Quantum
NEXTGEN FLOORING

manufactured by
Proline floors

LOOSE LAY VINYL PLANK

ACOUSTIC TEST REPORT

koikas acoustics PTY LTD
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DELIVERING SOUND ADVICE

ABN: 12 058 524 771

CERTIFICATE OF PERFORMANCE

IMPACT NOISE TESTING

QUANTUM VINYL PLANK

PROLINE FLOORS PTY LTD

Date: Wednesday, 20 November 2019

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QUANTUM VINYL PLANK

PROLINE FLOORS PTY LTD

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1.0 CONSULTANT'S BRIEF

Koikas Acoustics was requested by Proline Floors Pty Ltd to conduct impact noise tests of the **Quantum Vinyl Plank** in conjunction with 3 mm Regupol® 4515-S and 5 mm Regupol® K225 acoustic underlays.

The purpose of undertaking the impact noise testing was to quantify the acoustic performance of the floor covering in conjunction with selected underlays over the concrete sub-base with a suspended ceiling.

Test results were compared to the acoustic requirements of ***Part F5 of BCA (Building Codes of Australia)***, City of Sydney Council's DCP 2012 and the standards prescribed by the ***Association of Australian Acoustical Consultants (AAAC)***.

All measurements were carried out in accordance with 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 testing of the **Quantum Vinyl Plank** and underlays were conducted inside the unfurnished living/dining area of one residential unit (upper-floor level) to another unit (lower-floor level) directly below within a residential building in Kogarah NSW on Wednesday, 13th November 2019.

2.1 PARTITION SYSTEM AND TESTING SAMPLES

Koikas Acoustics has been advised that the existing ceiling/floor system of the subject assessment site in Kogarah NSW is constructed with the following:

- 200~220 mm thick reinforced concrete slab;
- Approximately 80~120 mm thick suspended ceiling cavity, and
- 13 mm thick plasterboard ceiling.

Hereafter the above concrete slab sub-base is referred to as the "***existing ceiling/floor system (ECFS)***".

The impact noise tests were conducted on the above described ECFS with the hybrid vinyl flooring and underlay samples:

- Test 00: Existing ceiling/floor (ECFS) (for comparison purpose only);
- Test 01: **Quantum Vinyl Plank**
- Test 02: **Quantum Vinyl Plank** + 3 mm Regupol® 4515-S acoustic underlay
- Test 03: **Quantum Vinyl Plank** + 5 mm Regupol® K225 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 with spectrum adaptation term (L_{nTw}) not more than 62 when determine under AS/ISO 717.2*

2.2.2 City of Sydney Council's DCP 2012

The impact isolation requirement of the floor system stated *in Part 10 of Section 4.2.3.11 Acoustic Privacy of City of Sydney DCP 2012* is as follow.

(10) To limit the transmission of noise to and between dwellings, all floors are to have a weighted standardised impact sound level ($L'_{nT,w}$) less than or equal to 55 where the floor separates a habitable room and another habitable room, bathroom, toilet, laundry, kitchen, plant room, stairway, public corridor, hallway and the like.

2.2.3 AAAC Star Rating Performance Requirements

Reproduced from the Association of Australian Acoustical Consultants (AAAC) Guideline for Apartment and Townhouse Acoustic Ratings, the following Table (Section C) describes the impact noise ratings with reference to 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 BSWA Technology Co. Type TM002 S/N 440504 Tapping Machine was used to generate the sound field in the source rooms for the impact noise test. Impact noise measurements were carried out in accordance with 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 so as 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 relevant 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 impact noise transmission measurements to reference reverberation time of 0.5 seconds as required by AS/NZS ISO 140.7:2006 Section 3.4, and AS ISO 140.4-2006 Section 3.4.

