



THE HALLMARK  
FLOOR IMPACT NOISE POLICY

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**Project:** **The Hallmark – Floor impact noise policy**

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## INTRODUCTION TO APARTMENTS & FLOORING

This floor policy details a number of requirements with regards to floor coverings and their acoustic ratings. To better understand the context and meaning of the requirements we provide this overview of apartment flooring and how impact noise relates to apartment owners.

Impact noise from people walking in their apartment is one of the few noise issues that almost exclusively affects someone other than the person generating the noise

The following factors determine how impact noise is perceived;

1. What is the impact source and is it on carpet or hard flooring. Are people wearing heels. Is the impact heavy. Does the apartment above have hard flooring throughout which means impact noise could be audible anytime someone is walking around. Or does it have hard flooring in only a small area.
2. What is the flooring type and what is the underlay, e.g. carpet, timber, tiles etc. What is the quality of the underlay under the hard flooring (there are many different types)
3. What is the thickness of the concrete slab?
4. Is there is a ceiling void below – and how big is it?
5. What is the ceiling suspended from? Is this a lightweight steel grid system or timber battens directly fixed against the concrete slab?
6. What is the ceiling type? Is this solid plasterboard, timber or a perforated ceiling?
7. Are there penetrations or other weaknesses in this ceiling? For example, supply & return air grilles, downlights, bulkheads with lower performance, access panels etc.
8. Is the receiver space very quiet? This would result in everything you hear sounding louder than if your apartment was next to a busy road where some of the impact noise is masked by traffic noise. The time of day is also important. At night when there is less noise outside, impact noise will sound more prominent.
9. How sensitive is the person below to impact sound? What is the expectation of the acoustic amenity?

All these factors combine to determine how impact noise is perceived.

In this document there are a range of numbers which denote the performance of different flooring constructions. The BCA requires an in-situ rating not more than  $L_{nT,w}$  62. A lower rating than 62 therefore represents a better (quieter) impact performance. The meaning of the  $L_{nT,w}$  parameter is not important for this summary however, for reference, the rating of 62 can be compared to the following flooring scenarios. Note that all ratings shown are typical and are based on a concrete construction where the apartment has a mix of carpet and hard flooring and a suspended plasterboard ceiling.

**Table 1: Impact reference**

No.	Construction	Typical rating ( $L_{nT,w}$ )
1	Carpet on (carpet) underlay. Subjectively and practically no audible impact noise from the apartment above.	30-38
2	Hard flooring with very good to good level of impact isolation. This is difficult to achieve but is often the performance nominated if flooring is changed from carpet to hard flooring. Impact noise can be heard occasionally but it is not generally considered intrusive if some masking noise is present (e.g. living in the CBD or on major road).	45-50
3	Hard flooring criterion for most new apartment building. Impact noise can be heard and can be intrusive occasionally but acceptable for most people particularly if some masking noise is present. (e.g. living in the CBD or on major road).	55
4	BCA limit of $L_{nT,w}$ 62. Not considered adequate for new apartment buildings.	62
5	Hard flooring with no special acoustic underlay, for example tiles or timber stuck directly to concrete.	62-75
6	Bare concrete with no ceiling below.	75-85



For reference, a difference of 10 in the numbers above is commonly regarded as the sound being 'twice as loud'. In other words, a rating of  $L_{nT,w}$  65 can be considered twice as loud as  $L_{nT,w}$  55. There are a number of other factors which influence how a sound is perceived however this reference holds true for most situations.

Considering the above, an impact rating similar to carpet for hard flooring would be ideal. Unfortunately, there are no practical hard flooring systems that will easily achieve ratings less than 40 with the existing Hallmark slabs and ceilings. The only systems that can, use a raised floor that is built on top of the concrete slab and they raise the floor height by typically 10cm. These floor systems are rarely used for new buildings, particularly as ratings of  $L_{nT,w}$  50-55 have been found to be acceptable. They are occasionally used when replacing carpet flooring in existing buildings, but the entire apartment must be re-fitted to accommodate the 10cm increase in floor height.

A more practical limit when replacing carpet, whilst maintaining a sensible acoustic amenity relative to carpet, is to aim for a rating of  $L_{nT,w}$  50. This is the rating that is nominated for the Hallmark.

## THE HALLMARK - FLOOR IMPACT POLICY

### 1.0 INTRODUCTION

The Hallmark apartment building is a 19-storey residential development located at 2-14 Albert Road, South Melbourne. Marshall Day Acoustics (MDA) has been engaged by OC Management Solutions to provide recommendations relating to acoustic design criteria for floor impact noise transfer between apartments at the Hallmark.

A glossary of terminology is included in Appendix A.

### 2.0 DESIGN CRITERIA

Floor impact sound insulation ratings under site conditions are commonly expressed in terms of the field measured, weighted, standardised impact sound level,  $L'_{nT,w}$ . The lower the rating, the better is the acoustic performance.

