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CERTIFICATE OF PERFORMANCE

IMPACT SOUND INSULATION

AUSWOOD 5mm RUBBER ACOUSTIC UNDERLAY

AUSWOOD INTERNATIONAL PTY LTD

Issue Date: Thursday, 2nd September 2021

Our File Reference: 4444C20210430jtAuswood_v4.2.docx

DOCUMENT CONTROL

Project Title	Certificate of Performance Impact Sound Insulation Auswood 5mm Rubber Acoustic Underlay Auswood Wholesale Pty Ltd
Project Number	4444
Document Reference	4444C20210430jtAuswood_v4.2.docx
Document Path	G:\Shared drives\KA Acoustics 2021\REPORT\Partition Testing Impact\4444 (jt) Auswood\4444C20210430jtAuswood_v4.2.docx

Version	Date	Author	Review	Notes
V1	30/04/2021	JT	NK	Report version 1 available for issue
V2	31/05/2021	MJ	JT	Report version 2 available for issue
V3	02/06/2021	MJ	JT	Report version 3 available for issue
V4	02/09/2021	MJ	JT	Report version 4 available for issue

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1.0 CONSULTANT'S BRIEF

Koikas Acoustics was requested by Auswood International Pty Ltd to conduct impact noise tests of the following floor systems:

- Auswood 5mm Rubber Acoustic Underlay

A total of one (1) test was conducted which included the base ceiling/floor system and the selected floor coverings (timber flooring) with selected underlays.

The purpose of undertaking these impact noise tests was to quantify the acoustic performance of the flooring systems with selected underlays and timber floor coverings in conjunction with the sub-base being concrete with suspending ceiling.

Test results were compared to the acoustic requirements of *Part F5 of BCA (Building Codes of Australia)* and the standards prescribed by the *Association of Australian Acoustical Consultants (AAAC)*.

All measurements were carried out following the guidelines and procedures outlined in *AS/NZS ISO 140.7:2006 "Field measurements of impact sound insulation of floors"* with the rating determined in accordance with *AS ISO 717.2-2004 "Rating of sound insulation in buildings and of building elements"*.

2.0 IMPACT NOISE COMPLIANCE TESTING

The impact noise tests were taken within residential flat units in Arncliffe NSW on Wednesday 28th April 2021.

2.1 PARTITION SYSTEM

Koikas Acoustics has been advised that the ceiling/floor system between the residential units is constructed with the following building materials:

- Approximately 200 mm thick concrete slab;
- 80~120 mm deep suspended ceiling cavity, and
- 13 mm thick plasterboard ceiling.

Hereafter referred to as the "*existing ceiling/floor system*" (ECFS). The tests were conducted with the following floor covering in conjunction with acoustic underlays over the ECFS:

- Test 00: Bare concrete floor (ECFS only)
- Test 01: 14 mm timber flooring over Auswood 5mm Rubber Acoustic Underlay

2.2 IMPACT NOISE REQUIREMENTS

2.2.1 BCA Requirement

For verification of the impact noise rating for floors, Part FV5.1 (b) of the latest update of the Building Code of Australia (BCA) 2019 states:

> *Impact: a weighted standardised impact sound pressure level ($L_{nT,w}$) not more than 62 when determine under AS ISO 717.2*

2.2.2 AAAC Star Rating Performance Requirements

Reproduced from the Association of Australasian Acoustical Consultants (AAAC) Guideline for Apartment and Townhouse Acoustic Ratings, the following Table (Section C) describes the acoustic ratings regarding the Star Rating System.

Table 1. Star Rating requirements for Inter-tenancy Activities – Published by the AAAC

INTER-TENANCY ACTIVITIES	2 Star	3 Star	4 Star	5 Star	6 Star
(c) Impact isolation of floors					
- Between tenancies $L_{nTw} \leq$	65	55	50	45	40
- Between all other spaces & tenancies $L_{nTw} \leq$	65	55	50	45	40

2.3 ASSESSMENT PROCEDURES & MEASUREMENTS

Spectrum sound level measurements of transmitted impact noise were recorded in 1/3 octave band centre frequencies between 50 and 10,000 Hertz.

