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CERTIFICATE OF PERFORMANCE

IMPACT NOISE TESTING

GERFLOR AUSTRALIA PTY LTD

SAGA2 CONNECT FLOORING

CREATION 55 (LOOSE-LAY) FLOORING

CREATION 55 ACOUSTIC (LOOSE-LAY) FLOORING

VIRTUO PREMIUM AND CREATION PREMIUM FLOORING

Date: Thursday, 30 July 2020

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Impact Noise Testing
Gerflor Australia Pty Ltd
Saga² Connect Flooring
Creation 55 (Loose-lay) Flooring
Creation 55 Acoustic (Loose-lay) Flooring
Virtuo Premium and Creation Premium Flooring

Project Number 3739

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Approved by James Tsevremetzi, MAAS
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The information contained herein should not be reproduced except in full. The information provided in this report relates to acoustic matters only. Supplementary advice should be sought for other matters relating to construction, design, structural, fire-rating, water proofing, and the likes.



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1.0 CONSULTANT'S BRIEF

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

- Saga² Connect Flooring;
- Creation 55 (Loose-lay) Flooring;
- Creation 55 Acoustic (Loose-lay) Flooring, and
- Virtuo Premium and Creation Premium Flooring.

A total of four (4) tests were conducted which included the base ceiling/floor system and the selected floor coverings.

The purpose of undertaking these impact noise tests was to quantify the acoustic performance of the flooring systems with selected 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)*, the standards prescribed by the *Association of Australian Acoustical Consultants (AAAC)* and City of Sydney Council's DCP 2012 requirements.

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 as per *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 apartment building in Sydney, NSW.

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 180-200 mm thick concrete slab;
- 80~120 mm 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: Saga² Connect Flooring;
- Test 02: Creation 55 (Loose-lay) Flooring;
- Test 03: Creation 55 Acoustic (Loose-lay) Flooring, and
- Test 04: Virtuo Premium and Creation Premium Flooring.



3.0 IMPACT NOISE CRITERIA

3.1 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_{nTw}) not more than 62 when determine under AS/ISO 717.2

3.2 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 acoustic 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
(a) Airborne sound insulation for walls and floors					
- Between separate tenancies $D_{nTw} + C_{tr} \geq$	35	40	45	50	55
- Between a lobby/corridor & bedroom $D_{nTw} + C_{tr} \geq$	30	40	40	45	50
- Between a lobby/corridor & living area $D_{nTw} + C_{tr} \geq$	25	40	40	40	45
(b) Corridor, foyer to living space via door(s) $D_{nTw} \geq$	20	25	30	35	40
(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
(d) Impact isolation of walls					
- Between tenancies	No	Yes	Yes	Yes	Yes
- Between common areas & tenancies	No	No	No	Yes	Yes

3.3 CITY OF SYDNEY DCP 2012

Furthermore, 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 also considered.

(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.*



4.0 IMPACT NOISE TESTING

The testing of the ceiling/floor system with the selected floorings were conducted inside the unfurnished living/dining area from one residential unit (upper floor level) to another unit (lower floor level) directly below within a residential building in Sydney NSW on Monday, 27th July 2020.

4.1 ASSESSMENT PROCEDURES

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 as 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 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)*.

4.2 AMBIENT BACKGROUND NOISE MEASUREMENT

A measure of the underlying ambient noise was taken in the receiving rooms to account for the perceived noise floor 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.



4.3 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 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.

4.4 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.



5.0 MEASURED RESULTS

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

Table 2. Impact Noise Insulation Performance Summary for Ceiling/Floor System			
System Tested^{1,2}	L'_{nTW}³	Equivalent AAAC⁴ Star Rating	FIIC^{5,6}
Test 00: Bare concrete floor (ECFS only)	57	2	42
Test 01: Saga ² Connect Flooring	51	3	51
Test 02: Creation 55 (Loose-lay) Flooring	48	4	57
Test 03: Creation 55 Acoustic (Loose-lay) Flooring	41	5	63
Test 04: Virtuo Premium and Creation Premium Flooring	50	4	54

