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CERTIFICATE OF PERFORMANCE

IMPACT NOISE TESTING

8 mm STONEFLOOR

NEW OZ TIMBER FLOORING

DOCUMENT CONTROL			
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Client	New OZ Building Materials Group P/L Attention: Min Zheng E-mail: newoz@bigpond.net.au		

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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CONTENTS

1.0	CONSULTANT'S BRIEF	4
2.0	IMPACT NOISE COMPLIANCE TESTING	5
2.1	SUB BASE AND IMPACT FLOORING SYSTEMS.....	5
3.0	IMPACT NOISE CRITERION	6
3.1	BCA REQUIREMENT.....	6
3.2	AAAC STAR RATING PERFORMANCE REQUIREMENTS.....	6
3.3	CITY OF SYDNEY DCP 2012	6
4.0	IMPACT NOISE TESTING	7
4.1	ASSESSMENT PROCEDURES.....	7
4.2	AMBIENT BACKGROUND NOISE MEASUREMENT	7
4.3	REVERBERATION TIME MEASUREMENTS	8
4.4	INSTRUMENTATION AND CALIBRATION.....	8
5.0	MEASURED RESULTS.....	9
6.0	CONCLUSION	11

APPENDIX A: Calculations and Graphs for Impact Noise Testing

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1.0 CONSULTANT'S BRIEF

Koikas Acoustics was requested by New OZ Building Materials Group P/L to conduct impact noise tests on the 8 mm Stonefloor in conjunction with two (2) different types of acoustic underlays (2 mm Stonefloor green underlay and 5 mm A1 Rubber underlay). A total of nine (2) tests were conducted.

The purpose of undertaking these impact noise tests was to quantify the acoustic performance of the 8 mm Stonefloor flooring system in conjunction with the underlays and the sub base being a steel reinforced concrete slab, suspended ceiling with Rondo channels and plasterboard ceiling below.

Test results were compared to the acoustics 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* impact noise rating requirements.

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 tests were taken in a residential flat units in Erskineville NSW.

2.1 SUB BASE AND IMPACT FLOORING SYSTEMS

Koikas Acoustics has been advised that the sub-base (ceiling/floor system) between the living/dining area of residential units is constructed with the following building materials:

- 200~220 mm thick steel reinforced concrete slab;
- Approximately 900~100mm suspended ceiling cavity held by Rondo channels or the likes, and
- 13mm thick plasterboard ceiling.

Hereafter referred to as the “existing ceiling/floor system (ECFS)”. This

The tests were conducted on the existing ceiling/floor system (ECFS) with the following floor covering and underlays:

- Test 1: 8mm Stonefloor over 2 mm Stonefloor Green Underlay
- Test 2: 8mm Stonefloor over 5 mm A1 Ruber Underlay

3.0 IMPACT NOISE CRITERION

3.1 BCA REQUIREMENT

Part FV5.1 (b) of the BCA states:

Impact: a weighted standardised impact sound pressure level (L_{nTw}) not more than 62 when determined under AS/ISO 717.2

3.2 AAAC STAR RATING PERFORMANCE REQUIREMENTS

Reproduced from the 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

Some Councils have adopted the AAAC 5 Star Rating, i.e. $L_{nTw} \leq 45$, for impact noise requirement within residential buildings. It is noted, these a recommended impact noise ratings.

3.3 CITY OF SYDNEY DCP 2012

In [Part 10 of Section 4.2.3.11 Acoustic Privacy of City of Sydney DCP 2012](#) it states the following for impact isolation requirements for floor systems:

- (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 8 mm Stonefloor flooring and acoustic underlay samples were conducted inside the unfurnished bedrooms from one residential unit (2nd floor level) to another unit (1st floor level) directly below within a residential building in Erskineville on Tuesday, 19th September 2017.

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 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)*.

4.2 AMBIENT BACKGROUND NOISE MEASUREMENT

A measure of the underlying ambient noise was taken in the ground floor unit (receiver room) to account for the perceived noise floor in the space. Inaccuracies in the measurements and calculations can occur in areas of high ambient noise. In this case, the receiver rooms had 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 measurements with a NATA calibrated field calibrator. No system drifts were observed.