A standardised Cesva MI006 S/N T 249742 Tapping Machine was used to generate the sound field in the source rooms for the impact noise test. Impact noise measurements were carried out per the recommendations of *AS/NZS ISO 140.7:2006 "Field measurements of impact sound insulation of floors"*. This document provides information on appropriate measurement equipment and the proper implementation of measurement practices to achieve reliable results of impact sound insulation between rooms in buildings.

For determining a single number quantity for impact sound insulation between rooms in buildings when measurements are conducted "in-situ", $L_{nT,w}$ (weighted standardised impact sound pressure level), the rel3nt standard is *AS/NZS ISO 717.2-2004 "Impact sound insulation"*. The calculated $L_{nT,w}$ derived from applying the formulae in this standard allows for a comparison between these calculated levels and the nominated acceptable levels outlined in the *Verification Methods* of the *Building Code of Australia (BCA).*

2.3.1 Ambient Background Noise Measurement

A measure of the underlying ambient noise was taken in the receiving rooms to account for the perceived noise in the space. Inaccuracies in the measurements and calculations can occur in areas of high ambient noise however the location of the site and receiver rooms meant little ambient noise was evident in this case.

Ambient noise levels in each 1/3 octave frequency bands were measured to take into account the effect of ambient noise during the recording of the transmitted impact noise levels.

2.3.2 Reverberation Time Measurements

To determine the $L_{nT,w}$ reverberation time measurements need to be performed in the receiving rooms. The reverberation time in the receiver room is calculated to 'standardise' the airborne/impact noise transmission measurements to reference reverberation time of 0.5 seconds as required by AS/NZS ISO 140.7:2006 Section 3.4.

Reverberation time measurements were conducted using the impulse-source method. This consisted of averaging the sound level decay time associated with several large balloon bursts within the receiver room. This transient response was analysed by the sound level meter and a measure of the reverberation time in 1/3 octave bands was used to calculate the standardised impact noise rating.

2.3.3 Instrumentation and Calibration

NTi XL2 Type Approved (TA) precision spectrum analyser S/N A2A-06312-E0 was used for all measurements (impact noise, ambient noise, reverberation). The equipment used for taking noise level measurements is traceable to NATA certification. Field calibrations were taken before and after the impact noise measurements with a NATA calibrated pistonphone. No system drifts were observed.

2.4 MEASURED RESULTS

The results of the impact noise tests are summarised in Table 2 below.

Table 2. Impact noise insulation performance summary for tested ceiling/floor Systems

System Tested[1]	L'_{nTw}[3]	FIIC[4,5]	AAAC[6]
Test 00: Bare concrete floor (ECFS only)	55	45	3
Test 02[2]: 14 mm timber flooring over Auswood 5mm Rubber Acoustic Underlay	44	59	5

Detail calculations of the partition system's impact noise insulation of the ceiling/floor systems are attached as **Appendix A**.

The following are also noted:

1. All tests were undertaken with the existing ceiling/floor system consisting of 200 mm thick concrete sub-base with approximately 80~120 mm suspended ceiling cavity and one layer of 13 mm thick plasterboard ceiling.
2. The selected timber flooring with and without the selected underlays as listed in Table 2 have met both the BCA 2019 minimum requirement ($L_{nT,w} \leq 62$) and the AAAC Star rating of 5 (i.e. $L_{nT,w} \leq 45$) for impact noise insulation.
3. The lower the $L'_{nT,w}$ rating the better the impact insulation.
4. The relation between Field Impact Insulation Class (FIIC) and Impact Insulation Class (IIC) can be described by the formula FIIC + 5 ≈ IIC.
5. The higher the IIC and FIIC the better the impact insulation.
6. The higher the AAAC Star Rating the better the impact insulation.
7. The information contained herein should not be reproduced except in full.
8. The information provided in this report relates to acoustic matters only. Supplementary advice should be sought for other matters relating to flooring installation, construction, design, structural, fire-rating, waterproofing, and the likes.
9. Product installation details and methodologies must be sought from the product supplier, installer or other experts. Koikas Acoustics is not liable for any product defects.
10. The acoustic ratings provided in this report are indicative and for comparative purposes only. Acoustic ratings will vary depending on the testing environment/conditions including, materials/structures of the existing ceiling/floor system, room volume, internal layout and workmanship. Even with the same testing environment, acoustic ratings can vary from room to room and so building to building as no two buildings are identical.
11. Floor covering must not make contact with any walls or joineries (kitchen benches, cupboards etc). During the installation of any hard floor coverings, temporary spaces of 5~10mm should be used to isolated the floor covering from walls and/or joineries and the resulting gaps should be filled with a suitable mastic type sealant or off-cut of underlay or the equivalent where available. The acoustic integrity could be degraded if the above precautions and treatments are not implemented. Refer to Figure 1 & 2 below for illustration.

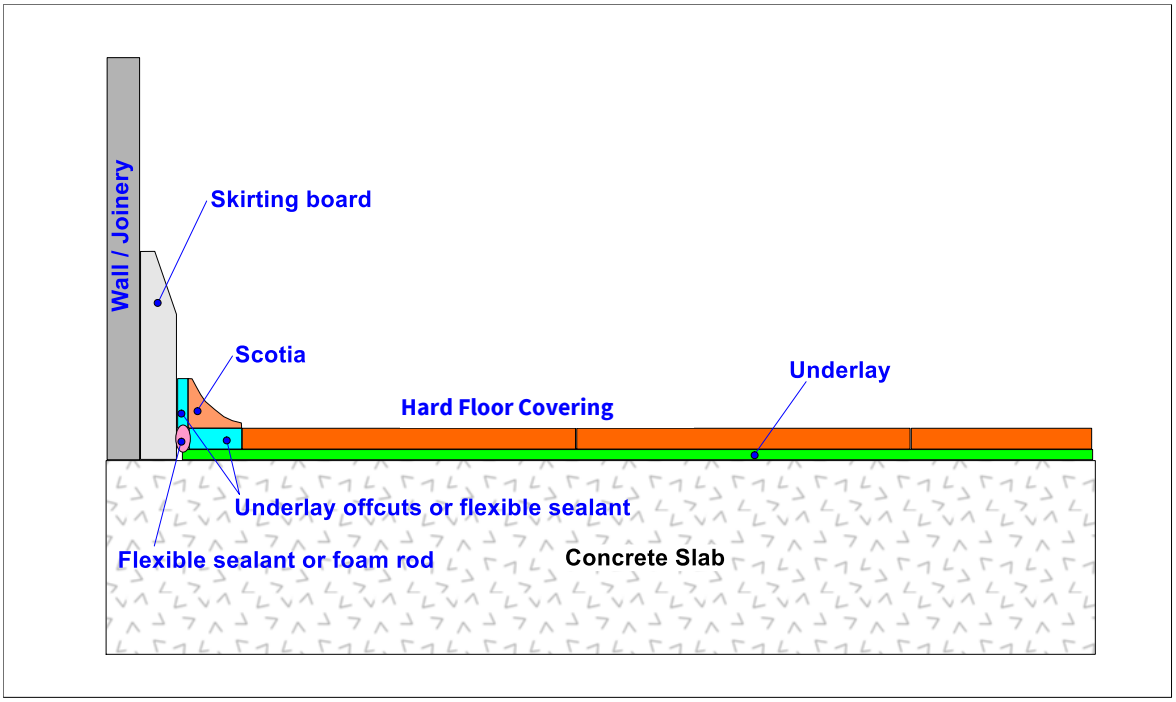

Figure 1. Wall / Joinery details (skirting board & scotia)