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 (**ECFS**) consisting of approximately 180-200 mm thick concrete sub-base with the inclusion of 80~100 mm suspended ceiling cavity and one layer of 13 mm thick plasterboard ceiling.
2. All the ceiling/floor system tested (Test 01 to Test 04) have met both the BCA 2019 criterion ($L'_{nTW} \leq 62$) and City of Sydney DCP 2012 requirement ($L'_{nTW} \leq 55$) for impact noise insulation.
3. The lower the rating number the better the acoustic performance for L_{nTW} ratings.
4. The higher the AAAC Star Rating the better the impact insulation.
5. The relation between Field Impact Isolation Class (FIIC) and Impact Isolation Class (IIC) can be described by the formula $FIIC + 5 \approx IIC$.
6. The higher the IIC and FIIC 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, water-proofing, 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 buildings to buildings 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. Acoustic ratings could be degraded if the above precautions and treatments are not implemented. Refer to Figure 1 & 2 below for illustration.



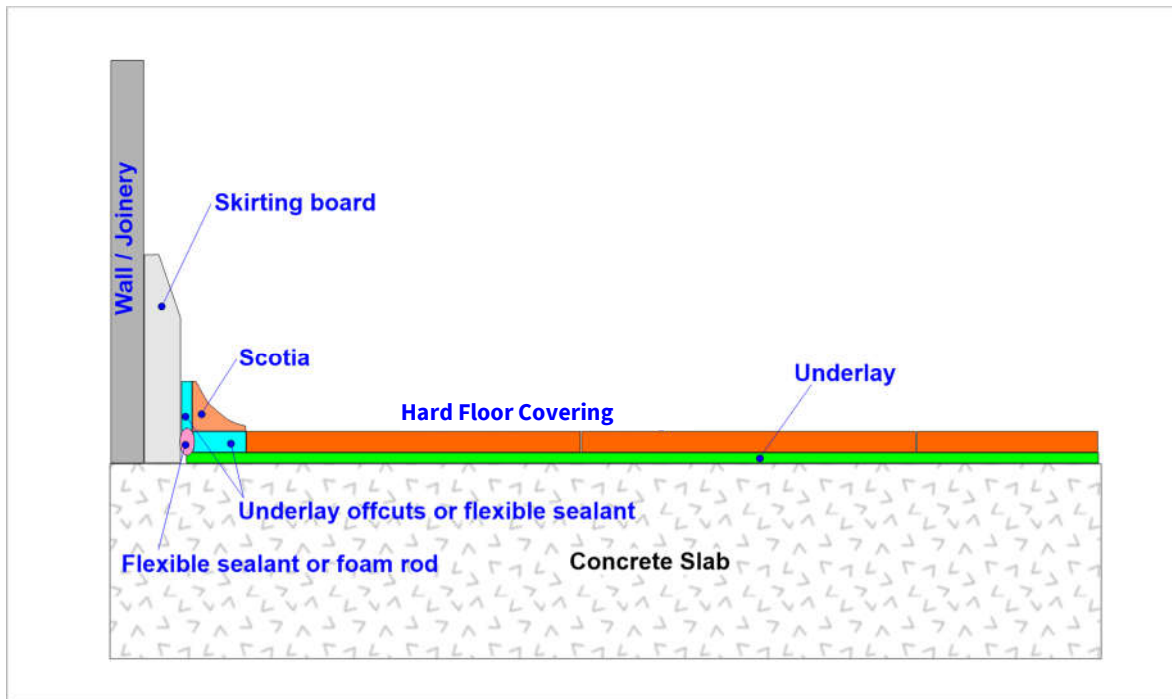


Figure 1. Wall / Joinery details (skirting board & scotia)

