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FIELD FLOOR IMPACT INSULATION TEST REPORT

U8 38 TERRENCE ROAD BRENDALE 4500 LNT

Commissioned by:	Homely Flooring
Date:	30 November 2023
Project number:	5979
Version:	V.1
Author:	Mathew Dyer

DOCUMENT INFORMATION	
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V.0	Final	30-11-2023	Mathew Dyer	Ross H. Palmer CPEng
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TITLE	Field Floor Impact Insulation Test U8 38 Terrence Road Brendale QLD 4500 Test Report
TESTS BY	Mathew Dyer Acoustic Consultant MSS025008
TEST DATE	28 November 2023
REPORT DATE	30 November 2023
TEST LOCATION	Unit 8 Above Office Area, Unit 8 Office Area
FOR	Homely Flooring

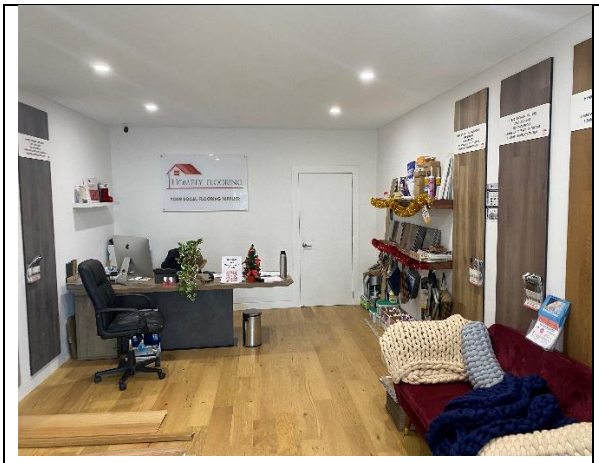
CONTENTS

1.0 INTRODUCTIONS

Homely Flooring has engaged Palmer Acoustics to perform field impact insulation tests at U8 38 Terrence Road Brendale. For these tests, we use an ISO 140 standard tapping machine (per ISO 16283-2: 2020(E).

Floor systems tested:

Test 1 - 200mm Concrete slab, 13mm plasterboard with 75mm air gap
Test 2 - 8 mm Hybrid with 2.0mm IXPE underlay – Loose laid
Test 3 - 6 mm Hybrid with 1.5mm IXPE underlay – Loose laid



Sample Size

8mm hybrid – 1.5m x 1.2m 1525mm x 182mm x 8	6mm hybrid – 1.5m x 1.2m 1218mm x 182mm x 6

2.0 EQUIPMENT AND PROCEDURES

2.1 Measurement Procedures

Testing conformed to ISO 16283-2:2020 "*Field measurement of impact sound insulation of floors*". Evaluation of the results to derive the single figure L'nT,w rating was conducted to ISO 717-2 2020 "*Rating of insulation in buildings and of building elements – Part 2 Impact Sound Insulation*".

The ambient sound levels were measured before testing.

The receiving room reverberation times were measured at various locations throughout the space, using the balloon-burst impulse test method, with the results averaged.

The Receiving room tapping sound levels were measured for 30 seconds at various locations throughout the room, with the results averaged.

Test results were analysed per ISO 16283 and ISO 717.

2.2 Instrumentation

The following instruments were used:

- Norsonic 140 1/3 octave band Sound Level Meter (Serial No. 1403252)
- B & K Tapping machine Type 3207 (serial number 2574503)
- B & K 4231 Calibrator (serial number 2153030)

Before and after each measurement session, the equipment was field-calibrated and was within 0.1dB of the reference signal. All instruments hold a current calibration certificate from a NATA-accredited calibration laboratory.

3.0 DESCRIPTION OF ROOMS

All windows and doors were closed in the receiving room. The source room was open to two of the facades. Reverberation and flanking were addressed with additional acoustic treatments applied to the facades of the building.

