MARSHALL DAY Acoustics

ARDEX DS 70 (5 MM) IMPACT SOUND OPINION

Rp 001 20190809 | 8 August 2019

MARSHALL DAY Acoustics

Level 3 69 Cambridge Terrace
PO Box 4071
Christchurch 8140 New Zealand
T: +64 3 365 8455 F: +64 3 365 8477
www.marshallday.com

Project: **ARDEX DS 70 (5 mm)**

Prepared for: **Ardex New Zealand Limited**
15 Alfred Street
Onehunga
Auckland 1061

Attention: **Leroy Paul-Andrews**

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1.0 INTRODUCTION

Marshall Day Acoustics have been asked to provide an opinion on the impact sound insulation performances that would be achieved by Ardex DS 70, 5 mm thick, underlay below ceramic tiles.

This opinion is based on previous tests of the flooring on a monolithic test slab, the floor material elements and previous tests of floor and ceiling combinations without the tile underlay system.

A glossary of the technical terminology used in this report is provided in Appendix A.

2.0 CONSTRUCTIONS

2.1 Floor Covering Construction

The tested construction is detailed below:

- 10 mm porcelain tile on,
- Ardex FG 8 Highly Versatile Flexible Coloured Grout on,
- Ardex X18 Fibre Reinforced Tile Adhesive on,
- Superflex WPM 002 Materproofing Membrane on,
- Ardex DS 70 (5 mm Acoustic Mat) adhered to the concrete floor slab with,
- Ardex AF 2365 Universal Adhesive

The impact performance provided by an underlay system is a result of the combination and interaction of all components including, but not limited to, the underlay adhesive. For the predicted results to be accurate, the underlay and all associated products must be installed as undertaken in the laboratory. Adequate perimeter isolation must also be used.

2.2 Cavity Absorption

The cavity absorption referred to in Table 1 is as follows:

- R1.8 Pink Batts, Autex Greenstuff or approved equivalent such as 75 mm thick fibreglass of minimum density 9.6 kg/m^3.

2.3 Ceiling Construction

The plasterboard ceiling referred to in Table 1 is as follows:

- 10 mm standard Gib®, (minimum 100 mm ceiling cavity), 13 mm standard Gib® or 2 layers of 13 mm standard Gib® as specified (minimum 300 mm ceiling cavity), installed in accordance with manufacturer's recommendations.
- Supported on one of the following ceiling suspension systems:
    - USG DONN® ScrewFix™ steel frame suspension system comprising 2.5 mm wire hangers at 1200 mm centres supporting DJ38 strongback channels spaces at 1200 mm centres and FC37 furring channels spaced at 600 mm centres maximum.
    - Rondo KEY-LOCK® system comprising wire hangers at 1200 mm supporting 127 Top Cross Rails at 1200mm centres and 129 Furring Channels and **STSU Furring Channel Clips** at 600mm centres
    - Rondo KEY-LOCK® system: comprising wire hangers incorporating **WHI Green Resilient Hanger** Element at 1200 mm supporting 127 Top Cross Rails at 1200mm centres and 129 Furring Channels at 600mm centres
- The perimeter of the ceiling is sealed with flexible acoustic sealant such as Gib® Soundseal.

3.0 TEST RESULTS

The floor covering constructions described in Section 2.1 was tested by University of Auckland Acoustic Testing Service (Test Report: T1752 dated 9 February 2018). Figure 1 reproduces the test results.

Figure 1: Ardex DS 70 (5 mm) underlay below Porcelain Tiles

Reduction of impact sound pressure level according to ISO 10140-3

Laboratory measurements of the reduction of transmitted impact sound by floor coverings on a heavyweight reference floor

Client: Ardex New Zealand Ltd.

Date of test: 18 December 2017

Test rooms: Reverberation Chambers A and B

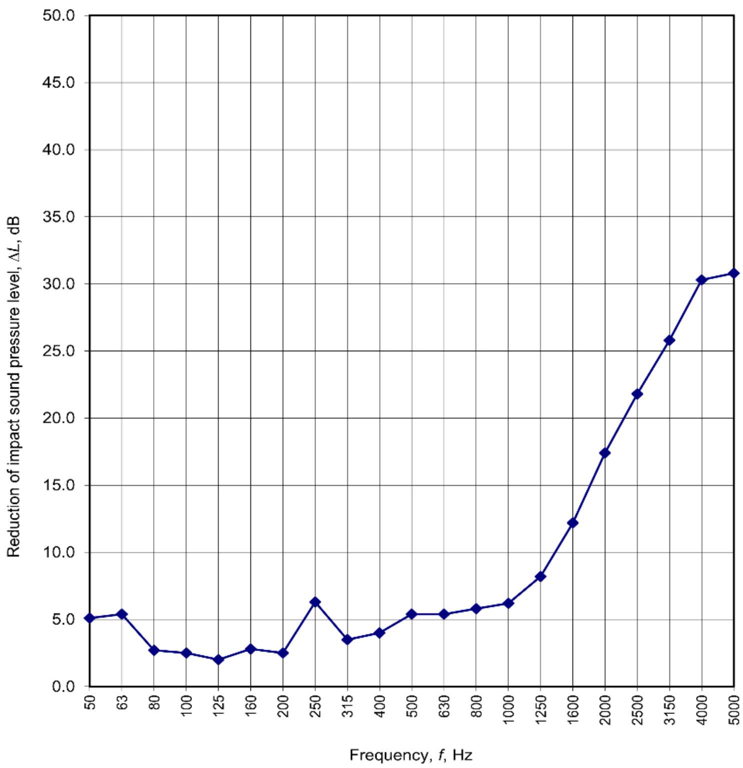
Description and identification of the test specimen and test arrangement: -

