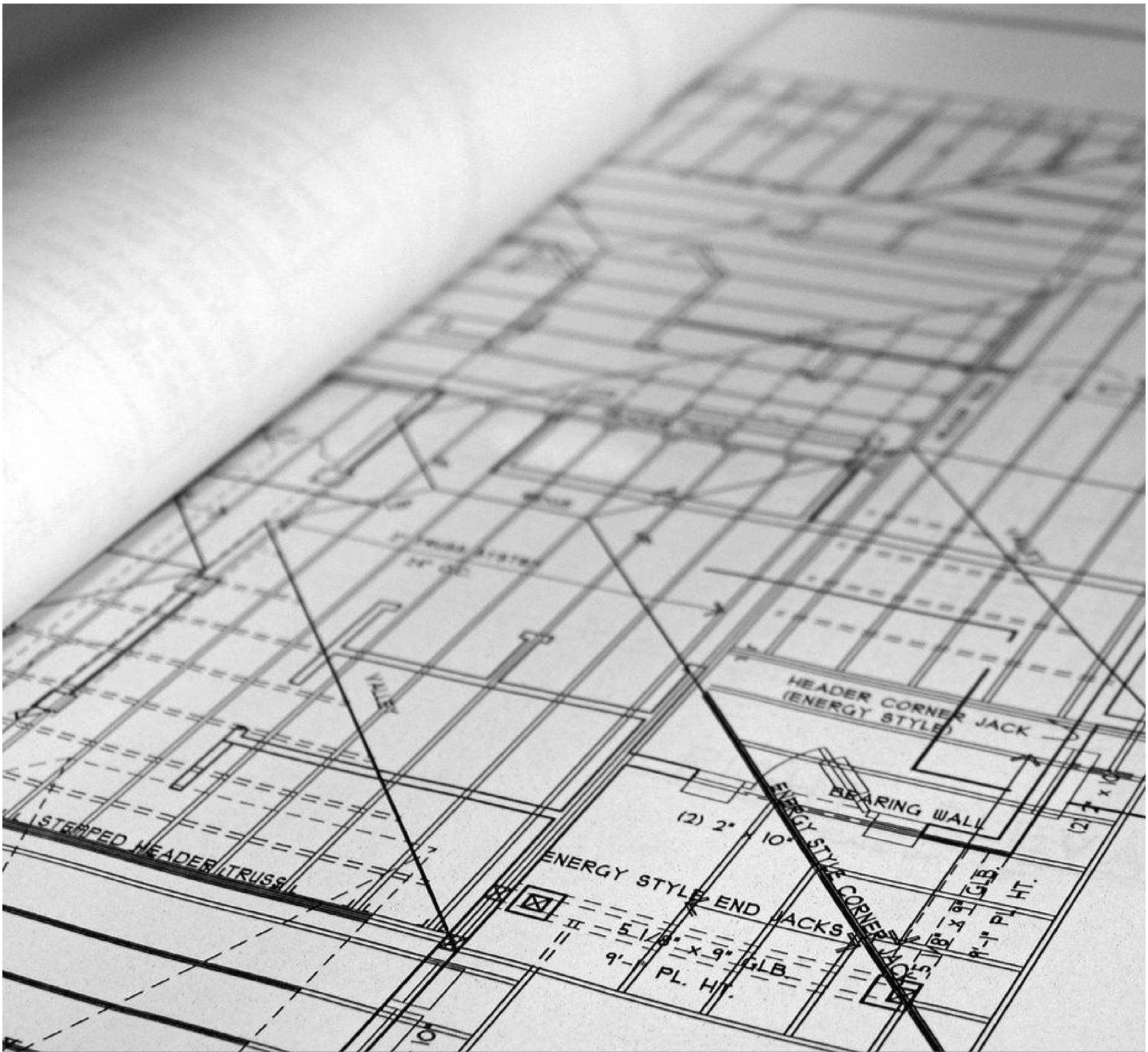

Holloway Head (Girl Guides Apartment)

Pre-Completion Sound Insulation Test Report

Client: WinVic

Project Number: 1492021

Date: 24/02/2023

REPORT ISSUE & STATUS LOG

	Revision Number		
	1	2	3
Author	Nick Adamson BSc (Hons) MIOA		
Position	Associate		
Date of Issue	24/02/2023		
Comment	For Issue		

Report Prepared By

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TABLE OF CONTENTS

1 INTRODUCTION

1.1.1 JPM Acoustics Ltd has been appointed to undertake pre-completion sound insulation testing at the Girl Guides apartment within the new (still under construction) Holloway Head residential development in Birmingham.

1.1.2 The pre-completion testing is required to verify that the sound insulation performance of the apartment's separating walls and floors achieve compliance with the minimum requirements outlined in Requirement E1 from Approved Document E 'Resistance to the Passage of Sound' of The Building Regulations (ADE).

2 DEVELOPMENT LAYOUT AND TEST STRATEGY

2.1.1 The Holloway Head development comprises several hundred new-build apartments over thirteen floors. At the base of the building, at ground floor level and mezzanine level, there will be several non-residential spaces including retail units and a new headquarters for Girl Guiding Birmingham. The Girl Guide's space will include a single residential apartment to be occupied by the building's caretaker. It is only these two lower floors which are advanced enough in the construction process for sound testing to be able to take place at this stage.

2.1.2 Details of the source and receiver rooms adopted during the tests are presented in **Table 1**. Scheme layout plans are provided in **Appendix A**.

Table 1 – Source and receiver rooms adopted for sound insulation tests

Test Type	Test Reference	Source Room	Receiver Room
Airborne (Wall)	109411	GG Activity Room 3	GG Apartment Kitchen/Living
Airborne (Floor)	109415	Site Office*	GG Apartment Bedroom 1
Impact (Floor)	109413	Site Office*	GG Apartment Bedroom 1
* Upon completion of the development the space currently occupied by the WinVic site office will be a residential apartment (type 2B2A).			

2.1.3 All tests referenced in this report have been undertaken in accordance with the procedures detailed in Annex B of ADE. Testing has been undertaken by acoustic engineers who are members of the Sound Insulation Testing and Measurement Association (SITMA) and the Institute of Acoustics (IOA).

3 PERFORMANCE REQUIREMENTS

3.1.1 **Table 2** presents a summary of the sound insulation performance requirements from ADE for separating walls, floors and stairs in new-build dwelling-houses and flats.

Table 2 – Dwelling-houses and flats – performance standards for separating walls, separating floors, and stairs that have a separating function

Element	**Airborne sound insulation $D_{nT,w} + C_{tr}$ dB (minimum values)**	**Impact sound insulation $L'_{nT,w}$ dB (maximum values)**
Purpose built dwelling-houses and flats		
Walls	45	-
Floors and Stairs	45	62

4 RESULTS

4.1.1 **Table 3** presents a summary of the results of the pre-completion sound insulation testing. Detailed sound insulation test results, including graphical results and certificates, are provided in **Appendix B**.

Table 3 – Summary of pre-completion sound insulation test results

Test Type	Test Ref.	Source Room	Receiver Room	Test Result	Pass / Fail
Airborne (Wall)	109411	GG Activity Room 3	GG Apartment Kitchen/Living	57 dB $D_{nT,w} + C_{tr}$	PASS
Impact (Floor)	109415	Site Office*	GG Apartment Bedroom 1	56 dB L'_{nTw}	PASS
Airborne (Floor)	109413	Site Office*	GG Apartment Bedroom 1	60 dB $D_{nT,w} + C_{tr}$	PASS
* Upon completion of the development the space currently occupied by the WinVic site office will be a residential apartment (type 2B2A).					

APPENDIX A – DEVELOPMENT LAYOUT PLANS

Figure A1 – Mezzanine Floor Plan

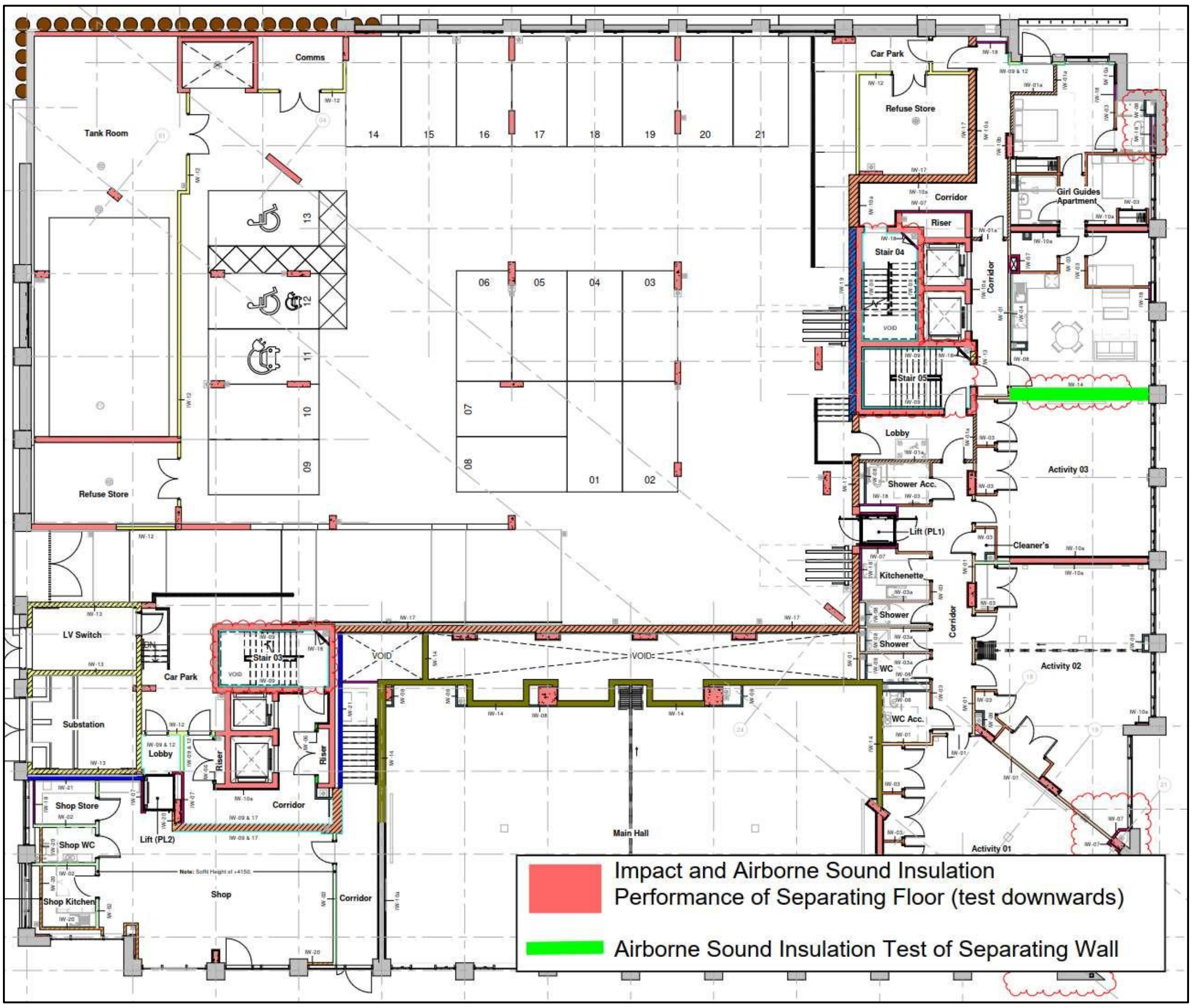
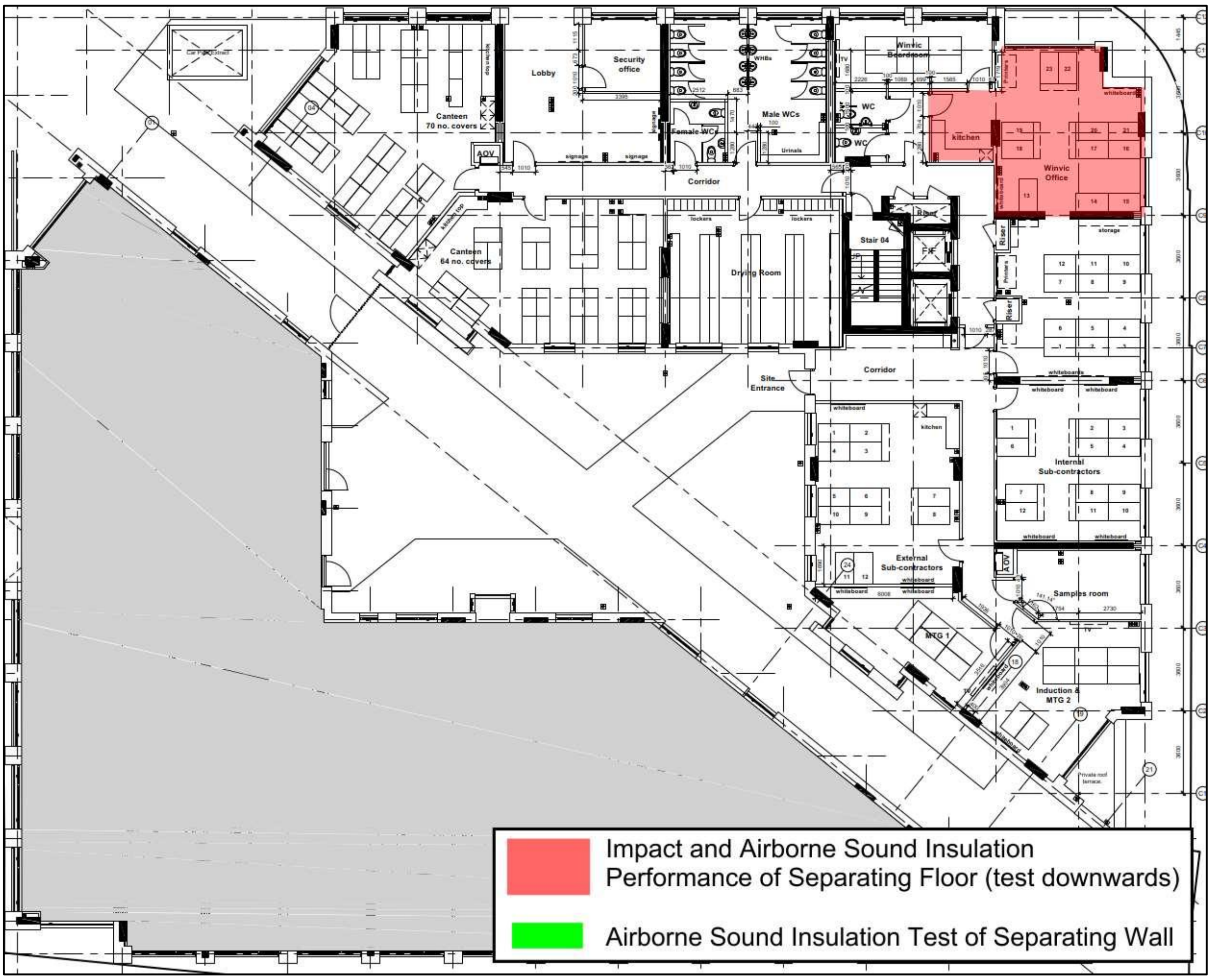


Figure A2 – Upper Ground Floor Plan (as tested)



APPENDIX B – SITMA SOUND INSULATION TEST REPORT

SOUND INSULATION TEST REPORT

Sound Insulation testing in accordance with Test Standards BS EN ISO 140-4 & BS EN ISO 140-7

Report Reference Number: 27342

Report Date: 24/02/2023

Abstract

Sound Insulation Testing is the process of measuring how much noise a building element, normally a wall or a floor, stops from travelling through to a neighbouring property.

This report describes the process taken and the results obtained from the sound insulation testing at Holloway Head, Birmingham, B1 1NG.

Competent Tester

Testing was conducted by Jordan Mayes who is a member of the SITMA Sound Insulation Testing Registered Testers Scheme, Registration Number: 7199

Contents

The SITMA Registered Testers' Scheme

This report was conducted by a tester that is registered with the SITMA Registered Testers' Scheme for Sound Insulation Testers. More information on the scheme, the lodgement system, quality control and auditing are discussed below.

Scheme Member Conducting this test

The tester that conducted your testing was:	Jordan Mayes	
Linked to:	JPM Acoustics Ltd, 97 Hazelhurst Road, Worsley, Manchester, M28 2SW.	

Entry Requirements
In order to enter the SITMA Registered Testers' Scheme, testers are required to either:

- Have completed the Institute of Acoustics Certificate of Competence in Building Acoustics Measurements (CCBAM), or
- Have been assessed by SITMA to hold suitable, demonstrable evidence of competence in sound insulation testing

Audit Requirements
Each tester is audited at least twice a year, completely unannounced. This is achieved by the tester logging their job onto the SITMA portal **in advance of testing taking place.**
Audits are carried out by independent SITMA employees who have been trained in accordance with BS EN ISO 19011:2018 and have extensive background in Sound Insulation Testing.
Each tester will be able to issue you with their SITMA audit documentation from their last audit alongside this report, if requested.

SITMA Portal
The SITMA Portal, besides logging every job for every tester, is used to generate reports, just like this one. The portal does not take pre-calculated information, it takes the raw data from the sound level meter and calculates each individual test itself, before producing this report. This ensures that no test data has been amended by any tester prior to the information being uploaded.

SITMA Accreditation
SITMA will shortly have achieved BS EN ISO/IEC 17024:2012 accreditation from UKAS (Application number 10579). SITMA has completed the Initial Audit and is awaiting final confirmation.

Calibration Requirements
SITMA holds some of the strictest calibration requirements in the world for sound insulation testing, with each sound level meter and tapping machine requiring UKAS calibration every 2 years and the microphone calibrator requiring calibration every 12 months. If the tester does not hold correctly calibrated equipment, the SITMA portal will not let them produce this report.

Complaints
You should speak directly with the tester if you wish to make a complaint. If your complaint is not handled to your satisfaction, you are then welcome to make a complaint directly to the SITMA registered testers' scheme in line with our complaints process PUS013.

TO CHECK THIS REPORT IS VALID

1. Head to this site: https://sitma.bcta.group/
2. Use these credentials:

a. Report Reference Number:
   i. 27342
b. Job Postcode:
   i. B1 1NG

Simplified Test Results

Certificate Number	Plot & Source Room	Plot & Receive Room	Target $D_{nT,w}+C_{tr}$ or $L'_{nT,w}$	Result $D_{nT,w}+C_{tr}$ or $L'_{nT,w}$	Pass / Fail
109411	Room Activity 3 Room	Apartment GG Kitchen / Living Room	45	57	PASS
109413	Room Office Office	Apartment GG Bedroom 1	45	60	PASS
109415	Room Office Office	Apartment GG Bedroom 1	62	56	PASS

Testing Methodology

Airborne Sound Insulation Tests

Measurements of Standardised Level Difference (D_{nT}) were conducted in accordance with BS EN ISO 140-4:1998.

