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Project:

University College London – 55-59 Gordon Square Day Nursery

Title:

Pre-works Sound Insulation Test Report

quietly moving forward

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Report Title	University College London – 55-59 Gordon Square Day Nursery Pre-works Sound Insulation Test Report
Reference	AF/EC17128-5
Version	0
Issue Date	14/10/2019
Client	Fowler Martin
Author	Adam Ford BA(Hons), MSc, MAES Acoustic Engineer
Checked	Tim Meed BSc(Hons), MIOA Director

CONTENTS:

1 INTRODUCTION

1.01 This report details tests that have been carried out to determine the acoustic insulation of the separating floor/ceiling constructions between the proposed lower-ground level Day Nursery and the vertically adjacent academic offices at the following premises:

University College London (UCL)
55-59 Gordon Square
London
WC1H 0NU

1.02 The property located at 55-59 Gordon Square is a mixed use academic/administration building, with part of the lower-ground floor currently operating as a Day Nursery. It is proposed to extend this Day Nursery into the currently unoccupied remainder of the lower-ground level through a permitted change of use.

1.03 The purpose of these tests is to determine the sound insulation of the separating floor structures prior to the change of use from the existing (designed as residential) to the proposed commercial Day Nursery premise. Layout plans for the properties are included in Appendix A.

1.04 We understand that no formal advice or design guidance has been given for this proposal, however planning guidance from the Local Authority – the London Borough of Camden (LBC), outlines the following requirements within the document, 'Camden Planning Guidance, Amenity, Noise and Vibration':

"The requirements of the Building Regulations are usually adequate for the sound insulation between floors and walls of adjoining dwellings, making planning conditions unnecessary.

The requirements of the Building Regulations are however likely to be inadequate in instances where:

- *A new commercial use is likely to generate noise adjoins an existing residential building (and vice versa); and/or*
- *A change of use will result in a residential development being sited in a noise environment.*

Where such a development is proposed, the Council is likely to use planning conditions requiring substantially enchanted sound insulation of the relevant walls, floors and ceilings compared to the minimum specifications of the Building Regulations. In proposing conditions, the Council will consider guidance available within BS8233:2014 Guidance on sound insulation and noise reduction for buildings, Guidelines for Community Noise (1999) and Night Noise Guidelines for Europe (2009) published by the World Health Organisation."

1.05 Due to the commercial-to-commercial nature of the proposed development, guidance for internal noise levels will be taken predominately from BS8233:2014. This British Standard outlines the typical noise levels expected within various types of buildings in order to not cause disturbance through external noise ingress. In this instance, the receiving rooms at the ground floor are predominantly single and multiple occupancy office/administration spaces.

1.06 The suitability of the existing sound insulation will be assessed based on the egress of the typical noise levels observed within the existing nursery space when in use, as measured on-site. Where any shortfalls are identified, recommendations will be made to enhance the relevant airborne

sound insulation. Due to the proposed site layout, this report does not consider any transfer of impact sound.

1.07 Additionally, the sound insulation offered by ceiling of the existing and permitted Day Nursery will be measured and characterised to further aid in the setting of suitable design targets. Both the existing and proposed nursery areas share a similar vertical adjacency with executive style offices and it is assumed therefore that the airborne sound insulation of the existing nursery is sufficient and the use of the relevant spaces Permitted.

1.08 This report is prepared solely for Fowler Martin. Environmental Equipment Corporation Ltd accept no responsibility for its use by any third party.

2 MEASUREMENT PROCEDURE

2.01 Measurements of Airborne Insulation of the floor/ceiling structures were undertaken in accordance with BS EN ISO 16283-1:2014 *"Acoustics- Field measurement of sound insulation in buildings and of building elements. Part 1: Airborne sound insulation".*

2.02 Corresponding Single Number Insulation Ratings were then determined in accordance with BS EN ISO 717:1996 "Acoustics – Rating of sound insulation in buildings and of building elements":

- *Part 1: Airborne sound insulation*
- *Part 2: Impact sound insulation.*

2.03 The instrumentation used for the measurements is listed below in Table 2.1

Description	Manufacturer & Model	Serial Number(s)
Integrating Sound Level Meter	Bruel & Kjaer 2250	2626193
Preamplifier	Bruel & Kjaer ZC0032	8391
½" Condenser Microphone	Bruel & Kjaer 4189	2529972
Powered Loudspeaker	KUB-1	-

Table 2.1: Noise Measurement Instrumentation

2.04 All acoustic equipment conforms to the relevant parts of IEC 60651:1979 (equivalent to BS 5969:1981) for the requirements of Type 1 acoustic accuracy. Additionally, the relevant equipment conforms to the specifications contained within IEC 60804:1985 (equivalent to BS 6698:1976) for integrating sound level meters.

2.05 In order to verify the correct operation of the equipment on site, an acoustic calibrator was applied during the course of the measurements. A maximum change of 0.05 dB(A) was noted, this can be considered as an insignificant change. The calibrators comply with the specifications of IEC 60942:1988.

2.06 The sound insulation tests were carried out in the evening of Tuesday 1st October 2019 by Acoustic Engineers Adam Ford and Thomas Buchan, representing Environmental Equipment Corporation Ltd.