Transmitting Room (U 8 Above Office Test Floor to U 8 Office**)**

Test 1

Walls:	Open;
Ceiling:	Insulated Steel Roofing;
Floor:	Concrete slab 200mm thick
Room finish:	Furnished with supplies.
Volume:	80m^3

Test 2

Walls:	Open;
Ceiling:	Insulated Steel Roofing;
Floor:	6 mm Hybrid with 1.5mm IXPE underlay – Loose laid
Room finish:	Furnished with supplies.
Volume:	80m^3

Test 3

Walls:	Open;
Ceiling:	Insulated Steel Roofing;
Floor:	8 mm Hybrid with 2.0mm IXPE underlay – Loose laid
Room finish:	Furnished with supplies.
Volume:	80m^3

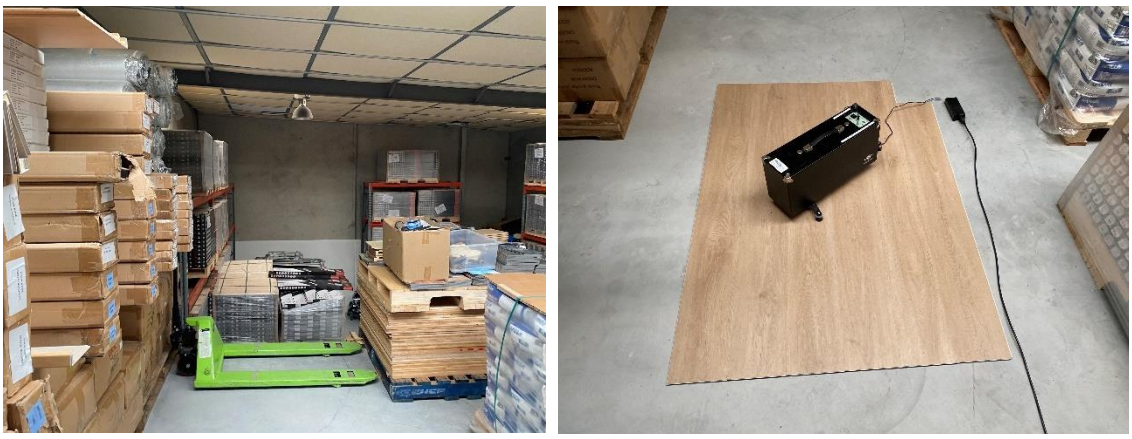


Figure 1: Photographs of Concrete slab above Office Photo 2 Tapping on Sample and Machine

The Association of Australasian Acoustical Consultants (AAAC) Guidelines for apartment and Townhouse Acoustic rating provide the following information when considering L'nT,w ratings. FIIC ASTM has been added to show the equivelant rating system.

These levels of isolation can be considered as follows:

ISO Rating	Star Rating	Approx. ASTM Rating	Perception
$L'_{nT,w}$ 70	No rating	FIIC 40	All floor impacts clearly audible (e.g. dropping comb on floor)
$L'_{nT,w}$ 65	2 Star	FIIC 45	Footsteps on tiled or parquetry floors clearly audible below
$L'_{nT,w}$ 60	2 ½ Star	FIIC 50	Footsteps on tiled or parquetry floors audible below;
$L'_{nT,w}$ 55	3 Star	FIIC 55	Footsteps on tiled or parquetry floors audible below
$L'_{nT,w}$ 50	4 Star	FIIC 60	Footsteps on tiled or parquetry floors barely audible below
$L'_{nT,w}$ 45	5 Star	FIIC 65	Footsteps on tiled or parquetry floors normally inaudible below
$L'_{nT,w}$ 40	6 Star	FIIC 65	Footsteps on tiled or parquetry floors near inaudible below

Note: Field impact Isolation class (FIIC) is the old ASTM standard descriptor used to define floor impact performance ratings. In Australia this term has now be superseded by the ISO standard terms, which are currently being adopted across Australia. It is advisable to now think in terms of the ISO terms $L'_{nT,w} + C_I$ and $L'_{n,w}$ (see above and enclosed glossary of terms).

There is an industry relationship that considers that the FIIC and $L'_{nT,w}$ when added should give 110. The relationship, is only very approximate and cannot be used as a reliable guide.

The achievement of impact isolation of less than $L'_{nT,w}$ 60 is not an easy task and requires careful consideration of all the building elements involved.

4.0 RESULTS

Our test gives the following results:

Table 1: Test Result Summary – Floor impact test

	Test System	L'nT,w	FIIC*	AAAC
1.	200mm Concrete slab, 13mm plasterboard with 75mm air gap	65	33	N/A
2.	8 mm Hybrid with 2.0mm IXPE underlay – Loose laid	46	59	4/5
3.	6 mm Hybrid with 1.5mm IXPE underlay – Loose laid	46	59	4/5

*FIIC – Field Impact Insulation Class – This is being phased out and is no longer referenced in the BCA/NCC.