Level measurements in the Source & Receive Rooms (L_1 & L_2)
The noise was generated in the source room by placing an active loudspeaker, which produces a steady spectrum of pink noise, in an external corner of the room but at least 0.5m away from any reflective surface.
The noise level was measured in both the source room and receive room, sampling as much of the room as possible. The sound level meter was always kept 0.7m away from any reflective surface as to not artificially increase or decrease noise levels into the microphone.
The measurements were taken at one-third octave band intervals from 100 to 3150 Hertz using an average time of 30 seconds The speaker was then moved to a corner junction on two internal walls and the measurements were repeated. The measurements in each room were arithmetically averaged. For separating walls the speaker should be in a corner opposite the test wall.

Background Measurements in Receive Room (L_b)
Where noise levels were measured in the receive room, the background noise level was also measured with the source room speaker turned off to ensure the background noise level did not influence the result. The background noise level is measured over a time period that accurately reflects the background noise measurement at the time of the test. This is normally between 6 & 30 seconds and can vary between the first and second background measurements.

Reverberation Time Measurements (T_2, T_{20})
A minimum of 6 reverberation time measurements were also taken in the receive room to accurately define the level of influence the diffuse field has on the microphone, ensuring that an increase in soft or hard surfaces does not impact the overall test result.
A minimum of 6 reverberation times were measured in each room using a minimum of 3 microphone positions at each of 2 loudspeaker positions in accordance with BS EN ISO 354:2003 (also complies with BS EN 20354:1993)

Impact Sound Insulation Tests

Impact Sound Insulation was conducted to BS EN ISO 140-7:1998

Measurements of standardised impact Sound Pressure Level (L'_{nT}) were conducted in accordance with BS EN ISO 140-7:1998.

Level Measurements in the Receive Room
Level measurements were acquired in the receive room using a tapping machine, which has a set of 5 steel hammers to produce impact noise on the separating floor surface.
The tapping machine was orientated at 45 degrees to the main floor axis.
The noise level was measured in the receive room at 2 microphone positions at one-third octave band

intervals from 100 to 3150 Hertz using an average time of at least 6 seconds for each of 4 tapping machine positions, creating 8 individual measurement readings.
Measurements were always taken at least 0.7m away from any reflective or absorptive surfaces.

Background Measurements in Receive Room (L_b)
Where noise levels were measured in the receive room, the background noise level was also measured with the tapping machine turned off. This is to ensure the background noise level did not influence the result. The background noise level is measured over a time period that accurately reflects the background noise measurement at the time of the test. This is normally between 6 & 30 seconds and can vary between the first and second background measurements.

Reverberation Time Measurements (T_2, T_{20})
A minimum of 6 reverberation times were measured in each room using a minimum of 3 microphone positions at each of 2 loudspeaker positions in accordance with BS EN ISO 354:2003 (also complies with BS EN 20354:1993)
These measurements are often the same readings as the airborne test when measured in the same group of tests where the receive room is the same and the test(s) carried out on the same day.

Calculation Methodology

Airborne Sound Insulation Tests

Background Noise Correction (‘Corrected L_2')
Any receive room noise measurements that are within 6dB of the background measurements are corrected by logarithmically averaging the difference to correct the receive room measurement. The correction is applied up to 10dB, where a maximum correction of 1.6dB is applied. Any background noise level greater than 10dB over the L_2 measurement will appear to reduce the sound insulation at that frequency.

Level Difference (‘*D*')
The difference between the source and ‘corrected’ receive room measurement is calculated for each speaker position and 2 differences averaged to obtain ‘*D*’ for each frequency measured. These are calculated separately for Speaker Position 1 and Speaker Position 2

Standardised Level Difference (‘D_{nT}')
The result is standardised by adding 10 times the logarithm of half the reverberation time at each frequency to give the standardized level difference (DnT) at each frequency. These are calculated separately for Speaker Position 1 and Speaker Position 2 and are arithmetically averaged to produce final $D_{nT,S}$.

Weighted Standardized Level Difference (‘$D_{nT,w}$')
The $D_{nT,S}$ are then compared to the standard reference curve as defined in BS EN ISO 717-1:1997 to give a single figure result of $D_{nT,w}$.

Weighted Standardized Level Difference with Spectrum Adaption (‘$D_{nT,w}$ + C;C_{tr}')
The spectrum adaptation terms (C;C_{tr}) are then calculated in accordance with BS EN ISO 717-1:1997.

Precision
All measurements are taken to 0.1dB precision, except reverberation times which are taken to 0.01 seconds precision.

Impact Sound Insulation Tests

Background Noise Correction (‘Corrected L_2’)
Any receive room noise measurements that are within 6dB of the background measurements are corrected by logarithmically averaging the difference to correct the receive room measurement. The correction is applied up to 10dB, where a maximum correction of 1.6dB is applied. Any background noise level greater than 10dB over the L_2 measurement will appear to reduce the sound insulation at that frequency.

Normalized Impact Sound Pressure Level (‘L'_{nT}’)
The result is normalized by adding 10 times the logarithm of half the reverberation time at each frequency to the ‘corrected’ L2 to give the Standardized Impact Sound Pressure Level (L'_{nT}) at each frequency.

Weighted Standardized Impact Sound Pressure Level (‘$L'_{nT,w}$')
The $L'_{nT,w}$ are then compared to the standard reference curve as defined in BS EN ISO 717-2:1997 to give a single figure result.

Precision
All measurements are taken to 0.1dB precision, except reverberation times which are taken to 0.01 seconds precision.

Sampling Regime

Testing was conducted using a sampling regime in accordance with Approved Document E 2003 [as amended] (ADE), ensuring each construction type was tested on the project, not necessarily each plot.
It is assumed that each construction type is constructed consistently. If this is not the case, and deviations of the construction type occur, further testing will be required to comply with the requirements of Approved Document E 2003 [as amended] to the Building Regulations.

ADE requires that sets of tests are carried out on one in ten of each construction type or sub-group. Each set of tests on houses is made up of two airborne sound insulation tests (Two Tests). Each set of tests on flats is made up of two airborne tests on walls and two airborne and two impact tests on floors (Six Tests).

The location of the sets of tests are selected at random by the tester except where specifically requested the Approved Inspector or specialist input from Robust Details.

Rooms were tested unfurnished unless testing is specifically requested in a furnished room. Testing is conducted using the larger room as the source room, with a tolerance of 10% of volume being acceptable either way. Doors, windows and trickle vents must be closed and kitchen units, cupboard doors, wardrobes etc shall be open for the duration of the test when they have been installed against the separating wall under test.

For impact testing, the tests are always conducted on the separating floor that has received Building Control Approval.
It is only ever acceptable to test on a soft floor covering where that covering is an integral part of a Type 1 concrete floor as defined by ADE and cannot physically be lifted by the testers own hands.

Occasionally, rooms may have an awkward layout, such as a stagger, be significant in length (>10m) or contain internal barriers. These requirements are defined in EN ISO 140-14:2004 which all testers hold a copy of as a mandatory entry requirement into the SITMA scheme. Where a test has an awkward layout, the testing method from BS EN ISO 140-14:2004 will be defined in the report and sketches held internally.

Deviations

Background Noise Levels
Background noise levels are often an unavoidable part of testing as testing must take place on a live building site. Though a correction is applied within the calculation, high background noise levels may result in the wall/floor under test not achieving its full potential. Situations can occur where background noise levels are not high but the sound insulation performance of the separating floor or wall is so good that the measured levels are close to the prevailing background levels. The equipment used cannot distinguish between background noise levels and the noise from the speaker.

Deviations Related to the test
If any deviation from the testing method was necessary, details of the deviation are indicated on each individual test certificate (appended to this report). Where deviations were avoidable, or tests have been conducted on a ‘trial’ basis, these will be highlighted at the bottom of each certificate.

Calibration

Calibration
The calibration certificates are appended to this report under Appendix B. The summary of calibrated equipment used is shown below:

Item	Calibration from	Calibration expiry	Certificate Number
SVAN 4 (971A)	14 Feb 2022	14 Feb 2024	UCRT22 1225
B&K Calibrator	10 Nov 2022	10 Nov 2023	06004/1
EOS Tapping Machine	18 Nov 2022	18 Nov 2024	06019/1

Tester Site Notes:

The space above the Girl Guides apartment was fitted out as the site office at the time of the sound insulation test. Upon completion of the development this space will be a residential apartment. The floor slab separating this space from the Girl Guides apartment (the tested floor) will however remain as it was during the testing.

Test Results

Airborne Wall Tests – New Build by Jordan Mayes

Certificate Number	Plot & Source Room	Source Room Volume	Plot & Receive Room	Receive Room Volume	**Target** $D_{nT,w}+C_{tr}$	**Result** $D_{nT,w}+C_{tr}$	Pass / Fail
109411	**Room Activity 3 Room**	105.6m³	**Apartment GG Kitchen / Living Room**	77.0m³	>= 45 dB	>= 57 dB	**Pass**
	Construction: Steel frame - twin metal frame: 2xGyproc SoundBloc 15mm fixed to outside faces of two Gypframe 48 S 50 'C' Stud frameworks with studs at 600mm centres, cross braced using Gypframe 99 FC 50 Fixing Channel at 1200mm centres. 25mm APR 1200 in the cavity						
	Deviations:						

Airborne floor Tests – New Build by Jordan Mayes

Certificate Number	Plot & Source Room	Source Room Volume	Plot & Receive Room	Receive Room Volume	**Target** $D_{nT,w}+C_{tr}$	**Result** $D_{nT,w}+C_{tr}$	Pass / Fail
109413	**Room Office Office**	118.0m³	**Apartment GG Bedroom 1**	46.8m³	>= 45 dB	>= 60 dB	**Pass**
	Construction: Generic Concrete: FC0001** : Generic Concrete250mm RC slab						
	Deviations: Source Room furnished						

Impact floor Tests – New Build by Jordan Mayes

Certificate Number	Plot & Source Room	Source Room Volume	Plot & Receive Room	Receive Room Volume	**Target** $L'_{nT,w}$	**Result** $L'_{nT,w}$	Pass / Fail
109415	**Room Office Office**	118.0m³	**Apartment GG Bedroom 1**	46.8m³	<= 62 dB	<= 56 dB	**Pass**
	Construction: Generic Concrete: FC0001** : Generic Concrete 250mm RC slab						
	Deviations: Source Room furnished						

Appendix A – Individual Certificates

Test Type	Source Room	Partition	Receiver Room
Airborne sound insulation	Room Activity 3 Room	E-WS-1	Apartment GG Kitchen / Living Room
Airborne sound insulation	Room Office Office	FC0001**	Apartment GG Bedroom 1
Impact sound insulation	Room Office Office	FC0001**	Apartment GG Bedroom 1

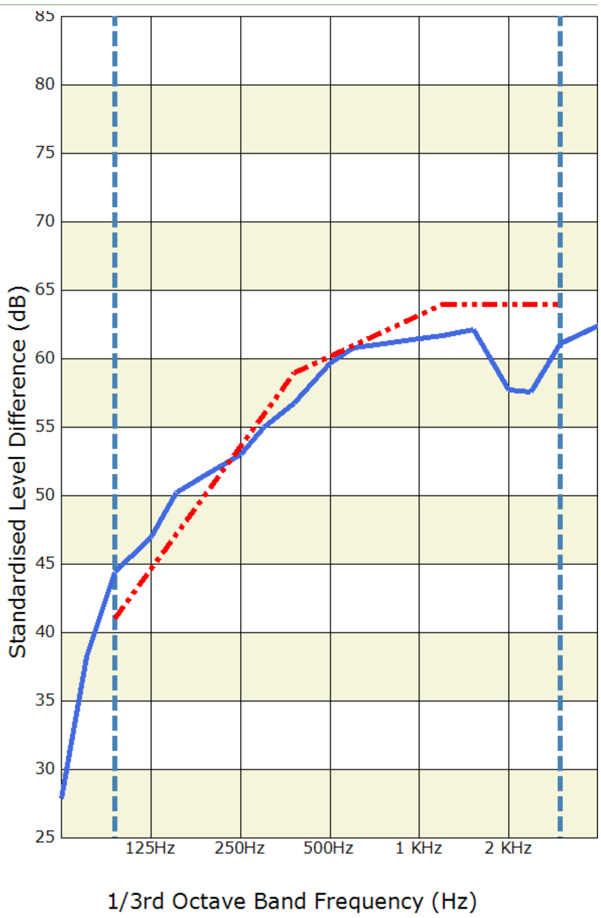
Registered Sound Insulation Test Certificate

Test No:	109411	Test Job Ref:	27342	Test Org Name:	JPM Acoustics Ltd
Customer:	WinVic Construction Ltd			Test Type:	Airborne (Wall)
Address:	Brampton House, 19 Tenter Road, Moulton Park, Northampton	Job Address:	Holloway Head, , Birmingham	Test Date:	21/02/2023
				Tester:	Jordan Mayes
				Site type:	New Build
Postcode:	NN3 6PZ	Postcode:	B1 1NG	Site Build:	Dwelling-House/Flat

	Source Room:	Partition:	Receiver Room:
Description:	Room Activity 3 Room	E-WS-1	Apartment GG Kitchen / Living Room
Volume / Area	105.6m³	14.5m²	77.0m³

Frequency (Hz)	D_{nT} 1/3 Octave (dB)	BGnd Correction
50 Hz*	19.6	X
63 Hz*	27.9	X
80 Hz*	38.2	
100 Hz	44.4	X
125 Hz	47	X
160 Hz	50.2	X
200 Hz	51.5	X
250 Hz	53	X
315 Hz	55	X
400 Hz	56.8	X
500 Hz	59.7	X
630 Hz	60.8	X
800 Hz	61.1	X
1 KHz	61.5	X
1.25 KHz	61.7	X
1.6 KHz	62.1	X
2 KHz	57.7	X
2.5 KHz	57.6	X
3.15 KHz	61.1	X
4 KHz*	62.4	X
5 KHz*	60	X

Evaluation based on field measurement using results obtained by an engineering method



*Outside scope of accreditation

Above graph shows frequency range according to the curve of reference values within BS EN ISO 717-1

$D_{nT,w}$ (C; C_{tr}) [dB]: 60 (-1, -3) dB
$D_{nT,w}$+ C_{tr} [dB]: 57 dB
Minimum Pass Level [dB]: 45 dB

PASS
Adverse Aggregated Deviations [dB]: 25.9

Partition Detail:2xGyproc SoundBloc 15mm fixed to outside faces of two Gypframe 48 S 50 ‘C’ Stud frameworks with studs at 600mm centres, cross braced using Gypframe 99 FC 50 Fixing Channel at 1200mm centres. 25mm APR 1200 in the cavity

Test Exceptions (if any):

AIRBORNE SOUND INSULATION TEST: Approved Document E (2003) including 2004, 2010, 2013, and 2015 Amendments
BS EN ISO 140 - Part 4:1998: Acoustics - measurement of sound in buildings and of building elements
BS EN ISO 717 - Part 1:1997: Acoustics - rating of sound in buildings and of building elements

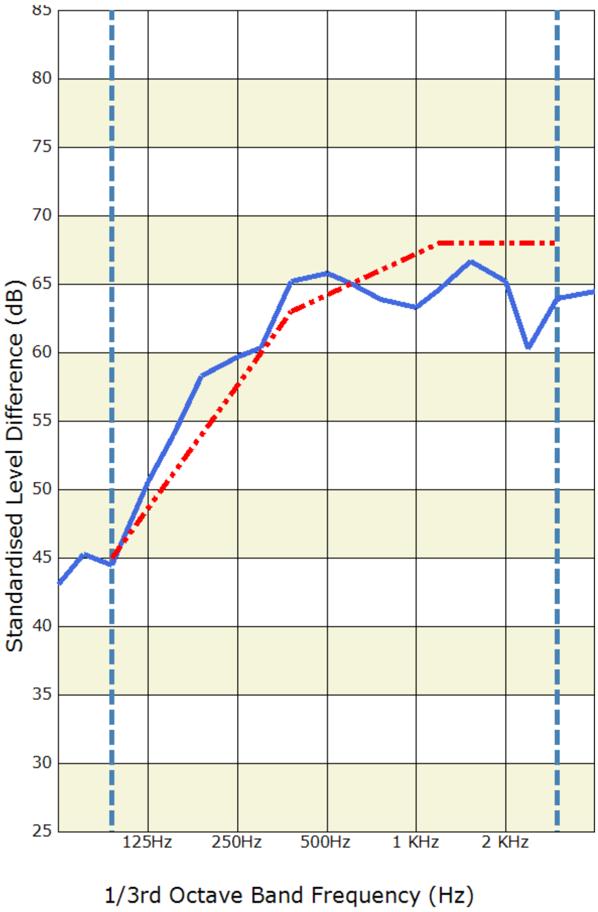
Registered Sound Insulation Test Certificate

Test No:	109413	Test Job Ref:	27342	Test Org Name:	JPM Acoustics Ltd
Customer:	WinVic Construction Ltd			Test Type:	Airborne (Floor)
Address:	Brampton House, 19 Tenter Road, Moulton Park, Northampton	Job Address:	Holloway Head, , Birmingham	Test Date:	21/02/2023
				Tester:	Jordan Mayes
				Site type:	New Build
Postcode:	NN3 6PZ	Postcode:	B1 1NG	Site Build:	Dwelling-House/Flat

	Source Room:	Partition:	Receiver Room:
Description:	Room Office Office	FC0001**	Apartment GG Bedroom 1
Volume / Area	118.0m³	20.0m²	46.8m³

Frequency (Hz)	D_{nT} 1/3 Octave (dB)	BGnd Correction
50 Hz*	26.6	X
63 Hz*	43.1	X
80 Hz*	45.3	X
100 Hz	44.5	
125 Hz	50.6	X
160 Hz	54	X
200 Hz	58.3	X
250 Hz	59.7	X
315 Hz	60.4	X
400 Hz	65.2	X
500 Hz	65.8	X
630 Hz	65.1	X
800 Hz	63.9	X
1 KHz	63.3	X
1.25 KHz	64.6	X
1.6 KHz	66.7	X
2 KHz	65.2	X
2.5 KHz	60.3	X
3.15 KHz	64	X
4 KHz*	64.5	X
5 KHz*	62.2	X

Evaluation based on field measurement using results obtained by an engineering method



*Outside scope of accreditation

Above graph shows frequency range according to the curve of reference values within BS EN ISO 717-1

$D_{nT,w}$ (C; C_{tr}) [dB]: 64 (-1, -4) dB
$D_{nT,w}$+ C_{tr} [dB]: 60 dB
Minimum Pass Level [dB]: 45 dB

