

ACOUSTIC PERFORMANCE



WHAT ARE ACOUSTICS?

Acoustics are the physical properties of sound which affect us all in everyday life. Textiles that demonstrate poor acoustic performance can have a negative impact on human health in that exposure to unwanted noise has been shown to be associated with hearing damage, sleep deprivation, impaired concentration and a range of other stress-related symptoms (Schust 2004).

WHAT CONTRIBUTION DO FLOOR COVERINGS MAKE TO ACOUSTIC PERFORMANCE?

Sound absorption is important in both commercial and residential applications because it assists in creating a more pleasant environment in which it is possible to eliminate unwanted sounds and focus on those which are desired.

Wool carpet can significantly improve the acoustic performance of rooms as it acts as a sound absorber and also dampens any impact noise in a room.

Some examples where it is important to optimise the sound absorption characteristics of a room include in theatres, class rooms, meeting rooms, libraries and equipment testing rooms. With the advent of home theatre systems, the acoustic properties of domestic residences have increased in importance also, and carpet can play a key role as a buffer between domestic living and sleeping areas.

Compared with most types of hard flooring, wool carpet has two distinct advantages in this respect:

- A reduced propensity to generate sound (eg through footfalls)
- An ability to absorb noise generated elsewhere

Each of these relies on the unique visco-elastic properties of wool to assist in the conversion of sound energy to heat, therefore dissipating noise. Carpets (or any other fibrous textile) do this much more efficiently than materials like concrete or brick. Wool carpets may have some advantages over nylon carpets in this respect, particularly for low frequency noise, as is demonstrated in Figure 1.

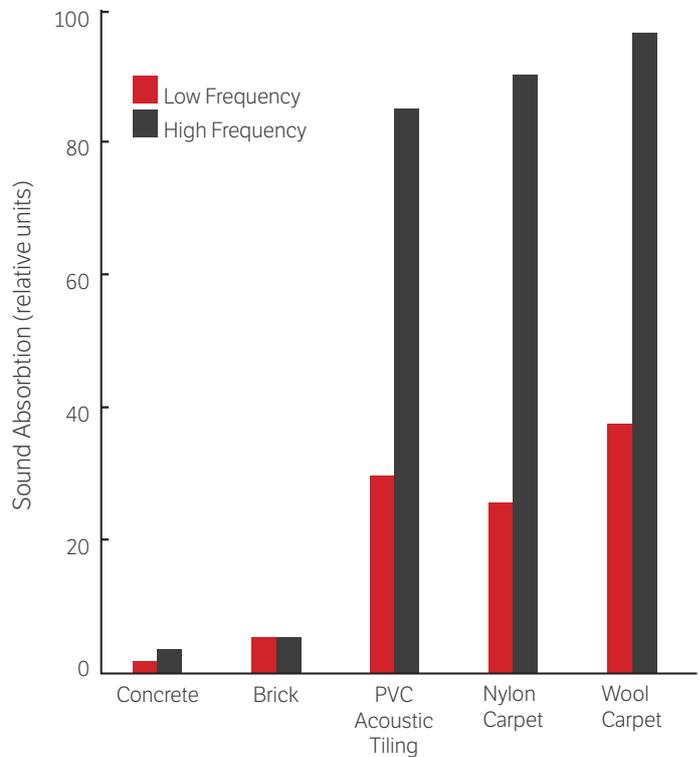


Figure 1. Sound attenuation provided by a range of interior materials (IWTO 2010).

Hard flooring surfaces more readily reflect sound than soft floor coverings. Carpets generally produce 7-12 times less surface noise than bare tile floors (IWTO 2010), being particularly good at converting high frequency noise to low frequency noise, of a shorter duration. The extent of the reduction is determined by various structural parameters, among the more important of which are:

- Pile height
- Pile density
- Pile conformation (cut pile carpets have a greater noise reduction coefficient)
- Presence/absence and construction of underlay
- Composition of backing and latex layers (the greater the mass and permeability the better)

Figures 2 and 3 illustrate the advantages of increasing pile height and density on the sound absorption characteristics of carpet.

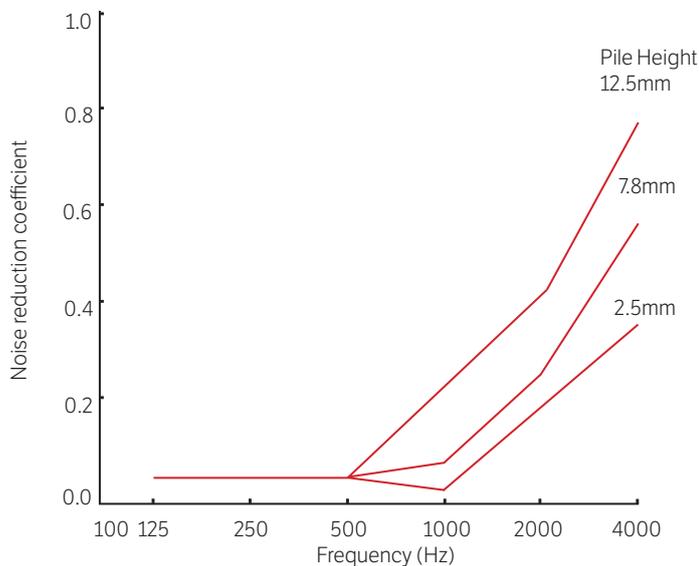


Figure 2. Effect of increasing carpet pile height on noise reduction coefficient (McNeil 1999).