The L'nT,w reduction achieved was 19. This is an expected result when compared to similar products of this type. Results are within a ±1dB making this product on this particular slab a 4/5 Star system when compared to the AAAC rating system.

Additional environmental factors to consider are to enclose the space above to eliminate additional external influences. In addition, beware of any shelving or loose products as the vibrations from the tapping machine may cause movement within the receiving room. This could affect the overall result.

The 6mm preformed the same as the 8mm, a subtle difference can be observed with the 1/3 octaves in the certificates.

Appendix C contains the Test Certificates detailing the 1/3 octave band results for this report in terms of L'nT,w following ISO 717 - 2: 2020.

L'nT,w is a term used in the Building Code of Australia (BCA - see Appendix A) and represents a corrected room noise level, with a lower number showing better performance.

FIIC is an ASTM term that represents a floor/ceiling assembly's ability to resist the transmission of impact noise. A higher value represents greater performance.

5.0 CONCLUSION

For this test – The hybrid achieved a reduction of 19dB(A). In a similar environment with a slab of 200 mm with a 75mm air gap or more for both samples would be suitable to achieve a high level of amenity for hard flooring.

It is our experience that a test sample will normally test to within 1 dB of the fully laid floor provided floor is installed with a 1-5mm gap around the edging.

The test certificate results are specific to this test and cannot be directly applied to any other location or flooring system. When applied to another floor, Palmer Acoustics can advise on the possible performance, but this must be in consultation with our office.

Author:

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Acoustic Consultant
MSS025008

Reviewed by:

PALMER ACOUSTICS PTY. LTD A.C.N. 058 751 349 COMMON SEAL

ROSS H. PALMER CPEng RPEQ 3534
Principal Engineer

APPENDIX A: CERTIFICATE

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Member Firm: AAAC
Association of Australasian Acoustical Consultants

FIELD IMPACT SOUND INSULATION - TEST CERTIFICATE

Test 1 of 3

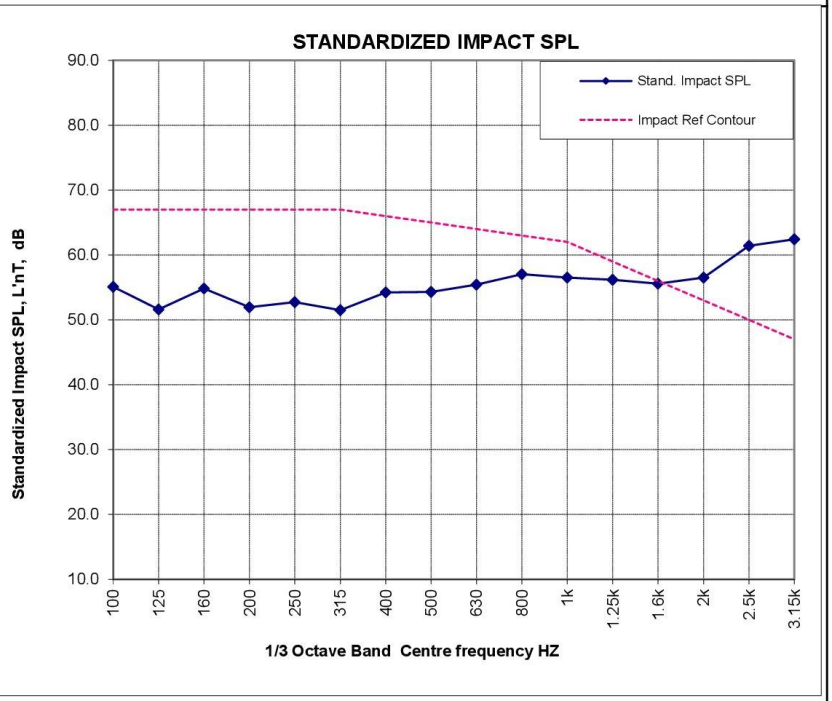
Concrete

ADDRESS:	Unit 8 38 Terrence Road Brendale 4500	**PN:**	PN5979	
Test Location:	U 8 Above Office Test Floor to U 8 Office Test Room	**Meas. Date:**	28-Nov-2023	
		Meas. Parameter:	Leq	
Client:	Homely Floorings	**Tapping Machine:**	B & K	
Test Performed:	Mathew Dyer	**Receiving Room Volume:**	80	m^3