PASS
Adverse Aggregated Deviations [dB]: 25.5

Partition Detail:FC0001** : Generic Concrete250mm RC slab

Test Exceptions (if any): Source Room furnished

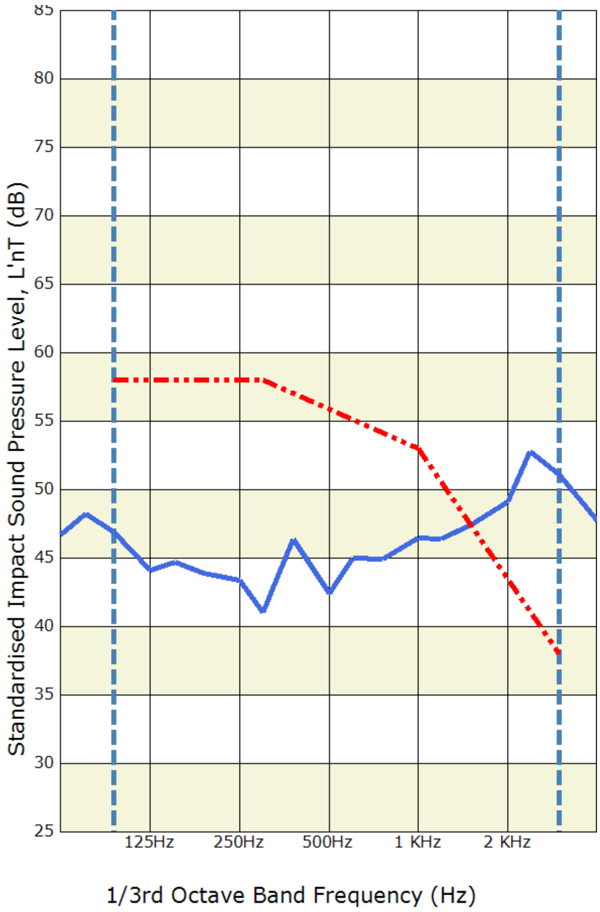
AIRBORNE SOUND INSULATION TEST: Approved Document E (2003) including 2004, 2010, 2013, and 2015 Amendments
BS EN ISO 140 - Part 4:1998: Acoustics - measurement of sound in buildings and of building elements
BS EN ISO 717 - Part 1:1997: Acoustics - rating of sound in buildings and of building elements

Registered Impact Test Certificate

Test No:	109415	Test Job Ref:	27342	Test Org Name:	JPM Acoustics Ltd
Customer:	WinVic Construction Ltd			Test Type:	Impact (Floor)
Address:	Brampton House, 19 Tenter Road, Moulton Park, Northampton	Job Address:	Holloway Head, , Birmingham	Test Date:	21/02/2023
				Tester:	Jordan Mayes
				Site type:	New Build
Postcode:	NN3 6PZ	Postcode:	B1 1NG	Site Build:	Dwelling-House/Flat

	Source Room:	Partition:	Receiver Room:
Description:	Room Office Office	FC0001**	Apartment GG Bedroom 1
Volume / Area	118.0m³	20.0m²	46.8m³

Frequency (Hz)	L'_{nT} 1/3 Octave (dB)	BGnd Correction
50 Hz*	50.1	X
63 Hz*	46.7	
80 Hz*	48.2	
100 Hz	46.9	
125 Hz	44.1	
160 Hz	44.7	
200 Hz	43.9	
250 Hz	43.4	
315 Hz	41	
400 Hz	46.4	
500 Hz	42.4	X
630 Hz	45	
800 Hz	44.9	
1 KHz	46.5	
1.25 KHz	46.4	
1.6 KHz	47.5	
2 KHz	49.1	
2.5 KHz	52.8	
3.15 KHz	51.1	
4 KHz*	47.7	
5 KHz*	45	



Evaluation based on field measurement using results obtained by an engineering method

*Outside scope of accreditation

Above graph shows frequency range according to the curve of reference values within BS EN ISO 717-2

$L'_{nT,w}$ (CI) [dB]: 56 (-12) dB
Maximum Pass Level [dB]: 62 dB

PASS

Adverse Aggregated Deviations [dB]: 30.5

Partition Detail:FC0001** : Generic Concrete 250mm RC slab

Test Exceptions (if any): Source Room furnished

IMPACT SOUND INSULATION TEST: Approved Document E (2003) including 2004, 2010, 2013, and 2015 Amendments
BS EN ISO 140 - Part 7:1998: Acoustics - measurement of sound in buildings and of building elements
BS EN ISO 717 - Part 2:1997: Acoustics - rating of sound in buildings and of building elements

Appendix B – UKAS Calibration Certificates

Certificate of Calibration

Issued by University of Salford (Acoustic Calibration Laboratory)
UKAS ACCREDITED CALIBRATION LABORATORY NO. 0801

APPROVED SIGNATORIES
Claire Lomax [x] Sean Furlong [ ]
Gary Phillips [ ] Daniel Wong-McSweeney [ ]

UKAS CALIBRATION 0801

University of Salford MANCHESTER

acoustic calibration laboratory
The University of Salford, Salford, Greater Manchester, M5 4WT, UK
http://www.acoustics.salford.ac.uk
t 0161 295 3030/0161 295 3319 f 0161 295 4456 e c.lomax1@salford.ac.uk

Certificate Number: 06004/1 Date of Issue: 10 November 2022

CALIBRATION OF A SOUND CALIBRATOR

FOR:	JPM Acoustics Ltd 69 Greenleach Lane Worsley Manchester M28 2RT
FOR THE ATTENTION OF:	Jordan Mayes
DESCRIPTION:	Calibrator with housing for one-inch microphones and adaptor type DB 0311 for half-inch microphones.
MANUFACTURER:	B&K
TYPE:	4230
SERIAL NUMBER:	449050
DATE RECEIVED:	9/11/2022
DATE OF CALIBRATION:	10/11/2022
LOCATION OF CALIBRATION:	Acoustic Calibration Laboratory, Newton G31, University of Salford.
TEST PROCEDURE:	CTP06 (Laboratory Manual)

Test Engineer (initial):	GP	Name:	Gary Phillips

Results in this certificate relate only to instruments tested.

Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)
UKAS ACCREDITED CALIBRATION LABORATORY NO. 0801

APPROVED SIGNATORIES
Claire Lomax [x] Sean Furlong [ ]
Gary Phillips [ ] Daniel Wong-McSweeney [ ]

0801

acoustic calibration laboratory
The University of Salford, Salford, Greater Manchester, M5 4WT, UK
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Certificate Number: 06019/1 Date of Issue: 30 November 2022

VERIFICATION OF TAPPING MACHINE CONFORMANCE TO ISO 140 Part 7

FOR:	JPM Acoustics Ltd 69 Greenleach Lane Worsley Manchester M28 2RT
FOR THE ATTENTION OF:	Jordan Mayes
DESCRIPTION:	Tapping Machine
MANUFACTURER:	Sources Line
TYPE:	EOS
SERIAL NUMBER:	NG E05 178
DATE RECEIVED:	17 November 2022
DATE OF CALIBRATION:	18 November 2022
LOCATION OF CALIBRATION:	Acoustic Calibration Laboratory, Newton G31, University of Salford

Test Engineer (initial):	LC	Name:	Luke Cambidge

Results relate only to instruments tested

Advisory Note: The hammer curvature radius has been measured after cleaning the impact surface. Any build up of debris on the impact surface can affect the hammer curvature radius, therefore we advise the impact surface is regularly checked for debris and cleaned as appropriate.

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 14 February 2022

Certificate Number: UCRT22/1225

Calibrated at & Certificate issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	JPM Acoustics Ltd 97 Hazelhurst Road Worsley Manchester M28 2SW
Order No.	0222_007
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification

Manufacturer	*Instrument*	*Type*	*Serial No. / Version*
NTi	Sound Level Meter	SV 971A	113221
NTi	Firmware		1.05.2
NTi	Pre Amplifier	SV 18A	113722
ACO	Microphone	7152	80629
Brüel & Kjær	Calibrator	4231	C001
	Calibrator adaptor type if applicable		UC 0210

Performance Class 1

Test Procedure TP 10. SLM 61672-3:2013

Procedures from IEC 61672-3:2013 were used to perform the periodic tests.

Type Approved to IEC 61672-1:2013 No

If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2013

Date Received 11 February 2022 ANV Job No. UKAS22/02110

Date Calibrated 14 February 2022

The sound level meter submitted for testing has successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 because (a) evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 and (b) because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	Initial Calibration		

CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0653

Certificate Number
UCRT22/1225

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	SVAN 971A User Manual		
SLM instruction manual ref / issue	Rev. 1.00 2021-09-23	Source	Svantek
Date provided or internet download date	09 February 2022		

	Case Corrections	Wind Shield Corrections	Mic Pressure to Free Field Corrections
Uncertainties provided	Yes	Yes	Yes

Total expanded uncertainties within the requirements of IEC 61672-1:2013 | YES

Specified or equivalent Calibrator	Specified		
Customer or Lab Calibrator	Lab Calibrator		
Calibrator adaptor type if applicable	UC 0210		
Calibrator cal. date	17 January 2022		
Calibrator cert. number	UCRT22/1065		
Calibrator cal cert issued by Lab	0653		
Calibrator SPL @ STP	94.10	dB	Calibration reference sound pressure level
Calibrator frequency	999.84	Hz	Calibration check frequency
Reference level range	Normal	dB	

Accessories used or corrected for during calibration - Wind Shield SA 22

Environmental conditions during tests	Start	End			
Temperature	22.85	22.99	±	0.30	°C
Humidity	40.1	37.1	±	3.00	%RH
Ambient Pressure	98.65	98.74	±	0.03	kPa

Indication at the Calibration Check Frequency

Initial indicated level	93.7	dB	Adjusted indicated level	94.0	dB
Uncertainty of calibrator used for Indication at the Calibration Check Frequency ±				0.10	dB

Self Generated Noise

Microphone installed - Less Than | 17.6 | dB A Weighting

Microphone replaced with electrical input device - | UR = Under Range indicated

Weighting	A			C			Z		
	4.4	dB	UR	3.4	dB	UR	7.3	dB	UR

Self Generated Noise reported for information only and not used to assess conformance to a requirement

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* =2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

Additional Comments The results on this certificate only relate to the items calibrated as identified above.
Electrical test completed with a nominal Cal Factor of 0 dB as specified in the manual.
The meter was supplied with a 01dB CAL21 sound calibrator, serial number 34675335(2017). However this is not an approved device for the meter, and the free-field correction data are unknown. For information only, once the meter was adjusted to read correctly in response to the laboratory calibrator the 01dB CAL21 was applied and produced a reading of 94.0 dB in sound level meter mode.

……………………………………………… END ………………………………………………

Calibrated by: B. Bogdan

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 14 February 2022

Certificate Number: UCRT22/1227

Calibrated at & Certificate issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

CUSTOMER: JPM Acoustics Ltd
97 Hazelhurst Road
Worsley
Manchester
M28 2SW

ORDER No: 0222_007 Job No: UKAS22/02110

DATE OF RECEIPT: 11 February 2022

PROCEDURE: Procedure TP 9 - Calibration of Filters

IDENTIFICATION

	Manufacturer	*Model*	*Serial No*
Filters in sound level meter	Svantek	971A	113221

CALIBRATED ON: 14 February 2022

The sound level meter was calibrated in accordance with the manufacturer's instructions, using an appropriate sound level calibrator, prior to measurements being carried out on the filters. The sound level meter has also undergone a full verification procedure, see certificate UCRT22/1225 issued by this laboratory. The manufacturer claims that the filters were designed in accordance with the Class 1 third octave requirements of IEC 61260:1995, and these tolerances are given with the results in this certificate. Base 10 test frequencies have been used throughout the filter calibration, in accordance with manufacturers' information.

Inter-band level accuracy test

The meter was set to the Normal measurement range and the 1 kHz third octave filter was selected. A 1 kHz sinusoidal signal was then injected and adjusted to give a reading of 94.0 dB. Following this each filter band was selected in turn, the signal frequency was adjusted to the centre-frequency of the filter, and the sound level meter reading relative to that for the 1 kHz band was noted. A similar test was carried out for the Z setting using a 1 kHz signal.

As the tolerance at the centre frequency in each band is ± 0.3 dB , it is expected (but not explicitly required in IEC 61260:1995), that the relative levels at each centre frequency shall lie within this spread. All bands tested met this expectation.

Filter shape test

Using the same measurement range as above, the 1 kHz third octave filter was again selected. A sinusoidal signal at the centre frequency of 1 kHz was injected, and its level adjusted to give a reading of 136.0 dB. The frequency of the input signal was then changed to each of the values shown in the table of results in turn, and the new meter reading was noted. Seventeen further third octave bands (as shown) were then selected and tested in the same manner, with the signal level being set at the new centre frequency in each case.

All bands tested met the requirements of the standard, which are shown with the results.

Uncertainties

The laboratories expanded measurement uncertainties are estimated as ± 0.16 dB at the centre frequency & at other frequencies within the pass-band of the filter, and ± 0.20 dB for frequencies outside the pass-band. **The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* =2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.**

NOTES

1 The attenuation figures given in the table(s) of filter shapes refer to the meter reading at the given frequency relative to that at the centre frequency in question. The required value is denoted as Δ in the column showing attenuation limits.

2 Since the tests carried out cover only a limited subset of the content of IEC 61260:1995, the results obtained do not confer compliance with the full requirements of that standard, and are applicable only to those filter bands tested.

3 Any linearity errors which the sound level meter may exhibit are included in the filter errors shown in this certificate. Since the meter errors may vary with frequency, it cannot be assumed that they are the same as those given in certificate number UCRT22/1225

4 The following firmware was in use at the time of the testing:

Identification	Version
SLM	1.05.2

1/3 octave filters: Inter-band accuracy

Band (Hz)	Error, dB	Band (Hz)	Error, dB	Band (Hz)	Error, dB
4	N/A	5	N/A	6.3	N/A
8	0.2	10	0.1	12.5	0.1
16	0.1	20	0.1	25	0.2
31.5	0.1	40	0.1	50	0.1
63	0.1	80	0.1	100	0.2
125	0.1	160	0.2	200	0.1
250	0.1	315	0.1	400	0.1
500	0.1	630	0.1	800	0.1
1000	Ref	1250	-0.2	1600	-0.2
2000	-0.3	2500	-0.3	3150	-0.2
4000	-0.1	5000	-0.1	6300	-0.2
8000	0.0	10000	0.2	12500	0.3
16000	0.3	20000	0.3	25000	N/A
31500	N/A				
Z @ 1 kHz	0.0				

1/3 octave filters: Filter shape

100 Hz band		125 Hz band		160 Hz band		Attenuation limits, dB
Freq, Hz	Atten, dB	Freq, Hz	Atten, dB	Freq, Hz	Atten, dB	
18.546	100.9	23.348	96.8	29.394	>109.0	$70.0 \leq \Delta \leq \infty$
32.748	79.3	41.226	75.1	51.902	98.2	$61.0 \leq \Delta \leq \infty$
53.143	56.3	66.902	52.8	84.226	67.2	$42.0 \leq \Delta \leq \infty$
77.257	26.1	97.259	24.4	122.445	29.1	$17.5 \leq \Delta \leq \infty$
89.126	3.1	112.201	3.0	141.256	3.0	$-0.3 \leq \Delta \leq 5.0$
91.958	0.4	115.766	0.4	145.744	0.2	$-0.3 \leq \Delta \leq 1.3$
94.719	0.1	119.242	0.0	150.120	0.0	$-0.3 \leq \Delta \leq 0.6$
97.402	0.1	122.619	0.0	154.372	0.0	$-0.3 \leq \Delta \leq 0.4$
100.000	Ref	125.890	Ref	158.490	Ref	$-0.3 \leq \Delta \leq 0.3$
102.667	0.0	129.247	0.0	162.717	0.0	$-0.3 \leq \Delta \leq 0.4$
105.575	0.1	132.908	0.0	167.326	0.0	$-0.3 \leq \Delta \leq 0.6$
108.746	0.2	136.900	0.1	172.352	0.0	$-0.3 \leq \Delta \leq 1.3$
112.201	3.0	141.250	3.0	177.827	3.0	$-0.3 \leq \Delta \leq 5.0$
129.437	35.9	162.948	47.8	205.145	47.5	$17.5 \leq \Delta \leq \infty$
188.173	>109.0	236.891	>109.0	298.235	>109.0	$42.0 \leq \Delta \leq \infty$
305.365	>109.0	384.424	>109.0	483.973	>109.0	$61.0 \leq \Delta \leq \infty$
539.195	>109.0	678.793	>109.0	854.570	>109.0	$70.0 \leq \Delta \leq \infty$

200 Hz band		250 Hz band		315 Hz band		Attenuation
Freq, Hz	Atten, dB	Freq, Hz	Atten, dB	Freq, Hz	Atten, dB	limits, dB
37.005	100.9	46.586	96.8	58.648	>109.0	$70.0 \le \Delta \le \infty$
65.342	79.2	82.260	75.2	103.559	98.2	$61.0 \le \Delta \le \infty$
106.036	56.2	133.490	52.8	168.054	66.9	$42.0 \le \Delta \le \infty$
154.151	26.1	194.062	24.4	244.310	29.0	$17.5 \le \Delta \le \infty$
177.833	3.0	223.876	3.0	281.843	3.1	$-0.3 \le \Delta \le 5.0$
183.484	0.4	230.989	0.4	290.799	0.3	$-0.3 \le \Delta \le 1.3$
188.993	0.0	237.925	0.1	299.530	0.1	$-0.3 \le \Delta \le 0.6$
194.346	0.0	244.664	0.0	308.014	0.0	$-0.3 \le \Delta \le 0.4$
199.530	Ref	251.190	Ref	316.230	Ref	$-0.3 \le \Delta \le 0.3$
204.851	0.0	257.889	0.0	324.664	0.0	$-0.3 \le \Delta \le 0.4$
210.654	0.0	265.194	0.0	333.860	0.0	$-0.3 \le \Delta \le 0.6$
216.981	0.2	273.159	0.1	343.887	0.2	$-0.3 \le \Delta \le 1.3$
223.875	3.0	281.838	3.1	354.813	3.1	$-0.3 \le \Delta \le 5.0$
258.266	36.0	325.133	47.6	409.319	47.4	$17.5 \le \Delta \le \infty$
375.462	>109.0	472.672	>109.0	595.059	>109.0	$42.0 \le \Delta \le \infty$
609.295	>109.0	767.046	>109.0	965.656	>109.0	$61.0 \le \Delta \le \infty$
1075.86	>109.0	1354.40	>109.0	1705.10	>109.0	$70.0 \le \Delta \le \infty$

400 Hz band		500 Hz band		630 Hz band		Attenuation
Freq, Hz	Atten, dB	Freq, Hz	Atten, dB	Freq, Hz	Atten, dB	limits, dB
73.833	100.5	92.951	96.2	117.018	101.3	$70.0 \le \Delta \le \infty$
130.373	79.2	164.130	75.2	206.627	89.8	$61.0 \le \Delta \le \infty$
211.568	56.2	266.347	52.9	335.311	66.6	$42.0 \le \Delta \le \infty$
307.568	26.1	387.204	24.4	487.461	28.8	$17.5 \le \Delta \le \infty$
354.820	3.0	446.691	3.0	562.349	3.0	$-0.3 \le \Delta \le 5.0$
366.094	0.4	460.884	0.5	580.218	0.2	$-0.3 \le \Delta \le 1.3$
377.086	0.0	474.722	0.0	597.639	0.0	$-0.3 \le \Delta \le 0.6$
387.767	0.0	488.169	0.0	614.568	0.0	$-0.3 \le \Delta \le 0.4$
398.110	Ref	501.190	Ref	630.960	Ref	$-0.3 \le \Delta \le 0.3$
408.728	0.0	514.557	0.0	647.788	0.0	$-0.3 \le \Delta \le 0.4$
420.305	0.0	529.131	0.1	666.136	0.0	$-0.3 \le \Delta \le 0.6$
432.929	0.2	545.024	0.1	686.144	0.2	$-0.3 \le \Delta \le 1.3$
446.683	3.1	562.340	3.1	707.943	3.0	$-0.3 \le \Delta \le 5.0$
515.302	35.9	648.725	47.4	816.696	47.3	$17.5 \le \Delta \le \infty$
749.136	>109.0	943.104	>109.0	1187.30	>109.0	$42.0 \le \Delta \le \infty$
1215.69	>109.0	1530.46	>109.0	1926.73	>109.0	$61.0 \le \Delta \le \infty$
2146.59	>109.0	2702.39	>109.0	3402.10	>109.0	$70.0 \le \Delta \le \infty$