Ardex tile flooring system comprising:
Wearing Surface: A 10.24 m^2 sample of 10 mm thick porcelain tiles (300 mm x 600 mm)
Grout: *Ardex FG 8 Highly Versitile Flexable coloured Grout*
Tile Adhesive: *Ardex X18 Fibre Reinforced Tile Adhesive*
Waterproofing: *Superflex WPM 002 Materproofing Membrane*
Underlay: *Ardek DS 70 (5 mm Acoustic Mat)* Rubber based
Underlay Adhesive: *Ardex AF 2365 Universal Adhesive*
Concrete Slab Test Bed.

Source chamber was Chamber A and receiving chamber was Chamber B . Test specimen installed by the client. Curing times: 3 days
Deviation from standard: The bare test floor used is of uniform thickness for an area of only 2.6m x 2.6m. The description of the bare test floor is given in the full report.

Air temp in the test rooms: 21 °C
Air humidity in test rooms: 55 %
Receiving room volume: 153 m^3

Frequency f Hz	$L_{n,0}$ One-third octave dB	ΔL One-third octave dB
50	54.4	5.1
63	50.0	5.4
80	56.8	2.7
100	**63.7**	**2.5**
125	**65.8**	**2.0**
160	**66.1**	**2.8**
200	**68.7**	**2.5**
250	**72.1**	**6.3**
315	**71.3**	**3.5**
400	**69.9**	**4.0**
500	**74.2**	**5.4**
630	**72.0**	**5.4**
800	**71.2**	**5.8**
1000	**71.3**	**6.2**
1250	**71.3**	**8.2**
1600	**71.1**	**12.2**
2000	**72.0**	**17.4**
2500	**72.5**	**21.8**
3150	**72.6**	**25.8**
4000	71.1	30.3
5000	68.2	30.8



Notes: #N/A = Value not available. **Bold** values are used to calculate ΔL_w.
< indicates that the true value is lower.
$L_{n,0}$ are the bare floor impact sound levels.

Rating according to ISO 717-2:

ΔL_w = 14 dB $C_{I,\Delta}$ = 8 dB $C_{I,r}$ = -3 dB $C_{I,50\text{-}2500}$ = -3 dB

These results are based on a test made with an artificial source under laboratory conditions (engineering Method) with the specified reference floor.

No. of test report: **T1752**

Name of test institute: University of Auckland Acoustics Testing Service.

Date: 09-February-2018

Signature:

4.0 OPINION

4.1 Impact Sound Insulation of Floor Construction

Table 1 details the expected impact sound insulation performance of the flooring system as described in Section 2.1 for a range of ceiling and floor slab combinations, including whether cavity absorption is installed.

Table 2 provides a range of concrete slab constructions that would equate to the average concrete thicknesses presented in Table 1.

Table 1: Ardex DS 70 (5 mm) underlay below Porcelain Tiles

Ceiling		**Floor – Average Concrete Thickness (Refer to Table 2 for construction options)**					
		90 mm(1)		**120 mm**		**150 mm**	
Thickness /layers	Cavity Absorption Present?	Impact Insulation Class	$L'_{nT,w}$ (2)	Impact Insulation Class	$L'_{nT,w}$ (2)	Impact Insulation Class	$L'_{nT,w}$ (2)
No plasterboard ceiling	N/A	IIC 35	75 dB	IIC 40	70 dB	IIC 42	68 dB
1 x 10 mm plasterboard (100 mm cavity)	No	IIC 45	65 dB	IIC 49	61 dB	IIC 51	59 dB
	Yes	IIC 55	55 dB	IIC 59	51 dB	IIC 60	49 dB
1 x 13 mm plasterboard (200 mm cavity)	No	IIC 49	61 dB	IIC 54	56 dB	IIC 55	54 dB
	Yes	IIC 56	54 dB	IIC 61	49 dB	IIC 63	47 dB
2 x 13 mm plasterboard (200 mm cavity)	No	IIC 52	58 dB	IIC 57	53 dB	IIC 58	51 dB
	Yes	IIC 57	53 dB	IIC 62	48 dB	IIC 64	46 dB

1 A floor slab of less than 120 mm is not recommended where horizontal transmission is a concern.

2 The $L'_{nT,w}$ has been calculated based on a receiving room volume of 50 m^3. No allowance has been made for on-site flanking transmission.

