Floor Underlay Impact Testing

Flooring Oddz and Endz

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Glossary

A-weighting	A spectrum adaption that is applied to measured noise levels to represent human hearing. A-weighted levels are used as human hearing does not respond equally at all frequencies.
dB	Decibel—a unit of measurement used to express sound level. It is based on a logarithmic scale which means a sound that is 3 dB higher has twice as much energy. We typically perceive a 10 dB increase in sound as a doubling of that sound level.
dB(A)	Units of the A-weighted sound level.
Frequency (Hz)	The number of times a vibrating object oscillates (moves back and forth) in one second. Fast movements produce high frequency sound (high pitch/tone), but slow movements mean the frequency (pitch/tone) is low. 1 Hz is equal to 1 cycle per second.
L_{eq}	Equivalent Noise Level—Energy averaged noise level over the measurement time.
$L_{n,w}$	Weighted Normalised Impact Sound Pressure Level—A measure of the noise impact performance of a floor and ceiling. It is a laboratory tested result and is characterised by how much impact sound reaches the receiving room via the floor and ceiling construction from a standard tapping machine test. The lower the $L_{n,w}$ rating the better the impact isolation.
$L_{n,w} + C_I$	A measure of the noise impact performance of a floor and ceiling with a C_I spectrum adaptation to account for foot fall noise.
$L_{nT,w}$	Weighted Standardised Impact Sound Pressure Level— A measure of the impact noise performance of a floor and ceiling between two enclosed spaces. It is an on-site measured level that relates to the laboratory $L_{n,w}$ value. The lower the $L_{nT,w}$ rating the better the impact isolation.
Reverberation Time (RT)	Of a room, for a sound of a given frequency or frequency band, the time that would be required for the reverberantly decaying sound pressure level in the room to decrease by 60 decibels.

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1 Introduction

Resonate Acoustics has been engaged by Flooring Oddz and Endz to undertake an impact assessment of various underlay products.

The main purpose of the commission was to undertake an on-site floor impact sound insulation test and determine the single-figure impact noise performance of the proposed systems.

This report documents our methodology, testing results and recommendations.

2 Standards and technical terms

Floor impact noise measurements and the methods used to provide a single-number rating are governed by Standards. The description and discussion of floor impact noise involves the use of specific technical terms. A brief summary of the relevant Standards and technical terms is presented below.

It is proposed to use a numerical descriptor that is governed by ISO (International) Standards as follows:

- **Measurement**: ISO 140-7: 1998 *Acoustics - Measurement of sound insulation in buildings and of building elements -- Part 7: Field measurements of impact sound insulation of floors*
- **Rating**: ISO 717-2: 2013 *Acoustics -- Rating of sound insulation in buildings and of building elements - Part 2: Impact sound insulation*

The technical descriptors used to describe the single-figure impact noise performance of a floor and ceiling in the above Standards are:

- **$L'_{nT,w}$**: Apparent Weighted Standardised Impact Sound Pressure Level— A measure of the impact noise performance of a floor and ceiling between two enclosed spaces. It is an on-site measured level that relates to the laboratory $L_{n,w}$ value. A lower $L'_{nT,w}$ rating equates to better impact isolation than a higher value. Refer also to the Glossary

- **$L'_{n,w}$**: Weighted Normalised Impact Sound Pressure Level—A measure of the noise impact performance of a floor and ceiling. It is a laboratory tested result and is characterised by how much impact sound reaches the receiving room via the floor and ceiling construction from a standard tapping machine test. The lower the $L_{n,w}$ rating the better the impact isolation. Refer also to the Glossary

- **C_I**: A correction term used in the Building Code of Australia, (i.e.: the descriptor used is $L'_{nT,w} + C_I$. Research[1] and peer reviewed papers[2] recommend that this term is not used in the description of impact noise because; *the incorporation of Ci was unreliable and, in the worst cases, allowed constructions previously known to be deficient to achieve compliance (Fitzell, Fricke, 2004).* Consequently, this term is excluded from further consideration in this assessment.