DESCRIPTION OF FLOOR AND SPECIMEN		**No. of Source posn:**	3	
Test Surface:	Concrete	**Mic. posn:**	3	sweeps
		RT meas:	3	Imp.
Underlay:		**SLM:**	NTI XL2	
Adhesive:		**Calibrator:**	B & K 4230 #2	
Ceiling:	13mm Plasterboard 75mm Air Gap			
Slab:	200			

Weighted Standardized Impact SPL	**L'nT,w**	**65**	ISO 16283-2:2015 & 717-2:2013
Results standardized to a RT of 0.5 seconds			
Impact Insulation Class	**FIIC**	**33**	ASTM E1007-97 & E989-89

Centre Frequency	Stand. Impact SPL	Impact Ref Contour	Deficiencies
Hz	dB	dB	dB
100	55.1	67	
125	51.6	67	
160	54.8	67	
200	52.0	67	
250	52.7	67	
315	51.5	67	
400	54.2	66	
500	54.3	65	
630	55.4	64	
800	57.1	63	
1k	56.5	62	
1.25k	56.2	59	
1.6k	55.6	56	
2k	56.5	53	3.5
2.5k	61.4	50	11.4
3.15k	62.4	47	15.4
			Total
L'nT,w	65		30.3



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LNT - Test 1.xlsm

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FIELD IMPACT SOUND INSULATION - TEST CERTIFICATE

Test 2 of 3

8 mm Hybrid

IXPE 2.0mm

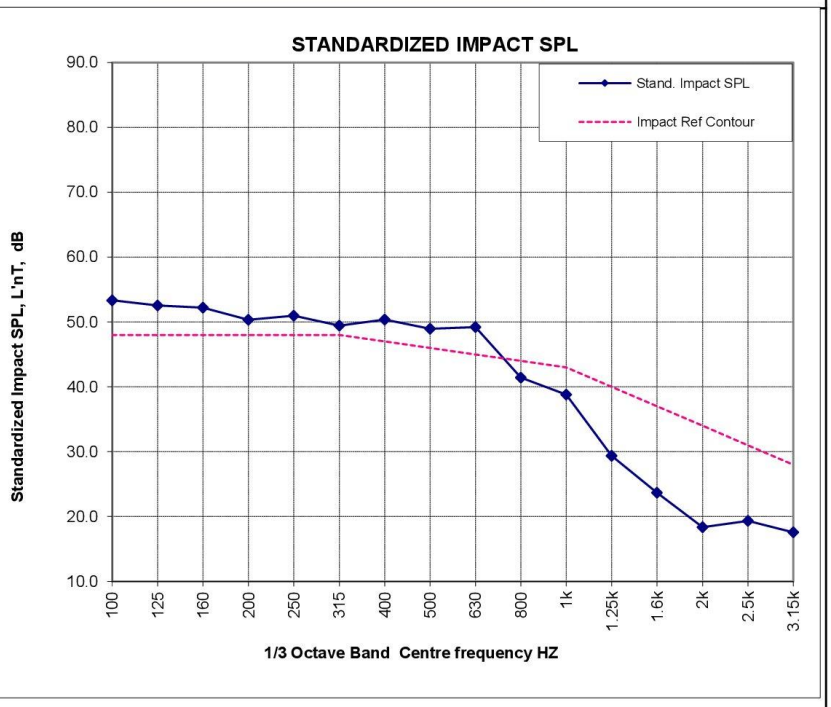
ADDRESS:	Unit 8 38 Terrence Road Brendale 4500	**PN:**	PN5979	
Test Location:	U 8 Above Office Test Floor to U 8 Office Test Room	**Meas. Date:**	28-Nov-2023	
		Meas. Parameter:	Leq	
Client:	Homely Floorings	**Tapping Machine:**	B & K	
Test Performed:	Mathew Dyer	**Receiving Room Volume:**	80	m^3