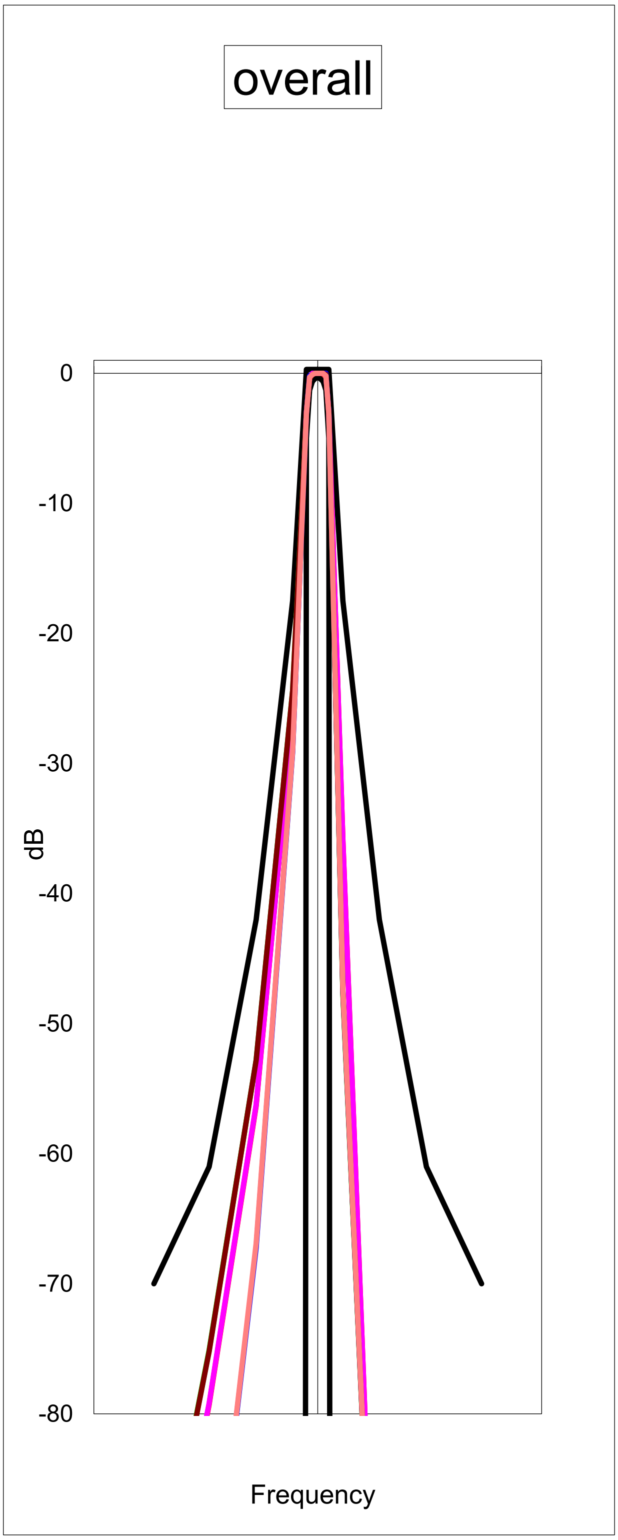
800 Hz band		1000 Hz band		1250 Hz band		Attenuation limits, dB
Freq, Hz	Atten, dB	Freq, Hz	Atten, dB	Freq, Hz	Atten, dB	
147.316	99.8	185.460	96.5	233.476	>109.0	$70.0 \le \Delta \le \infty$
260.127	78.6	327.480	74.8	412.265	95.4	$61.0 \le \Delta \le \infty$
422.131	56.2	531.430	44.8	669.017	66.1	$42.0 \le \Delta \le \infty$
613.676	26.1	772.570	24.2	972.588	28.5	$17.5 \le \Delta \le \infty$
707.955	3.0	891.260	3.0	1122.01	2.9	$-0.3 \le \Delta \le 5.0$
730.450	0.4	919.580	0.4	1157.66	0.2	$-0.3 \le \Delta \le 1.3$
752.381	0.0	947.190	0.0	1192.42	0.0	$-0.3 \le \Delta \le 0.6$
773.693	0.0	974.020	0.0	1226.19	0.0	$-0.3 \le \Delta \le 0.4$
794.330	Ref	1000.00	Ref	1258.90	Ref	$-0.3 \le \Delta \le 0.3$
815.515	0.0	1026.67	0.0	1292.47	0.0	$-0.3 \le \Delta \le 0.4$
838.614	0.0	1055.75	0.0	1329.08	0.0	$-0.3 \le \Delta \le 0.6$
863.802	0.2	1087.46	0.2	1369.00	0.2	$-0.3 \le \Delta \le 1.3$
891.246	3.1	1122.01	3.1	1412.50	3.0	$-0.3 \le \Delta \le 5.0$
1028.16	35.9	1294.37	46.9	1629.48	47.2	$17.5 \le \Delta \le \infty$
1494.71	>109.0	1881.73	>109.0	2368.91	>109.0	$42.0 \le \Delta \le \infty$
2425.61	>109.0	3053.65	>109.0	3844.24	>109.0	$61.0 \le \Delta \le \infty$
4282.99	>109.0	5391.95	>109.0	6787.93	>109.0	$70.0 \le \Delta \le \infty$

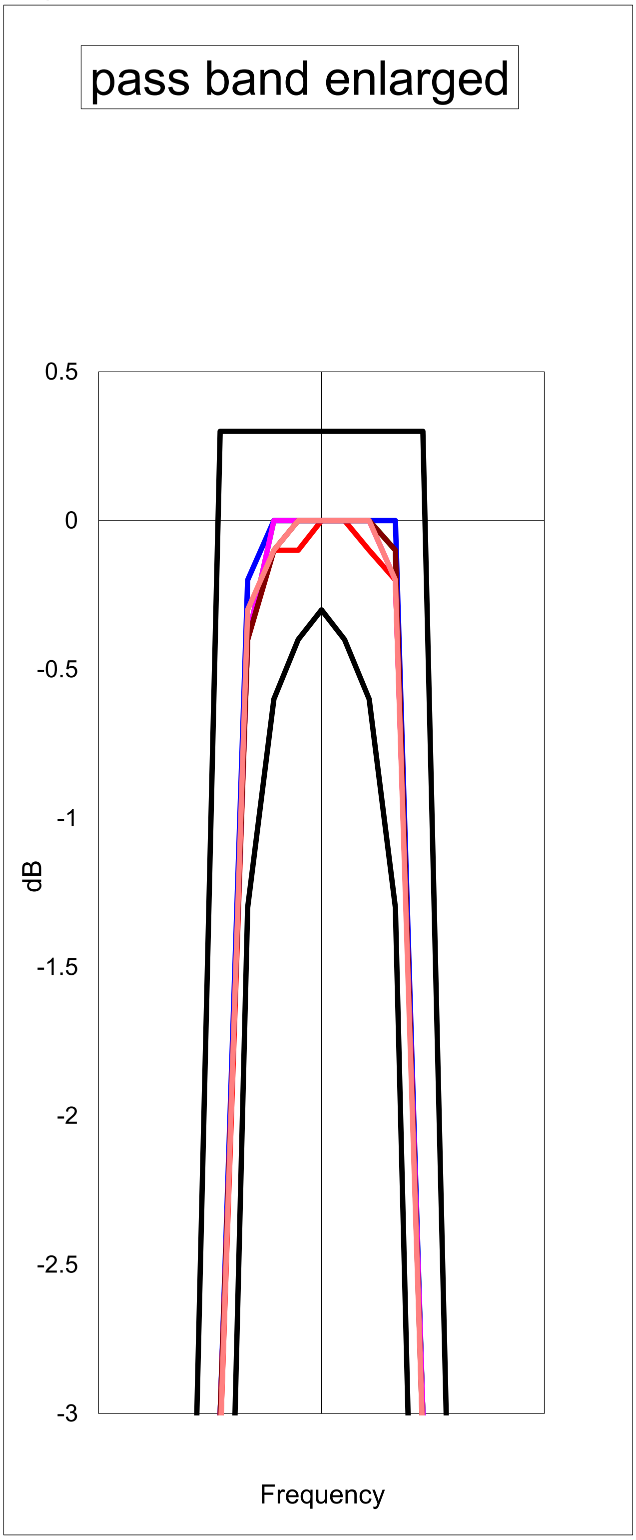
1600 Hz band		2000 Hz band		2500 Hz band		Attenuation limits, dB
Freq, Hz	Atten, dB	Freq, Hz	Atten, dB	Freq, Hz	Atten, dB	
293.936	100.9	370.048	96.3	465.857	>109.0	$70.0 \le \Delta \le \infty$
519.023	79.0	653.421	74.7	822.597	97.1	$61.0 \le \Delta \le \infty$
842.263	56.0	1060.36	52.4	1334.90	66.0	$42.0 \le \Delta \le \infty$
1224.45	26.0	1541.51	24.2	1940.62	28.5	$17.5 \le \Delta \le \infty$
1412.56	3.0	1778.33	2.9	2238.76	3.0	$-0.3 \le \Delta \le 5.0$
1457.44	0.3	1834.84	0.4	2309.89	0.2	$-0.3 \le \Delta \le 1.3$
1501.20	0.0	1889.93	0.0	2379.25	0.0	$-0.3 \le \Delta \le 0.6$
1543.72	0.0	1943.46	0.0	2446.64	0.0	$-0.3 \le \Delta \le 0.4$
1584.90	Ref	1995.30	Ref	2511.90	Ref	$-0.3 \le \Delta \le 0.3$
1627.17	0.0	2048.51	0.0	2578.89	0.0	$-0.3 \le \Delta \le 0.4$
1673.26	0.0	2106.54	0.0	2651.94	0.0	$-0.3 \le \Delta \le 0.6$
1723.52	0.2	2169.81	0.1	2731.59	0.1	$-0.3 \le \Delta \le 1.3$
1778.27	3.0	2238.75	3.0	2818.38	2.9	$-0.3 \le \Delta \le 5.0$
2051.45	35.8	2582.66	46.6	3251.33	46.9	$17.5 \le \Delta \le \infty$
2982.35	>109.0	3754.62	>109.0	4726.72	>109.0	$42.0 \le \Delta \le \infty$
4839.73	>109.0	6092.95	>109.0	7670.46	>109.0	$61.0 \le \Delta \le \infty$
8545.70	>109.0	10758.6	>109.0	13544.0	>109.0	$70.0 \le \Delta \le \infty$

3150 Hz band		4000 Hz band		5000 Hz band		Attenuation
Freq, Hz	Atten, dB	Freq, Hz	Atten, dB	Freq, Hz	Atten, dB	limits, dB
586.480	101.0	738.335	96.6	929.507	>109.0	$70.0 \le \Delta \le \infty$
1035.59	79.2	1303.73	75.2	1641.30	95.2	$61.0 \le \Delta \le \infty$
1680.54	56.4	2115.68	53.0	2663.47	66.1	$42.0 \le \Delta \le \infty$
2443.10	26.3	3075.68	24.5	3872.04	28.4	$17.5 \le \Delta \le \infty$
2818.43	3.1	3548.20	3.1	4466.91	3.0	$-0.3 \le \Delta \le 5.0$
2907.99	0.4	3660.94	0.4	4608.84	0.2	$-0.3 \le \Delta \le 1.3$
2995.30	0.1	3770.86	0.0	4747.22	0.0	$-0.3 \le \Delta \le 0.6$
3080.14	0.1	3877.67	0.0	4881.69	0.0	$-0.3 \le \Delta \le 0.4$
3162.30	Ref	3981.10	Ref	5011.90	Ref	$-0.3 \le \Delta \le 0.3$
3246.64	0.0	4087.28	0.0	5145.57	0.0	$-0.3 \le \Delta \le 0.4$
3338.60	0.0	4203.05	0.0	5291.31	0.0	$-0.3 \le \Delta \le 0.6$
3438.87	0.1	4329.29	0.0	5450.24	0.2	$-0.3 \le \Delta \le 1.3$
3548.13	3.0	4466.83	3.0	5623.40	3.1	$-0.3 \le \Delta \le 5.0$
4093.19	35.6	5153.02	46.4	6487.25	47.0	$17.5 \le \Delta \le \infty$
5950.59	>109.0	7491.36	>109.0	9431.04	>109.0	$42.0 \le \Delta \le \infty$
9656.56	>109.0	12156.9	>109.0	15304.6	>109.0	$61.0 \le \Delta \le \infty$
17051.0	>109.0	21465.9	>109.0	27023.9	>109.0	$70.0 \le \Delta \le \infty$

THIRD OCTAVE FILTERS

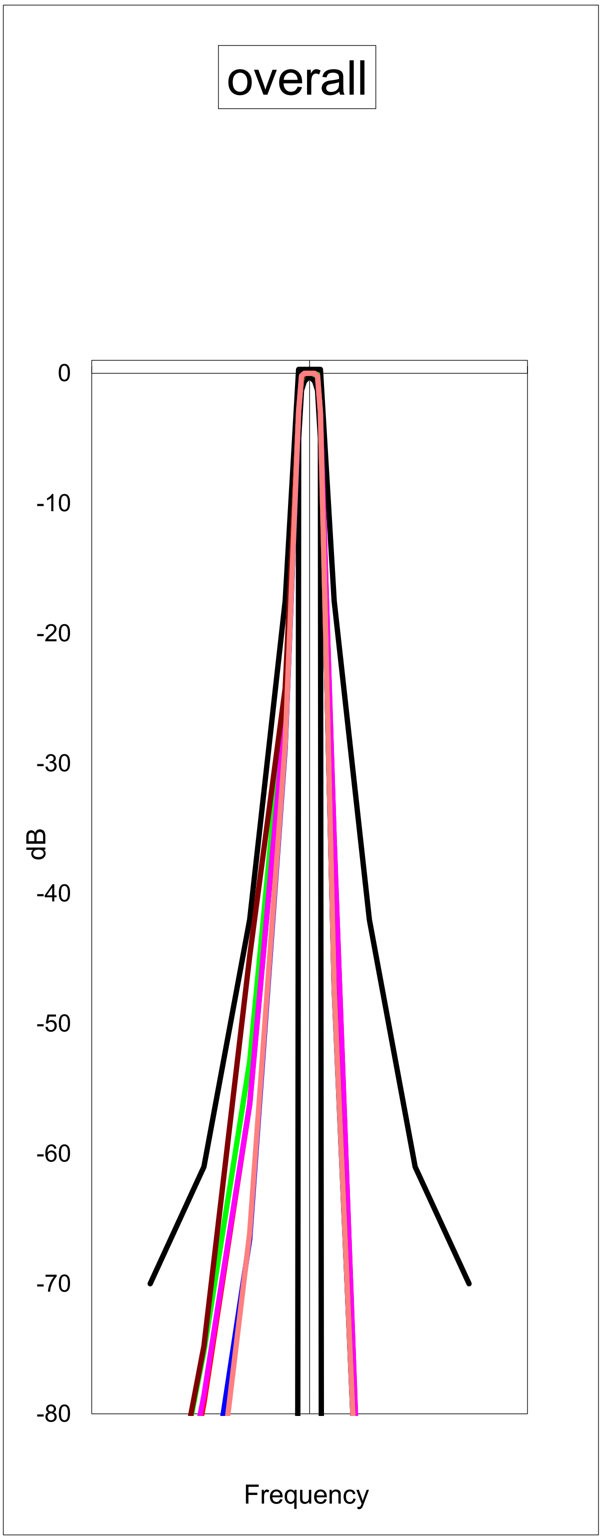
black	IEC 61260 limits		
red	100 Hz band	mauve	200 Hz band
green	125 Hz band	brown	250 Hz band
blue	160 Hz band	orange	315 Hz band

