Locally Available Materials As Sound Absorbers

by
P. C. Bhandari
R. K. Srivastava
R. D. Srivastava
R. L. Dhabal

Summary

Sound absorbing materials are employed for the reduction of noise in various types of buildings like factories, offices, schools, hospitals, restaurants and workshops etc. They are used for absorption of sound so as to avoid distant reflections from different surfaces of the enclosures. Generally, conventional sound absorbing materials with a facing of perforated hard board or partial board is used as sound absorbing combination. These combination of materials is found to be very expensive. There is a need for cheap and efficient sound absorbing materials which can be procurred easily. Some of the locally available materials like 'Sutli', 'Banh', 'woodwool', 'Sunn', 'nylon cloth', 'hessian cloth', and chattai etc. have been employed for the use of sound absorption. Their acoustical properties have been measured in reverberation chamber and it has been found that they are quite useful for the purpose of sound absorption and as a facing material.

The combination of 'sunn' and 'woodwool board' 12 mm thick has been found to be the most efficient and the cheapest material. It costs less than the combination of conventional sound absorbing material.

1. Introduction

Sound absorbing materials are employed for the reduction of noise in various types of buildings like factories, offices, schools, hospitals, restaurants and workshops etc. They are used to reduce the reverberation time and to avoid distant reflections from the walls, ceilings and other surfaces in an enclosure. Thus the use of acoustical materials improve the hearing conditions or speech intelligibility. Mostly good sound absorbing materials are fibrous or porous as this property of the materials helps in absorption of sound. It is essential that the pores of the material must be interconnected.

While treating an enclosure for good aural conditions, these materials are put behind a facing material. A combination of facing and sound absorbing material is found quite expensive. Therefore, there is an increasing need of cheap and efficient sound absorbing materials due to nonavailability and continuously increasing costs of conventional sound absorbing and facing materials. It has been observed that some locally available materials like sutli, banh, sunn, woodwool etc. are sound absorbing in nature and hence they could be used indivdually or in combination with other materials as sound absorbers.

2. Acoustical Performance

The efficiency of an acoustical absorbing material is measured by the sound absorption coefficient of a material, which is defined as the percentage/fraction of the incident sound energy absorbed by a material under a given reverberant condition. Any material which absorbs at least 30% of the incident sound energy may be regard as acoustical material. The absorption coefficient of the material depends upon the frequency of the sound. The overall behaviour of a material is calculated on the basis of average value of sound absorption coefficient at 250, 500, 1000 and 2000 Hertz. This average value is known as Noise Reduction Coefficient (NRC). The higher the value of NRC the better is the material. A material must show an NRC value of .3 to be regard as a sound absorbing material.

3. Testing Procedure

The testing of material for its sound absorption coefficient is done in reverberation chamber, specially designed to create reverberant conditions within the enclosure as per ASTM code No. (433 (1964)). The material of

2.4 m x 2.7 m size and of any thickness is laid on the floor of the chamber directly (i. e. rigid backing) or a desired air gap is left behind the sample. The reverberation time of the chamber is measured with and without sample to calculate the amount of sound absorbed by the sample according to Sabin's formula.

4. Locally Available Materials

It has been observed that some locally available materials like 'Sutli', 'Banh', 'woodwool', 'chattai' etc. can be utilised to act as a sound absorbing material or a facing material. Samples were therefore evolved by using sutli, banh as the facing material in different designs and patterns, fig. 1 but in the main drawback with these materials was that they accummulated dust with time and could not be easily cleaned. Nylon cloth has also been used as facing material; but this is not a sound absorbing material and hence reduce the efficiency of sound absorbing materials behind it. Woodwool board of the desired density (say 300 Kg/m^3) is a good sound absorbing material and a thin woodwool board could be used as a facing material to a good sound absorbing material like Bartex or Fibreglass. Loose sunn, a locally available cheap material has been found to be a good sound absorbing material and could be used with any facing material. A combination of sunn and woodwool board (300-350kg/m^3) has been found to be the best combination of all locally available materials.

5. Comparison of Sound Absorption Coefficients of conventional sound absorbing materials and locally available materials

The sound absorbing properties of a material improves if some air gap is left behind the sample or two or more layers of the same sample are laid one over the other. Multilayered samples were tested in the reverberation chamber with

Table I

S. No.	Material	Thickness cm.	Density kg/m^3	Cost Rs./m^3	NRC
1.	Sunn	2.5	40	2.30	.60
2.	Bartex	2.5	—	26.00	.71
3.	Spintex	2.5	40.5	46.00	.76
4.	Fibreglass	2.5	24	50.00	.65

Table II

S. No.	Combination of material	Thickness cm.	Density kg/m^3	Cost Rs./m^3	NRC
1.	Sunn+woodwool board	2.5+1.2	40+400	18.30	.49
2.	Sunn+woodwool board	2.5+2.0	40+400	18.30	.59
3.	Sunn+Banh	2.5	—	4.30	.60
4.	Sunn+Nylon cloth	2.5	—	22.30	.51
5.	Sunn+Hessian cloth	2.5	—	5.30	.57
6.	Bartex+Perforated hardboard	2.5+4.0	—	56.00	.60
7.	Spintex+Perforated hardboard	2.5+4.0	—	76.00	.65
8.	Fibreglass+Perforated hardboard	2.5+4.0	—	80.00	.61

one or more than one materials for their performance. A comparison of the tables I and II yield that certain combination of locally available materials show sound absorption as good as that provided by a good conventional sound absorbing material. A 2.5 cm thick sample of sunn with a packing density of 40 Kg/m^3 can be used as a good sound absorbing material with woodwool board (12 mm thick and 300-400 kg/m^3 density) as facing material. The cost of this sample is about 30% of the cost of combination of Bartex and perforated hardboard.

6. Conclusion

Table I and II show the results of some combinations of locally available materials. It can be concluded that the combination of sunn and Banh or Sunn and Hessian cloth give absorption comparable with Bartex and perforated hard-board. On the basis of cost analysis, some combinations of locally available material like sunn and banh, sunn and Hessian cloth and sunn and woodwool board are economical as compared to the conventional sound absorbing materials. But the main drawback with Banh and Hessian cloth is that they accummulate dust and are not durable. Therefore, the combination of sunn and woodwool board is found to be the most efficient and economical sound absorbing material. It costs less than the conventional sound absorbing materials.

References

1) Chattal-an acoustical material Architect's Trade Journal Vol. 7, No. 11-12, Nov/Dec. 1977 pp. (10-11).