DESCRIPTION OF FLOOR AND SPECIMEN

		No. of Source posn:	2	
		Mic. posn:	2	sweeps
Test Surface:	8 mm Hybrid	**RT meas:**	3	Imp.
Underlay:	IXPE 2.0mm	**SLM:**	NTI XL2	
Adhesive:	Loose laid	**Calibrator:**	B & K 4230 #2	
Ceiling:	13mm Plasterboard 75mm Air Gap			
Slab:	200			

Weighted Standardized Impact SPL Results standardized to a RT of 0.5 seconds	**L'nT,w**	**46**	ISO 16283-2:2015 & 717-2:2013
Impact Insulation Class	**FIIC**	**59**	ASTM E1007-97 & E989-89

Centre Frequency	Stand. Impact SPL	Impact Ref Contour	Deficiencies
Hz	dB	dB	dB
100	53.4	48	5.4
125	52.5	48	4.5
160	52.2	48	4.2
200	50.3	48	2.3
250	51.0	48	3.0
315	49.4	48	1.4
400	50.4	47	3.4
500	49.0	46	3.0
630	49.2	45	4.2
800	41.4	44	
1k	38.8	43	
1.25k	29.4	40	
1.6k	23.7	37	
2k	18.4	34	
2.5k	19.4	31	
3.15k	17.6	28	
			Total
L'nT,w	46		31.4



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FIELD IMPACT SOUND INSULATION - TEST CERTIFICATE

Test 3 of 3

6 mm Hybrid

IXPE 1.5mm

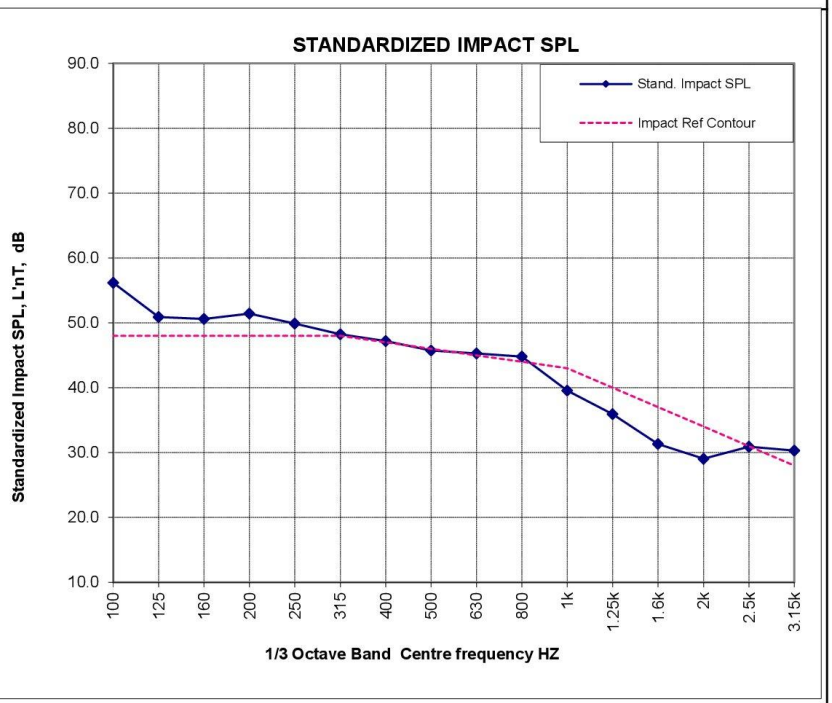
ADDRESS:	Unit 8 38 Terrence Road Brendale 4500	**PN:**	PN5979
Test Location:	U 8 Above Office Test Floor to U 8 Office Test Room	**Meas. Date:**	28-Nov-2023
		Meas. Parameter:	Leq
Client:	Homely Floorings	**Tapping Machine:**	B & K
Test Performed:	Mathew Dyer	**Receiving Room Volume:**	80 m^3

DESCRIPTION OF FLOOR AND SPECIMEN

Test Surface:	6 mm Hybrid	**No. of Source posn:**	2
		Mic. posn:	2 sweeps
		RT meas:	3 Imp.
Underlay:	IXPE 1.5mm	**SLM:**	NTI XL2
Adhesive:	Loose laid	**Calibrator:**	B & K 4230 #2
Ceiling:	13mm Plasterboard 75mm Air Gap		
Slab:	200		