Reverberation time measurements were conducted using the balloon source method. This consisted of bursting a large balloon and measuring the decay of sound pressure level using a spectrum analyser. 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 to measure the impact noise levels. 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			
System Tested	**L'_{nTw}[3]**	**AAAC[6] Star Rating**	**FIIC[4,5]**
Test 00: Existing ceiling/floor system[1] (ECFS) (bare concrete slab with suspended ceiling and without any floor covering), for comparison purpose only	64	2	35
Test 01[2]: **Quantum Vinyl Plank** + ECFS[1]	57	2	46
Test 02[2]: **Quantum Vinyl Plank** + 3 mm Regupol® 4515-S acoustic underlay + ECFS[1]	44	5	62
Test 03[2]: **Quantum Vinyl Plank** + 5 mm Regupol® K225 acoustic underlay + ECFS[1]	44	5	62

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. The existing ceiling/floor system (ECFS) (without any floor covering and underlay) consists of 200~220 mm thick concrete sub-base with approximately 80~120 mm suspended ceiling cavity and one layer of 13 mm thick plasterboard ceiling.

2. All hard flooring covering systems tested (Test 01 to 03) in conjunction with the existing ceiling/floor (ECFS) system have met the BCA 2019 criterion ($L'_{nTw} \leq 62$). Test 02 & 03 have achieved the City of Sydney Council's DCP 2012 requirement ($L'_{nTw} \leq 55$) and AAAC Star rating of 5 for impact noise insulation.

3. The lower the rating number the better the acoustic performance for L_{nTw} ratings.

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 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 purpose 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.

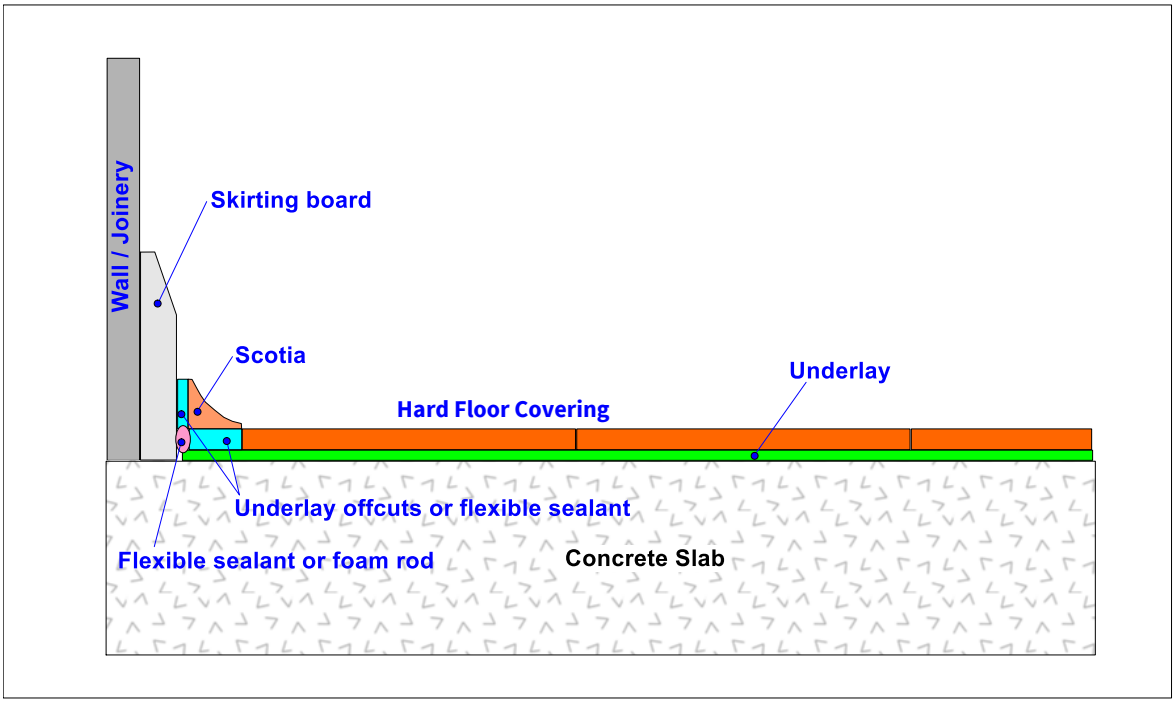

Figure 1. Wall / Joinery details (skirting board & scotia)