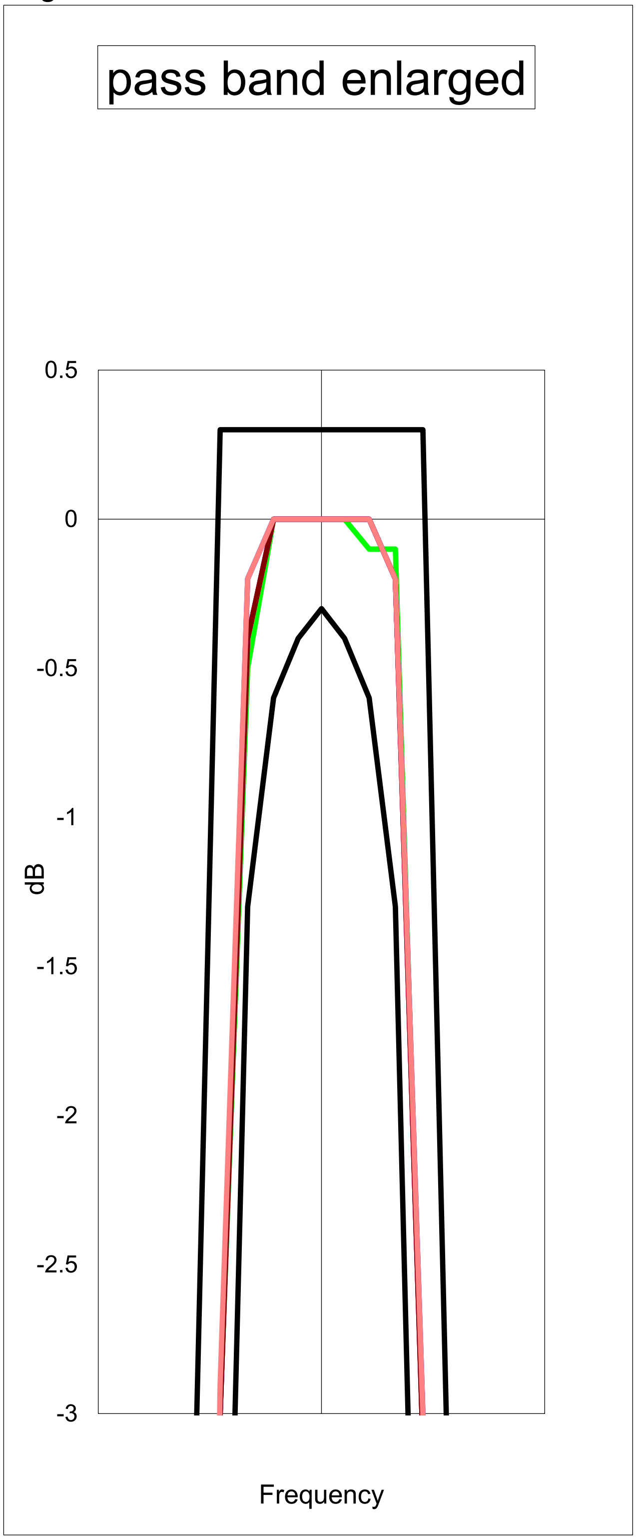




THIRD OCTAVE FILTERS

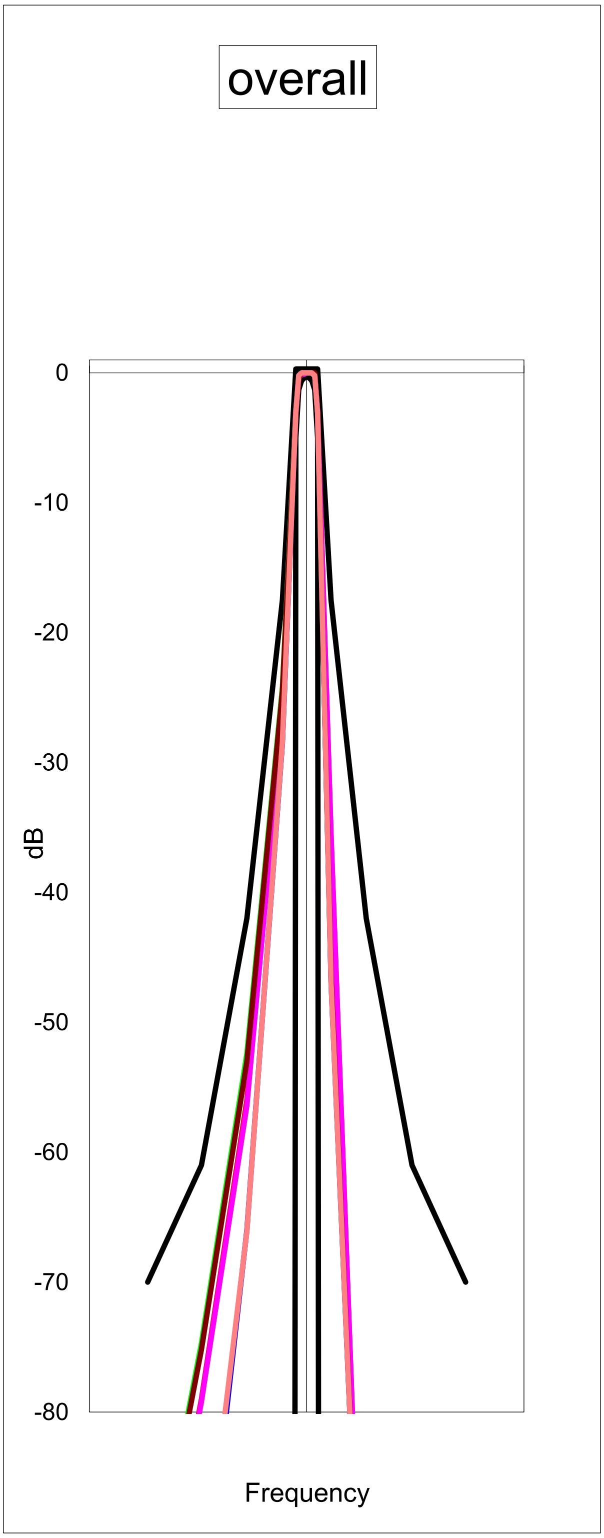
black	IEC 61260 limits		
red	400 Hz band	mauve	800 Hz band
green	500 Hz band	brown	1000 Hz band
blue	630 Hz band	orange	1250 Hz band





THIRD OCTAVE FILTERS

black	IEC 61260 limits		
red	1600 Hz band	mauve	3150 Hz band
green	2000 Hz band	brown	4000 Hz band
blue	2500 Hz band	orange	5000 Hz band



END

CERTIFICATE OF CALIBRATION

MEASUREMENT SYSTEMS

0653

Date of Issue: 14 February 2022

Certificate Number: UCRT22/1230

Calibrated at & Certificate issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

CUSTOMER	JPM Acoustics Ltd 97 Hazelhurst Road Worsley Manchester M28 2SW
ORDER No	0222_007 Job No UKAS22/02110
DATE OF RECEIPT	11 February 2022
PROCEDURE	Calibration Engineer's Handbook, section 26: calibration of reverberation time measurements.
IDENTIFICATION	Sound level meter Svantek type 971A serial number 113221
CALIBRATED ON	14 February 2022

MEASUREMENTS

The reverberation time measurements were verified using synthesised sinusoidal signals applied via a suitable input adapter in place of the microphone. These signals decayed at a known rate after an initial constant period. Base 10 centre-frequencies appropriate to each measured filter band were injected simultaneously.

Each measurement was carried out three times, and the mean value is reported in the following tables. The expanded uncertainty has been calculated in terms of a percentage of the applied decay time, and is ± 0.20 % for T_{20} and ± 0.13 % for T_{30} measurements.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* =2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

During the measurements the laboratory environmental conditions were:

Temperature: 23 to 24 ºC
Barometric pressure: 98.8 to 98.9 kPa
Relative humidity: 32 to 42 %RH

NOTES

1 The sound level meter was set to its Normal range, and was running firmware version 1.05.2

2 For some RT/filter combinations the bandwidth × time product is considered too small to be valid. These have therefore not been tested, and are indicated by a ► immediately to the left of the T20/T30 pair in the results table. It is advised that any results shown for such combinations when the meter is in normal use should be treated with caution.

Opinions & interpretations expressed in this note are not UKAS accredited.

All measurement data are held at ANV Measurement Systems for a period of at least six years.

CERTIFICATE OF CALIBRATION

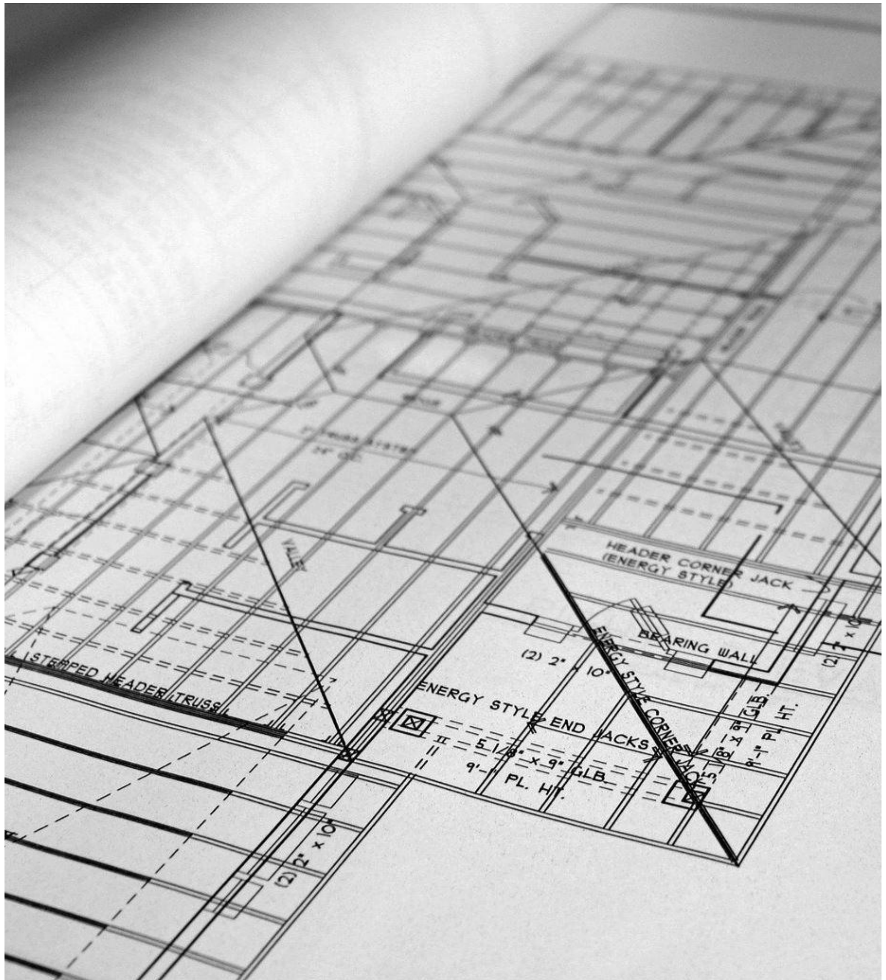
UKAS ACCREDITED CALIBRATION LABORATORY No 0653

Filter band Hz	Applied RT, s: 0.200		Applied RT, s: 0.500		Applied RT, s: 1.000	
	1/3-octave band		1/3-octave band		1/3-octave band	
	Mean T20, s	Mean T30, s	Mean T20, s	Mean T30, s	Mean T20, s	Mean T30, s
50	-	-	-	-	1.01	1.00
63	-	-	-	-	1.02	1.01
80	-	-	0.50	0.51	1.00	1.00
100	-	-	0.51	0.50	1.00	1.00
125	-	-	0.51	0.50	1.00	1.00
160	-	-	0.50	0.50	1.00	1.00
200	0.20	0.20	0.50	0.50	1.00	1.00
250	0.20	0.20	0.50	0.50	1.00	1.00
315	0.20	0.20	0.50	0.50	1.00	1.00
400	0.20	0.20	0.50	0.50	1.00	1.00
500	0.20	0.20	0.50	0.50	1.00	1.00
630	0.20	0.20	0.50	0.50	1.00	1.00
800	0.20	0.20	0.50	0.50	1.00	1.00
1000	0.20	0.20	0.50	0.50	1.00	1.00
1250	0.20	0.20	0.50	0.50	1.00	1.00
1600	0.20	0.20	0.50	0.50	1.00	1.00
2000	0.20	0.20	0.50	0.50	1.00	1.00
2500	0.20	0.20	0.50	0.50	1.00	1.00
3150	0.20	0.20	0.50	0.50	1.00	1.00
4000	0.20	0.20	0.50	0.50	1.00	1.00
5000	0.20	0.20	0.50	0.50	1.00	1.00
6300	0.20	0.20	0.50	0.50	1.00	1.00
8000	0.20	0.20	0.50	0.50	1.00	1.00
10000	0.20	0.20	0.50	0.50	1.00	1.00

Filter band Hz	Applied RT, s: 3.000		Applied RT, s: 10.000	
	1/3-octave band		1/3-octave band	
	Mean T20, s	Mean T30, s	Mean T20, s	Mean T30, s
50	3.01	3.00	9.99	9.97
63	2.99	2.99	10.00	9.96
80	3.01	3.00	10.00	9.96
100	3.00	3.00	9.99	9.96
125	3.00	3.00	10.00	9.97
160	3.00	3.00	10.00	9.96
200	3.00	3.00	10.00	9.96
250	3.00	3.00	10.00	9.97
315	3.00	3.00	10.00	9.97
400	3.00	3.00	10.00	9.97
500	3.00	3.00	10.00	9.97
630	3.00	3.00	10.00	9.97
800	3.00	3.00	10.00	9.97
1000	3.00	3.00	10.00	9.97
1250	3.00	3.00	10.00	9.97
1600	3.00	3.00	10.00	9.97
2000	3.00	3.00	10.00	9.97
2500	3.00	3.00	10.00	9.97
3150	3.00	3.00	10.00	9.97
4000	3.00	3.00	10.00	9.97
5000	3.00	3.00	10.00	9.97
6300	3.00	3.00	10.00	9.98
8000	3.00	3.00	10.00	9.98
10000	3.00	3.01	10.00	10.00

The results on this certificate only relate to the items calibrated as identified above.

END



Holloway Head Block C & D

RIBA Stage 3 Acoustic Design Report Rev 01

Client: WinVic

Project Number: 1492021

Date: 2nd February 2022

REPORT ISSUE & STATUS LOG

	Revision Number		
	1	2	3
Author	N. Adamson BSc (Hons) MIOA		
Position	Associate		
Date of Issue	2nd February 2022		
Comment	For Issue		

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1 INTRODUCTION

1.1 OVERVIEW

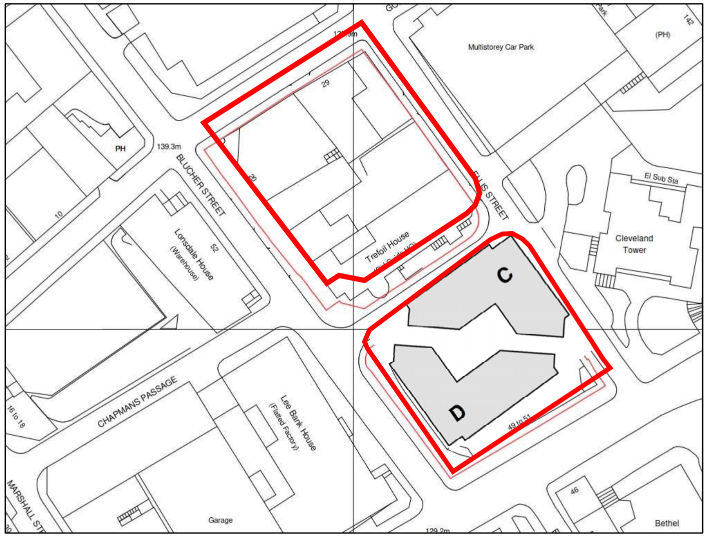
1.1.1 JPM Acoustics Ltd has been appointed by Winvic Construction Ltd to provide a RIBA Stage 3 acoustic design review for a residential development at 49-51 Holloway Head, in central Birmingham.

1.1.2 This report details relevant acoustic design criteria and guidance relating to the proposed development. The report uses some technical terminology where necessary and appropriate. **Appendix A** contains a glossary of relevant technical terminology to assist the reader.

1.2 DEVELOPMENT SITE

1.2.1 The development is to consist of four separate buildings split across two plots, north and south, in the area between Holloway Head, Ellis Street, Gough Street and Blucher Street in central Birmingham. There will be two buildings on each plot, with each pair connected at ground floor level. Block A and Block B will be located on the northern plot and Block C and Block D will be located on the southern plot. The location of both plots is shown in **Figure 1-1**. This report relates only to the design of Blocks C and D.

Figure 1-1: Site Location



1.3 SOUTHERN PLOT (BLOCK C & D) DEVELOPMENT PROPOSALS

1.3.1 The southern boundary of the southern plot is adjacent to Holloway Head, which is the only significant noise source in the vicinity of the site. The other boundaries of the plot are adjacent to relatively minor roads used by local traffic only.

1.3.2 The lower ground floor and mezzanine of the southern plot is to be predominantly used by the Girl Guides and will include a main hall, a common room, activity rooms, kitchen, offices, a three-bed apartment and associated facilities including a car park. The mezzanine will also contain a retail unit fronting onto Holloway Head.

1.3.3 The upper ground floor will consist mainly of apartments but will also have a lounge and co-working area for residents and some small offices for staff. There will be 13 floors of residential apartments above the upper ground level.

2 DESIGN CRITERIA

2.1.1 The criteria referenced in this document have been derived with consideration to the guidance from the following:

- Building Regulations' Approved Document E: 2003 Edition (ADE) with 2004,2010, 2013 & 2015 amendments.
- National and local planning requirements.
- British Standard 8233:2014 'Guidance on sound insulation and noise reduction for buildings'.
- British Standard 4142:2014+A1:2019: 'Methods for rating and assessing industrial and commercial sound'.
- The Finishes & Interiors Sector document '*A Guide to Office Acoustics*', published in 2015.
- The Chartered Institute of Building Services Engineers (CIBSE) Guide A: *Environmental Design 2015*, including subsequent amendments.
- The British Council for Offices document *Guide to Specification*.
- Manufacturer's installation instructions.

2.1.2 Summaries of ADE and relevant British Standards are included in the following sections.

2.2 APPROVED DOCUMENT E (ADE)

2.2.1 Approved Document E "*Resistance to the passage of sound*" (ADE) of the Building Regulations 2010 sets out the Office of the Deputy Prime Minister's (ODPM) requirements for acoustic conditions within residential developments.

2.2.2 ADE sets out three Requirements: E1, E2 and E3. Requirements E1 and E2 relate to airborne and impact sound insulation performances for separating and internal walls. Requirement E3 relates to the control of reverberant noise. Requirements E1, E2 and E3 are summarised below.

Requirement E1

"E1. Dwelling-houses, flats and rooms for residential purposes shall be designated and constructed in such a way that they provide reasonable resistance to sound from other parts of the same building and from adjoining buildings."

2.2.3 ADE goes on to state that:

"In the Secretary of State's view the normal way of satisfying Requirement E1 will be to build separating walls, separating floors, and stairs that have a separating function, together with the associated flanking construction, in such a way that they achieve the sound insulation values for dwelling-houses and flats set out in Table 1a"

2.2.4 **Table 2-1** summarises the minimum airborne sound insulation performance requirements to be achieved by separating walls, floors and stairs across the proposed development, taken from Table 1a of ADE.

Table 2-1 - Airborne Sound Insulation Performance Requirements to be Achieved by Separating Walls and Floors

Separating Element	Performance Standards for Separating Walls, Separating Floors and Stairs that have a Separating Function	
	Airborne Sound Insulation $D_{nT,w} + C_{tr}$	Impact Sound Insulation $L'_{nT,w}$
Walls	45 dB (minimum)	-
Floors and Stairs	45 dB (minimum)	62 dB (maximum)

2.2.5 Compliance with the performance requirements detailed in **Table 2-1** will need to be demonstrated to the Building Control Officer (BCO) through a series of on-site pre-completion impact and airborne sound insulation tests. The schedule of testing will need to be pre-agreed with the BCO. Should non-compliances be identified, remedial works and retesting will be required until compliance is demonstrated.

2.2.6 It should be noted that separating walls and floors are defined as "[a] *wall* [or floor] *that separates adjoining dwelling-houses, flats or rooms for residential purposes*". A corridor wall is therefore not a separating wall. However, it is important to ensure that flanking via a corridor wall is controlled so as not to undermine the sound insulation performance of a separating wall.

Requirement E2

2.2.7 Requirement E2 states that internal walls and floors within individual dwellings should be designed and constructed in such a way that they provide reasonable resistance to sound. In order to satisfy this requirement, walls within individual rooms for residential purposes should provide an airborne laboratory sound insulation performance of not less than 40 dB R_w.

2.2.8 Requirement E2 does not apply to internal walls which contain a door or internal walls which separate an en-suite toilet from an associated bedroom.

Requirement E3

2.2.9 Requirement E3 relates to the control of reverberant noise in common areas and is as follows:

> *"E3. The common internal parts of buildings which contain flats or rooms for residential purposes shall be designed and constructed in such a way as to prevent more reverberation around the common parts than is reasonable."*

2.2.10 ADE clarifies that Requirement E3 applies to corridors, stairways, hallways and entrance halls which give access to the flat or room for residential purposes.

2.2.11 Section 7 of ADE outlines two methods for demonstrating compliance with Regulation E3: Method A and Method B.

- Method A - Cover a specified area with an absorber of an appropriate class that has been rated in accordance with BS EN ISO 11654:1997: *Acoustics. Sound absorbers for use in buildings. Rating of sound absorbers*.
- Method B - Determine the minimum amount of absorptive material using a calculation procedure in octave bands.