Weighted Standardized Impact SPL Results standardized to a RT of 0.5 seconds	**L'nT,w**	**46**	ISO 16283-2:2015 & 717-2:2013
Impact Insulation Class	**FIIC**	**59**	ASTM E1007-97 & E989-89

Centre Frequency	Stand. Impact SPL	Impact Ref Contour	Deficiencies
Hz	dB	dB	dB
100	56.2	48	8.2
125	50.9	48	2.9
160	50.6	48	2.6
200	51.4	48	3.4
250	49.9	48	1.9
315	48.2	48	0.2
400	47.2	47	0.2
500	45.8	46	
630	45.3	45	0.3
800	44.8	44	0.8
1k	39.6	43	
1.25k	35.9	40	
1.6k	31.3	37	
2k	29.1	34	
2.5k	30.9	31	
3.15k	30.3	28	2.3
			Total
L'nT,w	46		22.9



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LNT - Test 3.xlsm

APPENDIX B

GLOSSARY

IMPACT MEASUREMENT AND ASSESSMENT DESCRIPTORS

- $L_{Aeq,T}$ – Time average A-weighted sound pressure level is the average energy equivalent level of the A-weighted sound over a period "T".

- L_{Aeq} – Equivalent Continuous Noise Level. The noise level in dB(A) which, if present for the entire measurement period, would produce the same sound energy to be received as was actually received as a result of a signal which varied with time. Normally abbreviated to "L_{eq}" or "L_{Aeq}", often followed by a specification of the time period (such as 1 hour or 8 hours) indicating the period of time to which the measured value has been normalised;

- $L'_{nT,w}$ – Weighted Standardised impact sound pressure level; a measurement of impact sound transmission between rooms. Lower values denote better performance. The single figure measure is derived by adapting a standard response curve to measured 1/3 octave band sound pressure levels. Measured results are adjusted based upon a reverberation time of 0.5 sec in receiving room. Normally derived from a field test.

- $L'_{n,w}$ – Weighted Normalised impact sound pressure level; a laboratory measurement of impact sound transmission between rooms. Lower values denote better performance. The single figure measure is derived by adapting a standard response curve to measured 1/3 octave band sound pressure level measurements. Measured results are adjusted based on the absorption of 10m^2 in the receiving room. Normally derived from a laboratory test.

- C_I – A spectrum adaptation term compensating for the effect of floor coverings when applied to bare floors under test. The usually negative value, in decibels, is added to the single-number quantity, L'_{nw} or L'_{nTw}.

- ***Impact Sound Pressure Level (L)*** – the average sound pressure level in a specified frequency band produced in the receiving room by the operation of the standard tapping machine on the floor assembly, averaged over each of the specified machine positions.

- L'_{nT} – ***Standardised Impact Sound Pressure Level*** – the impact sound pressure level standardised to a room with a reference reverberation time of 0.5 seconds.

- L'_n – ***Normalized Impact Sound Pressure Level*** – the impact sound pressure level normalised to reference absorption area of 10 metric sabins (108 sabins).

- ***Receiving Room*** – a room below or adjacent to the floor specimen under test in which the impact sound pressure levels are measured.

- ***Source Room*** – the room containing the tapping machine.

AAAC Table for impact insulation class

Intertenancy Activities	2 Star	3 Star	4 Star	5 Star	6 Star
(a) Airborne Sound Insulation for Walls and Floors					
Between Separate Tenancies $D_{nT,w} + C_{tr} \geq$	35	40	45	50	55
Between A Lobby/Corridor & Bedroom $D_{nT,w} + C_{tr} \geq$	30	40	40	45	50
Between A Lobby/Corridor & Living Area $D_{nT,w} + C_{tr} \geq$	25	40	40	40	45
(b) Corridor, Foyer To Living Space Via Door(s) $D_{nT,w} \geq$	20	25	30	35	40
(c) Impact Isolation of Floors					
Between Tenancies $L_{nT,w} \leq$	65	55	50	45	40
Between All Other Spaces & Tenancies $L_{nT,w} \leq$	65	55	50	45	40
(d) Impact Isolation of Walls					
Between Tenancies	No	Yes	Yes	Yes	Yes
Between Common Areas & Tenancies	No	No	No	Yes	Yes

Intertenancy Activities generate a wide range of different noises, which can be broadly classified into airborne and structure-borne noise.

