The Effectiveness of Soundproofing Materials Among Various Frequencies

Alex Forristal, Will Huet, Madison Vidmar, Dominic Woods
Cleveland State University

Choose Ohio First

Abstract

This research is intended to investigate various materials that can be used in soundproofing or to create a sound deadening layer in walls. The overall goal was to test the effectiveness of existing forms, such as typical drywall and fiberglass insulation. During experimentation, we also explored cheap alternatives such as vinyl, cloth, and polyester filling. A need for this research becomes relevant when living in dorms and apartments; many students become distracted and annoyed when dealing with loud neighbors. The results from this experiment can then be used to explore new materials that can be used when building walls or performing renovations in order to improve this problem. Our investigation was conducted by using a sealed wooden box lined with different materials to dampen sounds. A speaker was placed inside the box playing three pitches at a constant volume, and a microphone outside the box measured how much sound was audible.

Introduction

In college, finding a quiet place to study is sometimes necessary for concentration. It is often that noisy neighbors can interrupt your thought process and reduce your productivity. The goal of this research is to explore cheaper alternatives that can be added to wall insulation to reduce unwanted, outside noise or keep certain sounds contained within a confined room.

Objectives

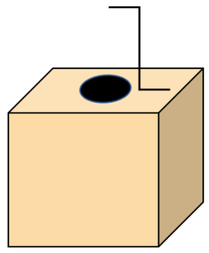
- To explore cheaper alternatives for reducing the ambient noise from other rooms inside of a building.
- To gather a basis of knowledge on the existing forms of soundproofing materials.

Methods

- AC Power Supply,
- TinySine TSA7498 Amplifier
- 5” speaker
- Custom Fabricated Enclosure
- SPL meter
- 3 different frequencies were played at a consistent volume and the SPL was recorded with the meter.

Figure 1. A box made out of ¾” MDF lined with our 1/2;” thick drywall with the a 5” speaker inside. During testing the box was sealed to keep the sound contained and the thickness at a constant.

Figure 2. A diagram showing the meter’s stand. It was used to keep a consistent distance when measuring the sound output.



Figures 3 and 4. Shown is our amplifier board to power our speaker along with the attached power supply.

Results

Column1	Low: 100 Hz	Medium: 1000 Hz	High: 4000 Hz
Open top (dB)	76.7	113.6	95.1
Closed top (dB)	61.4	88.3	51.7
Drywall (dB)	54.4	87	54.2
Drywall, insulation (dB)	47	71	39.1
Drywall, insulation, vinyl (dB)	37.1	64	45.1
Drywall, vinyl (dB)	54	86.1	56.7
Drywall, insulation, cloth (dB)	56	81	36
Drywall, cloth (dB)	57.3	90.2	54

Figure 5. A table of our results with their corresponding insulation.

Conclusion and Future Work

Through this research we gathered information on materials and their soundproofing effectiveness within various frequencies. With more time and resources, future work could involve testing more materials and analyzing the cost effectiveness, as well as implementing the research in construction and testing the materials in a real life situation. The main results from the research show a combination of drywall, insulation, and vinyl or cloth were the most effective in soundproofing. Adding cloth to the drywall and insulation allowed for the best soundproofing of a high pitch noise, while vinyl added with the drywall and insulation proved to be most effective for low and medium pitch noises. The results we gathered made sense, as the materials had difficulty in deadening the medium pitch noises. However, the materials were effective in soundproofing the low and high pitch noises.

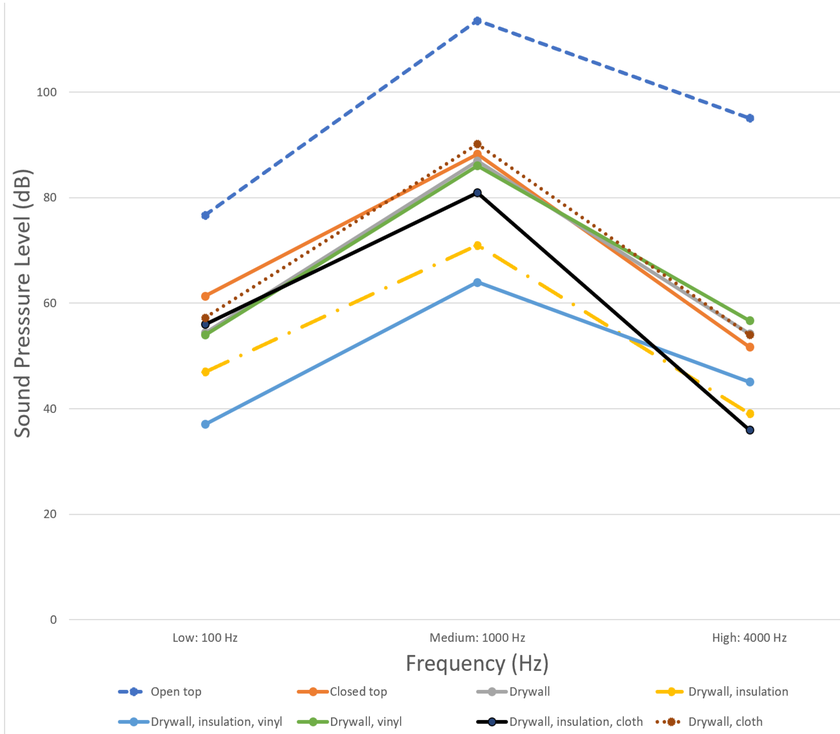


Figure 6. A line graph that represents volume perceived versus frequency emitted. Each colored line represents a different combination of materials.

References

Hawkins, T. G. (2014, April). Studies and Research Regarding Sound Reduction Materials With The Purpose of Reducing Sound Pollution. Retrieved January 21, 2019, from https://digitalcommons.calpoly.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=2263&context=theses

Acknowledgments

- Mark Syvuk, M.Sc. Mathematics
- Cleveland State University
- Choose Ohio First