LABORATORY MEASUREMENT OF IMPACT SOUND INSULATION OF A FLOORING SYSTEM (According to ISO 10140-3)

AUCKLAND UNISERVICES LIMITED
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THE UNIVERSITY OF AUCKLAND

Report prepared for:
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Auckland
Date: 28th October 2016

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LABORATORY MEASUREMENT OF IMPACT SOUND INSULATION OF A TONGUE AND GROOVE FLOORING SYSTEM

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Mr. Gian Schmid.

Dr. Michael Kingan.

Normalized Impact sound pressure levels according to ISO 10140-3
Laboratory measurements of impact sound insulation of floors

Description and identification of the test specimen and test arrangement:

Date of test: 11-Mar-16
Client: Rockcote Resene Ltd.

Test Floor Frame: 190mm x 45mm timber joists set at 450mm centres
Test Floor Linings: Source chamber side: 10mm thick x 600mm x 600mm porceline tiles adhered to 6mm cork adhered to *Resene Rockcote* 6mm cork adhered to *Rockcote Resene Integra* tongue and groove flooring panels
Receiving chamber side: 1 layer of 13mm *GIB Noiseline* on 28mm furring channel in ST001 clips
Cavity Absorption: 1 layer of *Pink Batts* Mid Floor Silencer batts in the 300mm cavity
Test Floor Lining Joint Filler: *GIB Soundseal*
Test Floor Perimeter Sealant: *GIB Soundseal*

Source chamber: Chamber B, Receiving chamber: Chamber A . Test specimen installed by client. Curing time: Tile adhesive: 27 hours

Computer files: T1608-6b Floor with 2x13mm NL wit...; T1608-6b Floor with 2x13mm NL wit...

Area *S* of test specimen: 10.24 m^2

Air temp in the test rooms: 21 ^oC
Air humidity in test rooms: 60 %
Source room volume: 202 m^3
Receiving room volume: 153 m^3

Frequency *f* Hz	*R* One-third octave dB
50	67.1
63	62.0
80	62.6
100	**62.0**
125	**62.9**
160	**61.9**
200	**60.0**
250	**60.8**
315	**62.6**
400	**62.3**
500	**61.7**
630	**62.3**
800	**62.3**
1000	**61.0**
1250	**58.2**
1600	**51.6**
2000	**46.4**
2500	**44.7**
3150	**43.0**
4000	38.6
5000	31.4

Notes:1. #N/A = Value not available.
2. **Bold** values are used to IIC and Ln,w.
3. Words in ***Blue Italic*** in the description are manufacturers brand names.
4. < indicates that the true value is lower.

Rating according to ISO 717-2:

$L_{n,w}$ (C_I) = 60 (-2) dB $C_{I,50-2500}$ = -1 dB

Rating according to ASTM E989:

Impact Insulation Class = 50 dB

Evaluation based on laboratory measurement results obtained by an engineering method.

No. of test report: **T1608-6**   Name of test institute: University of Auckland Acoustics Testing Service.
Date: *Friday, 28 October 2016*   Signature:

ANNEX A.

PHOTOS AND DETAILS OF THE TEST SPECIMEN

Figure 1: Cork layer being adhered to the original floor surface

Figure 2: Tiles being adhered to the layer of cork

Figure 3: Tiles laid out on test floor

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ANNEX B.

ADDITIONAL INFORMATION ABOUT EQUIPMENT USED

INSTRUMENTATION	EQUIPMENT	TYPE / SERIAL No.
	SOURCE ROOM	
	1/2" Microphone	4190 / 2143842
	Preamplifier	2619 / 945932
	Rotating Boom	3923 / 936486
	RECEIVING ROOM	
	1/2" Microphone	4190 / 2143842
	Preamplifier	2619 / 945932
	Rotating Boom	3923 / 936486
	Calibration of the above equipment was conducted by Electroacoustic Calibration Services (ECS), an IANZ registered laboratory.	
	BRÜEL & KJÆR	
	Pistonphone	4220 / 1048366
	Analyzer	2133 / 1529583
	Tapping Machine	3204 / 250841

ANNEX C.

SUMMARY OF THE MEASUREMENT OF SOUND IMPACT INSULATION IN FLOORS.

INSTALLATION OF TEST SAMPLE

The floor/ceiling system under test is installed in the opening between the two large reverberation chambers – chambers B and A. These chambers are vibration isolated from each other which results in a structural discontinuity at the middle of the test opening. This gap is covered over by a wooden collar, which seals the gap and provides for ease of fixing of samples
The sample is constructed by the client following the techniques normally used in practice for that type of floor/ceiling system, and is sealed into the test opening with perimeter seals of acoustic sealant.