5.0 MEASURED RESULTS

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

Table 2. Impact Noise Insulation Performance Summary for Ceiling/Floor System			
System Tested	L' nTw	AAAC Star Rating	FIIC
Bare Concrete (ECFS)	65	2	39
Test 0: <u>8mm Stonefloor</u>	47	4	63
Test 1: <u>8mm Stonefloor</u> over <u>2 mm Stonefloor Green Underlay</u>	43	5	66
Test 2: <u>8mm Stonefloor</u> over <u>5 mm A1 Ruber Underlay</u>	42	5	66

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

The following are noted:

- All tests were undertaken with the existing ceiling roof system consisting of:
 - 200~220mm thick steel reinforced concrete slab;
 - Approximately 90~100mm ceiling cavity held by Rondo channels or similar, and
 - 13mm thick plasterboard ceiling.
- The relation between Field Impact Isolation Class (FIIC) and Impact Isolation Class (IIC) can be described by the formula $FIIC + 5 \approx IIC$.
- All the ceiling/floor system tested with underlay (Test 1~2) have met the current BCA criterion ($L_{nTw} \leq 62$), City of Sydney Council's DCP 2012 requirement ($L_{nTw} \leq 55$) and AAAC Star Rating 5 ($L_{nTw} \leq 45$) for impact noise insulation.
- The lower the rating number the better the acoustic performance for L_{nTw} ratings.
- The higher the AAAC Star Rating the better the impact insulation.
- The higher the IIC and FIIC the better the impact insulation.
- 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 flooring installation, construction, design, structural, fire-rating, water proofing, and the likes.

- Product installation details and methodologies must be sought from product supplier, installer or other experts. Koikas Acoustics is not liable for any product defects.
- It is the client's responsibility to ensure that all Strata requirements (if any) for floors are met, as these (if any) were not known by Koikas Acoustics at the time of preparing this report.
- 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 environmental, acoustic ratings can vary from room to room and so buildings to buildings as no two buildings are identical.
- Floor covering must not make contact with any walls or joineries (kitchen benches, cupboards etc). During 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.

6.0 CONCLUSION

Koikas Acoustics was requested by New OZ Building Materials Group P/L to undertake impact noise tests of ceiling/floor system with the 8 mm Stonefloor flooring in conjunction with two different types of underlay samples. The acoustic performances of various ceiling/floor configurations were calculated and compared to against the acoustic rating criteria nominated by the current BCA, AAAC Star Ratings and the City of Sydney Council's DCP 2012 requirements.

The calculated acoustic rating of each tested flooring sample was summarised and presented in **Table 2** of this report. Detailed graphical presentations of the acoustic performance of each tested flooring sample is attached as **Appendix A** of this report.

All the ceiling/floor systems tested with underlay (Test 1~2) achieved the impact insulation rating of L'_{nTw} 42~43 and therefore:

- meet the current BCA criterion ($L'_{nTw} \leq 62$),
- met the City of Sydney Council's criterion ($L'_{nTw} \leq 55$) and
- met the AAAC 5 Star Rating ($L_{nTw} \leq 45$)

for impact noise insulation for this building.

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/conditions, acoustic ratings would still vary from buildings to buildings.

It is recommended that testing be conducted prior to 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 Appendix.

Floor covering must not make contact with any walls or joineries (kitchen benches, cupboards etc). During 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 (TEST 1)



Date of Test : Tuesday, 19 September 2017
 Project No. : 3252
 Testing Company : Koikas Acoustics
 Checked by : Nick Koikas
 Place of Test: Erskineville NSW
 Client : New OZ Building Materials Group P/L
 Client Address : 2/262 Parramatta Road, Granville

Description of Floor System	Name	Thickness (mm)	Density (SI)
8 mm Stonefloor		8	--
2 mm Stonefloor Green Underlay (Test 1)		2	--
200~200 mm Reinforced Concrete Slab		200~220	2540
90~100 mm Suspended Ceiling Cavity with 13 mm Plasterboard Ceiling		90~100 + 13	--