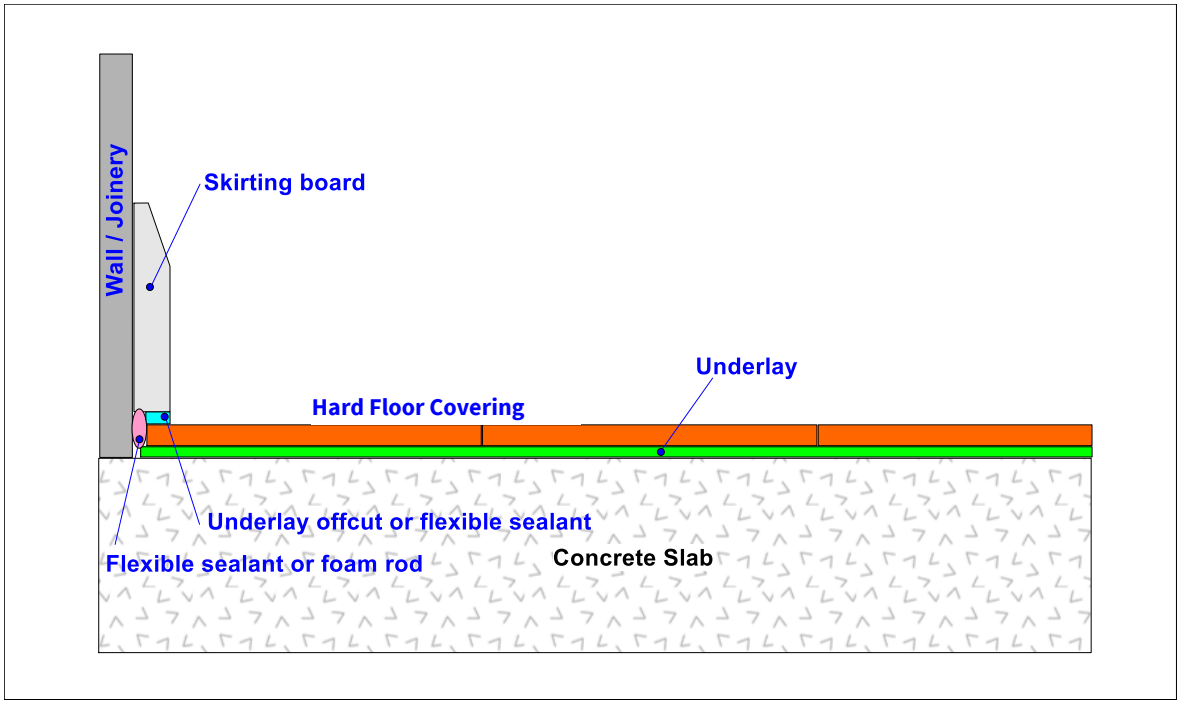

Figure 2. Wall / Joinery details (skirting board)

3.0 CONCLUSION

Koikas Acoustics was requested by Proline Floors Pty Ltd to undertake impact noise testing of **Quantum Vinyl Plank** in conjunction with the selected acoustic underlays. The acoustic performances of the **Quantum Vinyl Plank** with acoustic underlays over the ECFS (with concrete slab and suspended ceiling) were calculated and compared against the acoustical requirements of the current BCA, City of Sydney Council's DCP 2012 and AAAC Star Ratings.

The calculated acoustic ratings of the tested flooring systems were summarised and presented in **Table 2** of this report. Detailed graphically presentation of the acoustical performance of the tested flooring is attached as **Appendix A**.