METHOD

The normalized impact sound pressure levels are obtained in accordance with the recommendations of ISO standard 140-6:1998(E) "Laboratory measurements of impact sound insulation of floors."

The BK3204 tapping machine is placed sequentially in four different positions on the floor. The impact sound pressure level is measured in the room below the floor, using a rotating microphone, in third octave frequency bands. The impact sound pressure levels are normalized against the room absorption. The room absorption is calculated from the reverberation time and room volume. The reverberation time is measured from the decay of a steady state sound field.
Corrections are applied, where necessary, for airborne sound transmission and background noise. The airborne sound transmission is determined using a loudspeaker and the microphone.

RESULTS

The third octave band normalized impact sound pressure levels L_n are presented in both table and graph formats. Sometimes a highly reflective test sample means that the lower frequency normalized impact sound pressure levels cannot be reliably measured; this is indicated by #N/A in the table of results. Additionally, sometimes the airborne transmission of sound through the floor or loud background noise affects the measurements resulting in only an upper threshold being found; this is indicated by a < sign preceding the tabulated results.

Single figure ratings are also presented. The weighted normalized impact sound pressure level $L_{n,w}$, determined according to ISO 717-2, is presented along with a spectrum adaptation term C_I . $L_{n,w}$ is determined by fitting a reference curve to the third octave band normalized impact sound pressure levels L_n from 100Hz to 3150Hz, and gives a single figure determination of the sound levels which are transmitted through the floor from impacts (higher is worse). The spectrum adaptation term C_I is used to suggest the presence of high level peaks in the results over the frequency range 100Hz to 2500Hz, and may be added to $L_{n,w}$. For massive floors with effective coverings C_I will be about zero, for light timber floors C_I will be slightly positive, and for concrete floors with less effective covering C_I will range from –15 dB to 0dB. Another spectrum adaptation term $C_{I,50\text{-}2500}$, which covers the frequency range from 50Hz to 2500Hz, may also be presented if the low frequency levels are available.

The impact insulation class (IIC) determined according ASTM E989 is also presented. This is determined by fitting a reference curve to the third octave band normalized impact sound pressure levels L_n from 100Hz to 3150Hz, but in a slightly different way to ISO 717-2. The impact insulation class measures the insulating abilities of the floor so that higher is better (contrary to $L_{n,w}$).

ANNEX D.

DESCRIPTION OF THE REVERBERATION CHAMBERS AT THE UNIVERSITY OF AUCKLAND

There are three large interconnected reverberation chambers at the Acoustics Research Centre, two at ground level (Chambers C and A) and the third (Chamber B) below A.

All three reverberation chambers may be described as hexagonal prisms; each has 6 vertical sided walls, perpendicular to the floor. The roofs of chamber A and C are plane, but inclined at 12 degrees from horizontal. Chamber B has a plane, horizontal roof which is the floor of chamber A above it. The floor of chamber B is also horizontal, but has two angled sections at its North West and south east ends. The centre section is horizontal because a floor jack is installed there. The floor jack may be raised hydraulically to the ceiling of chamber B, the centre of which consists of a floor plug between the two chambers. This plug may be disconnected from chamber A and lowered down into chamber B, leaving a 3.2m x 3.2 m opening between the two chambers. This allows for the measurement of airborne and impact insulation of floor and roof elements.

The wall of chamber C adjacent to chamber A is left open, and the corresponding wall of chamber A consists of a pair of iron doors that are clamped against the chamber. The clamps may be removed and the iron doors pulled back, leaving the entire wall area (4.6m wide x 2.74m high) between the chambers open. This allows for the measurement of airborne sound insulation of wall elements.