2.3 BS 8233:2014: GUIDANCE ON SOUND INSULATION AND NOISE REDUCTION FOR BUILDINGS (BS 8233)

2.3.1 BS 8233 provides guidance for the control of noise in and around buildings. The guidance provided within the Standard is applicable to the design of new buildings, or refurbished buildings undergoing a change of use.

2.3.2 The Standard includes recommended internal and external noise level criteria for steady external noise sources such as road traffic. It is stated that it is desirable that internal ambient noise levels do not exceed the levels set out in **Table 2-2**.

Table 2-2 – Internal Desirable Guideline Values from BS 8233

Activity	Location	Period	
		07:00 to 23:00 Hours, i.e. Daytime	23:00 to 07:00 Hours, i.e. Night-time
Resting	Living Room	35 dB $L_{Aeq,16\ Hour}$	-
Dining	Dining Room/area	40 dB $L_{Aeq,16\ Hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16\ Hour}$	30 dB $L_{Aeq,8\ Hour}$

2.4 BRITISH STANDARD 4142: 2014+A1:2019 METHODS FOR RATING AND ASSESSING INDUSTRIAL AND COMMERCIAL SOUND (BS 4142)

2.4.1 This British Standard describes methods for rating and assessing the following:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train movements on or around an industrial and/or commercial site.

2.4.2 The method uses outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

2.4.3 In accordance with the assessment methodology, the specific sound level ($L_{Aeq,T}$) of the noise source being assessed is measured or predicted at a receptor location. A rating level ($L_{Ar,Tr}$) is then derived by adding a correction or penalty to the specific sound level for characteristic features, such as tonal qualities and/or distinct impulses, which make the source distinguishable against the residual noise climate. The British Standard effectively compares the difference between the rating level and the typical background sound level ($L_{A90,T}$) in the absence of the noise source being assessed.

2.4.4 It is advised that the time interval ('T') of the background sound measurement should be sufficient to obtain a representative or typical value of the background sound level at the time(s) when the noise source in question is likely to operate or is proposed to operate in the future.

2.4.5 Comparing the rating level with the background sound level, BS 4142 states:

"Typically, the greater this difference, the greater the magnitude of impact.

A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."

2.5 NOISE RELATED PLANNING CONDITIONS

2.5.1 The following noise related planning conditions are imposed on the development:

Planning Condition 11

2.5.2 Planning Condition 11 states the following:

"No phase of development shall take place until for that phase of development a scheme of noise insulation between the residential and commercial premises has been submitted to and approved in writing by the Local Planning Authority. The development shall be implemented in accordance with the approved details prior to the occupation of the building and thereafter maintained. Reason: In order to secure the satisfactory development of the application site and safeguard the amenities of occupiers of premises/dwellings in the vicinity in accordance with Paragraphs 3.8 and 3.10 of the Birmingham UDP 2005 and the NPPF."

2.5.3 The only 'commercial' spaces which are adjacent to the residential areas within Blocks C and d are the Girl Guide areas and single shop unit at the mezzanine level, and the lettings office and co-working space at Upper ground floor level, all of which are directly underneath residential dwellings.

2.5.4 This assessment therefore considers noise transfer from these spaces to residential areas.

Planning Condition 24

2.5.5 The wording of Planning Condition 24 is as follows:

"Prior to occupation of the development, glazing and ventilation to habitable rooms shall be installed as specified in section 3.1 of Cascade noise assessment report Project No: CC1154 (July 2015) and thereafter retained and maintained."

2.5.6 Planning Condition 24 therefore relates to the recommended glazing and ventilation performances from the previous report, which are repeated again in Section 4 of this report.

3 ENVIRONMENTAL NOISE SURVEY

3.1.1 This assessment is based on the baseline noise data captured during a survey undertaken at the planning application stage of the development, details of which are documented in Cascade Consulting's report (Ref: CC1154) noise report. A summary of the noise survey and results is summarised below.

3.2 SURVEY SUMMARY

3.2.1 Noise levels were measured next to each of the roads surrounding the proposed plots. As part of the assessment it was intended to carry out a 24-hour measurement in the existing building facing Holloway Head, however, due to safety and security concerns this was not possible. Instead, attended measurements were carried out over a 24-hour period (16th – 17th May 2014), taking sample measurements of road traffic on each of the surrounding roads. Consultation in 2015 confirmed that the 2014 data was considered to be valid and representative of baseline noise levels at the time of the application in June 2015. Noise levels were measured at five locations as described below and labelled in **Figure 3-1**.

1. Ellis Street, a façade noise measurement taken outside the multi-storey car park on Ellis Street, representative of the noise levels affecting the eastern site boundary of the north plot.

2. Brownsea Drive, a façade noise measurement taken outside the office building on the northern plot, representative of the noise levels affecting the centre of the development.

3. Gough Street, a façade noise measurement on the pavement of Gough Street, relevant for noise levels affecting the northern plot, including noise from the Craven Arms.

4. Blucher Street, a façade noise measurement on the pavement of Blucher Street adjacent to the north-western boundary of the south plot, relevant for noise levels affecting the southern plot.

5. Holloway Head, a façade noise measurement on the pavement of Holloway Head taken outside the site hoardings adjacent to the southern site boundary.

3.2.2 Noise levels were measured for 20-minute periods on a rotational basis, at each of the five locations over daytime and night-time periods. Six measurements were carried out during the daytime period and four measurements during the night-time period. **Table 3-1** details the noise measurement equipment used for the noise survey.

Figure 3-1 – Measurement Locations

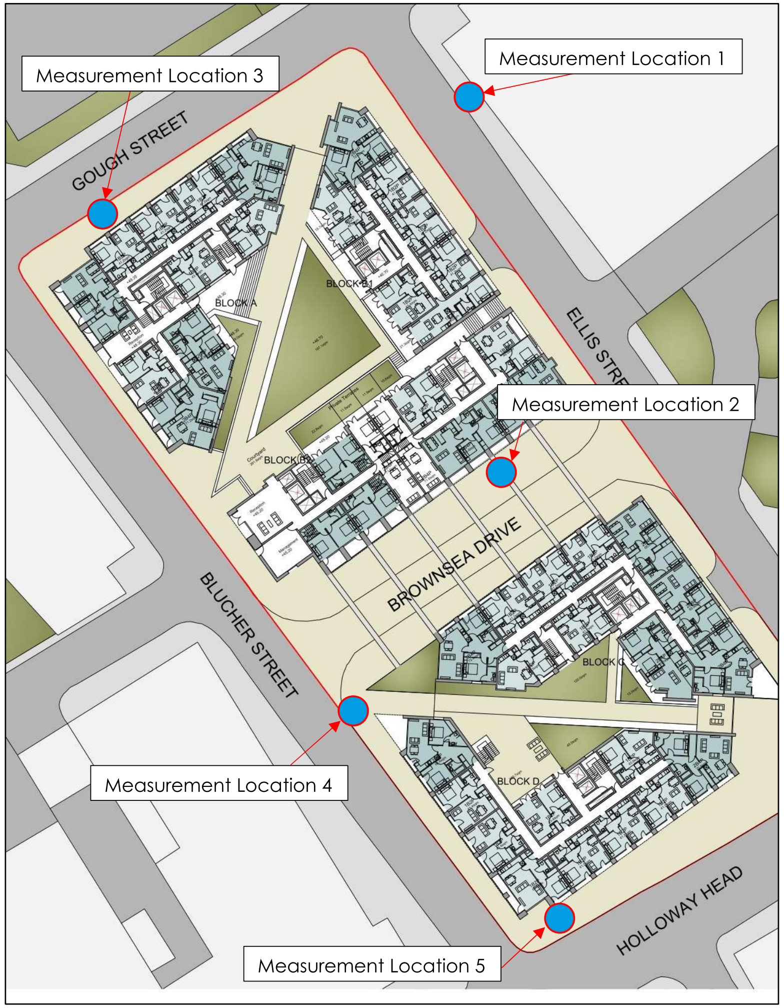


Table 3-1 – Equipment Details

Equipment	Make & Model	Serial Number
Sound Level Meter	Norsonic 118	31501
Microphone	Norsonic 1225	52234
Pre-Amplifier	Norsonic 1206	30539
Calibrator	Norsonic 1251	31057

3.2.3 At all measurement positions, the dominant noise source was road traffic, mainly cars and light goods vehicles. There was occasional noise from overflying helicopters at levels similar to that of passing cars. There was also occasional noise from emergency vehicle sirens and passers-by.

3.3 NOISE SURVEY RESULTS

3.3.1 The results of the noise survey results are presented in **Table 3-2**.

Table 3-2 – Measured Sound Pressure Levels, 20-minute Measurements, dB

Position	Time	$L_{Aeq,20mins}$	L_{AFmax}	$L_{A10,20mins}$	$L_{A90,20mins}$
1	07:46	56.0	73.5	57.0	52.0
	10:01	56.6	73.9	58.6	52.4
	12:06	57.0	72.7	59.8	52.3
	14:10	58.6	74.9	61.9	52.4
	16:16	57.9	77.2	61.4	52.0
	19:07	55.6	72.6	58.4	51.5
	21:04	53.4	61.7	54.5	51.8
	23:05	51.1	69.8	54.5	48.6
	10:01	50.6	64.2	52.4	47.7
	02:59	50.4	67.5	51.3	47.9
	04:58	52.1	70.8	56.0	49.6
2	08:16	54.8	63.7	57.1	52.1
	10:29	55.5	71.2	57.2	52.5
	12:30	59.5	80.1	59.3	52.8
	14:33	58.3	72.4	61.1	53.0
	16:36	58.6	75.1	61.7	52.9
	19:26	55.2	67.8	56.9	52.1
	21:29	58.0	88.5	57.4	50.1
	23:29	51.9	73.9	54.1	48.2
	01:27	49.4	64.8	53.9	47.8
	03:24	50.4	66.6	52.0	46.0
	05:22	53.6	68.1	54.8	50.4
3	08:44	55.8	68.7	58.5	51.7
	10:55	56.8	71.4	58.8	51.8
	12:54	55.0	67.3	56.8	52.4
	14:57	56.8	67.0	58.9	53.9
	17:04	56.9	69.5	59.6	53.7
	19:51	56.4	71.0	58.9	52.3
	21:54	55.5	72.9	58.1	50.6
	23:52	50.6	70.0	53.4	47.8
	01:50	48.3	60.7	51.7	47.5
	03:47	49.2	61.8	52.0	48.3
	05:46	52.9	71.1	55.2	50.2
4	09:09	55.0	69.1	56.2	52.2
	11:18	54.8	67.4	56.3	52.5
	13:21	55.9	66.8	58.0	53.1
	15:26	56.8	67.0	58.9	53.9
	17:30	57.3	67.8	57.9	52.8
	20:15	54.2	67.2	55.5	51.7
	22:18	53.7	68.9	55.8	50.0
	00:15	51.2	66.4	54.3	48.1
	02:14	48.7	65.3	51.9	45.8
	04:10	49.9	62.9	51.5	48.0
	06:09	52.6	61.8	54.0	49.9
5	09:34	67.6	89.1	69.1	60.8
	11:43	68.5	85.7	71.8	62.2
	13:43	67.0	77.2	69.8	60.6
	15:48	66.2	76.7	68.8	60.5
	17:56	68.3	81.0	70.4	62.3
	20:39	65.4	79.6	68.2	59.7
	22:41	63.6	80.1	66.2	56.7
	00:38	61.9	74.1	64.9	53.7
	02:37	60.2	71.2	62.9	51.2
	04:34	62.5	80.6	65.9	50.5
	06:33	65.8	82.0	68.3	56.9

4 External Building Fabric

4.1.1 Planning Condition 24 references the glazing and ventilation specifications from Section 3.1 of the planning stage noise report, which are based on the highest measured noise levels at each measurement location. The specifications for Block C and Block D, as detailed in Table 5 of the planning report, are shown in **Table 4-1** below.

Table 4-1: Sound Insulation Performance Requirements from Previous Report, dB

Block	Façade	Street	Daytime L_{Aeq}	Night-time L_{Aeq}	Required Level Difference	
					Day	Night
C	Northeast	Ellis Street	59	52	24	22
C	Northwest	Brownsea Drive	60	54	25	24
D	Southwest	Blucher Street	57	53	22	23
D	Southeast	Holloway Head	69	66	34	36

4.1.2 As the values in **Table 4-1** are based on maximum measured L_{Aeq} levels during the daytime and night-time, the stated level difference performances are considered to be robust and suitable.

4.1.3 The planning stage noise report goes on to state the following in the paragraphs after Table 5:

"*The windows of habitable rooms in residential units on Blucher Street, Gough Street, Ellis Street and Brownsea Drive will require a sound reduction of at least 25dB to meet the criteria shown in Table 1. This could be achieved using 6-12-4 double glazing which gives a reduction (R_w+C_{tr}) of 28dB and allows for a margin of comfort to meet the required standard. In order to maintain this level of sound reduction, the windows would have to remain closed thus acoustic ventilation would be needed. The sound insulation of the ventilation system would need to give a reduction (D_{new}+C_{tr}) of at least 32dB.*"

4.1.4 It is therefore considered that standard double glazing would be appropriate for residential dwellings on Blucher Street, Gough Street, Ellis Street and Brownsea Drive. A glazing arrangement of 4 mm glass/16 mm air gap/4 mm glass would also typically achieve 28 dB R_w+C_{tr} and would be appropriate, as would any other double-glazing arrangement with the same acoustic performance. Standard window mounted trickle ventilators are typically capable of achieving 32 dB $D_{ne,w}$+C_{tr} and would likely be appropriate.

4.1.5 Therefore, standard double glazing and window mounted passive trickle ventilation units are considered appropriate for most facades, with the only exception being the façade overlooking Holloway Head.

4.1.6 With regards to dwellings facing Holloway Head, the planning stage report states the following:

"*The windows of habitable rooms in residential units facing Holloway Head will require a sound reduction of at least 36dB to meet the criteria shown in Table 1.*"

4.1.7 From the above statement, and from the values shown in Table 4.1 (Table 5 of the planning stage report), it is considered that the façade of residential apartments facing Holloway Head is required to achieve a minimum level difference of 36 dB from outside to inside.

4.1.8 Detailed noise break-in calculations have been undertaken to determine suitable glazing and ventilation units capable of achieving this level difference, and to predict internal noise levels with windows closed. The calculation have been undertaken based on the rigorous method provided in Section G.2 of BS 8233:2014, and have been based on a road traffic noise spectrum corrected to match the A-weighted levels from the final row of **Table 4-1.** A reverberation time of 0.5 seconds was assumed in each frequency band and room and glazing dimensions for bedrooms and lounge spaces were based on the current scheme layout, and were as follows:

Lounge spaces

- Room height: 2.35 m;
- Room width: 3.8 m;
- Room depth: 6.0 m; and
- Façade glazed area: 5.8 m^2

Bedrooms

- Room height: 2.35 m;
- Room width: 3.4 m;
- Room depth: 3.8 m; and
- Façade glazed area: 5.8 m^2

4.1.9 The results of the above predictions are included in **Table 4-2**, including the required performance of glazing and ventilation units.

Table 4-2: Predicted Internal Noise Levels, Dwellings Facing Holloway Head, Closed Windows

Room	Façade Element	Required Sound Insulation Performances and Example Constructions	Predicted Daytime Level dB $L_{Aeq,16h}$	Predicted Night-time Level dB $L_{Aeq,8h}$
Lounge	Glazing	31 dB R_w+C_{tr} 4mm glass/ 12mm air gap/ 10mm glass	35	-
	Passive Ventilator	35 dB $D_{n,e,w}+C_{tr}$ Acoustic Trickle Ventilator for example Titon SF Sound Attenuator V50 vent + Standard Canopy		
Bedroom	Glazing	36 dB R_w+C_{tr} 8mm glass/ 12mm air gap/ 8.4mm acoustic laminated glass	32	30
	Passive Ventilator	39 dB $D_{n,e,w}+C_{tr}$ High Performing Acoustic Trickle Ventilator for example Titon SF Sound Attenuator V75 vent + C50 canopy		

4.1.10 From **Table 4-2**, it can be seen that the internal noise level criteria from BS 8233 can be achieved, provided the selected glazing and ventilation units achieve the sound insulation performances from the table. Example glazing and ventilator models are provided for reference only and to demonstrate that the required performances are achievable using proprietary products.

4.1.11 Comparing the measured noise levels in the final row of **Table 4-1** to the predicted noise levels in **Table 4-2**, it can be seen that the level difference achieved by the façade is 34 dB and 36 dB in the lounge and bedroom spaces respectively. Therefore, the specifications from Table 5 of the Cascade report, as included in **Table 4-1**, are achieved. Hence, the requirements of Planning Condition 24 are achieved.

4.1.12 Once the final glazing and ventilation units have been selected based on the specifications in this report, details of the units will be submitted to the local authority to allow Planning Condition 24 to be discharged.

5 INTERNAL SOUND INSULATION

5.1 SEPERATING WALLS

5.1.1 Marked-up drawings showing the minimum airborne sound insulation performance requirements for the residential areas of Block C and Block D are included in **Appendix B**. The first-floor plan is largely repeated for the 2^{nd} to 12^{th} floors and it is therefore considered to also be representative of the floors above.

5.1.2 There are two performance parameters referenced in the sound insulation mark-ups in **Appendix B**: $D_{nT,w}$ + C_{tr} and R_w + C_{tr}. For reference, $D_{nT,w}$ + C_{tr} relates to the sound insulation performance to be achieved on-site and is the parameter referenced in ADE. The R_w + C_{tr} parameter is a laboratory tested value and is typically higher than the on-site $D_{nT,w}$ + C_{tr} performance for the same construction.

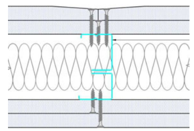
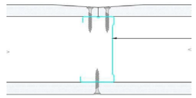
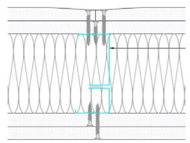
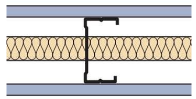
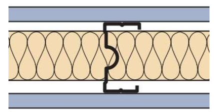
5.1.3 The difference between the laboratory and on-site performances is typically due to the imperfect conditions which occur on-site compared to those in a laboratory where there are no penetrations, flanking details, or workmanship issues. To avoid confusion, it is the R_w + C_{tr} parameter only that should be included on specifications submitted to, and received by, tenderers.

5.1.4 It is considered necessary in the case of the Holloway Head development to allow for at least a 7 dB difference between the lab tested and on-site performance, and therefore any proposed party wall construction should be rated as a minimum of 52 dB R_w+C_{tr} in order to achieve an on-site performance of 45 dB $D_{nT,w}$ + C_{tr}.

5.1.5 Preliminary partition constructions proposed for the project have been developed by Corstorphine & Wright and Siniat, and the main types proposed (IW01, IW02 and IW07), together with the respective acoustic performance ratings are shown in **Table 5-1**.