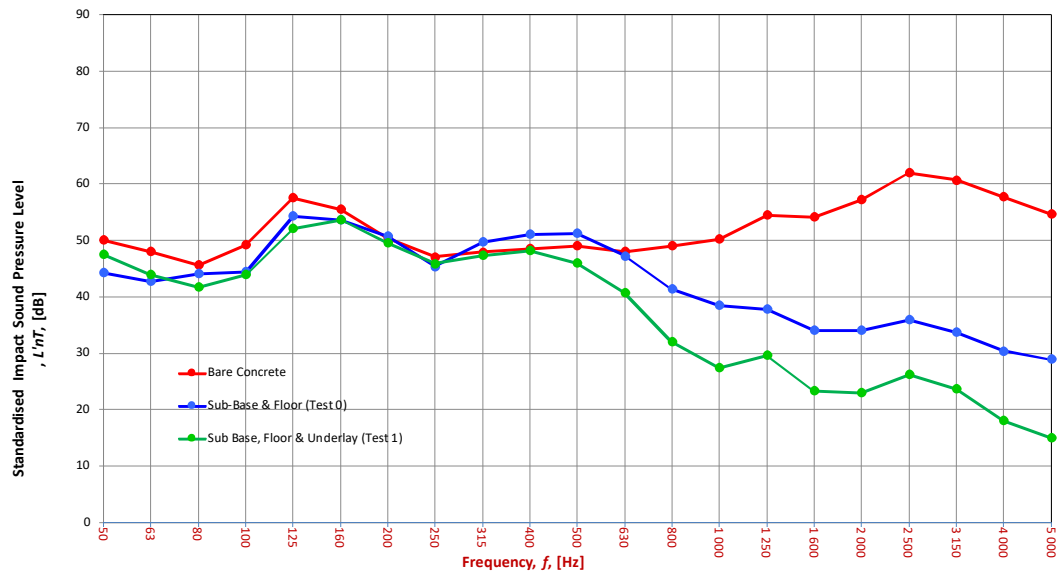
Room Dimensions	Width (m)	Length (m)	Area (m ²)
Room	3		
Floor		3.3	
Dimensions			9.9

Sample Dimensions	Width (m)	Length (m)	Area (m ²)
Sample	1		
Dimensions		1	
			1

Receiver Rm	Location	Width	Length	Area	Height	Volume
	Level 1 Bedroom	3	3.3	9.9	2.7	26.73

Room Surfaces		
Walls	Floor	Ceiling
concrete	concrete	concrete

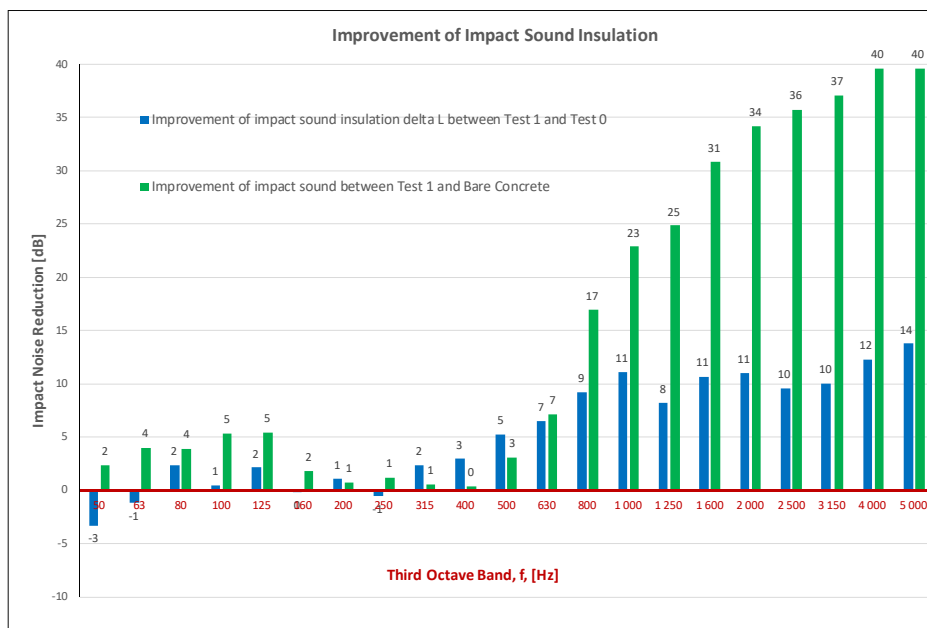
Frequency f Hz	L'nT (one-third octave) dB		
	Sub Base	Sub Base Floor	Sub Base Floor Underlay
50	50.0	44.3	47.5
63	47.9	42.8	43.9
80	45.6	44.1	41.7
100	49.2	44.4	43.9
125	57.5	54.3	52.1
160	55.5	53.6	53.7
200	50.4	50.7	49.6
250	47.1	45.4	45.9
315	47.9	49.7	47.3
400	48.5	51.1	48.1
500	49.0	51.2	45.9
630	47.9	47.2	40.7
800	49.0	41.3	32.1
1 000	50.3	38.5	27.4
1 250	54.5	37.8	29.6
1 600	54.2	34.1	23.3
2 000	57.2	34.0	22.9
2 500	62.0	35.9	26.2
3 150	60.7	33.7	23.6
4 000	57.7	30.4	18.1
5 000	54.7	28.9	15.0



