Installation over acoustic underlays

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Introduction

Timber floors are often installed in high rise and unit developments where it is necessary to reduce to acceptable levels the noise transmission through to the dwelling below. Due to this, timber and other similar hard flooring products are often laid on an acoustic underlay. The purpose of this information sheet is to outline the requirements and what must be considered when installing a timber floor where the noise transmission must be reduced or attenuated.

Noise and its Control

There are two main types of noise to be considered. The first is the higher frequency noise from music, phones ringing, people talking, televisions and the like. This type of noise is controlled by mass and with timber floors over concrete slabs, the mass of the slab generally provides sufficient control for this not to be a problem. The second type relates to the noise associated with the lower frequency vibrations. This includes foot fall noise and particularly from stiletto heels but also from sub-woofers in entertainment systems. This low frequency tends to vibrate the whole structure including the slab and walls and is more difficult to deal with. To control this type of noise many things become important including the depth of the slab and isolation of the timber floor from the slab, walls, skirtings and any adjoining other hard surfaces such as tiles.

Many multistorey apartments require timber floors to be laid over sound insulation and meet the requirements of the BCA and Strata Schemes Management Act

To control the low frequency vibrations, shock absorbing acoustic underlays play an important role to reduce noise transmission to an acceptable level. However, the choice of underlay and system used will also depend on many factors including the type of flooring, slab thickness, ceiling heights and the type of ceiling system beneath.

Sound pressure is measured in decibels (dB) and an increase or decrease is perceived by us as a change in loudness. Most of us would notice a change of 3dB and a reduction of 10dB would sound about half as loud.

The International Standard ISO 717-2 is used to assess the noise transmission through a floor into a receiving room below. When tests are being undertaken the L_{nTw} or 'Weighted Standardised Impact Sound Pressure Level' is determined which provides a single figure on which to assess the noise transmission. The lower the figure the better the attenuation and the better the result. The standard also takes into consideration and makes adjustment for whether the receiving room is furnished or not.

Compliance requirements

The Building code of Australia (BCA) and Strata Schemes Management Act

BCA Requirements

The BCA requires the L_{nTw} (plus a modification factor CI) to be not more than 62 dB for floors separating dwellings. This provides industry with a number to work to and with selected systems this can generally be achieved. For comparative purposes it should be noted that carpet will generally achieve an L_{nTw} of about 40dB and for bare concrete with a 175 mm slab a L_{nTw} may be about 70dB.

Comparative tests of underlay systems to bare concrete can be used to provide useful results and specific field tests on installed floors are also being undertaken to determine whether BCA requirements are being met. In such tests the size and shape of the room and degree of completion of both the transmission and receiving rooms are recorded. Aspects of slab thickness and ceiling material beneath the floor are also recorded. The floor or flooring sample is then tested with a tapping machine to create the noise and with a set procedure in the receiving room, a noise level meter is used to record the results. From the results over a range of frequencies and considering such aspects as background noise, the L_{nTw}+CI is determined.

Engineered floor laid on acoustic underlay

Tests undertaken with timber flooring adhesive fixed to acoustic underlays which in turn are adhesive fixed to the slab, often achieve L_{nTw}+CI results of between 50dB and 60dB with 175mm thick slab systems struggling to comply with thinner slabs.

Strata Management Requirements

Although the above provides the necessary guidelines for construction to meet BCA requirements, we must also consider the Strata Schemes Management Act.

This act permits an apartment block to have its own set of by-laws which owners must comply with and as such these can add additional restrictions and in some instances the requirements are much less well defined than the BCA requirements. For example a by-law may indicate that an owner must ensure that their floor space is covered in such a way as to prevent noise transmission that is likely to disturb the peaceful enjoyment of the owner beneath. The bylaws could also call on local body requirements or require an acoustic report from an Acoustic Engineer.

This highlights the need to obtain the specific by-laws for an apartment block in the early stages of any flooring projects.

The choice of system and products

In the market there are many products and many systems which range from thin foam underlays, applied products that provide acoustic benefits and various shapes and thicknesses of often rubber based underlays. Some are applicable to floating floor installations while others are for stick down applications.

In many new developments, floors are more commonly being tested by Acoustic Engineers. However, tests are expensive, often running into a few thousand dollars per test. Such an approach may be prohibitive for owners of existing apartment blocks.

The next best approach is to consider tests of systems that are similar to what you are considering. Many acoustic insulation material suppliers will have undertaken tests on something similar and as such similar results would be expected. However, it must be stressed that there is still a degree of risk in this as no two situations are exactly the same. Note also that for full compliance to the BCA an exact replica would be required. It must also be stressed that it is necessary to compare apples with apples and realise amongst other things that slab thickness is very important. For example, if the slab thickness is 150 mm, then test results on a 175 mm thick slab cannot be used as even a rough a guide, even though the acoustic underlay and flooring may be the same. Similarly, different floors systems using the same acoustic underlay will also give different results.

A test floor and 'tapping machine' at the CSIRO acoustic test laboratory in Melbourne

The CSIRO has undertaken testing on a number of different timber flooring systems and the results available from acoustic underlay suppliers often provide a good starting point for comparison between one product and system and another. In these tests the flooring system is generally laid on a plastic sheet over a concrete slab measuring 3.2m x 3.6m. The tapping machine is placed diagonally on the floor and tests are undertaken consecutively in four locations. The results are then averaged.

