An overview of assessment of multi-storey noise

Noise associated with multi-storey living, and particularly Strata title schemes, has become a subject of increasing importance in Australia over the last several years.

As people become more concerned with “personal space” and quality of life issues, the subject of noise and multi-storey living has become a study for specifiers, unit owners and strata mangers alike.

When considering multi-storey noise and flooring systems, our primary consideration is impact noise, rather than air borne noise. That is, the noise associated with foot fall, dropping and “thumping” etc. rather than that of the TV or the spoken voice. This is because it is the impact noise thru to the unit below which is most effected by the selection of flooring systems, while flooring selection will have little or no influence over air borne noise transfer to adjoining dwellings.

Testing of Impact noise involves the use of a set of mechanical “hammers” in the upstairs unit, with the testing or monitoring of noise carried out in the unit below with sensitive and hi-tech listening equipment. This type of testing is a “site specific” test, often referred to as a field test. It is a test not only of the flooring system, but also of the concrete construction, and ceiling treatments which may be in place. Other factors which may effect the test result may include the wall cavities, window construction, external noise sources, and other test irregularities.

It is the acoustic Engineer’s job to perform the tests to a given standard, and to provide a report based on the given results across a range of frequencies. The result may be “weighted” towards certain frequencies depending on the equation, or type of test standard to be followed.

As one might imagine, the nature of this test method is such that carpet performs excellently. The hammers create very little noise on this cushioned surface, while noise in the transmitting room can be somewhat deafening when the hammers are placed on a hard surface like wood or tile.

As such, no hard floor system will ever perform as well as carpet, regardless of the system or underlay in use.

After carpet, the next best flooring systems tend to be the floating floor systems. This is due to the inherent separation of the flooring from the concrete. Although not as quiet as carpet, these systems can provide an entirely acceptable level of noise transfer in most applications.

There has been a massive growth in the number of expensive “acoustic” underlay products on the market for floating floors. However, it can be shown that in general, underlay selection will have only an incremental influence over the completed test result.
Of far greater significance in the test result is the thickness and density of the concrete construction and associated ceiling treatments.

This is why most underlay suppliers do not provide comparative results from a given site, because even thick expensive and impressive rubber underlayment may provide no improvement.

To illustrate this, here is a table of results yielded from blind testing with an impartial acoustic engineer on a given Multiplex building site. The results are given as $L'_{nTw}+C_I$, where the lower the number the better the result.

Test Number	Sample Type	$L'_{nTw}+C_I$
0	Bare concrete	71
1	6mm cork	49
2	5mm Rubber type 1	47
3	Quiet-Step Combilay	46
4	4mm Quiet-Step	45
5	2mmC'lay/3mmcork	48
6	5mm Rubber type 2	49
7	3mm Foam	49
8	10mm Rubber	50
9	3/6mm Rubber	49
10	17mm Rubber	47
11	3mm cork	49

It should be stated that the variation measured here does not constitute an audible variation. That is, the differences can be measured, but not differentiated with the human ear.

As you can see, in this site test the 10mm rubber has yielded a poorer test result than the 5mm rubber, while the Quiet-Step 2mm has outperformed the 10mm rubber that is 5 times thicker and 3 times the price!

It is clear that all is not as it appears in the world of acoustics!

Let us now look at the appropriate standards and requirements for multi-storey projects.

The standard **Strata title act** does not lay down any specific performance guidelines for flooring systems. Claus 14 specifically requires the occupant to provide “peaceful enjoyment” to adjoining occupants. This is regardless of the flooring type used, and provides a vague and often problematic guide line for those involved.

When hard floors are installed, the factors that will most substantially influence “peaceful enjoyment” will include, the general level of activity, use of hard verses soft shoes, use of rugs and runners (think of our earlier discussion about carpet). All such factors will have a much greater influence over “peaceful enjoyment” than the selection of underlay.

Some Body Cooperates may sometimes introduce special bi-laws for their strata scheme. These special bi-laws may set specific sound requirements for floor systems, or prohibit hard flooring altogether. Always check to see if special by-laws are applicable for the building involved, as these must be followed.

The Building Code of Australia (now known as the National Construction Code) has now introduced a specific guideline for multi-storey noise. This provides a guide for builders and specifiers based on all the best information on the subject from around the world.

The requirements are based on the equation $L'_{nT,w}$. In this type of test result, the lower the figure the better. **The BCA (NCC) states that site test result should not exceed 62db.**

You may occasionally see a test result expressed in FIIC or IIC (field impact isolation class). In this superseded terminology, the higher the number the better the result. It can be loosely cross calculated to $L'_{nT,w}$ by subtracting it from 110.

Due to this BCA (NCC) requirement, $L'_{nt,w}$ has now become the accepted test standard and all results should be expressed in this way.

A typical test result achieved with ReadyFlor and Quiet-Step is as follows, and falls well within this BCA (NCC) requirement.

ReadyFlor on 2mm Quiet-Step Combi-Lay **$L'_{nT,w}$ = 44**
Laid on 200mm concrete slab
With 150mm ceiling cavity with insulation.

You may also be asked to provide a system that will comply with a 4, 5 or 6-star rating. This rating system was developed by the Association of Australian Acoustic Consultants (AAAC), and applies a number of stars depending on the test performance of the product. This is also based on the $L'_{nt,w}$ rating.

The details on this can be found at www.aaac.org.au, and are as follows:

Impact isolation of Floors	2-Star	3-Star	4-Star	5-Star	6-Star
Between Tenancies $L'_{nt,w}$	<65	<55	<50	<45	<40

Quiet-Step is so called due to its ability to significantly reduce the walk sound for the user. This is often referred to as “reflected noise’. Quiet-Step reduces this by about a third, providing a quieter more solid sounding floor to walk on. It has been used extensively in thousands of Strata Title apartments all over Australia with excellent results.

In Conclusion, underlay selection should be considered as only a single small component of multi-storey noise considerations. There are many other factors like construction type and use that will have a far greater influence on the actual result.

We should always remember that all test results are site specific, and do not reflect the performance of an individual component, but of the flooring system in that given location. A given test certificate will provide an indication of performance and this may or may not be able to be duplicated at your location.

We have accumulated many of these site specific test certificates, over several years, all showing a broad range of results. We make many of these test certificate available to our customer on request.

I hope this article has provided a useful overview of the subject matter, and of the “black art” of multi-storey noise.