Bare Concrete	
L'nT,w	65
Ci	-14
Ci(50-2500)	-13
Ci(63-2000)	-16
AAAC★	2 Star
FIIC	39

Sub Base & Floor (Test 0)	
L'nT,w	47
Ci	-2
Ci(50-2500)	-1
Ci(63-2000)	-1
AAAC★	4 Star
FIIC	63

Sub Base, Floor & Underlay (Test 1)	
L'nT,w	43
Ci	1
Ci(50-2500)	1
Ci(63-2000)	1
AAAC★	5 Star
FIIC	66



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

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 2)



Date of Test : Tuesday, 19 September 2017
 Project No. : 3252
 Testing Company : Koikas Acoustics
 Checked by : Nick Koikas
 Place of Test : Erskineville NSW
 Client : New OZ Building Materials Group P/L
 Client Address : 2/262 Parramatta Road, Granville

Description of Floor System	Name	Thickness (mm)	Density (SI)
8 mm Stonefloor		8	--
5 mm A1 Rubber Underlay (Test 2)		5	--
200~200 mm Reinforced Concrete Slab		200~220	2540
90~100 mm Suspended Ceiling Cavity with 13 mm Plasterboard Ceiling		90~100 + 13	--

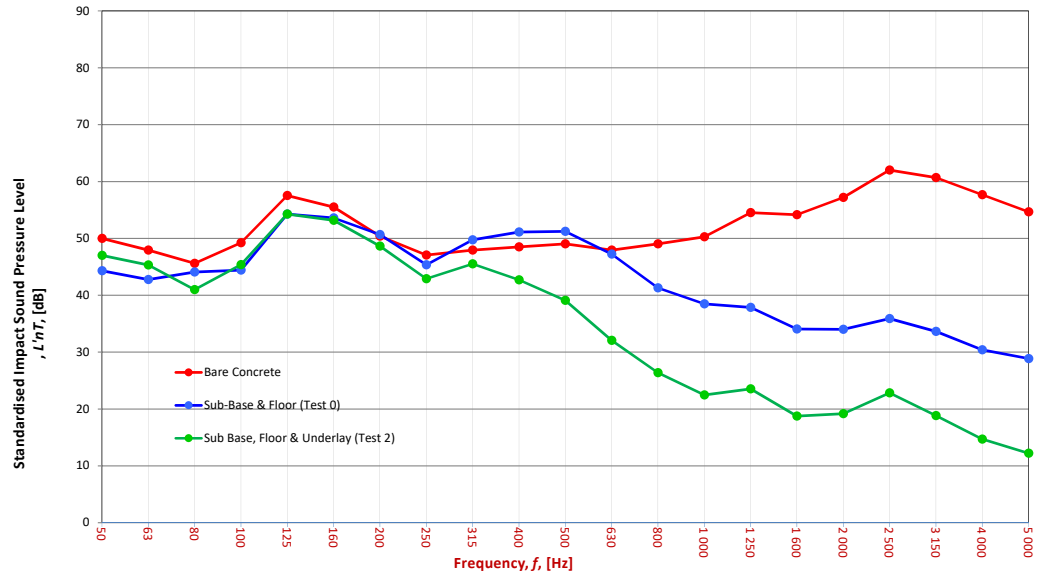
Room Floor Dimensions
 Width : 3 m
 Length : 3.3 m
 Area : 9.9 m²