[1] Rindel J.H., and Rassmussen B., "Some consequences of including low frequencies in the evaluation of floor impact sound", ASA 132nd meeting – Hawaii, December 1996.

[2] Fitzell, R., and Fricke, F., "2004 Changes to the BCA – Are they a step forward?" Proceedings of Acoustics 2004, Gold Coast Australia.

3 Floor impact sound insulation testing

3.1 Test Configuration

This section summarizes the results of floor impact testing conducted on Thursday, 28th April, 2016 at 18 Kate St, East Victoria Park.

Impact noise testing measurements were taken between the kitchen/living area space downstairs and an upstairs bedroom. These measurements were taken in general accordance with ISO 140-7: *Acoustics -- Measurement of sound insulation in buildings and of building elements -- Part 7: Field measurements of impact sound insulation of floors.*

This pair of rooms was chosen as they had well-defined rooms, were sufficiently complete to allow testing and had a relatively uniform sound field within.

The construction of the sample, floor and ceiling was as follows:

- 14 mm thick floating engineered timber floor with a plan size of approx. 2.1 m x 2.7 m
- Underlay
- 257 mm thick concrete floor slab
- Skim coat plaster ceiling underneath.

The following Resilient underlay/fixing combinations were used:

Test	Sample	Description
Test 1	Sample A	Oddz and Endz “Peaceful Warrior”
Test 2	Sample B	“Premium flooring” product
Test 3	Sample C	Oddz and Endz “Quiet Acheiver”
Test 4	Bare concrete	Bare concrete

3.2 Test Procedure

For each test, a Norsonic type 211A tapping machine was placed in operation on the test sample.

The transmitted impact sound was characterised by measuring the one-third-octave band spectrum of the average sound pressure level produced by the tapping machine in the receiving room below.

Sound pressure level measurements were undertaken using a Brüel and Kjær precision sound level meter Type 2260. The calibration of the sound level meter was checked prior to and following the test procedure and calibration remained stable.

Reverberation time measurements were conducted in the receiver space by bursting balloons to create an impulsive noise source and then measuring the sound decay.

The Apparent Weighted Standardised Impact Sound pressure Level ($L'_{nT,W}$) has been calculated using the receiving room noise levels with appropriate adjustments for the one-third-octave band acoustic absorption within the receiver room and adjustments as necessary for background noise influence.

The single figure performance values have been calculated in accordance with ISO 717-2: 2013 *Acoustics -- Rating of sound insulation in buildings and of building elements - Part 2: Impact sound insulation.*

4 Results and Discussion

The tested performance of the floor system with a large receiving room was:

Sample	$L'_{nT,w}$	$L'_{n,w}$
Bare concrete	70	76
Concrete floor with Sample A	49	56
Concrete floor with Sample B	49	55
Concrete floor with Sample C	49	55

The $L'_{nT,w}$ for a small receiving room (e.g. bedroom) is expected to be approximately 7 dB higher than the $L'_{nT,w}$ value reported above.

The definition of $L'_{nT,w}$ 'standardises' the test results to a 'standard room' of reverberation time 0.5 seconds. This provides lower results (i.e. better results) for large receiving rooms than it does for smaller, bedroom sized rooms. On the other hand, $L'_{n,w}$ normalizes the room to 10 square meters of absorber. The effect of this normalization process is that the $L'_{nT,w}$ appears lower for a large room than for a small room of the same sound pressure level. The $L'_{nT,w}$ and $L'_{n,w}$ will be approximately equal for a room volume of 31m^3, and therefore the $L'_{n,w}$ serves as an indicator of the $L'_{nT,w}$ performance in small rooms.

Based on the findings of a recent case in the State Administrative Tribunal, regarding impact noise from floors (Friday and Luck [2014] WASAT 109, August 2014), it is our interpretation that a floor system possessing an impact performance compliant with the NCC/BCA requirement not to exceed 62 dB is not necessarily compliant with the Strata Titles Act 1985 – Schedule 2, i.e. "...treated to an extent sufficient to prevent the transmission of noise likely to disturb the peaceful enjoyment of the proprietor". Therefore, we recommend a rating between 52-57 dB, which would be considered noticeably quieter and would more likely be compliant with the Strata Titles Act, where it applies.

