

Smart Cities: Reducing Noise Pollution with an Adaptive Barrier

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Abstract

To confront the long-term impacts of noise pollution on health, this paper explores the development of a wall employing reflection and absorption properties emphasized by the structure and material to attenuate sound. Through changing the curvature of the wall panels, the absorption and reflection properties of the various panel shapes were discovered. Of the tested curvatures, data was compiled and analyzed to determine the optimal curve. This technology will be incorporated to improve the mental and physical well-being of urban inhabitants.

Future Improvements and Implementation

- More experimentation to determine scalability and convexity
 - Test additional curvatures
 - Test additional shapes
 - Test additional panels
 - Smaller increments for above
 - Use a larger sheet of EPDM
 - Test larger panels
 - Additional trial runs
- Test a sound source moving at a constant speed to simulate cars in motion
- Test sound intensity in real-world environment
- Test sound intensity with open panels



Fig. 1. Diagonal Profile of Barrier Model



Fig. 2. Front View of Barrier Model with Panels Open

References

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Materials and Methods

Ethylene Propylene Diene Monomer (EPDM) Rubber

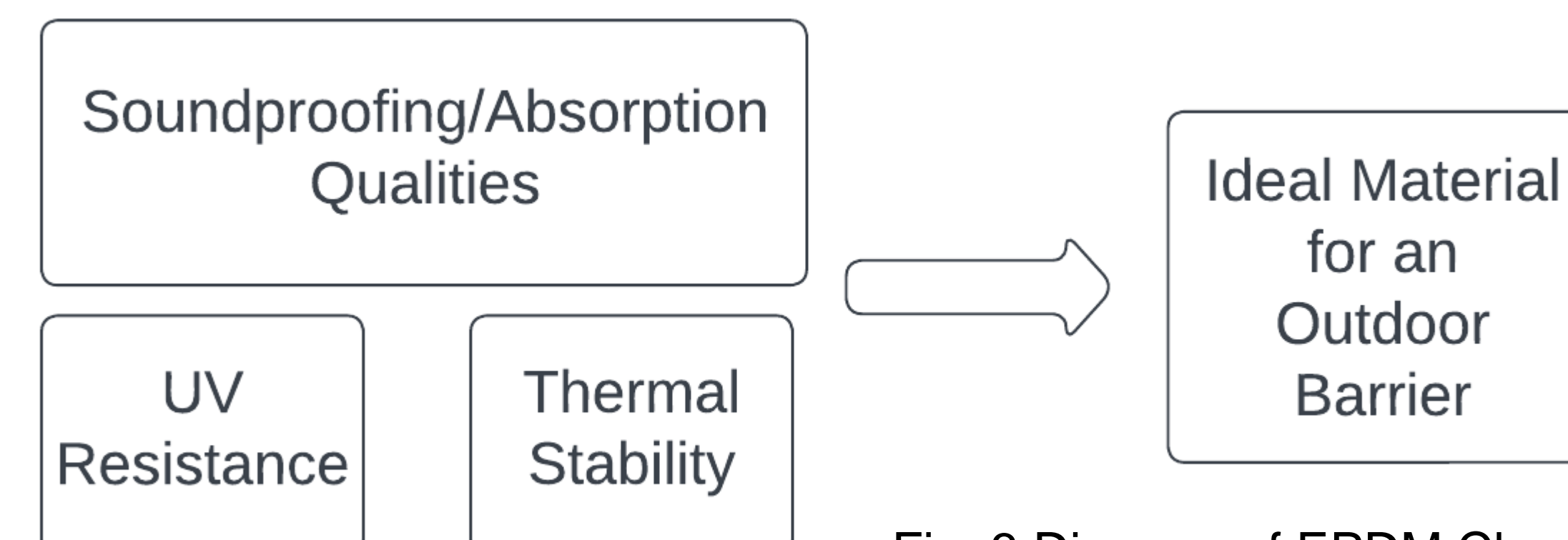


Fig. 3 Diagram of EPDM Characteristics

Setup

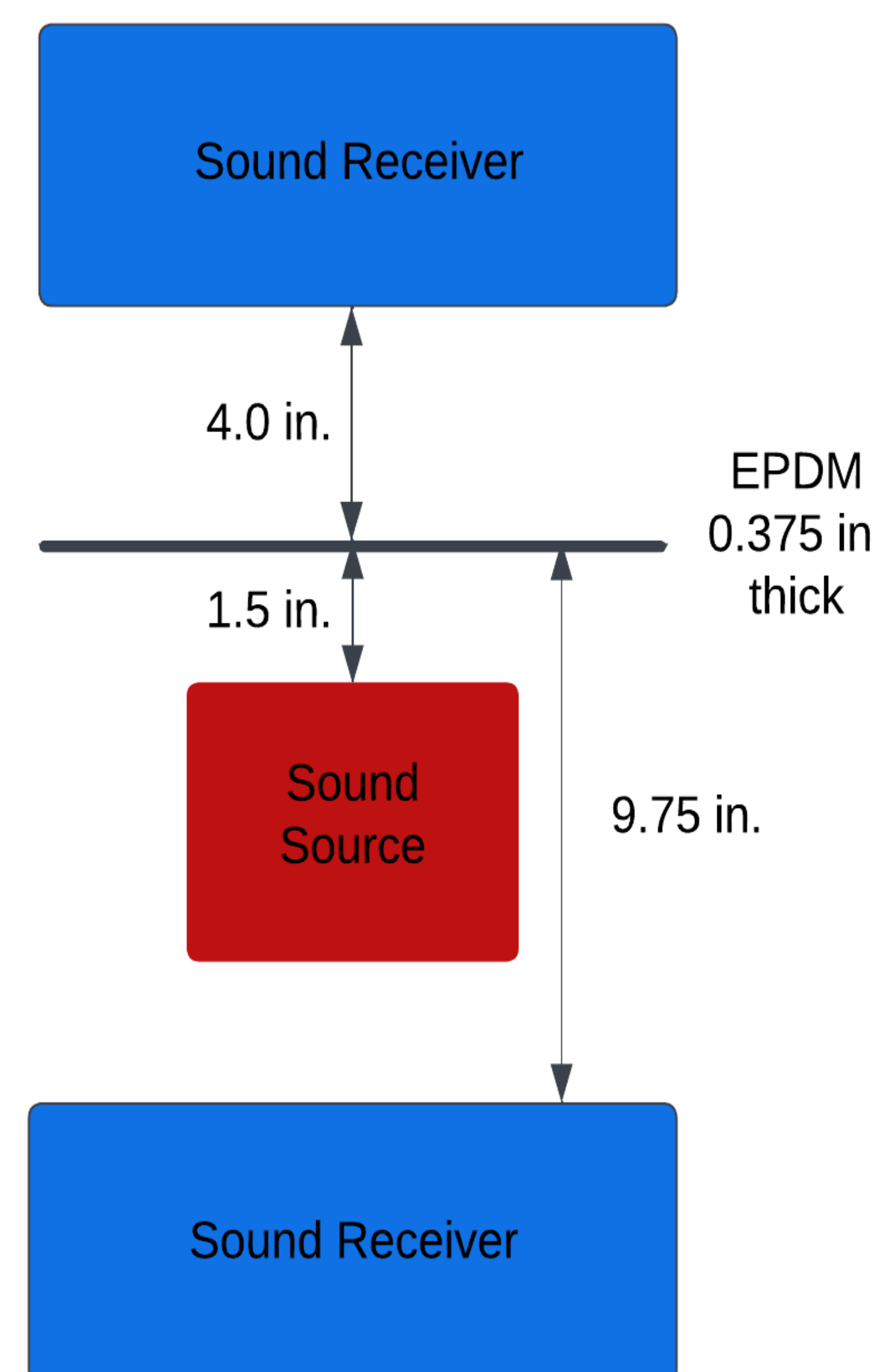


Fig. 4. Diagram of Experimental Setup



Link to Full Research Paper
[Will be published in IEEE Xplore Digital Library from MIT Undergraduate Research Conference (URTC) and Rutgers GSET journal]