The acoustic ratings provided in this report are indicative and for a comparative purpose 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 prior to 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

APPENDIX A

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FIELD MEASUREMENTS OF IMPACT SOUND INSULATION OF FLOORS (TEST 01)

KOIKAS ACOUSTICS PTY LTD

Date of Test :	Wednesday, 13 November 2019
Project No. :	3303
Testing Company :	Koikas Acoustics
Checked by :	Nick Koikas
Place of Test:	Residential apartment in Kogarah NSW
Client	Proline Floors Pty Ltd
Client Address	-

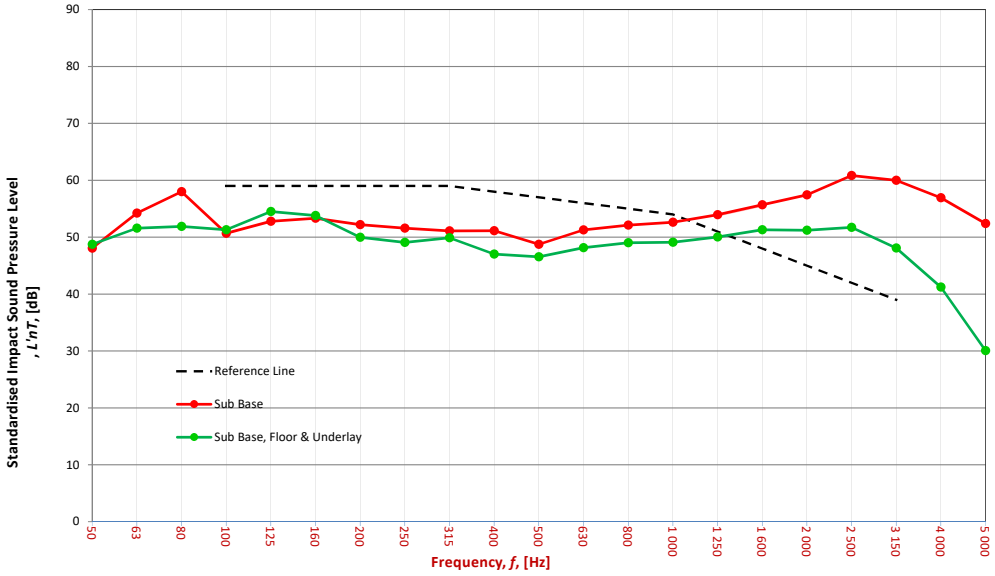
	Name	Thickness (mm)	Density (Sl)
Description of Floor System	Quantum Vinyl Plank	--	--
	--	--	--
	200~220 mm reinforced concrete slab	200~220	2540
	80~120 mm suspended ceiling caivty + 13 mm plasterboard ceiling	80~120 + 13	--

Room Floor Dimensions	Width :	7	m
	Length :	4.5	m
	Area :	31.5	m^2
Sample Dimensions	Width :	1	m
	Length :	1	m
	Area :	1	m^2

	Location	Width	Length	Area	Height	Volume
Receiver Rm	Level 1, living/dining/kitchen area	7	4.5	31.5	2.7	85.05

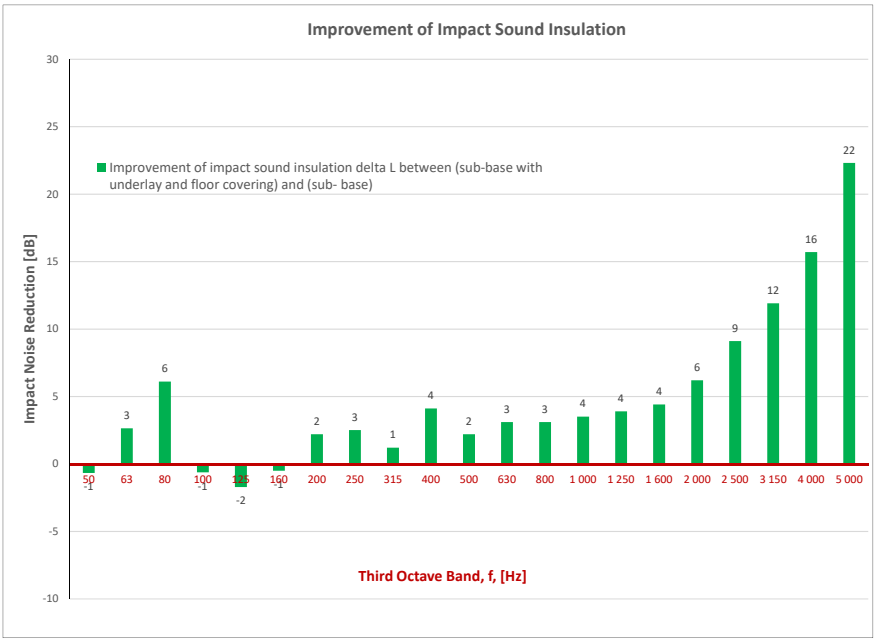
Room Surfaces		
Walls	Floor	Ceiling
Plasterboard	Concrete	Plasterboard