3 Where the New Zealand Building Code sound insulation requirements are achieved, the results are highlighted in blue.

4 Performances have been calculated using INSUL version 9.0.7

5.0 LIMITATIONS

The above opinion is an estimate of the laboratory performance not the field performance. The estimate is based on the original laboratory tests, the materials as currently manufactured and the construction details set out above. Readers are advised to check that this opinion has not been revised by a later issue. The estimate is expected to be in error by less than 3 STC/IIC/dB.

Table 2: Floor systems equating to average concrete thickness

Floor Type	ACT	Construction
Hollowcore/Dycore	90 mm	200 mm Hollowcore/Dycore
	120 mm	200 mm Hollowcore/Dycore with 20 mm topping
	150 mm	200 mm Hollowcore/Dycore with 50 mm topping
Rib and Infill	90 mm	Rib and Infill flooring system with 90 mm concrete topping
	120 mm	Rib and Infill flooring system with 120 mm concrete topping
	150 mm	Rib and Infill flooring system with 150 mm concrete topping
Double Tee	90 mm	Double Tee with 50 mm flange and 40 mm topping
	120 mm	Double Tee with 50 mm flange and 70 mm topping
	150 mm	Double Tee with 50 mm flange and 100 mm topping
Comflor 60	90 mm	125 mm overall thickness
	120 mm	155 mm overall thickness
	150 mm	185 mm overall thickness
Comflor 80	90 mm	140 mm overall thickness
	120 mm	170 mm overall thickness
	150 mm	200 mm overall thickness
Traydec	90 mm	90 mm overall thickness
	120 mm	120 mm overall thickness
	150 mm	150 mm overall thickness
Unispan	90 mm	90 mm overall thickness
	120 mm	120 mm overall thickness
	150 mm	150 mm overall thickness

ACT Average Concrete Thickness

Surface mass of 90 mm ACT: 211 kg/m^2
Surface mass of 120 mm ACT: 281 kg/m^2
Surface mass of 150 mm ACT: 251 kg/m^2

6.0 INTERPRETATION

6.1 Rating Systems

6.1.1 NZ Building Code

The Impact Insulation Class (IIC) of a floor/ceiling system reflects its ability to prevent impact on its surface from being transmitted as structure-borne vibration and radiating as air-borne noise. Higher IIC ratings indicate that less noise is transmitted to the room below. The NZ Building Code requires that new floors have a laboratory rating of IIC 55 or higher. In addition, the floor must be constructed to ensure the on-site Field Impact Insulation Class (FIIC) is no less than FIIC 50.

6.2 Field Performance

To ensure the on-site measurements are similar to the laboratory results the products must be installed and constructed in a similar way to the laboratory tests and any substitution of materials must be approved by the project's Acoustic Consultant. In addition, potential flanking paths, such as external walls, need to be considered and mitigated against.

Structure-borne vibration is readily transmitted in all directions in concrete flooring substructures. There is often little difference between measured impact noise levels in rooms directly below the source room compared with rooms that are diagonally below. Therefore, the impact isolation to rooms other than those directly below the floor area should also be considered.

Where horizontal transmission or flanking is likely to be a concern it is recommended that concrete slabs of no less than 120 mm effective thickness be used. Hard floor surfaces on lightweight concrete floors are likely to require specialist isolation to avoid high levels of impact noise being transmitted to adjacent spaces.

The use of materials other than those referred to in Section 2.0 or the introduction of additional materials (e.g. underfloor heating), including the lack of any perimeter isolation, can significantly affect the field performance rating (i.e. may result in a failure in accordance with the NZ Building Code). We strongly recommend trial performance testing on site before proceeding with full installation.

APPENDIX A GLOSSARY OF TERMINOLOGY

Sound Insulation	Provision of a degree of acoustical separation between two spaces such that sound is reduced in travelling between the two spaces.
Impact sound	Sound produced by an object impacting directly on a building structure, such as footfall noise or chairs scrapping on a floor.
Flanking Transmission	Transmission of sound energy through paths adjacent to the building element being considered. For example, sound may be transmitted around a wall by travelling up into the ceiling space and then down into the adjacent room.
Structure-Borne Transmission	The transmission of sound from one space to another through the structure of a building.
IIC	Impact Insulation Class A single number system for quantifying the transmission loss due to impact noise produced by a standard "Tapper Machine" through a building element.
FIIC	The 'field' or in situ measurement of Impact Insulation Class. Building tolerances and flanking noise have an effect on the performance of a partition when it is actually installed, which result in FIIC values lower than the laboratory derived IIC values, typically 5 dB less.
$L_{n,w}$	Weighted, Normalized Impact Sound Pressure Level A single number rating of the impact sound insulation of a floor/ceiling when impacted on by a standard 'tapper' machine. $L_{n,w}$ is measured in a laboratory. The lower the $L_{n,w}$, the better the acoustic performance.
$L'_{nT,w}$	Weighted, Standardised Impact Sound Pressure Level A single number rating of the impact sound insulation of a floor/ceiling when impacted on by a standard 'tapper' machine. $L'_{nT,w}$ is measured on site. The lower the $L'_{nT,w}$, the better the acoustic performance.