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

Receiver Rm	Location	Width	Length	Area	Height	Volume
	Level 1 Bedroom	3	3.3	9.9	2.7	26.73

Room Surfaces		
Walls	Floor	Ceiling
concrete	concrete	concrete

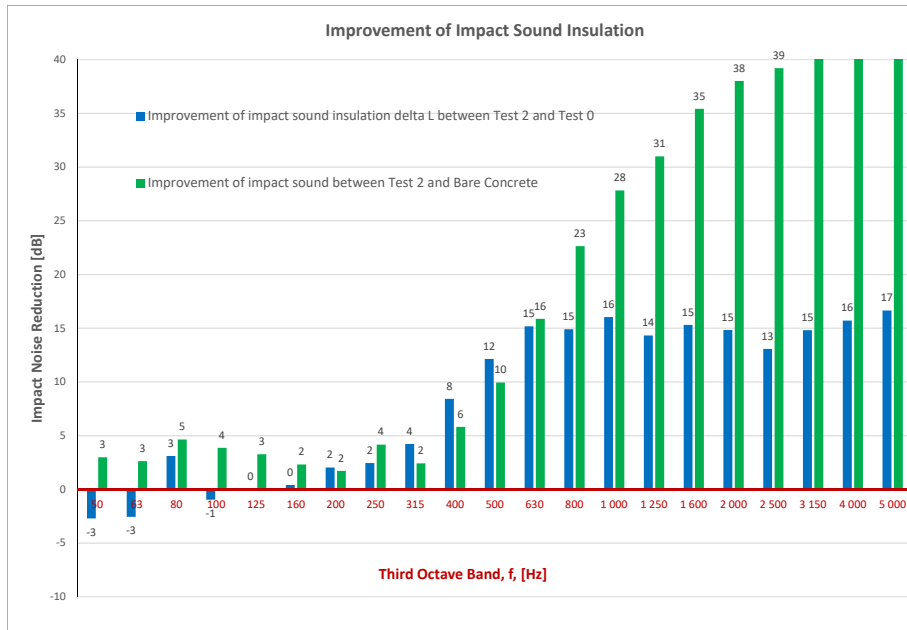
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160	55.5	53.6	53.2
200	50.4	50.7	48.7
250	47.1	45.4	42.9
315	47.9	49.7	45.5
400	48.5	51.1	42.7
500	49.0	51.2	39.1
630	47.9	47.2	32.1
800	49.0	41.3	26.4
1000	50.3	38.5	22.5
1250	54.5	37.8	23.5
1600	54.2	34.1	18.8
2000	57.2	34.0	19.2
2500	62.0	35.9	22.8
3150	60.7	33.7	18.8
4000	57.7	30.4	14.7
5000	54.7	28.9	12.2



Bare Concrete	
L'nT,w	65
Ci	-14
Ci(50-2500)	-13
Ci(63-2000)	-16
AAAC★	2 Star
FIC	39

Sub Base & Floor (Test 0)	
L'nT,w	47
Ci	-2
Ci(50-2500)	-1
Ci(63-2000)	-1
AAAC★	4 Star
FIC	63

Sub Base, Floor & Underlay (Test 2)	
L'nT,w	42
Ci	1
Ci(50-2500)	2
Ci(63-2000)	2
AAAC★	5 Star
FIC	66



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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