Frequency f Hz	L'nT (one-third octave) dB		
	Sub Base	Sub Base Floor	Sub Base Floor Underlay
50	48.1	48.7	48.7
63	54.2	51.6	51.6
80	58.0	51.9	51.9
100	50.7	51.3	51.3
125	52.8	54.5	54.5
160	53.3	53.8	53.8
200	52.2	50.0	50.0
250	51.6	49.1	49.1
315	51.1	49.9	49.9
400	51.1	47.0	47.0
500	48.8	46.5	46.5
630	51.3	48.2	48.2
800	52.1	49.0	49.0
1 000	52.6	49.1	49.1
1 250	53.9	50.0	50.0
1 600	55.7	51.3	51.3
2 000	57.4	51.2	51.2
2 500	60.8	51.7	51.7
3 150	60.0	48.1	48.1
4 000	56.9	41.2	41.2
5 000	52.4	30.1	30.1



Sub Base		
L'nT,w	64	AS ISO 717.2 - 2004
Ci	-13	AS ISO 717.2 - 2004
Ci(50-2500)	-12	AS ISO 717.2 - 2004
Ci(63-2000)	-13	AS ISO 717.2 - 2004
AAAC★	2 Star	AAAC Guidleline
FIIC	35	ASTM E1007-14

Sub Base & Floor		
L'nT,w	57	AS ISO 717.2 - 2004
Ci	-10	AS ISO 717.2 - 2004
Ci(50-2500)	-9	AS ISO 717.2 - 2004
Ci(63-2000)	-9	AS ISO 717.2 - 2004
AAAC★	2 Star	AAAC Guidleline
FIIC	46	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 m^2 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

FIELD MEASUREMENTS OF IMPACT SOUND INSULATION OF FLOORS (TEST 02)

KOIKAS ACOUSTICS PTY LTD

Date of Test :	Wednesday, 13 November 2019
Project No. :	3303
Testing Company :	Koikas Acoustics
Checked by :	Nick Koikas
Place of Test:	Residential apartment in Kogarah NSW
Client	Proline Floors Pty Ltd
Client Address	-

