ENVIRONMENTALLY FRIENDLY HOMES

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Introduction

Civil engineering is at the base of our cities and therefore has a direct influence on our lives, including our safety and health. There are several aspects of this engineering, however, in this work, we will focus only on building acoustics. Acoustics is a fundamental part of building construction, as it interferes not only with our daily comfort, but also with our health, and noise can have implications for the sleep cycle, just as noise pollution is harmful. , so the development of this area in big cities is imperative. This project is linked to the objective of, using recycled materials in the construction of a wall mold (70x70 cm), to be able to find the best solution for the cladding of a house, specifically looking for a better acoustic performance, as an insulator for the sound. In today's world, where environmental problems are so present and waste is increasing, sustainability is the future. As such, sustainable construction is no exception. The search for alternatives to traditional construction based on sustainability becomes increasingly important. That's why, in this project, we start from waste in order to understand how it can be inserted in the construction world efficiently. It is also intended, through the tests carried out, to prove the essential principles of acoustics that were previously studied. Allied to the scientific part, this project will be a way to bring high school students closer to future life in a college, making known the work developed within the institution.

Methodology

In order to fulfill the outlined objectives, we divided the work into three parts: an initial phase of information gathering and study of the theoretical part associated with the theme along with the collection of recycled materials at home, followed by a trip to the FEUP laboratory to build the wall models with the materials previously collected and their testing, finally the interpretation of the data obtained in the experiment and reflection on the results obtained. In the initial phase of the work, we collected as much information as possible on the subject in order to understand how, in theory, an interesting acoustic behavior using waste would be possible. We also started to collect materials at home such as: egg boxes, yoghurt packages, tuna cans, plastic lids, toilet paper rolls, plastic (air bubbles). In the next phase, on Friday the 30th of April, we were accompanied by
the materials we had collected to FEUP's facilities with the objective of building and testing the wall models with different compositions, starting, logically, from these materials. We created four models together, all of them with different compositions and layouts, based on a 70 cm square wooden frame.

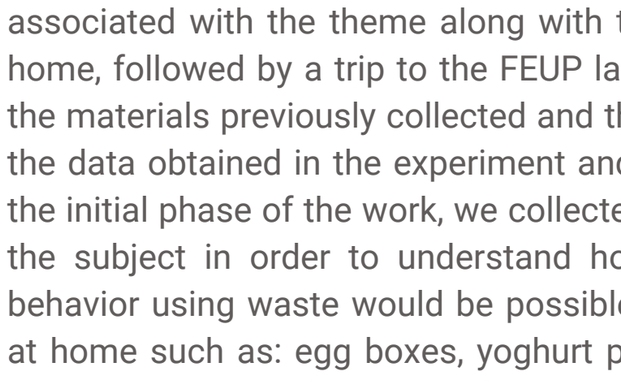

Figure 1: Information gathering

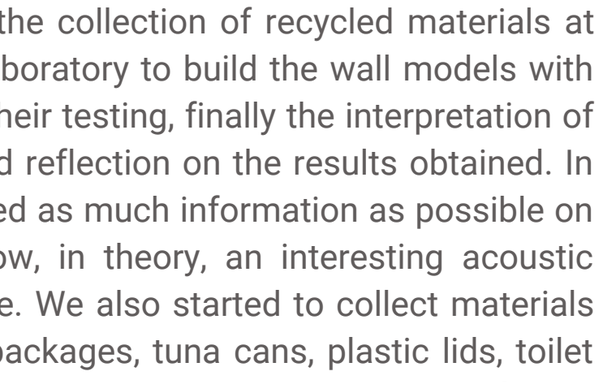

Figure 2: Construction of the models

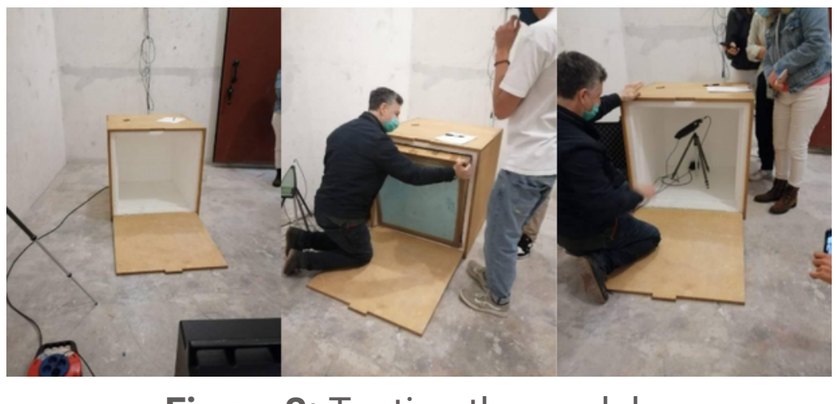

Figure 3: Testing the models

Results

After measuring the sound intensity outside and inside the box coated with each solution, we enter the data in the following table:

Valores recolhidos (dB)	125	250	500	1000	2000	4000	Total	Massa aproximada (Kg)
Exterior	81,7	80.8	80,8	79,4	80,4	73,2	85,0	---
Modelo 1	67,4,	72,1	66,7	63,1	59,7	51,9	69,0	15
Modelo 2	71,4	75,8	69,9	62,4	57,0	51,1	71,1	7/8
Modelo 3	70,8	76,5	69,9	63,3	58,1	52,4	71,5	7/8
Modelo 4	68,7	73,6	67,8	61,4	60,7	53,2	69,7	10

We can state, interpreting the results obtained, that:

The solution that presented the best acoustic behavior was Model 1.
Next, in descending order of this behavior, are Model 4, Model 2 and finally Model 3.
Comparing the sound insulation of each board with its mass, we realized that the main factor that influenced the acoustic behavior was its mass: Models 1 and 3 are the heaviest, verifying a better sound insulation with these solutions; the lighter ones, Models 2 and 4, presented a worse insulating behavior.

We have also proven the effectiveness of other methods in sound insulation, such as the existence of air gaps and extending the path for the sound wave by creating obstacles

Conclusion

Through the methodology used, we were able to achieve the goals initially proposed. It was also possible to prove some of the principles of acoustics in buildings, namely the isolation of noise transmitted by air vibration. We managed to prove that it is possible to create effective solutions using recyclable materials and, therefore, not only give them a second life, but also promote sustainable construction with an eye on the future, in which this seems to be the way forward.

Figure 4: Students and mentors at FEUP

Acknowledgements

In order to carry out this project, we count on the contribution of the engineer Ana Vaz Sá, who explained the proposed problem and guided us in the various phases of the work's development. Engineer Eduardo Costa introduced us to the FEUP laboratory and guided us in the experimental part of the work, namely in the use of the Faculty's acoustic isolation chamber. From the Clara de Resende Secondary School, teacher Maria Isabel Pinto presented the project to us and accompanied us throughout the process that made it possible to obtain the results achieved.