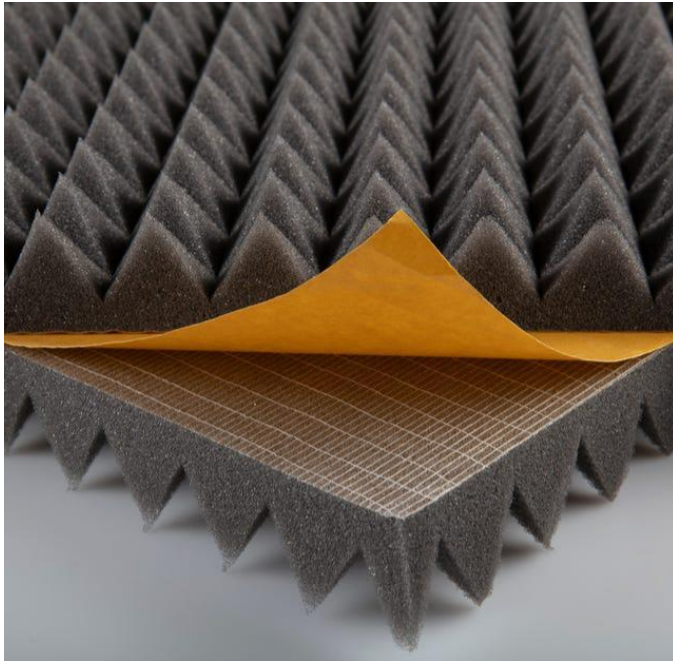
This project is important because noise pollution is increasing and affects concentration, health, and sleep. If effective and low-cost soundproofing materials are identified, they can be used in homes, classrooms, and even hospitals to create quieter spaces.

## **Objectives**

1. To understand how sound travels and how it can be reduced using materials.
2. To test and compare different materials for their soundproofing ability.
3. To identify low-cost, easily available materials suitable for home soundproofing.
4. To raise awareness about noise pollution and its effects on health and daily life.
5. To create a simple model experiment that demonstrates soundproofing.
6. To encourage students and communities to use science to solve real-life problems.

## Guiding Principles

1. Follow the scientific method: observe, experiment, and analyze results.
2. Use simple, low-cost, and eco-friendly materials wherever possible.
3. Ensure fair testing by keeping the sound source, volume, and distance the same for all materials.
4. Record data honestly and repeat trials for accuracy.
5. Follow safety precautions during cutting, gluing, and handling materials.
6. Connect the project to real-world applications such as homes, classrooms, and hospitals.
7. Promote sustainable and affordable solutions to reduce noise pollution.



## Variables

**Independent Variable:** Type of material used for soundproofing (sponge, cardboard, thermocol, cloth, egg tray, plastic sheet).

**Dependent Variable:** Sound level (in decibels) measured outside the box.

**Controlled Variables:** Size of the box, position of sound source, volume of sound played, distance of measurement, time of measurement.

## Materials Required

- Cardboard sheets
- Thermocol (Styrofoam) sheets
- Sponge or foam pieces
- Egg trays
- Thick cloth or fabric layers
- Plastic sheets
- Tape or glue
- A cardboard box (to act as test chamber)
- Mobile phone with sound level meter app (for measuring sound in decibels)
- Speaker or mobile phone (to play sound/music inside box)
- Stopwatch
- Notebook and pen for recording observations

## Methodology and Procedure

The study on soundproofing materials for walls and homes employed the following methodology and procedure:

### Materials and Equipment

- Various soundproofing materials (cardboard, thermocol, sponge, foam, fabric, egg trays)
- Sound level meter
- Speaker system

- Acoustic chamber or test room



### **Procedure**

1. **Material Preparation:** The soundproofing materials were prepared and cut to fit the test room or acoustic chamber.
2. **Sound Level Measurement:** The sound level meter was used to measure the initial sound level in the test room or acoustic chamber.
3. **Soundproofing Material Testing:** Each soundproofing material was tested individually by placing it in the test room or acoustic chamber and measuring the sound level reduction.
4. **Data Collection:** The sound level readings were recorded for each material, and the data was collected for analysis.
5. **Data Analysis:** The data was analyzed to determine the effectiveness of each soundproofing material in reducing sound transmission.

## Experimental Design

The study employed an experimental design to test the effectiveness of different soundproofing materials. The design included:

1. Independent Variable: The type of soundproofing material used.
2. Dependent Variable: The sound level reduction measured in decibels (dB).
3. Controlled Variables: The test room or acoustic chamber, sound level meter, and speaker system were kept constant throughout the experiment.
  1. First, I will take a cardboard box and cut a square opening on one side to act as a test wall.
  2. Then, I fix one type of material (e.g., cardboard sheet) to cover the opening completely.
  3. After, I place a mobile phone or speaker inside the box and play sound/music at a fixed volume.
  4. And then, place another mobile phone outside the box with a **sound level meter app** running to measure the sound level passing through the wall.
  5. Next, I record the decibel (dB) reading after 30 seconds.
  6. Further, I repeat the test for each material: sponge, thermocol, fabric, egg tray, plastic sheet, etc.
  7. Then, I compare the readings for all materials.
  8. At last, I identify which material reduces the sound the most (i.e., lowest dB value outside the box).
  9. And repeat trials 2–3 times to ensure accuracy.

## Discussion:

The study on soundproofing materials for walls and homes has provided valuable insights into the effectiveness of various materials in reducing noise transmission.