Procedure

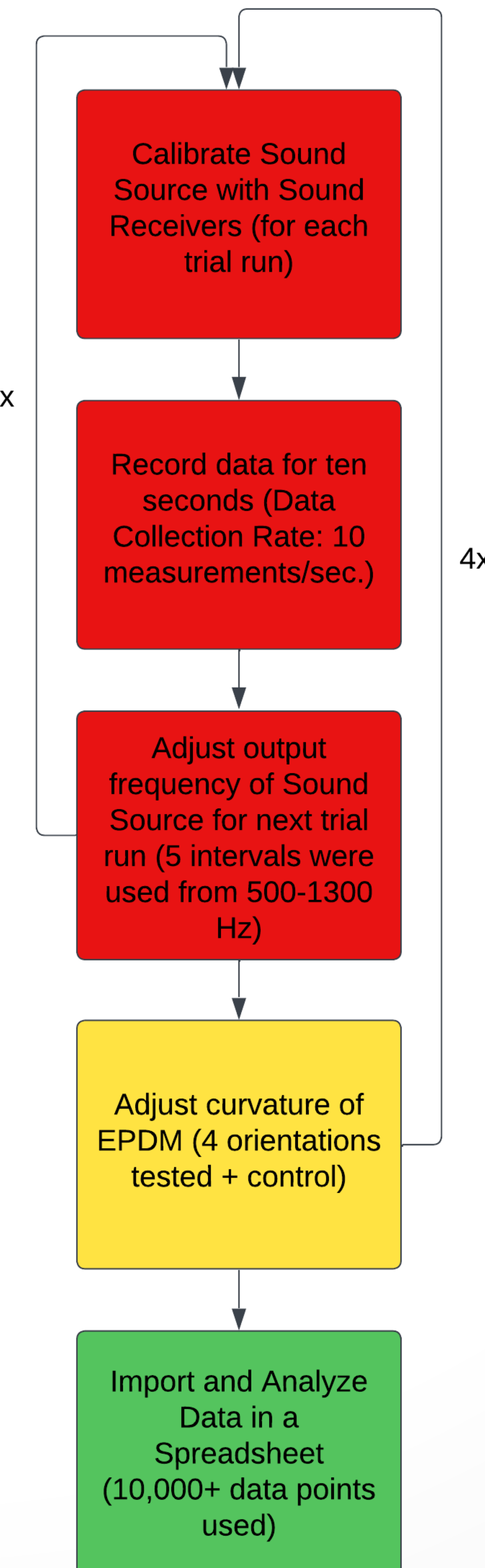


Fig. 5. Diagram of Experimental Procedure

Results

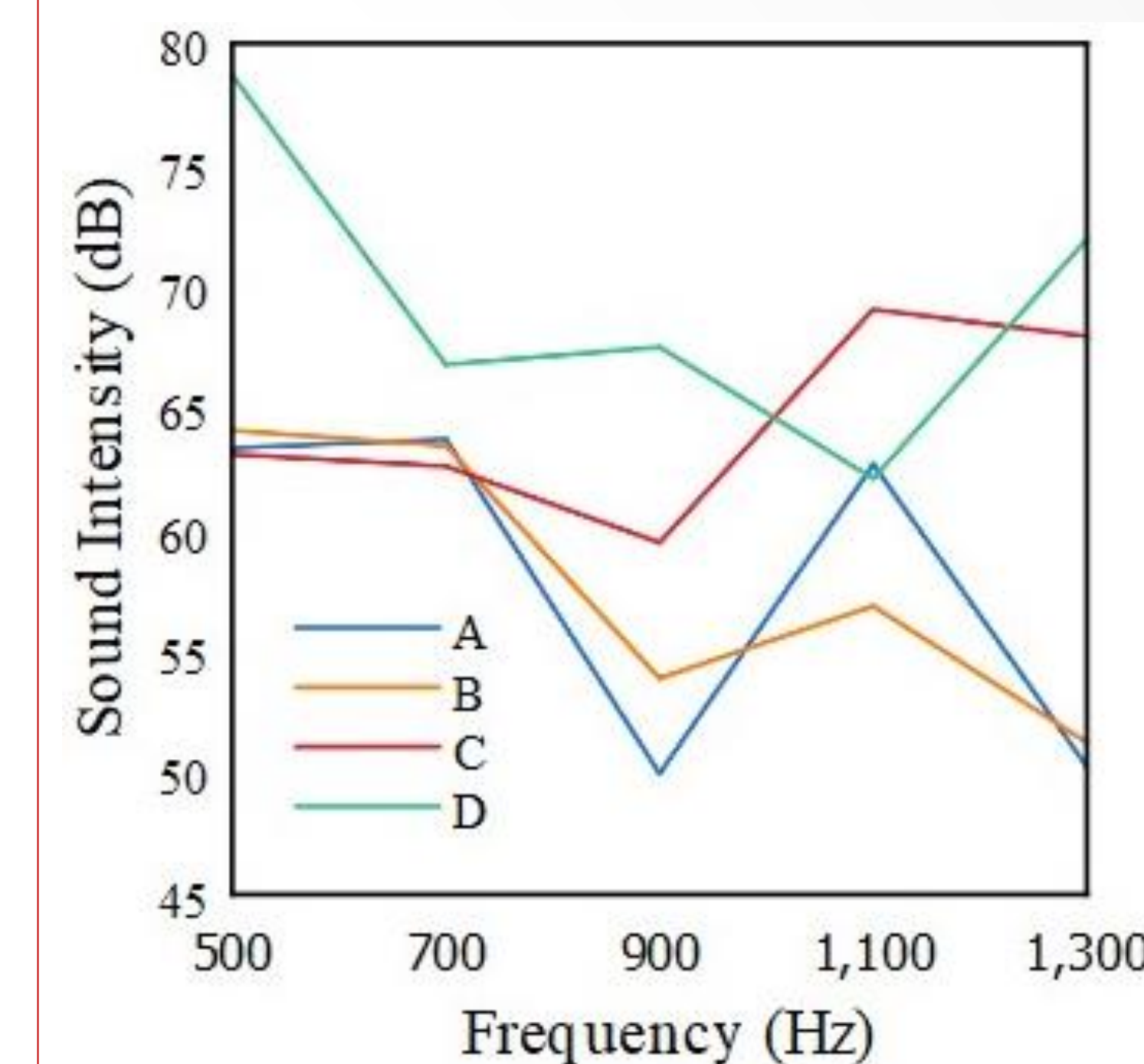


Fig. 6. Graph of Average Sound Intensity Recorded

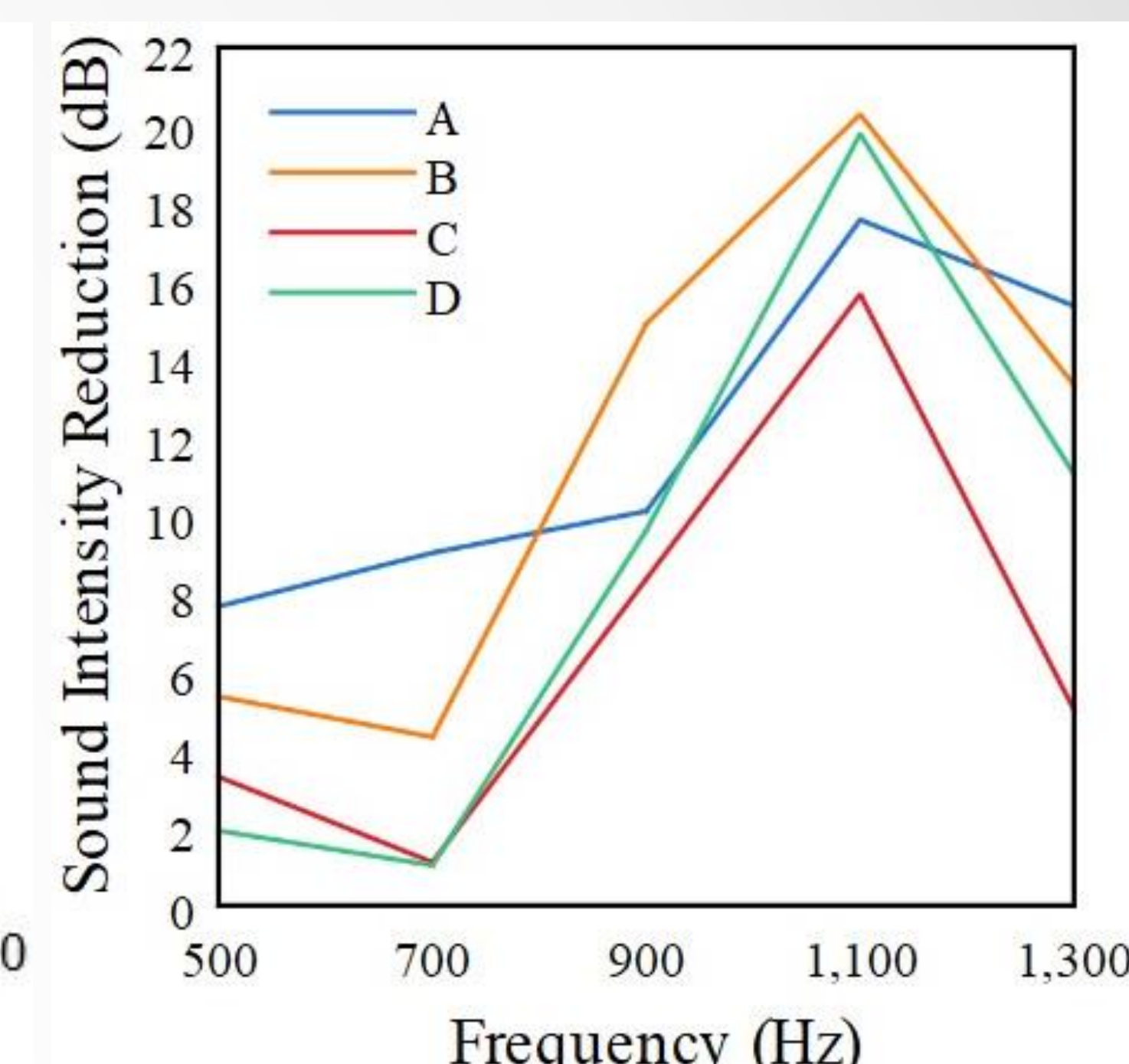


Fig. 7. Graph of Sound Intensity Reduction from Control

A – Small Curve B – Medium Curve C – Large Curve D – Flat

Conclusion

- Relationship between curvature/convexity of a panel and their ability to reduce noise was discovered
- Small and medium curves were optimal for mitigating sound
- Estimated five-fold noise reduction for pedestrians with implemented wall