Given that the measurements demonstrated $L'_{n,w}$ 56 for Sample A and 55 for Samples B and C, the flooring systems are found to be compliant.

Certificates are provided in Appendix A.

5 Conclusions

All three flooring systems (14 mm floating timber with underlay samples A-C on a 257 mm slab) were found to be compliant.

The $L'_{n,w}$ provided in the certificates can be used as a guide to the performance of the systems when placed above smaller rooms.

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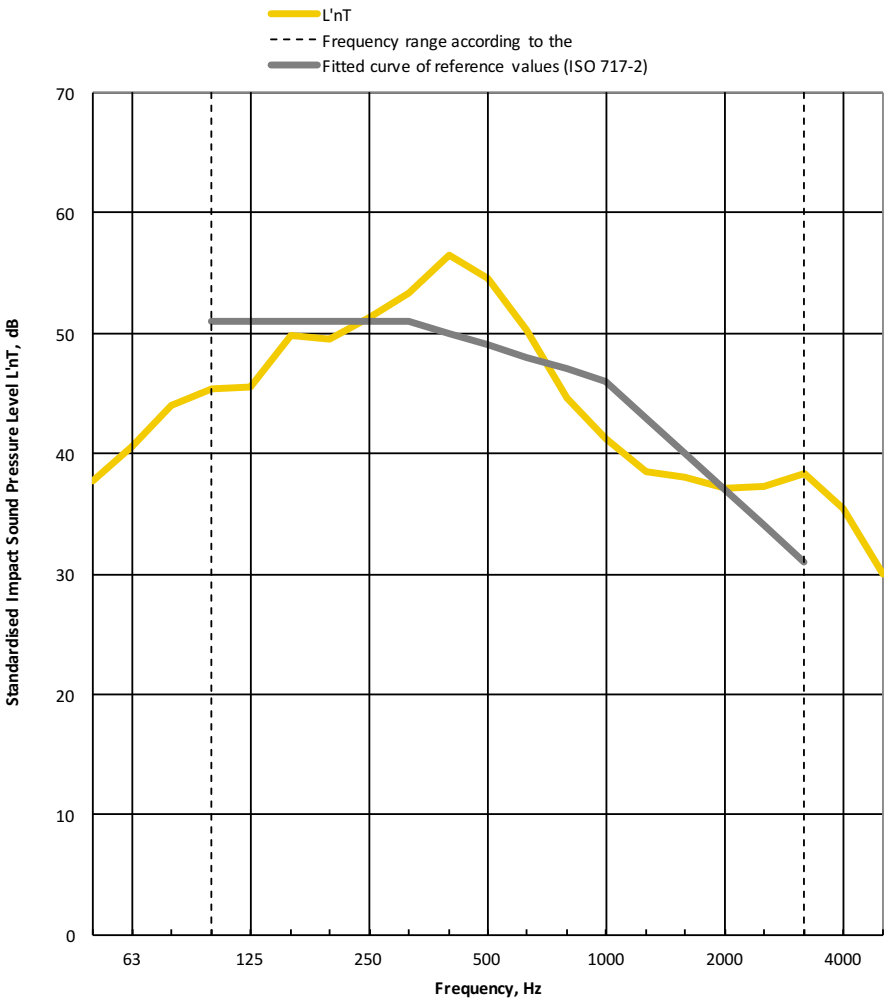
Appendix A – Floor impact sound insulation certificates

Impact noise field test certificate

Job Number	P16238				
					Material Under Test
Client	Flooring Oddz and Endz	Source Room	Level 1 Bedroom		
Building	18 Kate St, East Victoria Park	Receiver room	Level 0 Kitchen/Living		Flooring Oddz and Endz "Peaceful Warrior" underneath floating 14mm engineered timber; 257mm slab
Results Summary	L'nT,w 49	Ci from 100-2500hz	Ci - 2		
	L'nw 56	By-Law Compliance	N/A		