Section 5 of the Building Code of Australia (BCA) includes acoustic performance requirements for sole-occupancy units. The current version of the BCA (at the time of writing) requires a specified minimum level of floor impact sound insulation between apartments to be achieved. While this is the legislated requirement, the specified performance is considered by MDA to be inadequate (subjectively very poor) for apartments of even moderate quality.

The Association of Australian Acoustical Consultants (AAAC) has developed an Acoustic Star Rating System, which ranks the acoustic performance of dwellings on a scale ranging from 2-star (for basic dwellings with relatively poor acoustic performance) up to 6-star (for luxury dwellings and penthouses).

Table 2 compares the BCA requirements with the more appropriate criteria of the AAAC Star Rating System.

**Table 2: Floor impact sound insulation criteria**

Inter-tenancy floor	BCA	2 star	3 star	4 star	5 star	6 star
Floor separating sole-occupancy units – impact performance	$L'_{nT,w} \leq 62$	$L'_{nT,w} \leq 65$	$L'_{nT,w} \leq 55$	$L'_{nT,w} \leq 50$	$L'_{nT,w} \leq 45$	$L'_{nT,w} \leq 40$

### 3.0 EXISTING FLOOR IMPACT PERFORMANCE

#### 3.1 Existing floor construction

We understand that the floor/ceiling construction at The Hallmark is as follows:

- Floor finish: carpet, tiles and/or timber floor
- Underlay (unknown)
- 115mm concrete slab up to level 14 and 150mm concrete slab for level 14 and higher.
- Suspended ceiling - cavity and plasterboard thickness varies

#### 3.2 Benchmark testing

Floor impact and airborne benchmarking tests were conducted at The Hallmark on 5 March 2018.

Table 3 provides a summary of the results and predicted impact noise levels with tiles.

**Table 3: Impact sound insulation test results - floors**

Source Room	Receiver Room	Floor type	Test results $L'_{nT,w}$
Apt 1801 Living room	Apt 1701 Living room	Carpet / 150mm slab	29
Apt 1801 Kitchen	Apt 1701 Kitchen	Tiles / 150mm slab	52
Apt 1801 Bedroom	Apt 1701 Bedroom	Carpet / 150mm slab	30
Apt 503 Living room	Apt 403 Living room	Carpet / 115mm slab	43
Apt 503 Study	Apt 403 Study	Carpet / 115mm slab	37
Levels 1 to 13 predicted tile results -		Tiles / 115mm slab	54-55 (predicted)

#### 4.0 RECOMMENDED FLOOR IMPACT CRITERIA

Recommendations for acoustic design criteria for new and replacement floor coverings (specifically hard floors such as timber or tiles) have been developed based on the limitations of the existing floor construction.

The acoustic rating for apartment new or replacement floors at The Hallmark is to achieve a rating of  $\leq L'_{nT,w}$  50 between dwellings. This equates to a AAAC star rating of 4 stars. A rating of 4 stars for a hard floor can only be achieved with the best underlay available on the market. This underlay would be required for both the 150mm and 115mm concrete slabs.

Note that the acoustic requirements are nominated as a performance that must be achieved on-site upon completion of the works, including any effects of sound flanking via facade systems or secondary noise paths. When evaluating building systems, and acoustic treatment for the works, appropriate allowances and factors must be made to take into consideration the differences that occur between laboratory test results and field performance.

#### 5.0 PRACTICAL CONSIDERATIONS OF THE NEW FLOOR IMPACT POLICY

In an established occupied residential building, it is generally not possible to achieve a floor impact sound insulation performance based on a hard floor finish (i.e. timber/tiles) that is acoustically equivalent (i.e. no worse than) to carpet (with underlay).

What this means in practical terms is that where floor impact noise from a carpeted floor in an apartment above was not generally heard previously, if the carpeted floor is replaced with a hard floor finish (e.g. timber/tiles), it is highly likely that floor impact noise would potentially be significantly more audible than before, even with the incorporation of high performance acoustic underlay.

It is generally accepted that an increase of 10dB is perceived by most people to be 'twice as loud'. This means that if for example Apartment 1801 replaces carpet in the living room with a hard floor laid on the recommended underlay, the residents of 1701 are likely to experience footfall noise at least twice or possibly two and a half times louder than before.

On this basis, the acoustic performance standard in this document is based on what we regard to be the highest impact level that is generally acceptable for residents.

The nominated standard does not therefore provide an equivalent performance compared to the performance of a carpet floor finish. Whether impact noise is deemed acceptable is ultimately dependant on the following factors; impact noise severity, frequency of occurrence, floor and ceiling

performance, background noise levels in the receiving space and the sensitivity of the occupant below.

## 6.0 ACOUSTIC TESTING REQUIREMENTS

Each owner will be responsible for ascertaining the necessary floor isolation measures required to comply with the floor impact design criteria. It is envisaged that owners will seek the engagement of an acoustic isolation system supplier in conjunction with the services of an experienced and qualified acoustic consultant who is a member of the AAAC to determine a compliant floor isolation system for the selected floor covering.