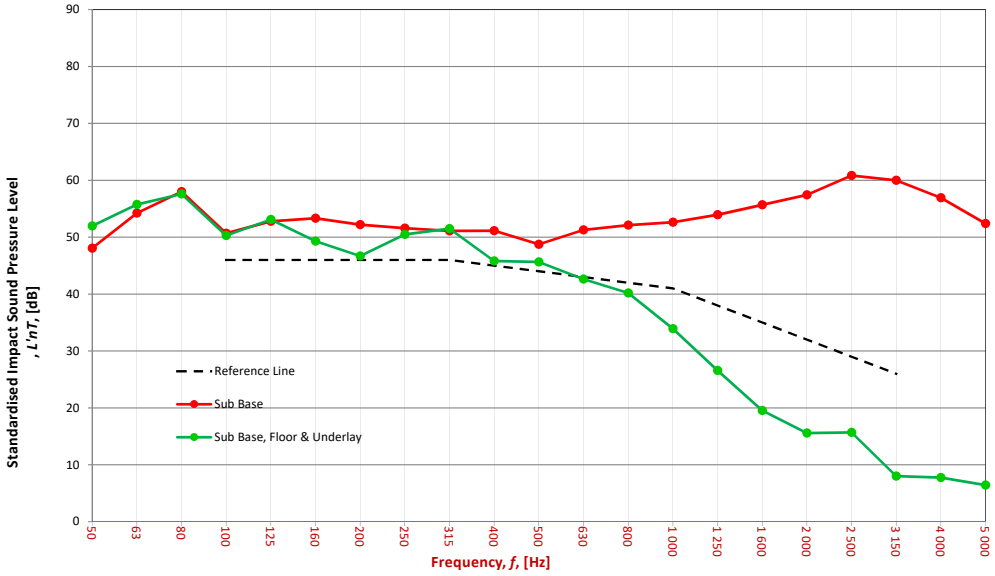
	Name	Thickness (mm)	Density (Sl)
Description	Quantum Vinyl Plank	--	--
of	3 mm Regupol® 4515-S	3	--
Floor	200~220 mm reinforced concrete slab	200~220	2540
System	80~120 mm suspended ceiling caivty + 13 mm plasterboard ceiling	80~120 + 13	--

Room Floor Dimensions	Width :	7	m
	Length :	4.5	m
	Area :	31.5	m^2
Sample Dimensions	Width :	1	m
	Length :	1	m
	Area :	1	m^2

	Location	Width	Length	Area	Height	Volume
Receiver Rm	Level 1, living/dining/kitchen area	7	4.5	31.5	2.7	85.05

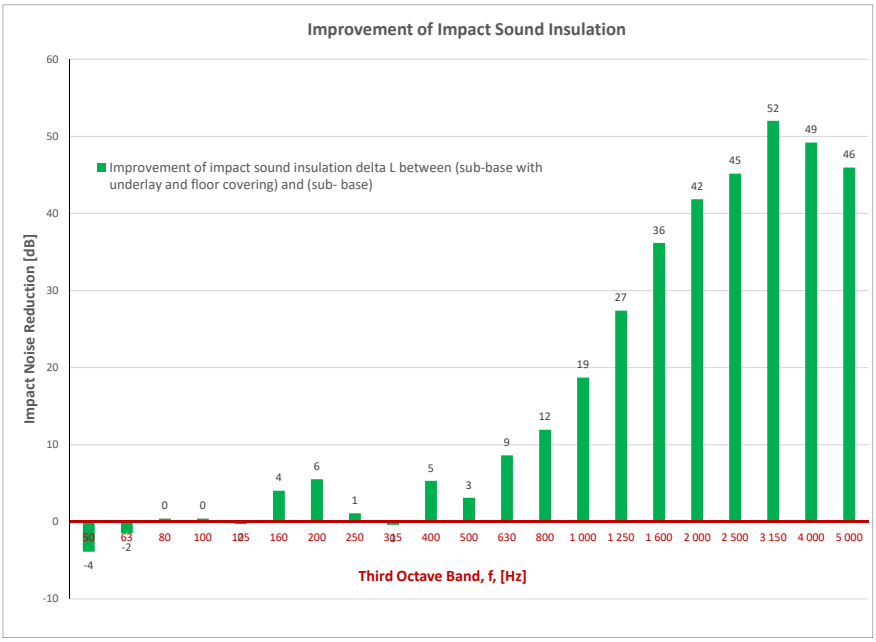
Room Surfaces		
Walls	Floor	Ceiling
Plasterboard	Concrete	Plasterboard