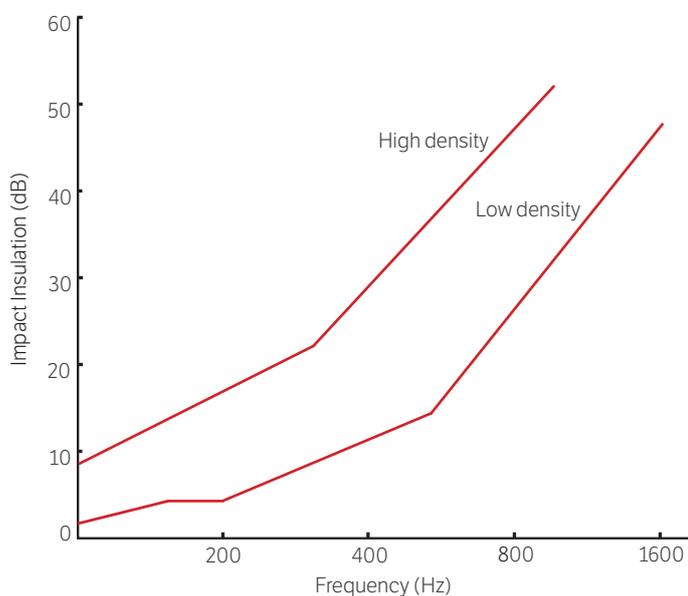


Figure 3. Effect of increasing pile density on impact insulation (McNeil 1999).

HOW IS ACOUSTIC PERFORMANCE MEASURED?

There are numerous standards for measuring the acoustic or sound insulation performance of building elements such as wall panels, insulation and carpeting etc. Examples include:

- ISO 354:2003 specifies a method of measuring the sound absorption coefficient of acoustical materials used as wall or ceiling treatments, or the equivalent sound absorption area of objects, such as furniture, people or space absorbers, in a reverberation room.
- ISO 140 part 6 is the measurement of sound insulation in buildings and of building elements - Part 6: Laboratory measurements of impact sound insulation of floors

NB. ISO = International Standards Organisation.

WAYS OF IMPROVING ACOUSTIC PERFORMANCE

Carpet improves room acoustics in that it acts as a sound absorber and also dampens any impact noise such as foot falls and dropped objects. Sound is transmitted by the vibration of air molecules. The porosity of the surface of carpets means that sound waves can penetrate into the pile, rather than being immediately reflected back into the room as they would from a smooth or hard flooring surface.

Wool carpets have particularly good acoustic properties because of their generally higher weight and pile density than carpets made from synthetic fibres. It has been demonstrated that as pile density and height of a carpet is increased the Noise Reduction Coefficient (NRC) and impact insulation also increase.

The NRC values of heavy duty wool carpets are in the range 0.5 - 0.7, which matches that of the best acoustic ceiling materials. The following observations are also relevant.

- Because of their more open surface, cut pile carpets are generally better sound absorbers than loop pile carpets;
- Sound absorption is reduced if the carpet backing is too impermeable (wool carpets mostly have permeable backings which assist sound absorption);
- An underlay can contribute to the absorption of sound, as long as the carpet backing is permeable;
- Carpets and rugs mounted on walls have the same sound absorbing effect as carpet on the floor;
- Bare tile floors produce 7 - 12 times more surface noise than carpets with or without underlay;
- Because of their high resilience, wool carpets show only small decreases (around 16%) in their sound absorbing efficiency after sustained foot traffic, and the decrease improves to just 10% after shampooing. (McNeil, 1999).

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KEY POINTS

- Exposure to unwanted or excessive noise has been shown to result in a range of negative health impacts, including hearing loss, loss of concentration, sleep deprivation, stress, headaches, ulcers and a higher incidence of respiratory complaints.
- Wool carpets out perform hard flooring in terms of their capacity to suppress unwanted noise.
- The fibrous nature of wool carpets and upholstery means that, unlike many other materials, wool products can reduce, at the same time, a) airborne sound, b) surface noise, and c) sound transmission.
- Wool carpeting is a healthy and comfortable choice for a flooring system as it provides thermal insulation allowing the room in which it is installed to remain a comfortable temperature while aiding in sound absorption.

REFERENCES

- Ballagh, K.O, 1995 Acoustical properties of wool, Marshall Day Associates.
International Wool Textile Organisation, 2010, Wool for Interior Textiles, 12p.
McNeil, S. J., 1999. Acoustic Advantages of Wool Carpeting. WRONZ Technical Bulletin.
Schust M., 2004 Effects of low frequency noise up to 100 Hz, Noise Health, 6: 73 - 85.

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