Apartment owners are required to carry out the following acoustic testing as part of the process of replacing an existing carpeted floor with a hard floor:

- On-site benchmark testing of the existing base-building floor construction without the carpet/underlay finish (test to be performed on the bare slab)
- On-site pre-installation testing of the proposed new hard floor (tests of samples of the proposed new floor construction)

These tests can be carried out at the same time. It is envisaged that part of the existing flooring is pulled up to allow these tests to take place.

Details for testing are included in [Appendix B](#) and all floor testing shall be conducted at the apartment owner's expense. With the above procedure, no verification testing of the completed floor is required provided the completed floor matches the construction of the tested floor samples.

## 7.0 TYPICAL FLOOR SYSTEMS

Marshall Day Acoustic has analysed several possible floor underlays to determine if they can achieve the  $L'_{nT,w}$  50 requirement in conjunction with the existing building construction.

At the time of writing, only one underlay product is estimated to achieve this criterion. The details for this product and construction options are detailed in [Appendix C](#).



## APPENDIX A GLOSSARY OF TERMINOLOGY

<b>Impact sound</b>	Sound produced by an object impacting directly on a building structure, such as footfall noise or chairs scrapping on a floor.
<b>Flanking Transmission</b>	Transmission of sound energy through paths adjacent to the building element being considered. For example, sound may be transmitted around a wall by travelling up into the ceiling space and then down into the adjacent room.
<b><math>L_{n,w}</math></b>	<u>Weighted, Normalized Impact Sound Pressure Level</u> A single number rating of the impact sound insulation of a floor/ceiling when impacted on by a standard ‘tapper’ machine. $L_{n,w}$ is measured in a laboratory. The lower the $L_{n,w}$ , the better the acoustic performance.
<b><math>L'_{nT,w}</math></b>	<u>Weighted, Standardised Impact Sound Pressure Level</u> A single number rating of the impact sound insulation of a floor/ceiling when impacted on by a standard ‘tapper’ machine. $L'_{nT,w}$ is measured on site. The lower the $L'_{nT,w}$ , the better the acoustic performance.

## APPENDIX B ACOUSTIC TESTING REQUIREMENTS

Impact sound insulation testing is required to be carried out for the base-building floor construction of the apartment and pre-installation testing is required for a number of samples of the proposed new hard floor.

This is required when an existing carpeted floor is to be replaced with a hard floor finish.

In order to manage the potential risk of a new floor being non-compliant following installation (which would require the floor to be removed and re-installed at considerable cost to the owner), samples of the proposed new floor are required to be tested prior to full installation of the floor.

All floor testing shall be conducted at the apartment owner's expense

### Pre-installation testing

1. Sample testing involves conducting a floor impact test onto a 1m<sup>2</sup> sample of the finished hard floor system. The sample test must be conducted in a minimum of three separate positions across the full area of the proposed new floor.
2. Depending on the type of finished hard floor system, a single 1m<sup>2</sup> sample may be moved to each test location as required, if it is representative of the final floor treatment (i.e. not glued to the floor slab). In order for the test to be representative in the event that the finished hard floor is to be glued to the floor slab, three 1m<sup>2</sup> samples glued to the floor slab must be tested.
3. It should also be noted that the sample test is indicative only and does not fully consider the final edge flanking of the finished hard floor system. It is important that the manufacturer's installation instructions are strictly adhered to – this includes the correct isolation of junction details at the edge of the floor.
4. For one position, the bare slab must also be tested. The position is at the discretion of the tester.
5. Note the requirement to also test with the 9mm compressed fibre cement sheet layer as detailed in Appendix C.
6. Total testing is therefore 3x new hard floor with acoustic underlay, 3x new hard floor with 9mm CFC sheet and acoustic underlay, 1x bare concrete slab for a total of 7 positions.
7. Sample floor impact testing must be conducted by an independent acoustic consultant who is a member of the AAAC. A test report detailing the test methodology and results of the sample testing shall be submitted to the Owners Corporation for approval prior to commencement of the final floor installation. Typical pricing for a floor test and report at the time of writing (2018) is \$1800,- ex GST.

## **APPENDIX C FLOOR UNDERLAY**

The floor underlay that is estimated to achieve the minimum requirement of  $L'_{nT,w}$  50 together with the existing building construction is Angelstep Gold8 underlay. This product is 8mm thick and is made and distributed by Acoustica Pty Ltd. This underlay can be used under tiles and timber flooring.

We recommend the floor system be tested with and without a 9mm compressed fibre cement mass layer. For some floor finishes the mass layer improves the performance and may therefore enable the floor to comply. This mass layer should be positioned between the top floor finish and the Angelstep Gold8.

Acoustica should be consulted with regards to their recommendations using their product.

### **Other systems**

Other systems may become available in the future that can also achieve the requirements. These should be assessed by MDA or another Acoustic Consultant who is a member of the AAAC.