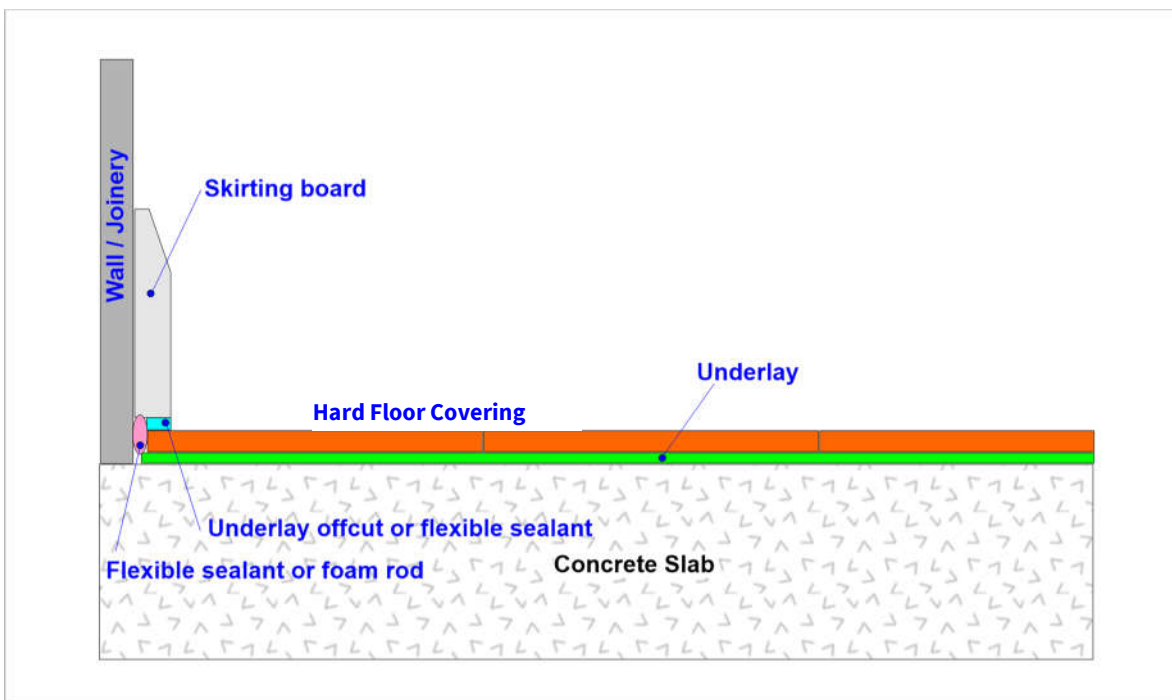


Figure 2. Wall / Joinery details (skirting board)

6.0 CONCLUSION

Koikas Acoustics was requested by Gerflor Australia Pty Ltd to undertake impact noise tests of ceiling/floor system for the selected floor coverings. The acoustic performances of various ceiling/floor configurations were calculated and compared against the acoustic requirements of the current BCA, AAAC Star Ratings and City of Sydney Council's DCP 2012 requirement that is commonly used in Australia.

The calculated acoustic rating of each tested flooring sample was summarized and presented in **Table 2** of this report. Detailed graphically presentation of the acoustic performance of each tested flooring sample is attached 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 can vary from buildings to buildings.

It is recommended that testing be conducted before any full fit-out as the sub-base ceiling floor system and the wall junctions can impact upon the resultant flanking noise in the unit below.

The above report should be reproduced in full including the attached Appendices.

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. Acoustic ratings could be degraded if the above precautions and treatments are not implemented.



APPENDIX A

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APPENDIX A

FIELD MEASUREMENTS OF IMPACT SOUND INSULATION OF FLOORS

Date of Test : Monday, 27 July 2020
Project No. : 3739
Testing Company : Koikas Acoustics
Checked by : Nick Koikas
Place of Test : Residential apartment in Sydney
Client : Gerflor
Client Address : -

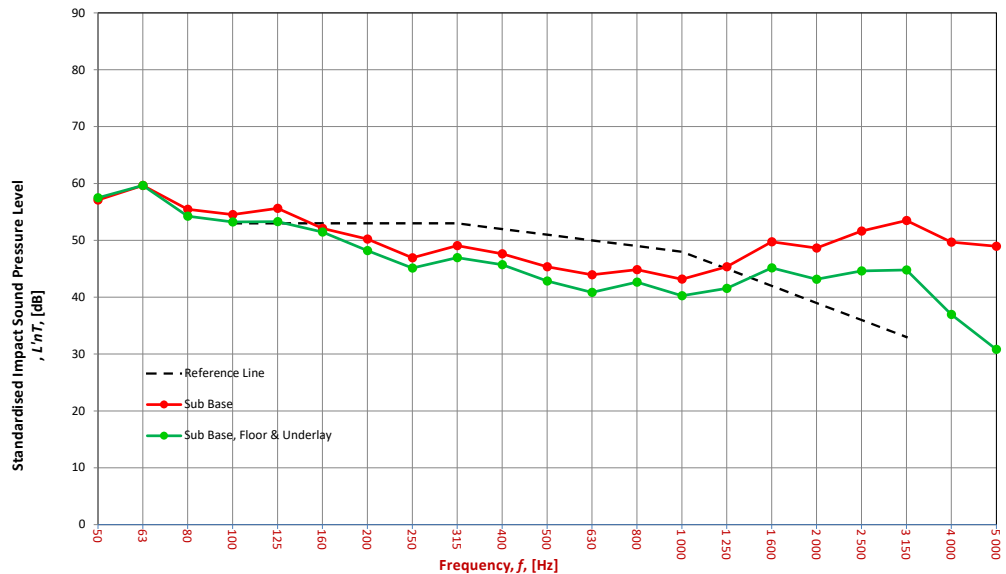
Description of Floor System	Name	Thickness (mm)	Density (SI)
	Saga2 Connect	--	--
	Concrete	180-200	--
	Suspended plasterboard ceiling	80-100	--