With the acoustic performance of floor systems there are some general principals to consider, as follows:–

- A thin laminate floating floor will deflect to some degree under the hammers and allows the acoustic underlay to do its job and absorb the sound and vibration generated in the area of the hammers. Thicker floor systems with higher density hardwood perform less well as with less deflection or flexibility of the board, the sound waves are distributed over a wider area and the influence is greater. Therefore the timber flooring product has a significant effect on test results. Ceramic tiles with almost no flexibility provide greater sound transmission than timber floors.
- Acoustic underlays are manufactured from different materials, and are of different profiles and densities, but the thickness from different suppliers are frequently the same. Even though the thickness of the acoustic underlay may be the same, there can be a significant difference in the performance of one product to another and therefore you cannot substitute products and expect to get the same results.
- The concrete slab thickness has a significant effect with 175 mm thick slabs often having a sound transmission of about 70 dB but 150mm thick slabs about 80 dB.
- Timber flooring systems including acoustic underlays often provide about 10 to 20 dB attenuation (reduction in noise).
- If there is a suspended ceiling in the room beneath the floor, then some further attenuation can be expected.

A test report or information on about the acoustic performance of a flooring system will generally contain the following:–

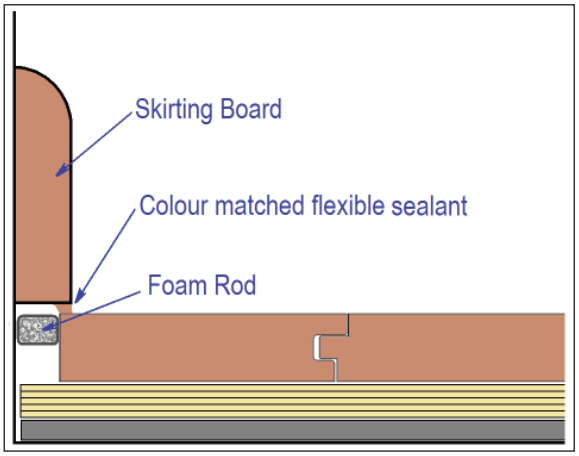
- The timber flooring material e.g. 14 mm T&G Engineered Timber
- The acoustic material e.g. 5 mm acoustic mat
- The method of fixing e.g. polyurethane adhesive
- The slab thickness e.g. 150 mm
- The noise transmission through the bare slab e.g. 79 dB
- The attenuation or reduction in noise transmission e.g. 19 dB
- The L_{nTw}+Cl e.g. (79-19=) 60 dB

In the example above the system complies to BCA requirements.

In summary:–

- Be aware that the requirements of the BCA and also the Strata Schemes Management Act need to be considered.
- The only way to prove that specific sound attenuation criteria has been met is by testing in the unit or apartment where the floor is to be laid.
- If relying on comparative tests then there are risks that the sound attenuation will differ to some degree (better or worse) in the actual dwelling where the floor is being laid. This is also when systems – the flooring, the acoustic underlay, the slab and ceiling beneath appear the same. It is also only appropriate to make comparisons with systems that match your own.
- Comparisons, particularly with CSIRO tested systems are useful and may be all that is necessary, particularly if the tested floor system that is similar, is significantly below the BCA required value. When evaluating data be sure to compare apples with apples and note that a L_{nTw} figure that may be quoted is often a little different by a few dB from the L_{nTw}+Cl figure.

Other considerations



It is important that the flooring system chosen is proven in practice with regard to the fixing of the flooring and the acoustic underlay (as applicable), particularly with solid timber flooring which can exert high forces after installation. With solid timber floors it often requires an intermediate layer of plywood between the flooring and the acoustic underlay. With the system that is to be used both the flooring manufacturer and the acoustic underlay supplier should be fully accepting of the method used and be satisfied that the installation will perform under the expected internal environment conditions that the floor will experience. This includes the floor's performance with heating and cooling systems operating and possible naturally higher humidity conditions in coastal environments or during construction. As such specific written installation instructions should be provided and adhered to.

In addition to paying attention to the fixing of the floor it is also necessary to pay attention to the perimeter of the floor. This is because noise can travel across the floor and if hard up against walls it can travel through the walls and into the adjacent units. This is referred to as flanking noise. Manufacturers of acoustic underlay often have details for what needs to happen at the edge of the timber floor. That is no direct connection to the skirtings and often a flexible sound absorbing rod at the extremities of the floor.

A typical detail is shown in the above diagram and similar details apply where the timber floor may for example abut a tiled area. Note that all floors require expansion allowance to walls and in these installations it is not unusual for the skirting to be 3 mm or so higher than the floor and for the gap to be filled with a flexible sealant. In other areas such as at door jams a similar allowance is necessary to ensure no direct contact with the flooring.

Finally, all concrete sub-floors require evaluation and preparation prior to the installation of the floor. This includes the slab surface being sound, the slab being flat, dry and free from contaminants that can affect adhesion. Moisture vapour barriers may also be necessary. Unless floated, the systems invariably rely on direct bonding of the acoustic underlay to the slab and the flooring or an intermediate layer to the acoustic underlay. For this reason greater care and attention is necessary in the preparation to ensure that the required bond strength is achieved and to minimise possible drummy spots.