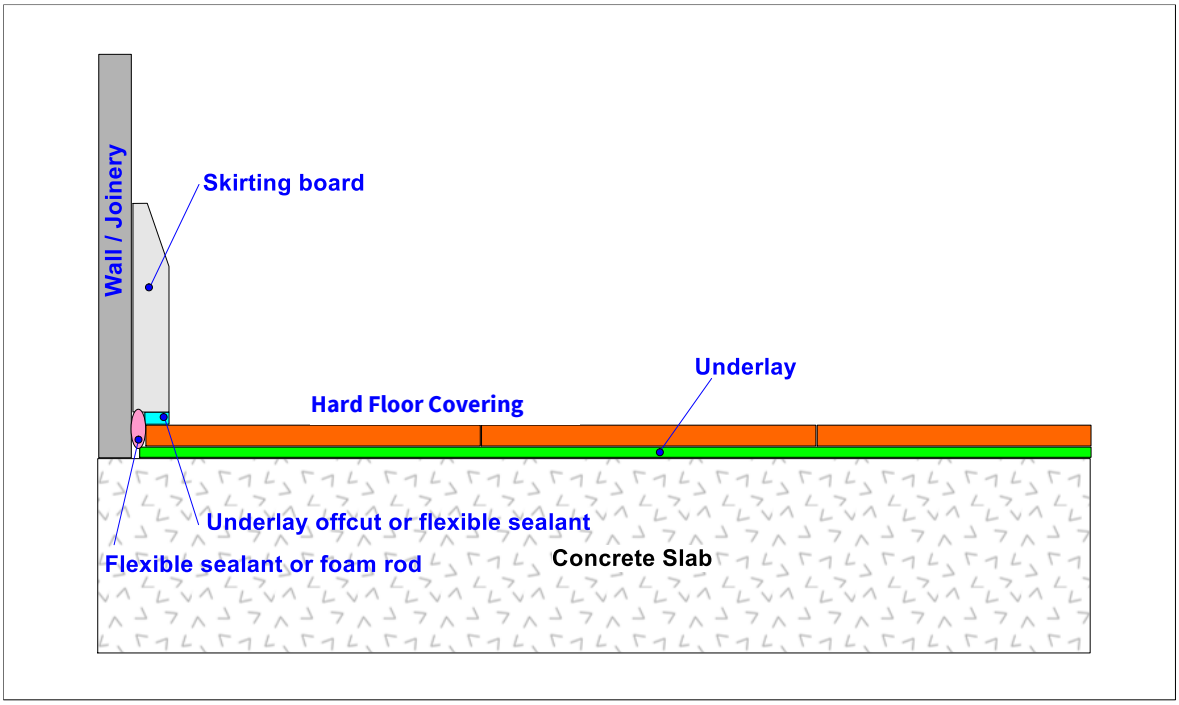

Figure 2. Wall / Joinery details (skirting board)

3.0 CONCLUSION

Koikas Acoustics was requested by Auswood International Pty Ltd to undertake impact noise tests of ceiling/floor system for the selected floor coverings (timber flooring) and associated underlays. The acoustic performances of various ceiling/floor configurations were calculated and compared against the acoustic requirements of the current BCA and AAAC Star Ratings that are commonly used in Australia.

The calculated acoustic rating of the tested flooring system is summarised and presented in **Table 2** of this report. A detailed test certificate is provided as **Appendix A**.

The acoustic ratings provided in this report are indicative and for comparative purposes only. Acoustic ratings will vary depending on the testing environment/conditions including, materials/structures of the existing ceiling/floor system, room volume, internal layout and workmanship. Even with the same testing environment/conditions, acoustic ratings would still vary from building to building.

It is recommended that in-situ testing be conducted before any full fit-out as the sub-base ceiling/floor system and the wall junctions could impact the noise transfer to the unit below.

This report should be reproduced in full including the attached Appendix.

Floor covering must not make contact with any walls or joineries (kitchen benches, cupboards etc). During the installation of any hard floor coverings, temporary spaces of 5~10mm should be used to isolated the floor covering from walls and/or joineries and the resulting gaps should be filled with a suitable mastic type sealant or off-cut of underlay or the equivalent where available. The acoustic integrity could be degraded if the above precautions and treatments are not implemented.