Room Floor Dimensions
Width : 6.7 m
Length : 4.1 m
Area : 27.5 m²

Sample Dimensions
Width : 1 m
Length : 1 m
Area : 1 m²

Receiver Rm	Location	Width	Length	Area	Height	Volume	Room Surfaces		
							Walls	Floor	Ceiling
Dining/Living area		6.7	4.1	27.5	2.7	74.2	Plasterboard	Carpet	Plasterboard

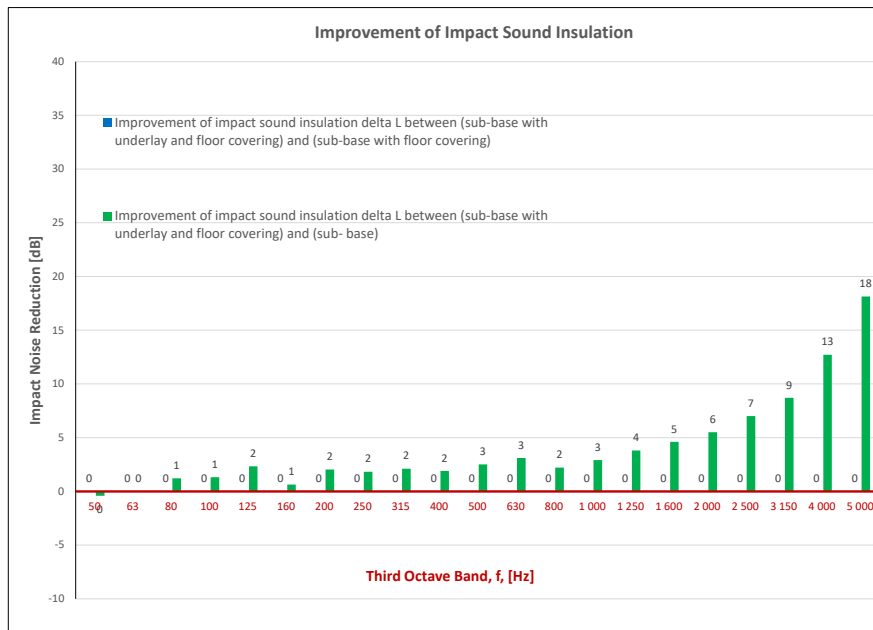
Frequency f Hz	L'nT (one-third octave) dB		
	Sub Base	Sub Base Floor	Sub Base Floor Underlay
50	57.1	N/A	57.5
63	59.7	N/A	59.7
80	55.4	N/A	54.2
100	54.5	N/A	53.2
125	55.6	N/A	53.3
160	52.1	N/A	51.5
200	50.2	N/A	48.2
250	46.9	N/A	45.1
315	49.1	N/A	47.0
400	47.6	N/A	45.7
500	45.3	N/A	42.8
630	44.0	N/A	40.8
800	44.9	N/A	42.6
1000	43.2	N/A	40.3
1250	45.4	N/A	41.6
1600	49.8	N/A	45.2
2000	48.7	N/A	43.1
2500	51.6	N/A	44.6
3150	53.5	N/A	44.8
4000	49.7	N/A	37.0
5000	48.9	N/A	30.8