Airborne sound insulation is measured in accordance with Australian Standard AS 2253 and rated in accordance with AS 1276 (ISO 140-4 and ISO 717.1).

The nominated $D_{nT,w} + C_{tr}$ values are considered as minimums and there is no site tolerance applicable.

Floor impact transmission is measured in accordance with ISO 140-7 and rated in accordance with ISO 717.2.

STANDARDS

- ***ISO 16283 – 2***
  Acoustics – Field measurement of sound insulation in buildings and of building elements – Part 7: Default procedure for sound pressure level measurement

- ***ISO 717 – 2***
  Acoustics – Rating of sound insulation in building and of building elements – Part 2: Impact sound insulation

- ***ISO 3382-2:2008***
  Acoustics – Measurement of room acoustic parameters — Part 2: Reverberation time in ordinary rooms.

APPENDIX C

CALCULATION METHODOLOGY - L'nT,w

Correction to the signal level for background noise – ISO 16283-2:2015

If $(L_{sb}- L_b) > 10$, then $L = L_{sb}$

If $10 > (L_{sb}- L_b) > 6$, then $L = 10 \log \left(10^{\frac{L_{sb}}{10}} - 10^{\frac{L_b}{10}}\right)$

If $6 > (L_{sb}- L_b)$, then $L = L_{sb} - 1.3$

L is the adjusted signal level, in decibels;
L_{sb} is the level of signal and background noise combined, in decibels;
L_b is the background noise level, in decibels.

Standardised impact sound pressure level – ISO 16283-2:2015

$$L'_{nT} = L_i - 10 \log \left(\frac{T}{T_0}\right)$$

L'_{nT} is the standardised impact sound pressure level;
L_i is the impact sound pressure level;
T is the reverberation time in the receiving room;
T_0 is the reference reverberation time in the receiving room; for dwellings, T_0 = 0.5 s.

Method of comparison – ISO 717-2:2013

To evaluate the results of a measurement of L'_{nT} in one-third-octave bands, the reference curve is shifted in increments of 1 dB towards the L'_{nT} curve until the sum of unfavourable deviations is as large as possible but not more than 32.0 dB.

An unfavourable deviation at a particular frequency occurs when the results of measurements exceed the reference value. Only the unfavourable deviations are taken into account.

The value, in decibels, of the reference curve at 500 Hz, after shifting in accordance with this procedure is $L'_{nT,w}$.

CALCULATION METHODOLOGY – FIIC

Correction to the signal level for background noise – ASTM E 1007 - 97

If $(L_{sb}- L_b) > 10$, then $L_s = L_{sb}$

If $10 > (L_{sb}- L_b) > 5$, then $L_s = 10 \log \left(10^{\frac{L_{sb}}{10}} - 10^{\frac{L_b}{10}}\right)$

If $5 > (L_{sb}- L_b)$, then $L_s = L_{sb} - 2$

L_s is the adjusted signal level, in decibels;
L_{sb} is the level of signal and background noise combined, in decibels;
L_b is the background noise level, in decibels.

Normalised impact sound pressure level – ASTM E 1007 - 97

$$L_n = L_p - 10 \log \left(\frac{A_0}{A_2}\right)$$

$$A_2 = 0.921 \left(\frac{Vd}{c}\right)$$

L_n = normalised impact sound pressure level;
L_p = average one-third octave band sound pressure level;
A_2 = equivalent sound absorption area of the room, in m²;
A_0 = reference sound absorption area of the room, A_0 = 10 m²;
V = volume of the room, in m²;
d = rate of decay of sound pressure level in the room, in dB/s (d = 60/T, T = reverberation time);
c = speed of the sound in air, in m/s ($c = 20.047\sqrt{273.15 + t}$, t = receiving room's temperature).

Determination of Impact Insulation Class – ASTM E 989 - 1999

To determine the impact insulation class (IIC) of a floor-ceiling assembly, the reference IIC contour is shifted vertically relative to the normalised impact sound pressure levels until the following conditions are fulfilled:

- The sum of the deviations above the contour do not exceed 32 dB
- The maximum deviation at a single test frequency do not exceed 8 dB

The normalised sound pressure level at the intersection of the contour and 500 Hz ordinate is subtracted from 110 to obtain the impact insulation class.