Frequency f Hz	L'nT (one-third octave) dB		
	Sub Base	Sub Base Floor	Sub Base Floor Underlay
50	48.1	48.7	52.0
63	54.2	51.6	55.7
80	58.0	51.9	57.6
100	50.7	51.3	50.3
125	52.8	54.5	53.1
160	53.3	53.8	49.3
200	52.2	50.0	46.7
250	51.6	49.1	50.5
315	51.1	49.9	51.5
400	51.1	47.0	45.8
500	48.8	46.5	45.6
630	51.3	48.2	42.6
800	52.1	49.0	40.2
1 000	52.6	49.1	33.9
1 250	53.9	50.0	26.6
1 600	55.7	51.3	19.5
2 000	57.4	51.2	15.6
2 500	60.8	51.7	15.7
3 150	60.0	48.1	8.0
4 000	56.9	41.2	7.8
5 000	52.4	30.1	6.4



Sub Base		
L'nT,w	64	AS ISO 717.2 - 2004
Ci	-13	AS ISO 717.2 - 2004
Ci(50-2500)	-12	AS ISO 717.2 - 2004
Ci(63-2000)	-13	AS ISO 717.2 - 2004
AAAC★	2 Star	AAAC Guidleline
FIIC	35	ASTM E1007-14

Sub Base, Floor & Underlay		
L'nT,w	44	AS ISO 717.2 - 2004
Ci	0	AS ISO 717.2 - 2004
Ci(50-2500)	4	AS ISO 717.2 - 2004
Ci(63-2000)	3	AS ISO 717.2 - 2004
AAAC★	5 Star	AAAC Guidleline
FIIC	62	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 m^2 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

FIELD MEASUREMENTS OF IMPACT SOUND INSULATION OF FLOORS (TEST 03)

KOIKAS ACOUSTICS PTY LTD

Date of Test :	Wednesday, 13 November 2019
Project No. :	3303
Testing Company :	Koikas Acoustics
Checked by :	Nick Koikas
Place of Test:	Residential apartment in Kogarah NSW
Client	Proline Floors Pty Ltd
Client Address	-

	Name	Thickness (mm)	Density (Sl)
Description	Quantum Vinyl Plank	--	--
of	5 mm Regupol® K225	5	--
Floor	200~220 mm reinforced concrete slab	200~220	2540
System	80~120 mm suspended ceiling caivty + 13 mm plasterboard ceiling	80~120 + 13	--

Room Floor Dimensions	Width :	7	m
	Length :	4.5	m
	Area :	31.5	m^2
Sample Dimensions	Width :	1	m
	Length :	1	m
	Area :	1	m^2

	Location	Width	Length	Area	Height	Volume
Receiver Rm	Level 1, living/dining/kitchen area	7	4.5	31.5	2.7	85.05