Sub Base		
L'nT,w	57	AS ISO 717.2 - 2004
Ci	-10	AS ISO 717.2 - 2004
Ci(50-2500)	-7	AS ISO 717.2 - 2004
Ci(63-2000)	-8	AS ISO 717.2 - 2004
AAAC★	2 Star	AAAC Guideline
FIC	42	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 Guideline
FIC	N/A	ASTM E1007-14

Sub Base, Floor & Underlay		
L'nT,w	51	AS ISO 717.2 - 2004
Ci	-6	AS ISO 717.2 - 2004
Ci(50-2500)	-2	AS ISO 717.2 - 2004
Ci(63-2000)	-3	AS ISO 717.2 - 2004
AAAC★	3 Star	AAAC Guideline
FIC	51	ASTM E1007-14



Definitions of Noise Metrics

FIC:
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
FIC	45	55	60	65	70
Comments	Below BCA 62	Clearly Audible	Audible	Barely Inaudible	Normally Inaudible

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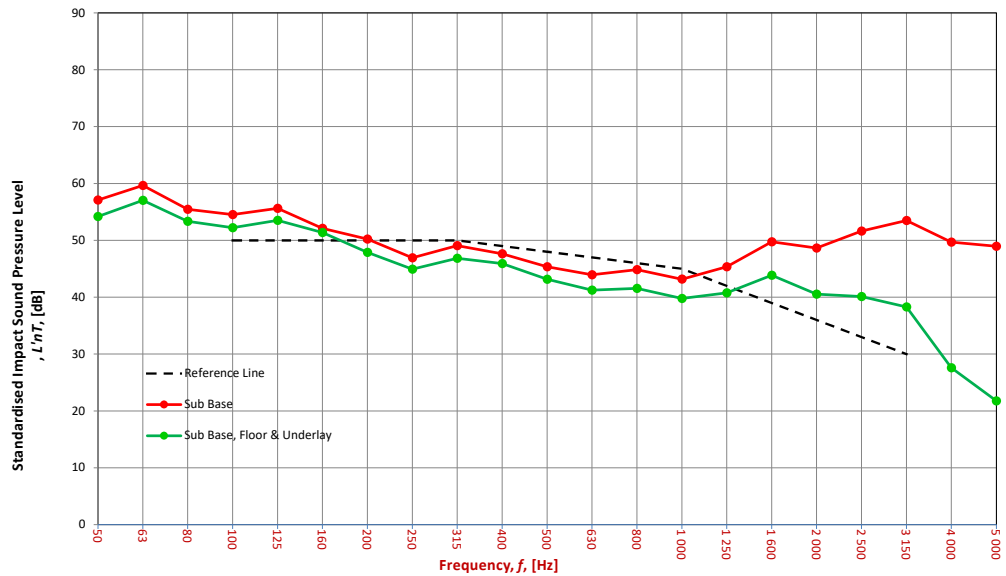
Description of Floor System	Name	Thickness (mm)	Density (SI)
	Creation 55 (Looselay)	--	--
	Concrete	180-200	--
	Suspended plasterboard ceiling	80-100	--

Room Floor Dimensions
Width : 6.7 m
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Area : 27.5 m²

Sample Dimensions
Width : 1 m
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Receiver Rm	Location	Width	Length	Area	Height	Volume	Room Surfaces		
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Dining/Living area		6.7	4.1	27.5	2.7	74.2	Plasterboard	Carpet	Plasterboard