5.1.6 Example drywall constructions capable of achieving the sound insulation performances detailed in **Appendix B** are also included in **Table 5-1**. It should be noted however that that the constructions in **Table 5-1** are examples only, and alternative constructions may also be appropriate. JPM Acoustics will be happy to review the proposals as they are developed to ensure that the sound insulation requirements are capable of being achieved by the proposed systems.

***Table 5-1** – Summary of Main Wall Constructions*

WALL TYPE	DETAIL	SPECIFICATION	SOUND INSULATION PERFORMANCE
IW01		• 2 x layers of 15mm GTEC dB Board each side of partition • 70mm GTEC Resilient Acoustic Studs RAS70/P at 600mm centres • 50mm of glass mineral wool (≥16kg/m³) in cavity • Nominal construction width130mm	51 dB R_w + C_{tr}
IW02		• 1 x layer of 12.5mm GTEC dB Board each side of partition • 70mm GTEC C Studs CS70/Rx at 600mm centres • Nominal construction width 95mm	40 dB Rw
IW07		• 2 x layers of 15mm GTEC dB Board each side of partition • 90mm GTEC Resilient Acoustic Studs RAS90/P at 600mm centres • 100mm of glass mineral wool (≥16kg/m³) in cavity • Nominal construction width150mm	53 dB R_w + C_{tr}
RSP028		• 1 x layer of 12.5mm GTEC dB board each side of partition • 70mm GTEC C Studs CS70/Rx at 600mm centres • 25mm of glass mineral wool (≥16kg/m³) in cavity • Nominal construction width 95mm	45 dB R_w
ASP003		• 1 x layer of 15mm GTEC dB board each side of partition • 70mm GTEC C Studs CS70/Rx at 600mm centres • 25mm of glass mineral wool (≥16kg/m³) in cavity • Nominal construction width 95mm	49 dB R_w

5.2 RESIDENTIAL PARTY WALLS

5.2.1 Residential party walls between dwellings are proposed to be formed by the IW07 dry wall construction. The sound insulation performance of this partition type is 53 dB $R_w + C_{tr}$, and is therefore considered capable of achieving the required on-site performance of 45 dB $D_{nT,w} + C_{tr}$, subject to suitable workmanship and junction detailing.

5.3 PARTY WALLS BETWEEN DWELLINGS AND CORRIDORS

5.3.1 The sound insulation performance requirement of party walls between dwellings and circulation spaces (stairwells and corridors) is the same as that required between dwellings. The current scheme design includes IW01 wall constructions between apartments and corridors, which are capable of achieving the required on-site performance of 45 dB $D_{nT,w} + C_{tr}$, subject to suitable workmanship and junction detailing.

5.4 INTERNAL WALLS WITHIN DWELLINGS

5.4.1 Partitions within apartments which separate bedrooms and bathrooms from other rooms, and do not contain a door, need to be selected or designed to achieve 40 dB R_w.

5.4.2 It is understood that current proposals for internal walls typically comprise the IW02 wall type, which will provide a minimum laboratory performance of 40 dB R_w and will therefore be compliant with the requirements of ADE.

5.5 BATHROOM PODS

5.5.1 In instances where bathroom pods are separated from other rooms, the sound insulation of the total separating wall (i.e. the pod plus additional architectural linings) should achieve the 40 dB R_w requirement, in order to meet the Building Regulations requirement. The exception to this is for walls that include the door that provides access to the bathroom.

5.5.2 If the bathroom pod construction is unknown or likely to change, it is recommended that either the pod construction alone, or the lining alone should be designed to achieve a minimum weighted sound reduction index of 40 dB R_w, without any reliance being placed on the other element. A construction such as IW02 would therefore be appropriate as a 'lining'.

5.5.3 As the pods will be separate to the party walls, they will not contribute to the sound insulation of the separating wall. In order to ensure adequate acoustic sealing of the party wall, the party wall must be fully installed before the pod.

5.5.4 In order to maintain the impact sound insulation of the entire dwelling, including the bathroom area, the bathroom pod should either have a resilient layer as part of its floor build up, or the pod should be installed on top of the resilient layer installed across the wider apartment floor plate. It is noted that the bathroom pods represent significant loads compared to those normally imposed on resilient layers, so details of this are expected to require checking once a pod manufacturer is chosen.

5.6 ENTRANCE DOORS TO APARTMENTS

5.6.1 Entrance doors to apartments shall meet at least one of the following criteria:

- Install doors which have been tested in a laboratory and have been shown to achieve an acoustic rating of at least 29 dB R_w; or
- Install doors with a minimum mass per unit area of 25 kg/m^2, fitted with perimeter seals, including at the threshold where practicable.

5.6.2 Doors shall be fitted with appropriate closers to minimise 'banging'.

5.7 PARTITIONS IN NON-RESIDENTIAL AREAS

5.7.1 ADE does not contain any mandatory requirements for the minimum sound insulation performance of partitions which are not directly related to residential dwellings. Performances for these partitions (which form the majority of the lower ground, mezzanine and upper ground floors) are therefore recommended based on relevant British Standards and industry best practice, and are shown in **Appendix B**.

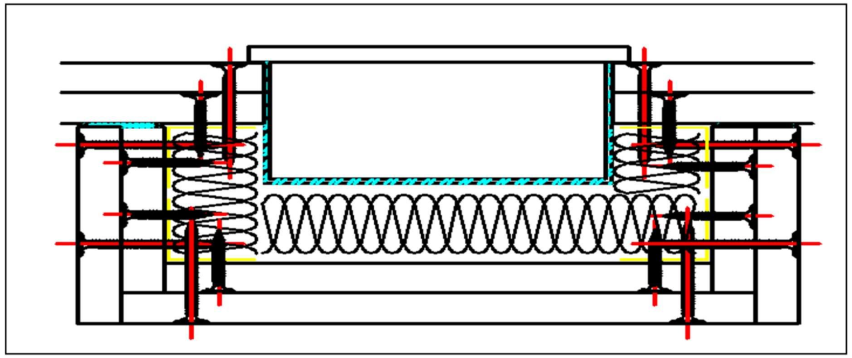
5.8 BUILDING SERVICES PENETRATIONS

5.8.1 There must be no building services pipe or duct penetrations through the separating walls between apartments and other spaces. Pipe and ductwork penetrations are permitted through internal walls and riser walls.

5.8.2 Vertical pipes or ducts should be located within the allocated service risers and must not otherwise penetrate the floor construction. Should there be any instances where this is not practical and a pipe or duct is required to penetrate the floor slab, the pipe or duct must lagged with 25 mm thick mineral fibre for the full length and then installed within an enclosure with a minimum mass per unit area of 15 kg/m^2. This mass per unit area could be provided using 2 x 12.5 mm thick wallboard. Where fire stopping is required, this should be flexible and should prevent rigid contact between the pipe and the floor.

5.8.3 Electrical sockets and switches should be avoided in separating partitions, as far as practical. Where recessed sockets are proposed they should not be mounted in a 'back to back' formation, without acoustic protection, and care should be taken to ensure a minimum of 600 mm spacing between sockets located either side of a partition. A typical baffle detail is shown in **Figure 5-1**.

Figure 5-1 - Typical Baffle Box Detail for Plasterboard Partitions



5.8.4 Regarding baffle boxes on the back of sockets and switches the following advice would apply:

- Sockets are to be boxed in with two layers of plasterboard, equivalent in density to the main partition lining.
- Socket baffle boxes should not be located within the same stud bay. Staggering between adjacent stud bays is acceptable.
- The baffle box should be fully sealed on all sides, including top and bottom. Holes in the box for cables should not be over-sized, and should be fully sealed. A further detail showing this should be subject to JPM's review.
- The baffle box should extend 150 mm above and below the socket.

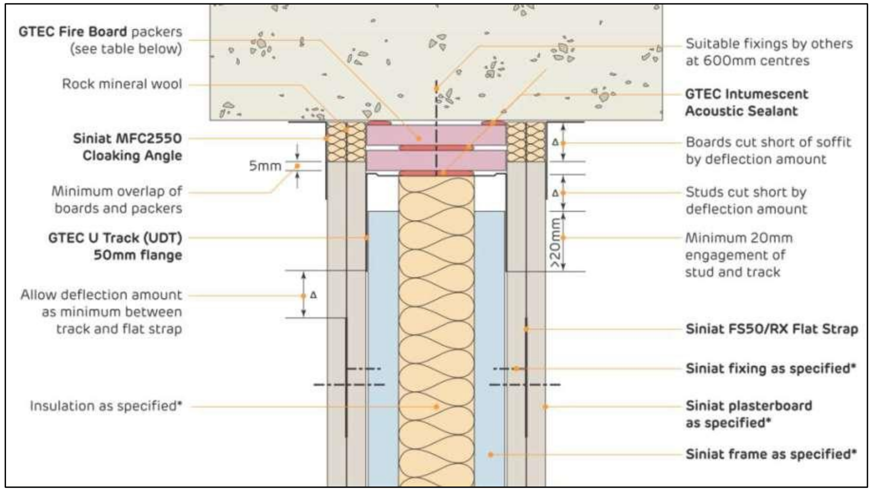
5.9 JUNCTION DETAILING

5.9.1 Partition junction details must be designed carefully so as to not compromise the acoustic performance of the partitions. This is particularly important for party walls (IW07) and in the following situations:

- At junction with corridor walls. The internal linings of corridor walls should be discontinuous between horizontally adjacent spaces to control flanking sound transmission.
- Party walls must not be built off a floating floor. They should extend down to the structural slab with the floating floor isolated on either side with resilient perimeter strips.
- Where party walls (or floors) abut external cladding, the internal lining of the external wall should overlap the junction full height on both sides of the wall. Linings to the external wall should not, under any circumstances, run continuously between rooms.
- Where two layers of board are fixed to studs, they should be installed with staggered joints which should be wet plastered to form an airtight seal.
- In instances where party walls are interrupted by structural columns it should be ensured that the resilient element of the party wall frame is maintained as the partition passes the column (e.g. by using resilient bar on which to fix the boards to the columns), and the internal lining of the party wall should continue as far as possible to the column.

5.9.2 Partition details currently shown in the Siniat Project Pack (Rev D dated 10/03/2020) have not changed significantly since JPM reviewed them in March 2019 (results of which were issued DDN-AC01). This review concluded that the majority of details were acceptable. However the deflection detail provided by Siniat for corridor and separating walls is not considered to be appropriate for high performing partitions. An appropriate deflection head detail for party walls and corridor walls is shown in **Figure 5-2**.

Figure 5-2 Appropriate Deflection Head Detail for Separating Partitions and Corridor Walls



5.9.3 JPM Acoustics will be pleased to review specific junction details as and when they become available during the ongoing design phase of the project.

5.10 SEPARATING FLOORS

5.10.1 Separating floors between vertically adjacent apartments are required to achieve a minimum airborne sound insulation performance of 45 dB $D_{nT,w}$ + C_{tr} and a maximum impact sound insulation performance of 62 dB $L_{nT,w}$.

5.10.2 In addition to the above requirements, it should be noted that the proposed floor construction will be continuous between horizontally adjacent apartments above and below the partition construction. This will create a potential sound flanking path between apartments which will need to be controlled. Therefore in addition to considering the sound insulation performance achieved between vertically adjacent apartments provided by the separating floor construction it is also necessary to consider flanking sound insulation performance provided by the concrete floor construction between apartments. Where the concrete floor construction is continuous above and below party wall constructions, it is recommended (in accordance with Approved Document E) that the concrete floor provided a mass per unit area of 365 kg/m^2 in order to control sound flanking.

5.10.3 The floor constructions throughout the development are understood to comprise 250mm insitu concrete slabs underdrawn with plasterboard ceilings, although precise details of the slab and ceiling remain in development.

5.10.4 Based upon the proposed thickness of 250mm and assuming a normal density of 2400 kg/m^3, the floor slab should be capable of meeting the recommended minimum mass per unit area to control flanking sound transmission, and assuming a ceiling comprised of a single layer of plasterboard with cavity depth of at least 150mm the proposed overall construction should also be capable of meeting the party floor airborne sound insulation requirements.

5.10.5 In order that the floor construction is capable of meeting the impact sound insulation performance a resilient floor covering will be required to be installed which must meet the following specification:

- Any resilient material, or material with a resilient base, with an overall uncompressed thickness of at least 4.5 mm; or
- Any floor covering with a weighted reduction in impact sound pressure level (ΔL_w) of not less than 17 dB when measured in accordance with BS EN ISO 140-8:1998 and calculated in accordance with BS EN ISO 717-2:1997.

5.10.6 Notwithstanding the above, downlighters installed in the plasterboard ceilings in habitable spaces should be at centres of not less than 0.75 m and should have openings no greater than 100 mm diameter or 100x100 mm. There should be no more than one downlighter per 2 m^2 of the total ceiling area in each room. If a greater number of downlighters are required acoustically rated downlighter coverings or hoods are likely to be required.

5.10.7 It should be noted that electrical cables can give off heat when in use and special precautions may be required when they are covered by thermally insulating materials (see BRE RE 262, Thermal Insulation: avoiding risks, Section 2.4).

5.11 NON-DOMESTIC SPACES TO RESIDENTIAL APARTMENTS

5.11.1 The level of sound insulation required by elements that separate residential dwellings from non-domestic use areas may need further consideration and enhancement where noise levels are expected to be higher than those in a typical residential dwelling. Whilst the enhancements to the 'base' party floor construction will need to be developed once further details of the main slab and ceilings are known, the areas where this would apply and suggestions regarding what allowances should be made at this stage in each case are as follows:

Shop at Mezzanine level

5.11.2 The sound insulation of the ‘base’ floor construction alone (plasterboard ceiling, 250mm concrete slab, and resilient floor covering within the apartments above) is expected to be sufficient providing the use classes of the space is either A1, A2, A5, D1 or B1.

5.11.3 Where the use of the commercial space is to be A3 or A4 (Food & Drink and Drinking Establishments) the internal noise would typically be expected to be higher, and a suspended mass barrier ceiling comprising two layers of dense plasterboard with insulation in the cavity, may be required to the entire ceiling area of the commercial space, mounted to the soffit to the soffit on acoustically resilient hangers.

Girl Guide Spaces at Mezzanine level

5.11.4 The sound insulation of the ‘base’ floor construction alone (plasterboard ceiling, 250mm concrete slab, and resilient floor covering within the apartments above) is expected to be sufficient for the Girl Guides Apartment Area, corridor, kitchen and showers.

5.11.5 The Activity Rooms and Main Hall are expected to typically have higher noise levels associated with their use, and so it would be recommended that in these spaces, allowance is made for an enhanced suspended mass barrier ceiling, comprising two layers of dense plasterboard with insulation in the cavity, mounted to the soffit on acoustically resilient hangers.

Lettings area at Upper Ground Level

5.11.6 The sound insulation of the ‘base’ floor construction alone (plasterboard ceiling, 250mm concrete slab, and resilient floor covering within the apartments above) is expected to provide a sufficient level of airborne sound insulation between the lettings area and residential dwellings above.

6 Control of Reverberant Noise

6.1 SOUND ABSORPTION

6.1.1 Requirement E3 of the Building Regulations relates to the provision of sound absorption within common areas which provide direct access to dwellings and is aimed at minimising the potential for disturbance to residents from reverberant noise build-up in common areas.

6.1.2 The underlying principle of Requirement E3 is to provide sound absorbent finishes so that the reverberant noise level in common areas is reduced. This includes all corridors, hallways, stairwells and entrance lobbies which provide direct access to any dwelling. The requirements of E3 do not apply to corridors or hallways within dwellings, and do not apply to stairwells which do not provide direct access to apartments.

6.1.3 Based upon the proposed Holloway Head development floor plans, Requirement E3 would apply to the communal corridors to all residential floors, as shown in green in **Figure 6-1** and **Figure 6-2**.

Figure 6-1: Upper Ground Level Areas where Requirement E3 applies

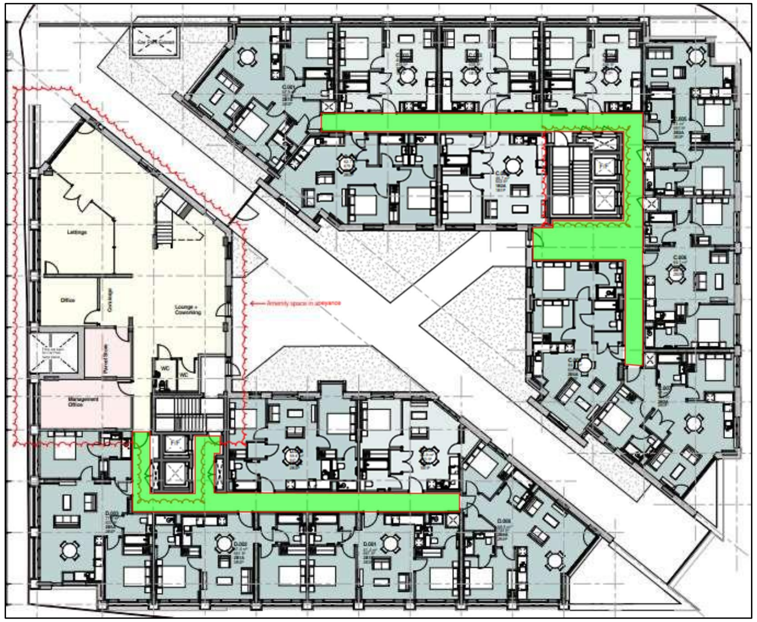
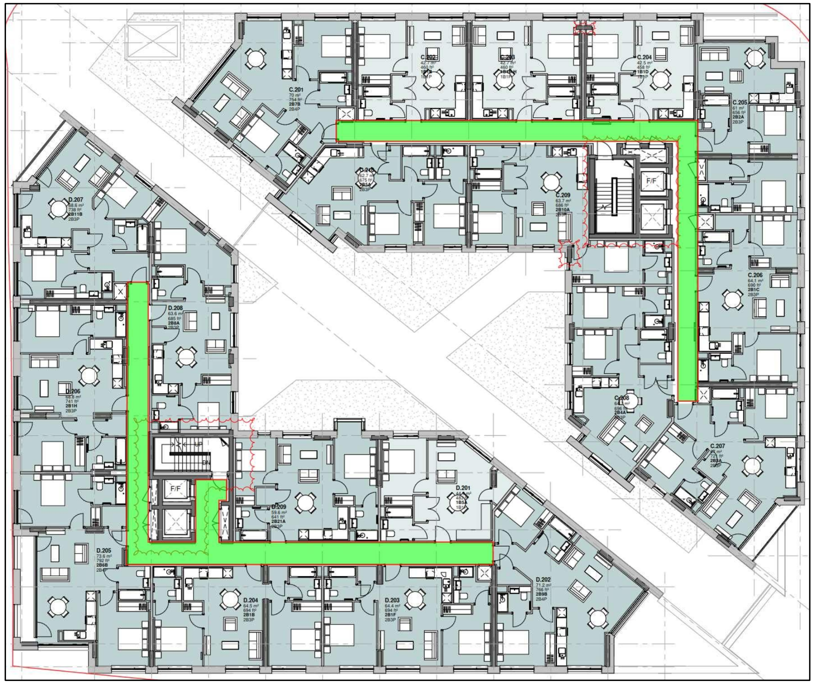


Figure 6-2: First Floor Level (and levels above) Areas where Requirement E3 applies



6.1.4 For corridors giving access to dwellings, the most convenient and cost effective means of meeting Requirement E3 would typically be to install a ceiling system providing a minimum Class C absorptive performance. This performance is typically achievable using a lay in grid mineral fibre or perforated metal tile ceiling, or using perforated plasterboard with a suitable void and acoustic lining behind.