APPENDIX A

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FIELD MEASUREMENTS OF IMPACT SOUND INSULATION OF FLOORS

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Date of Test :	Wednesday, 28 April 2021
Project No. :	4444
Testing Company :	Koikas Acoustics
Checked by :	Nick Koikas
Place of Test:	Arncliffe, NSW
Client	Auswood International Pty Ltd
Client Address	-

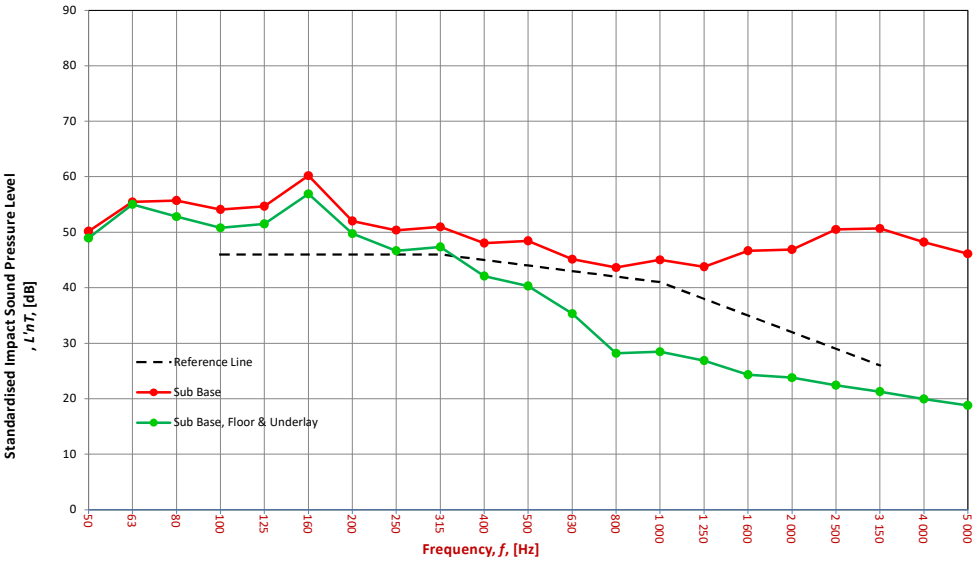
	Name	Thickness (mm	Density (Sl)
Description of Floor System	14 mm Timber Flooring	14	--
	Auswood 5mm Rubber underlay	5	--
	Concrete	180-200	--
	Suspended plasterboard ceiling	--	--

Room Floor Dimensions	Width :	7.3	m
	Length :	3.9	m
	Area :	28.5	m^2
Sample Dimensions	Width :	1	m
	Length :	1	m
	Area :	1	m^2

	Location	Width	Length	Area	Height	Volume
Receiver Rm	Dining/Living area	7.3	3.9	28.5	2.7	76.9