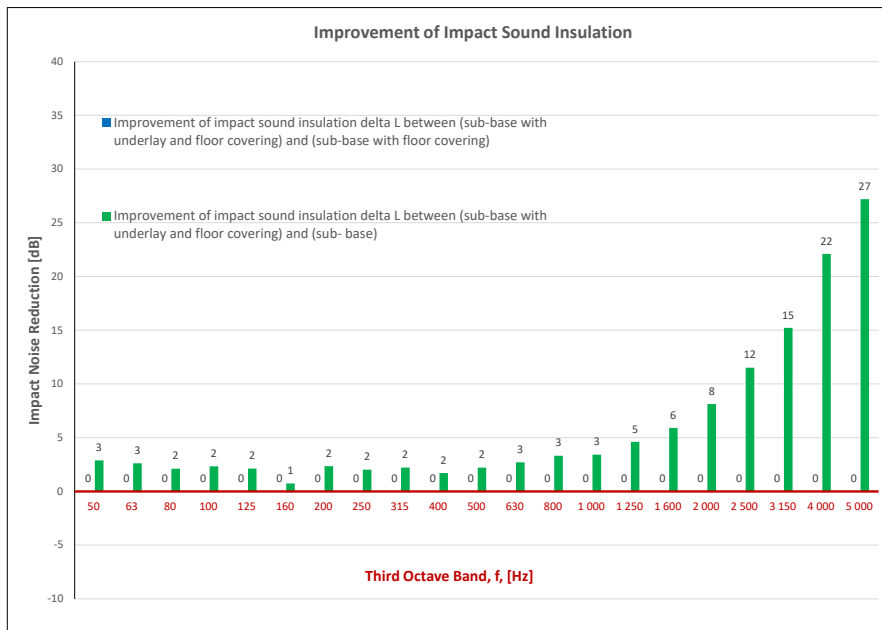
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Sub Base		
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Ci(63-2000)	N/A	AS ISO 717.2 - 2004
AAAC★	N/A	AAAC Guideline
FIC	N/A	ASTM E1007-14

Sub Base, Floor & Underlay		
L'nT,w	48	AS ISO 717.2 - 2004
Ci	-4	AS ISO 717.2 - 2004
Ci(50-2500)	0	AS ISO 717.2 - 2004
Ci(63-2000)	-1	AS ISO 717.2 - 2004
AAAC★	4 Star	AAAC Guideline
FIC	57	ASTM E1007-14



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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.

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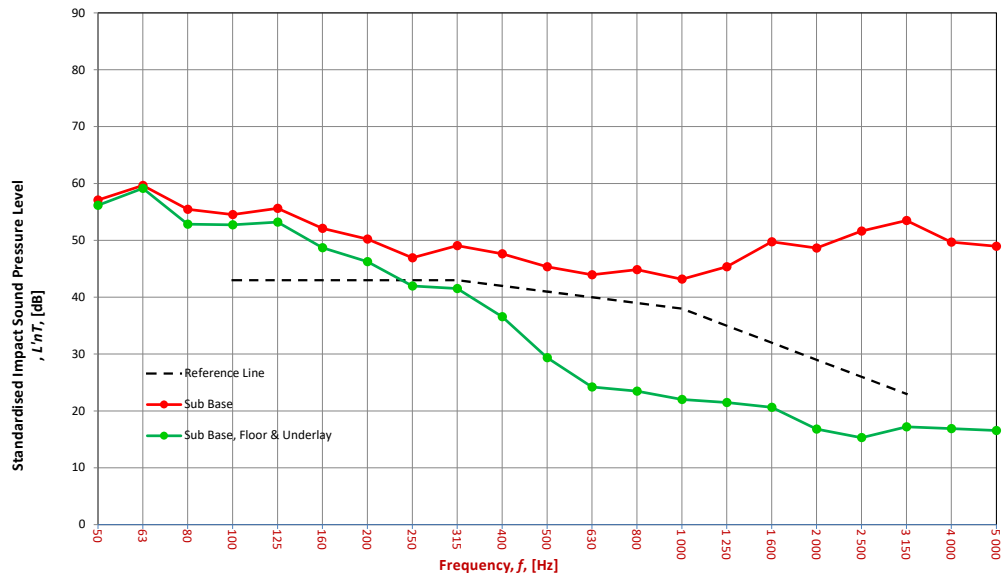
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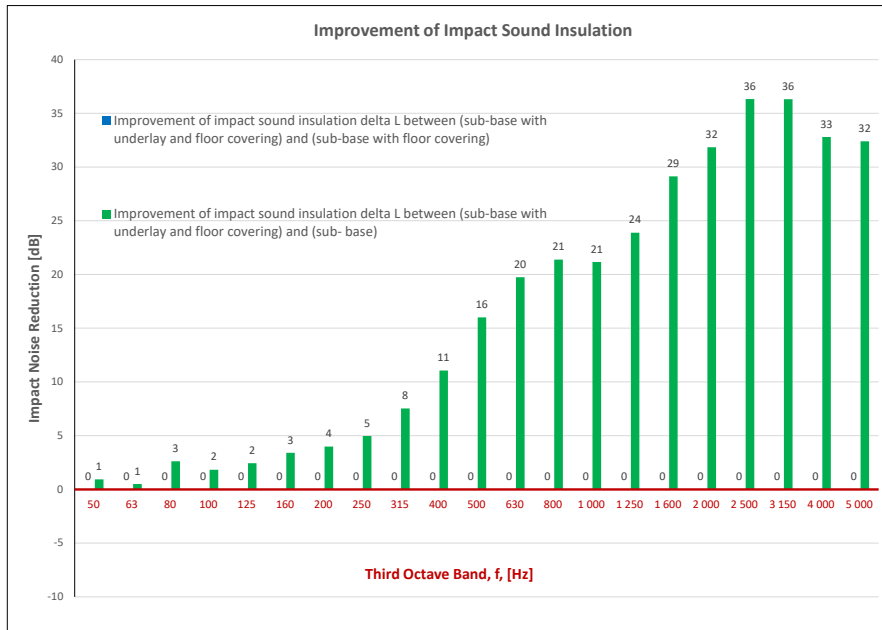
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1000	43.2	N/A	22.0
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2000	48.7	N/A	16.8
2500	51.6	N/A	15.3
3150	53.5	N/A	17.2
4000	49.7	N/A	16.9
5000	48.9	N/A	16.6