Room Surfaces		
Walls	Floor	Ceiling
Plasterboard	Concrete	Plasterboard

Frequency f Hz	L'nT (one-third octave) dB		
	Sub Base	Sub Base Floor	Sub Base Floor Underlay
50	48.1	48.7	49.7
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100	50.7	51.3	50.0
125	52.8	54.5	53.4
160	53.3	53.8	50.3
200	52.2	50.0	48.1
250	51.6	49.1	49.9
315	51.1	49.9	51.3
400	51.1	47.0	44.9
500	48.8	46.5	43.8
630	51.3	48.2	41.0
800	52.1	49.0	36.3
1 000	52.6	49.1	28.9
1 250	53.9	50.0	18.6
1 600	55.7	51.3	14.6
2 000	57.4	51.2	12.5
2 500	60.8	51.7	12.4
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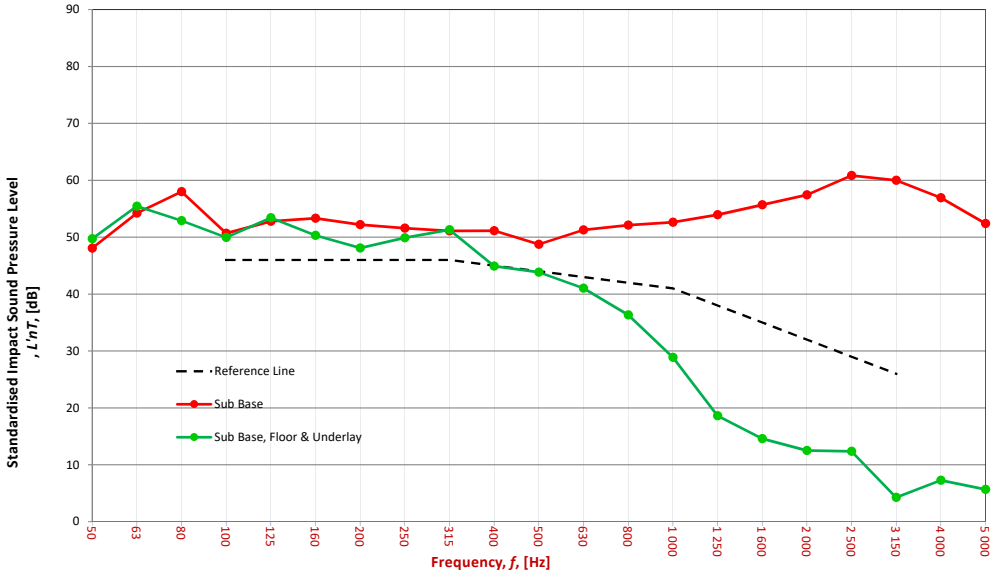
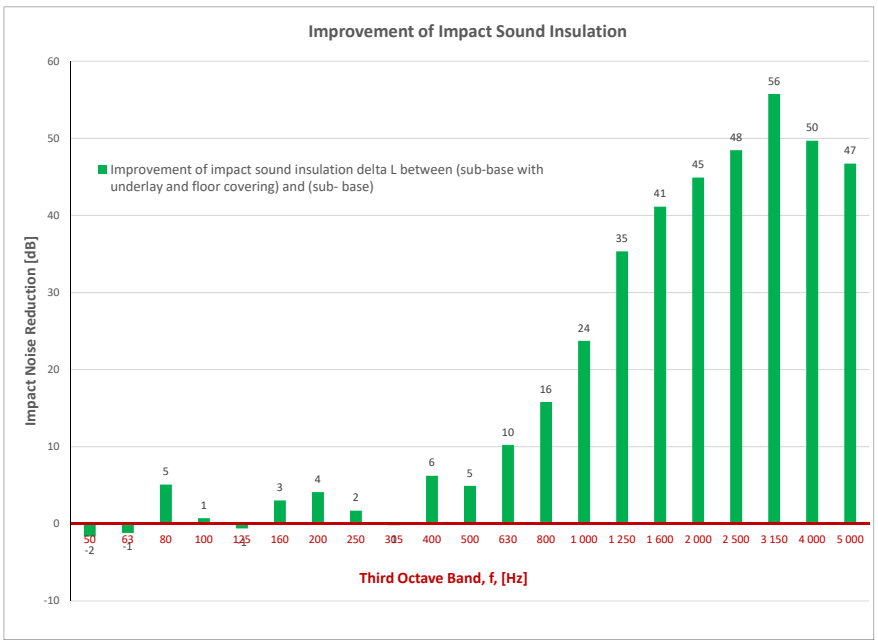
5 000	52.4	30.1	5.7



Sub Base		
L'nT,w	64	AS ISO 717.2 - 2004
Ci	-13	AS ISO 717.2 - 2004
Ci(50-2500)	-12	AS ISO 717.2 - 2004
Ci(63-2000)	-13	AS ISO 717.2 - 2004
AAAC★	2 Star	AAAC Guidleline
FIIC	35	ASTM E1007-14

Sub Base, Floor & Underlay		
L'nT,w	44	AS ISO 717.2 - 2004
Ci	0	AS ISO 717.2 - 2004
Ci(50-2500)	3	AS ISO 717.2 - 2004
Ci(63-2000)	2	AS ISO 717.2 - 2004
AAAC★	5 Star	AAAC Guidleline
FIIC	62	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 m^2 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.

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