Room Surfaces		
Walls	Floor	Ceiling
Plasterboard	Carpet	Plasterboard

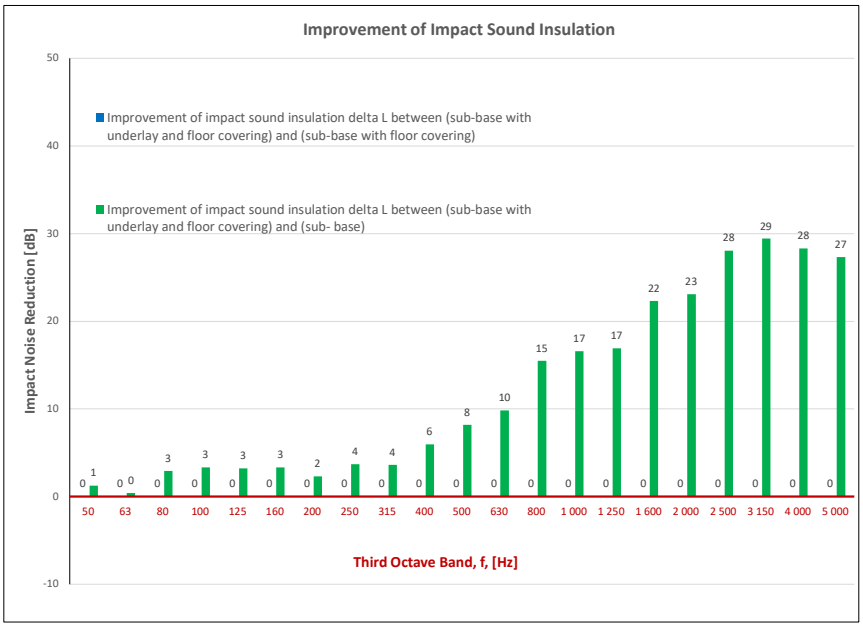
Frequency f Hz	L'nT (one-third octave) dB		
	Sub Base	Sub Base Floor	Sub Base Floor Underlay
50	50.2	N/A	48.9
63	55.4	N/A	55.0
80	55.7	N/A	52.8
100	54.1	N/A	50.8
125	54.7	N/A	51.5
160	60.2	N/A	56.9
200	52.0	N/A	49.7
250	50.4	N/A	46.7
315	51.0	N/A	47.4
400	48.0	N/A	42.1
500	48.5	N/A	40.3
630	45.1	N/A	35.3
800	43.7	N/A	28.2
1 000	45.0	N/A	28.5
1 250	43.8	N/A	26.9
1 600	46.7	N/A	24.3
2 000	46.9	N/A	23.8
2 500	50.5	N/A	22.4
3 150	50.7	N/A	21.3
4 000	48.2	N/A	19.9
5 000	46.1	N/A	18.8



Sub Base		
L'nT,w	55	AS ISO 717.2 - 2004
Ci	-6	AS ISO 717.2 - 2004
Ci(50-2500)	-5	AS ISO 717.2 - 2004
Ci(63-2000)	-5	AS ISO 717.2 - 2004
AAAC★	3 Star	AAAC Guidleline
FIIC	45	ASTM E1007-14

Sub Base & Floor		
L'nT,w	N/A	AS ISO 717.2 - 2004
Ci	N/A	AS ISO 717.2 - 2004
Ci(50-2500)	N/A	AS ISO 717.2 - 2004
Ci(63-2000)	N/A	AS ISO 717.2 - 2004
AAAC★	N/A	AAAC Guidleline
FIIC	N/A	ASTM E1007-14

Sub Base, Floor & Underlay		
L'nT,w	44	AS ISO 717.2 - 2004
Ci	1	AS ISO 717.2 - 2004
Ci(50-2500)	3	AS ISO 717.2 - 2004
Ci(63-2000)	3	AS ISO 717.2 - 2004
AAAC★	5 Star	AAAC Guidleline
FIIC	59	ASTM E1007-14



Definitions of Noise Metrics

FIIC:

Field Impact Insulation Class is a single-number rating of how well a floor system attenuates impact type sounds, such as footsteps. Calculated from third-octave band normalised impact sound pressure level data and referenced to 10 m² as described in ASTM E989. The higher the single-number rating, the better its impact insulation performance.

L'nT,w:

The Weighted Standardised Impact Sound Pressure Level when measured in situ referenced to a reverberation time (RT60) of 0.5 seconds. Used by the AAAC to determine their respective Star Rating.

Ci:

Spectrum adaption term is a low frequency correction factor. Typically for massive floors such as concrete, the values are about zero while for timber joist floors Ci is positive because of the low resonant frequencies. Considers frequency range between 100 -and 2500 Hz.

Ci(50-2500):

Same as above, but for the frequency range 50 -2500 Hz.

Ci(125-2000):

Same as above, but for the frequency range 125 -2000 Hz.

AAAC Star R.	2	3	4	5	6
L'nT,w	65	55	50	45	40
FIIC	45	55	60	65	70
Comments	Below BCA 62	Clearly Audible	Audible	Barely Inaudible	Normally Inaudible