Sub Base	
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Ci(50-2500)	-7
Ci(63-2000)	-8
AAAC★	2 Star
FIC	42

Sub Base & Floor	
L'nT,w	N/A
Ci	N/A
Ci(50-2500)	N/A
Ci(63-2000)	N/A
AAAC★	N/A
FIC	N/A

Sub Base, Floor & Underlay	
L'nT,w	41
Ci	1
Ci(50-2500)	7
Ci(63-2000)	6
AAAC★	5 Star
FIC	63



Definitions of Noise Metrics

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Date of Test : Monday, 27 July 2020
 Project No. : 3739
 Testing Company : Koikas Acoustics
 Checked by : Nick Koikas
 Place of Test : Residential apartment in Sydney
 Client : Gerflor
 Client Address : -

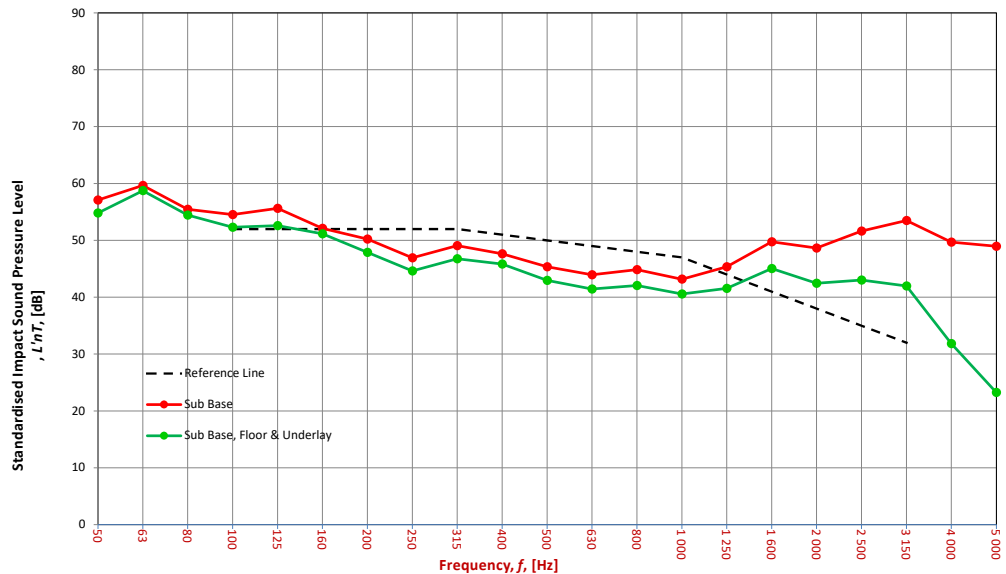
Description of Floor System	Name	Thickness (mm)	Density (SI)
Virtuo Premium and Creation Premium Concrete Floor System	Virtuo Premium and Creation Premium Concrete	--	--
		180-200	--
	Suspended plasterboard ceiling	80-100	--