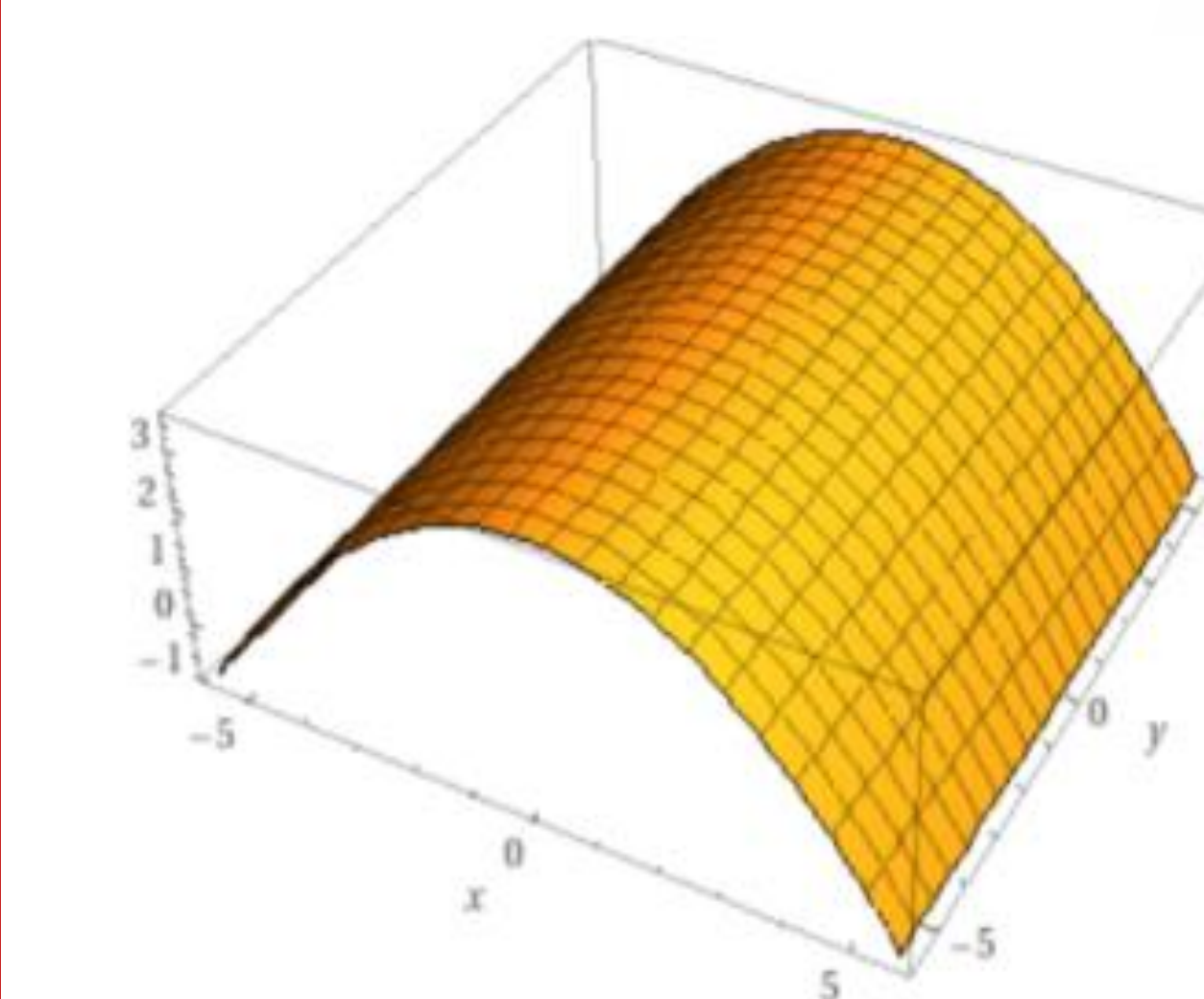


Fig. 8. 3D Graph of Small Curve Tested

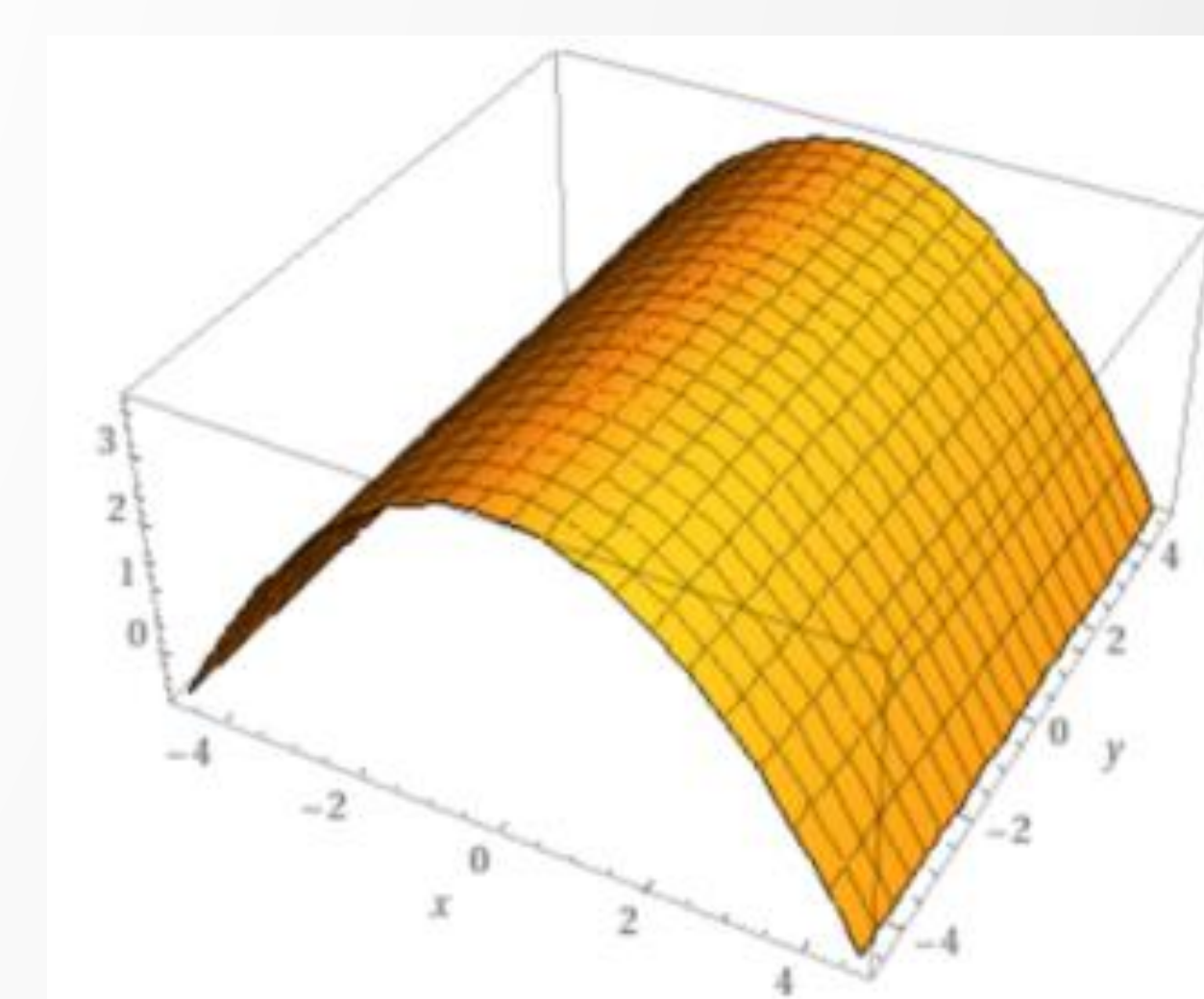


Fig. 9. 3D Graph of Medium Curve Tested

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