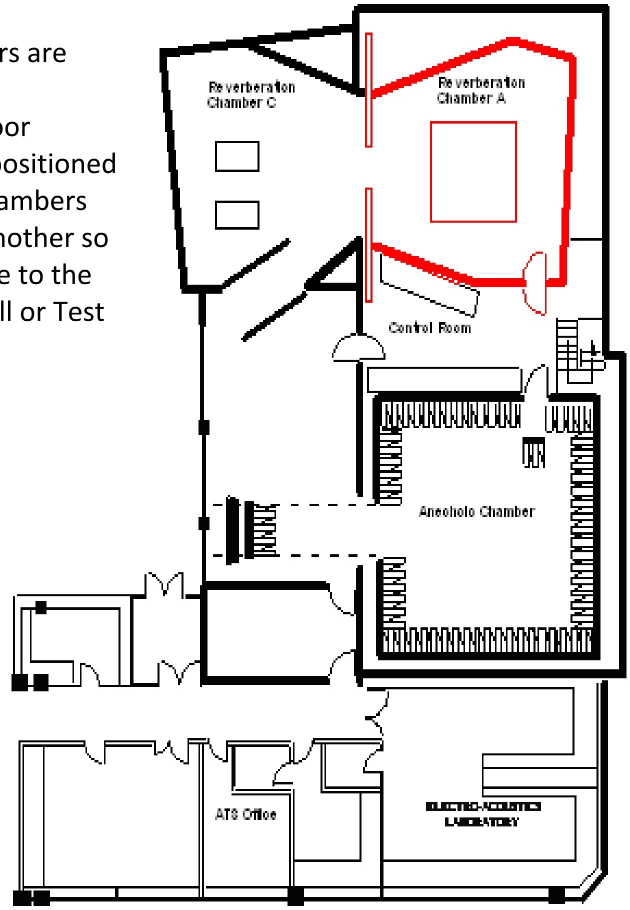
Chamber A has a rotating vane diffuser in a central position with an area (both sides) of about 53 m2. It has the shape of two cones with their bases joined, with the two opposite quadrants of one cone open and the complementary quadrants in the other cone open. Chamber C has a similar rotating vane diffuser but it is smaller, having a total area of about 27 m2.

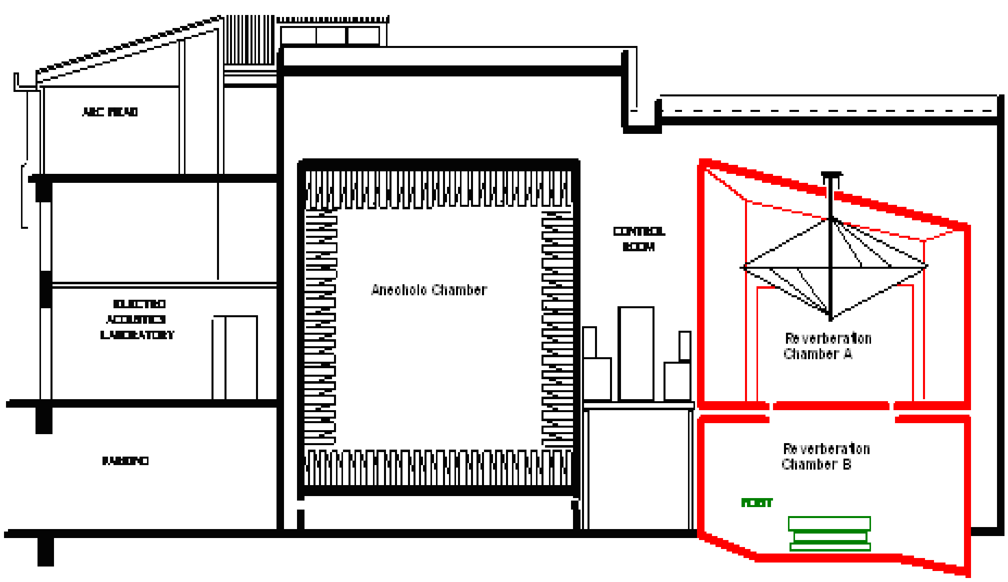
In addition, up to ten static diffusers may be employed if needed. These are constructed of two laminated layers of dense Formica, of dimensions 1m x 1m. The Formica elements are riveted to a frame constructed of aluminium T section. Four aluminium arms may be bolted onto the frame to allow the diffusers to be mounted as desired.
Currently four of these are used in chamber C, and three are used in chamber B.

The volumes and surface areas of the reverberation chambers are as follows:

	VOLUME (m^3)	SURFACE AREA (m^2)
Chamber A	202 ± 3	203.6 ± 0.9
Chamber B	153 ± 2	173 ± 1
Chamber C	209 ± 4	214 ± 0.9

The three Reverberation Chambers are linked by heavy steel doors and a removable Standard Industrial Floor Section which is removed and repositioned by a hydraulic hoist. The three chambers are vibration isolated from one another so that sound can only pass from one to the other via the intervening Test Wall or Test Floor/Ceiling Section





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