Room Dimensions
 Width : 6.7 m
 Length : 4.1 m
 Area : 27.5 m²

Sample Dimensions
 Width : 1 m
 Length : 1 m
 Area : 1 m²

Receiver Rm	Location	Width	Length	Area	Height	Volume	Room Surfaces		
							Walls	Floor	Ceiling
Dining/Living area		6.7	4.1	27.5	2.7	74.2	Plasterboard	Carpet	Plasterboard

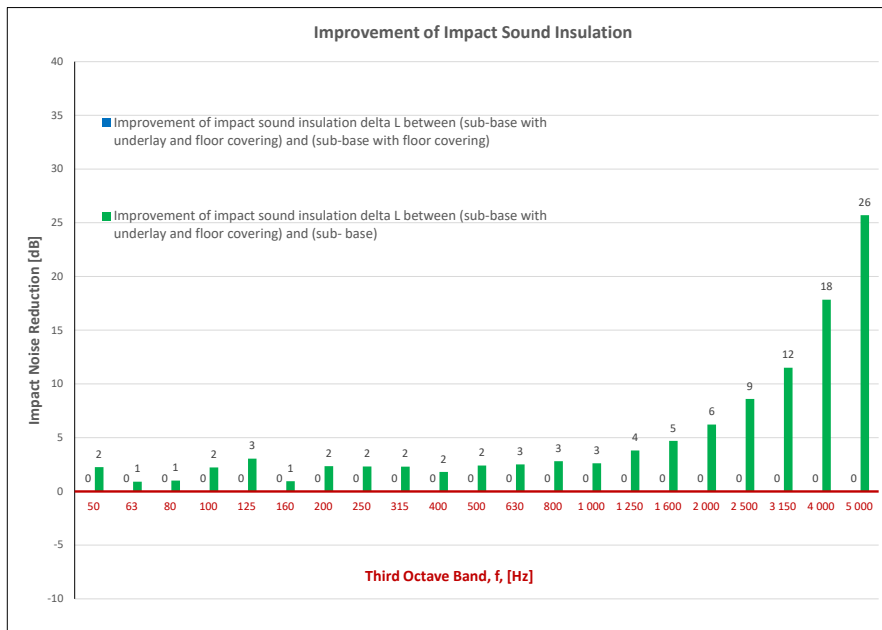
Frequency f Hz	L'nT (one-third octave) dB		
	Sub Base	Sub Base Floor	Sub Base Floor Underlay
50	57.1	N/A	54.8
63	59.7	N/A	58.7
80	55.4	N/A	54.4
100	54.5	N/A	52.3
125	55.6	N/A	52.6
160	52.1	N/A	51.2
200	50.2	N/A	47.9
250	46.9	N/A	44.6
315	49.1	N/A	46.8
400	47.6	N/A	45.8
500	45.3	N/A	42.9
630	44.0	N/A	41.4
800	44.9	N/A	42.0
1000	43.2	N/A	40.6
1250	45.4	N/A	41.6
1600	49.8	N/A	45.1
2000	48.7	N/A	42.4
2500	51.6	N/A	43.0
3150	53.5	N/A	42.0
4000	49.7	N/A	31.8
5000	48.9	N/A	23.2



Sub Base		
L'nT,w	57	AS ISO 717.2 - 2004
Ci	-10	AS ISO 717.2 - 2004
Ci(50-2500)	-7	AS ISO 717.2 - 2004
Ci(63-2000)	-8	AS ISO 717.2 - 2004
AAAC★	2 Star	AAAC Guideline
FIC	42	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 Guideline
FIC	N/A	ASTM E1007-14

Sub Base, Floor & Underlay		
L'nT,w	50	AS ISO 717.2 - 2004
Ci	-6	AS ISO 717.2 - 2004
Ci(50-2500)	-2	AS ISO 717.2 - 2004
Ci(63-2000)	-2	AS ISO 717.2 - 2004
AAAC★	4 Star	AAAC Guideline
FIC	54	ASTM E1007-14



Definitions of Noise Metrics

FIC:
 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
FIC	45	55	60	65	70
Comments	Below BCA 62	Clearly Audible	Audible	Barely Inaudible	Normally Inaudible