Frequency, Hz	L'nT 1/3rd Oct dB
50	37.7
63	40.6
80	44.0
100	45.4
125	45.5
160	49.8
200	49.5
250	51.3
315	53.3
400	56.5
500	54.6
630	50.3
800	44.7
1000	41.3
1250	38.5
1600	38.1
2000	37.1
2500	37.3
3150	38.4
4000	35.5
5000	30.0

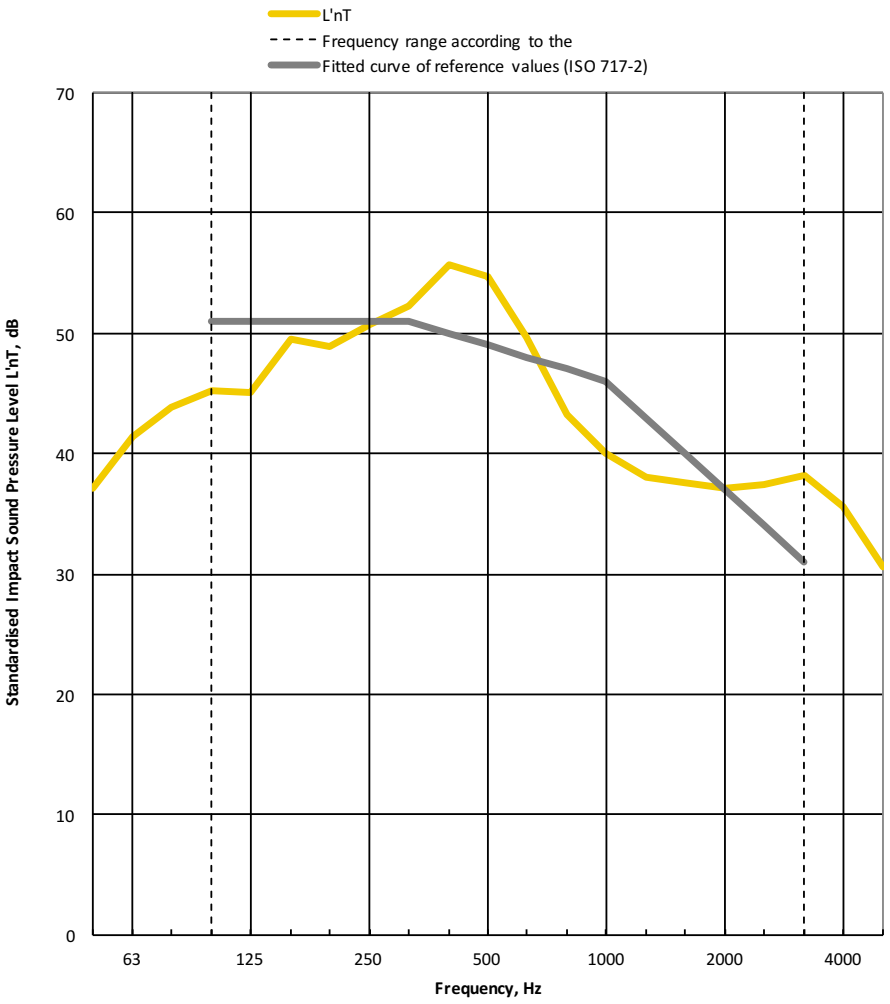


Certificate is to be read in conjunction with report P16238RP1

Impact noise field test certificate

Job Number	P16238				
					Material Under Test
Client	Flooring Oddz and Endz	Source Room	Level 1 Bedroom		
Building	18 Kate St, East Victoria Park	Receiver room	Level 0 Kitchen/Living		"Premium flooring" product underneath floating 14mm engineered timber; 257mm slab
Results Summary	L'nT,w 49	Ci from 100-2500hz	Ci - 3		
	L'nw 55	By-Law Compliance	N/A		

