INFORMATION SHEET

ACOUSTIC PERFORMANCE

FLOORS

The information provided below has been taken from the New Zealand Timber Design Guide 2007, published by the Timber Industry Federation and edited by Professor A H Buchanan. To purchase a copy of the Timber Design Guide, visit www.nztif.co.nz

IMPACT INSULATION OF FLOORS

The principals of airborne sound insulation developed for walls also apply to floors. However, the main challenge in floor design is often to achieve effective impact sound insulation.

The impact insulation class (IIC) of a floor construction is an ASTM single number that rates the effectiveness of a floor in providing insulation against impact sounds.

This single number rating increases with the increased impact isolation performance of the floor, that is, the greater the rating the greater the insulation.

The International Organization for Standardization (ISO) standard single number rating for impact insulation of a floor is the weighted impact sound level $L_{n,w}$.

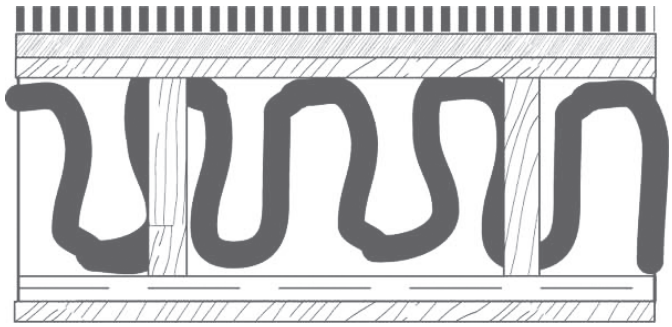
This rating works differently from the IIC in that it is a measure of the impact sound level experienced in an adjoining room (often below the floor), so a greater value means worse impact insulation.

To approximately convert IIC to $L_{n,w}$ the IIC is subtracted from 110 dB, that is, $L_{n,w} = 110 - \text{IIC}$.

One of the most practical methods to increase the IIC value (and decrease the $L_{n,w}$ value) is to reduce the effects of impact at the point of contact, which, in the case of a floor, is on the surface. To achieve acceptable IIC ratings between dwellings or similar occupancies, a good quality carpet and underlay can be used. It is difficult to achieve high IIC ratings for exposed timber floor construction without the use of carpet or a similar soft material.

The importance of floor covering is demonstrated in diagram 1, where a basic floor design without floor coverings has a sound transmission class (STC) of 47 decibels (dB), an IIC rating of 45 dB and an Ln,w rating of 65 dB. By covering the floor with 50 oz carpet on 24 oz felt underlay, the IIC rating increases to 65 dB, although the STC rating remains at 47 dB.

Diagram 1: Typical timber joist floor construction



Notes: STC = 47 dB, IIC = 67 dB. Carpet, on rubber pad, on 250 x 50 mm timber joists, with 75 mm batts. Ceiling is 13 mm gypsum plasterboard screwed to resilient battens.

LOW-FREQUENCY IMPACT INSULATION

The single number ratings IIC and $L_{n,w}$ have been developed to focus on the higher-frequency impact sounds, such as those made by hard shoes on floors.

Insulation for these sounds is effectively addressed by reducing the Ln,w rating (or increasing the IIC rating).

However, once these sharp impact sounds are reduced, low-frequency booming or thumping noises produced by walking are then often heard.

Unfortunately, IIC and $L_{n,w}$ do not adequately rate such low-frequency impact sounds, although an 'impact spectrum adaptation term' C_I to $L_{n,w}$ can be added to include some assessment of the sounds.

In Japan and Korea a special technique is used to measure and rate the low-frequency impact insulation of floors.

If the floor is light in weight, these low-frequency thumps can be quite loud and annoying.

Adding thick carpet will not improve the insulation for low-frequency impact sounds, and increasing the stiffness of joists also does not tend to work; it can make things worse.

The best way to reduce low-frequency sound is to increase the mass on the floor upper surface by adding concrete or some other heavy material.

In the United States and Canada a layer (19 to 38 mm) of dense (1,800 kg/m^3) gypsum concrete is poured over the floor to level it and to reduce low-frequency impact insulation problems.

In New Zealand, successful floors have been built using a 50 mm concrete screed poured on the timber subfloor. The floor can also be topped by a battened cavity filled with a sand mixture to increase the mass and absorb sound.

FLOATING FLOORS

In some countries, such as the United Kingdom, high acoustic requirements for timber floors are met by using 'floating floors', which consist of an additional layer of wood-based flooring supported on timber battens and foam plastic strips above the conventional floor.

Floating floors can also consist of concrete screeds on resilient layers, such as gypsum concrete poured on a polyethylene foam underlay, as is now used in the United States (this specialty trade is not easily available in New Zealand).

Separation of the floating floor from the structural floor must extend to all edges and penetrations with suitable details; further information is provided in the Robust Details Handbook, which includes specification sheets and checklists, and benchmarking test requirements.