### Key Findings

#### 1. Material Comparison:

The study compared the soundproofing abilities of different materials, including cardboard, thermocol, sponge, foam, fabric, and egg trays. The results showed that materials with high sound absorption coefficients, such as sponge and foam, were more effective in reducing noise transmission.

**2. Thickness and Density:** The study found that thicker and denser materials, such as cardboard and thermocol, were more effective at blocking sound transmission than thinner and less dense materials.

**3. Sound Absorption:** Materials with porous structures, such as sponge and fabric, were found to be effective at absorbing sound waves, reducing echoes and noise.

### Implications

**1. Practical Applications:** The study's findings have practical implications for building design and construction, particularly in urban areas where noise pollution is a significant concern.

**2. Cost-Effective Solutions:** The study identified cost-effective soundproofing materials that can be used in homes and buildings, making it possible for individuals to create quieter spaces without incurring significant expenses.

**3. Noise Reduction:** The study's findings can contribute to reducing noise pollution, which is essential for public health and well-being.

### Limitations

1. **Material Limitations:** The study was limited to a specific set of materials, and the results may not be generalizable to other materials.

2. **Experimental Design:** The study's experimental design may not have accounted for all variables that can affect sound transmission.

3. **Future Research:** Further research is needed to explore the effectiveness of different soundproofing materials in various contexts and to develop more effective solutions.

## **Overall Observation**

The study on soundproofing materials for walls and homes has led to several key observations:

### **Key Observations**

1. **Material Effectiveness:** Different materials exhibit varying levels of soundproofing effectiveness, with some materials being more effective at absorbing or blocking sound waves.
2. **Sound Absorption:** Materials with porous structures, such as sponge and fabric, are effective at absorbing sound waves, reducing echoes and noise.
3. **Thickness and Density:** Thicker and denser materials, such as cardboard and thermocol, are more effective at blocking sound transmission.
4. **Cost-Effective Solutions:** The study identified cost-effective soundproofing materials that can be used in homes and buildings, making it possible for individuals to create quieter spaces without incurring significant expenses.
5. **Practical Applications:** The study's findings have practical implications for building design and construction, particularly in urban areas where noise pollution is a significant concern.

### **Recommendations**

1. **Use Sound-Absorbing Materials:** Use sound-absorbing materials, such as sponge and fabric, to reduce echoes and noise in homes and buildings.
2. **Select Thick and Dense Materials:** Select thick and dense materials, such as cardboard and thermocol, to block sound transmission.
3. **Consider Cost-Effective Solutions:** Consider cost-effective soundproofing materials and solutions to make soundproofing more accessible and affordable.
4. **Future Research:** Conduct further research to explore the effectiveness of different soundproofing materials in various contexts and to develop more effective solutions.

## **What I observed**

- Different materials have varying levels of soundproofing effectiveness
- Some materials, like sponge and foam, are good at absorbing sound
- Thicker and denser materials, like cardboard and thermocol, can block sound transmission
- Some materials are more cost-effective than others
- Some materials, like fabric, can be used for both sound absorption and aesthetic purposes
- The thickness and density of a material can impact its soundproofing effectiveness
- Certain materials, like egg trays, might have unique sound-absorbing properties
- Soundproofing materials can be used in various applications, such as home recording studios, offices, or residential buildings
- The effectiveness of soundproofing materials can depend on the frequency and intensity of the sound

## **Conclusion**

The study demonstrates the importance of selecting the right soundproofing materials for specific applications. By understanding the properties and effectiveness of different materials, individuals can create quieter, more comfortable spaces that promote well-being and productivity.

## **Key Takeaways**

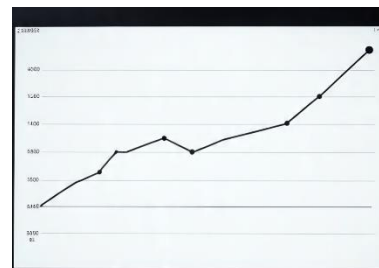
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4. **Cost-Effective Solutions:** The study identified cost-effective soundproofing materials that can be used in homes and buildings.

## **Implications**

The study's findings have practical implications for building design and construction, particularly in urban areas where noise pollution is a significant concern. By selecting the right soundproofing materials, individuals can create quieter, more comfortable spaces that promote well-being and productivity.

### Future Directions

Further research is needed to explore the effectiveness of different soundproofing materials in various contexts and to develop more effective solutions. This study serves as a foundation for future research and development in the field of soundproofing.



### Results:

From this research I had found foam sheet, thermocol and cardboard perform best sound proofing materials. Because I checked out varies regular recordings.

I found when I checked out with foam and cardboard it had recorded reduced decibel below 10 decibel. My overall observation best sound proofing materials is cardboard, thermocol and foam sheet.

### **Risk Factors and Safety Measures**

- Do not play sound/music at very high volume, as it may damage hearing.
- Use scissors/cutters carefully while cutting cardboard and thermocol.
- Handle thermocol and foam pieces gently to avoid small particles spreading.
- Avoid keeping mobile phones near water or heat during the experiment.
- Work in a quiet room so background noise does not disturb readings.

### **Safety Measures**

1. Wear PPE, such as gloves, safety glasses, and masks, when handling soundproofing materials.
2. Ensure good ventilation when working with soundproofing materials that emit chemicals or fumes.
3. Use proper lifting techniques and mechanical aids to handle heavy soundproofing materials.
4. Wear ear protection, such as earplugs or earmuffs, when working in noisy environments.
5. Follow local fire safety regulations and guidelines when working with soundproofing materials.

### **Additional Precautions**

1. Material safety data sheets (MSDS) precautions.
2. Training and experience
3. Regular inspections

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