Frequency, Hz	L'nT 1/3rd Oct dB
50	37.2
63	41.4
80	43.9
100	45.2
125	45.1
160	49.5
200	48.9
250	50.7
315	52.3
400	55.7
500	54.7
630	49.7
800	43.2
1000	40.1
1250	38.0
1600	37.6
2000	37.1
2500	37.5
3150	38.2
4000	35.6
5000	30.6



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Impact noise field test certificate

Job Number	P16238				
					Material Under Test
Client	Flooring Oddz and Endz	Source Room	Level 1 Bedroom		
Building	18 Kate St, East Victoria Park	Receiver room	Level 0 Kitchen/Living		Flooring Oddz and Endz "Quiet Acheiver" underneath floating 14mm engineered timber; 257mm slab
Results Summary	L'nT,w 49	Ci from 100-2500hz	Ci - 2		
	L'nw 55	By-Law Compliance	N/A		

Frequency, Hz	L'nT 1/3rd Oct dB
50	37.3
63	40.7
80	44.1
100	44.8
125	45.3
160	49.9
200	49.5
250	51.1
315	53.9
400	56.6
500	53.8
630	48.3
800	43.5
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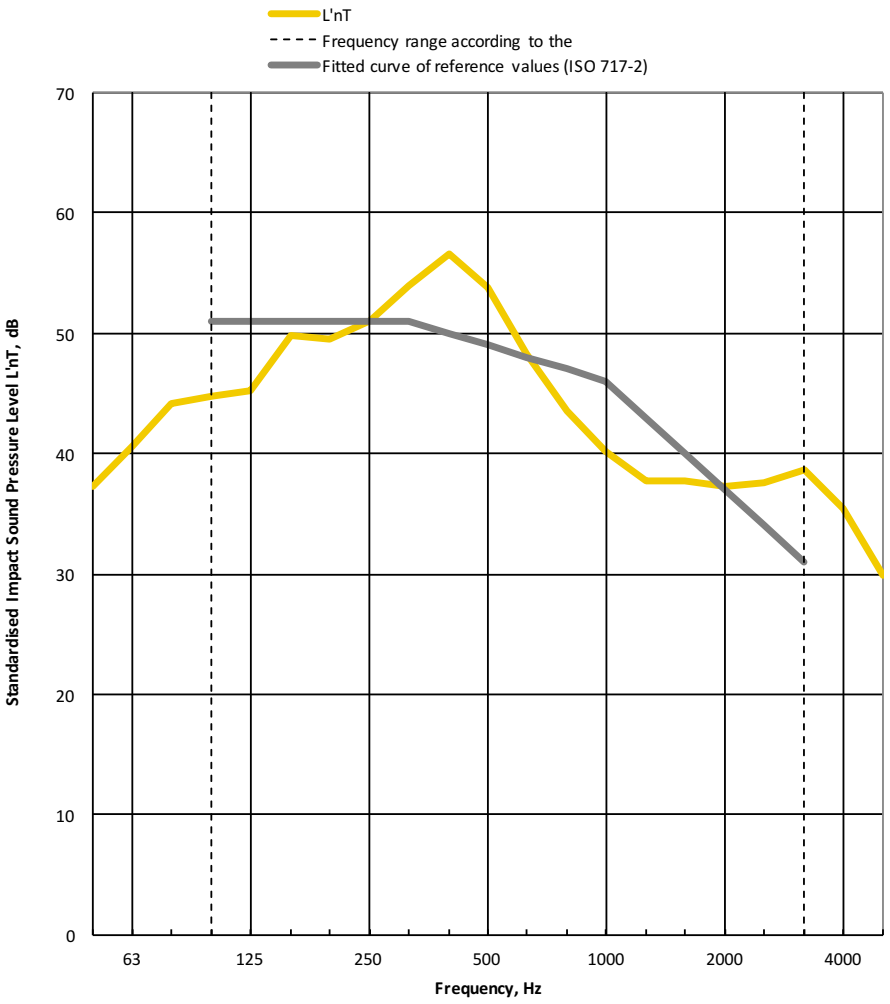
2000	37.3
2500	37.6
3150	38.6
4000	35.4
5000	29.9



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