Non-residential Areas

6.1.5 Although there are no statutory requirements for reverberation times in the ancillary non-residential spaces. It is recommend that reverberant noise build-up in the Girl Guides' Main Hall and Activity Rooms is controlled to an extent in order to both limit the potential for noise break out and also to provide more comfortable acoustic conditions for users.

6.1.6 It is recommended that a Class A acoustic absorptive finishes, or equivalent, are installed to an area equal to that of the ceiling. This could for example be provided by a mixture of ceiling tiles and/or wall panels.

7 Building Services Noise

7.1.1 There are no statutory noise level limits for building services plant in residential spaces. The proposed criteria presented in this section are therefore based on relevant guidance documents, British Standards, industry best practice and experience on similar projects.

7.2 INTERNAL NOISE LEVEL LIMITS

7.2.1 Proposed internal noise level limits for building services plant (e.g. MVHR) are presented in **Table 7-1**. Noise level limits should consider duct-borne noise and casing radiated noise from the MVHR unit, where applicable. The building services engineer should design the system to ensure the noise level limits are not exceeded.

Table 7-1 - Proposed Building Services Noise Level Limits in Sensitive Spaces

Location	Proposed Criteria	
	Noise Rating Level (NR)	dB(A)
Bedrooms	25 (35[1])	30 (40[1])
Living / Dining Rooms	30	35
Bathrooms	40	45
Kitchens	40 (50[1])	45 (55[1])
Foyer / Reception	40	45
Circulation Spaces (Communal Corridors)	40	45
Open Plan Coworking Space	40	45
Retail Unit	40	45
[1]*Criteria under boost setting (e.g. for purge ventilation when cooking)*		

7.2.2 JPM Acoustics would be pleased to review the details of proposed building services plant and ductwork layouts once these details become available, to determine whether building services noise levels are predicted to comply with the limits from **Table 7-1**.

7.3 RECOMMENDED MAXIMUM VELOCITIES

7.3.1 To control the impact of noise generated by air turbulence within the mechanical ductwork systems, it is recommended that the airflow speeds through the ductwork be limited. **Table 7-2** outlines the recommended maximum airspeeds to be achieved. It should be noted that the maximum airspeeds vary depending on the Noise Rating level in the space served.

Table 7-2: Recommended Maximum Airspeeds (m/s) Through Ventilation Systems

Location	Noise Rating Level (NR) Requirement in Room			
	NR 40-50	NR 35	NR 30	NR 25
Riser	9	7.5	6	5
Main Branch	6	5	4	3
Grilles	4	3	2.5	1.5
Diffusers	2.5	2	1.5	1
Extract Stub Ducts (above ceiling)	4	3	2.5	1.5

7.4 SERVICES RISERS AND PIPEWORK

7.4.1 Pipes (e.g. SVPs) and ducts (excluding gas pipes) are required to be enclosed (full height) where they penetrate a floor separating habitable rooms. For Building Regulations' compliance, the pipe should be separated from the habitable room with 2 No. layers of board (total min. 15 kg/m²) and 25 mm mineral wool. Access to pipes will be via destructive means only.

7.4.2 It should be noted that the above will not ensure inaudibility in habitable rooms. If there is an aspiration for noise from pipes to approach inaudibility in habitable areas, JPM Acoustics will advise further on possible additional treatments (e.g. acoustic HDPE soil pipes etc.).

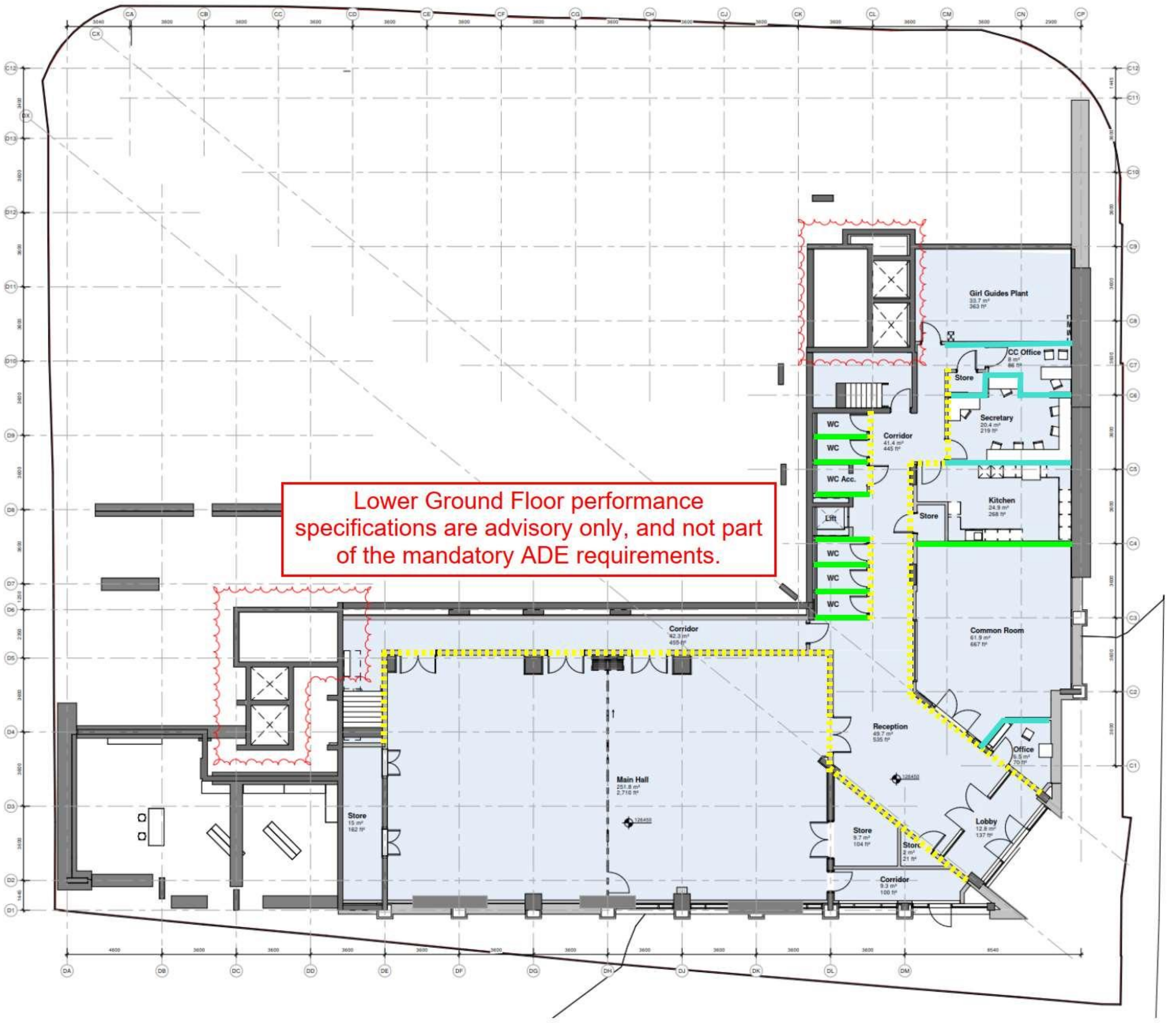
7.4.3 Pipework within risers shall be supported in a manner which precludes the transmission of structure-borne noise to walls and floors. This could be achieved by:

- Supporting pipework off masonry elements (e.g. via Unistrut off slabs if required) so that pipes are fully independent of lightweight walls with a minimum 10 mm clearance.
- Using oversized brackets containing neoprene inserts.
- Incorporating acoustic dampeners where pipework is suspended from floor slabs.
- Using rubber lined pipe brackets.

APPENDIX A: TECHNICAL GLOSSARY

Term	Descriptions
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20 μPa (20×10^{-6} Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds S1 and S2 is given by 20 log10 (S1 / S2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20 μPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{eq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5 m.
Façade	At a distance of 1 m in front of a large sound reflecting object such as a building façade.
Fast/Slow Time Weighting	Averaging times used in sound level metres.
Octave Band	A range of frequencies whose upper limit is twice the frequency of the lower limit.

Appendix B: Acoustic Sound Insulation Mark-up Drawings



Min. on-site performance	Wall Type	Lab Performance Rating
45 dB DnT,w+Ctr	red	>52 dB Rw+Ctr
n/a	blue	>40 dB Rw
52 dB DnT,w	magenta	59 dB Rw
47 dB DnT,w	orange	54 dB Rw
42 dB DnT,w	cyan	49 dB Rw
37 dB DnT,w	green	44 dB Rw

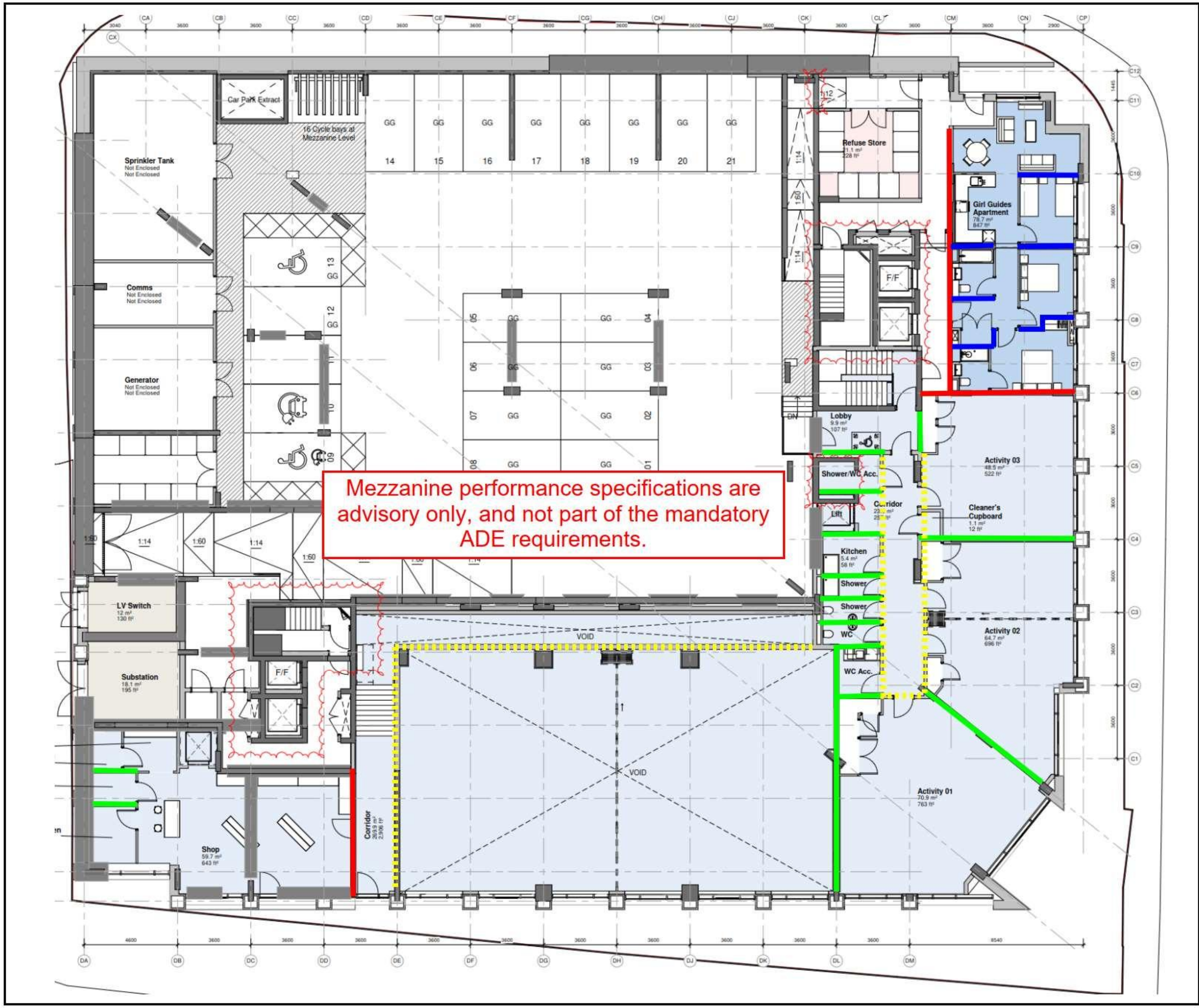
Minimum Sound Insulation of Walls Containing Doors and/or Vision Panels	
45 dB R_w	green dotted
40 dB R_w	yellow dotted

Date	Rev	Description	By
19/01/22	A	Stage 3	NA

JPM Acoustics Drawing Number:

1392021_SI_LG_01_A

Title: Holloway Head
Airborne Sound Insulation
Lower Ground Floor



Min. on-site performance	Wall Type	Lab Performance Rating
45 dB $D_{nT,w}+C_{tr}$	(red)	>52 dB R_w+C_{tr}
n/a	(blue)	>40 dB Rw
52 dB DnT,w	(magenta)	59 dB Rw
47 dB DnT,w	(orange)	54 dB Rw
42 dB DnT,w	(cyan)	49 dB Rw
37 dB DnT,w	(green)	44 dB Rw

Minimum Sound Insulation of Walls Containing Doors and/or Vision Panels	
45 dB R_w	(green dotted)
40 dB R_w	(yellow dotted)

Date	Rev	Description	By
19/01/22	A	Stage 3	NA

JPM Acoustics Drawing Number:
1392021_SI_MEZ_01_A

Title: Holloway Head
Airborne Sound Insulation
Mezzanine Level

Min. on-site performance	Wall Type	Lab Performance Rating
45 dB DnT,w+Ctr	(red)	>52 dB Rw+Ctr
n/a	(blue)	>40 dB Rw
52 dB DnT,w	(magenta)	59 dB Rw
47 dB DnT,w	(orange)	54 dB Rw
42 dB DnT,w	(cyan)	49 dB Rw
37 dB DnT,w	(green)	44 dB Rw

Minimum Sound Insulation of Walls Containing Doors and/or Vision Panels	
45 dB R_w	(green dotted)
40 dB R_w	(yellow dotted)

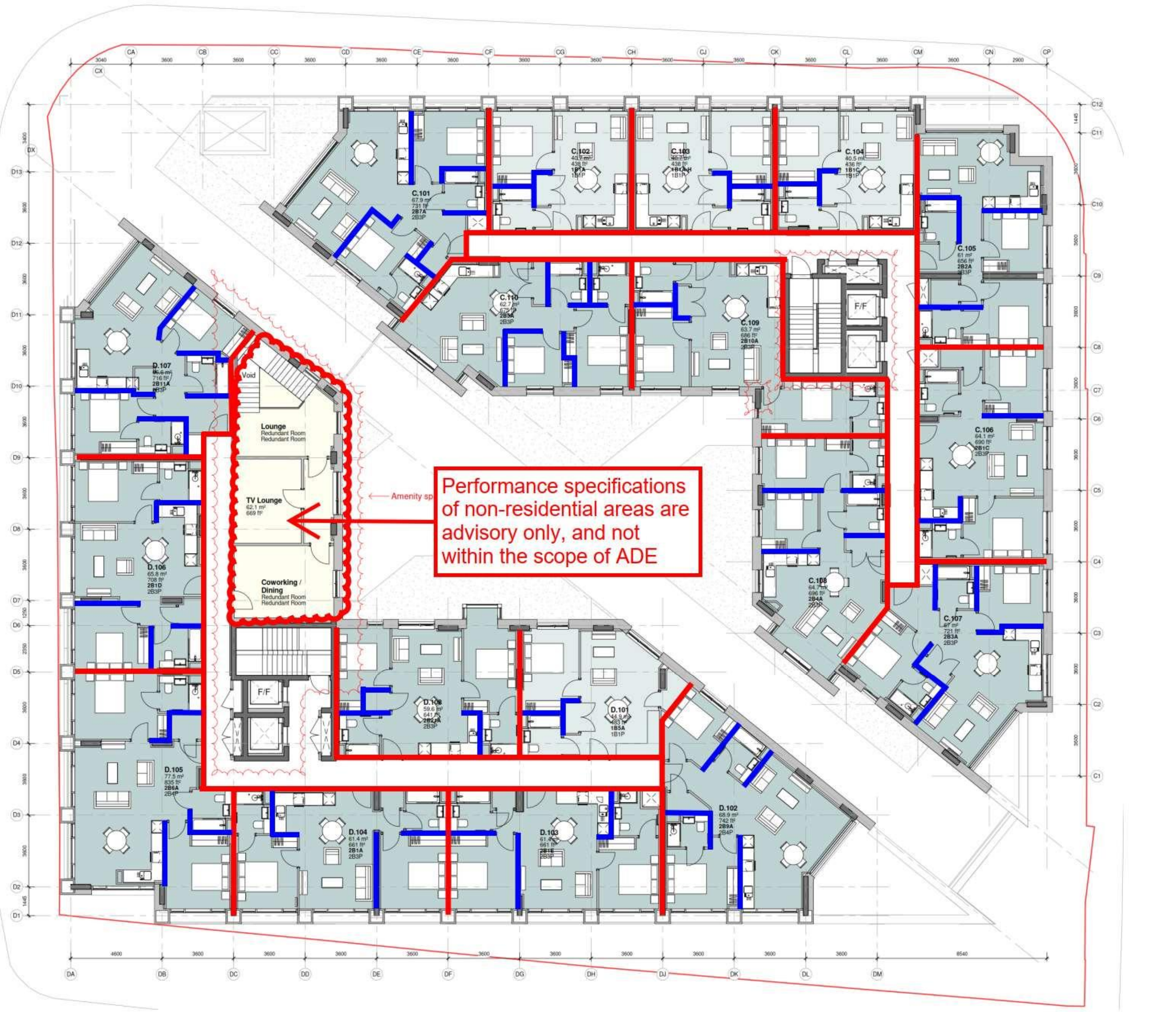
Date	Rev	Description	By
19/01/22	A	Stage 3	NA

JPM Acoustics Drawing Number:

1392021_SI_UG_01_A

Title: Holloway Head
Airborne Sound Insulation

JPM ACOUSTICS



Min. on-site performance	Wall Type	Lab Performance Rating
45 dB DnT,w+Ctr	red	>52 dB Rw+Ctr
n/a	blue	>40 dB Rw
52 dB DnT,w	magenta	59 dB Rw
47 dB DnT,w	orange	54 dB Rw
42 dB DnT,w	cyan	49 dB Rw
37 dB DnT,w	green	44 dB Rw

Minimum Sound Insulation of Walls Containing Doors and/or Vision Panels	
45 dB R_w	green dotted
40 dB R_w	yellow dotted

Date	Rev	Description	By
19/01/22	A	Stage 3	NA

JPM Acoustics Drawing Number:

1392021_SI_1F_01_A

Title: Holloway Head
Airborne Sound Insulation

JPM ACOUSTICS