2.07 Fast meter response was used for all measurements carried out during the survey.

3 DESIGN GUIDANCE

3.01 The UCL Day Nursery is an existing commercial premise located on the lower ground floor of the UCL property at 55-59 Gordon Square, located within the eastern half of basement. This report refers to the proposed change of use to the currently unoccupied western quadrant of the same building to operate as an extension to the Day Nursery. This extension of the operation will consist of two new playrooms, staff office, kitchen, toilets and circulation area. We understand that the existing internal separating partitions between rooms will remain unchanged.

3.02 The area above the proposed change of use consists of academic/administration offices and circulation areas. There are no direct/open routes between the basement and ground floor areas under assessment, however the two circulation areas share an emergency fire escape staircase with sealed security door.

3.03 Due to the commercial-to-commercial nature of the partitions, guidance has been taken from BS8233 for the typical internal noise levels expected within the offices. This guidance, combined with the typical expected noise levels within the nursery have been used to derive the minimum required airborne sound insulation. Additionally, the airborne sound insulation of the existing nursery has been measured in order to further aide in the setting of design targets.

3.04 BS8233 states that an office used for work requiring concentration should ideally not exceed 35-40 dB $L_{Aeq,T}$. The noise ingress from the nursery should therefore be designed so as to not significantly increase this level, and thus aim for an internal noise level within the offices of 25-30 dBA.

3.05 Additional areas under assessment include the ground-floor circulation area and kitchenette. BS8233 states that internal noise levels in these areas should typically not exceed 45-50dBA. A design target for noise ingress should therefore aim to achieve 35-40 dBA. In addition to this, consideration has been given where the circulation area gives direct access to the offices to ensure that the ambient noise level does not cause excess noise ingress into the office to cause disturbance.

3.06 During EEC's attendance at the site, acoustic measurements were taken over a 1-hour period in order to identify the typical operational noise levels of the existing nursery. Table 3.1 shows the measured levels.

Existing Nursery Operational Noise	**$L_{Aeq,T}$**	**L_{A1}**	**$L_{AF,Max}$**
	69 dB	80 dB	98dB

Table 3.1: In-situ noise within the existing nursery.

3.07 Based on the observed operation of the existing nursery, we expect that this noise level will be consistent throughout the proposed playrooms and circulation areas due to the open-plan and reverberant nature of the finishes, however the noise levels within the kitchen and staff office are expected to be considerably lower in practice.

3.08 Using the above L_{A1} data as the worst-case noise source and the required internal noise level as defined by BS8233, the following sound separation targets have been provisionally set to ensure that disturbance due to noise ingress is minimised. Due to the noise within the nursery consisting

predominantly of human speech, the metric of $D_{nT,W}$ will be used, without the C_{tr} correction applied to account for the transmission of additional and extended low frequency content:

Receiving Room	Office	Kitchenette	Circulation Area
Derived Minimum Acoustic Separation, $D_{nT,w}$	50-55	40-45	40-45

Table 3.1: Derived airborne sound insulation values to minimise disturbance.

3.09 The above design targets will ensure that the $L_{Aeq,T}$ within the receiving offices and additional spaces does not regularly exceed the recommended levels defined within BS8233.

4 TEST REQUIREMENTS

4.01 The existing floor/ceiling construction is unknown; however, we understand that the construction is likely to be based around a timber joist construction. The ceiling construction is expected to be similar throughout the lower-ground level.

4.02 Based on the standard requirements and the room layouts a test schedule was determined as indicated in Table 4.1 below.

Source Room	Volume	Receiving Room	Volume
Existing Playroom	73 m^3	Meeting Room	98 m^3
Proposed Playroom 1	60 m^3	Office G15	39 m^3
Proposed Playroom 2	57 m^3	Office G21	54 m^3
Proposed Staff Office	25 m^3	Ground floor Kitchenette	15 m^3
Proposed Kitchen	34 m^3	Office G14	74 m^3
Proposed Circulation Area	23 m^3	Circulation Area	45 m^3

Table 4.1: Test Schedule

4.03 The results of the Existing Playroom to Meeting Room test will be used to further advise the required performance of the proposed new Day Nursery areas.

5 RESULTS

5.01 Results of the sound insulation tests are summarised below and are also reproduced in graphical format in Appendix B.

5.02 Table 4.1, below, shows the results of the Airborne sound insulation tests in accordance with the Building Regulations 2000, Approved Document E: 2003 Edition (ADE 2003), and BS8233:2014.

Source Room	Receiving Room	Test Sample	Measured $D_{nT,w}$	Measured $D_{nT,W+Ctr}$	Report Ref
Existing Play Room	Meeting Room	Floor/Ceiling	52 dB	43 dB	1
Proposed Play Room 1	Office G15	Floor/Ceiling	50 dB	43 dB	2
Proposed Play Room 2	Office G21	Floor/Ceiling	49 dB	40 dB	3
Proposed Staff Office	Kitchenette	Floor/Ceiling	40 dB	36 dB	4
Proposed Kitchen	Office G14	Floor/Ceiling	53 dB	44 dB	5
Lower-ground Circulation Area	Ground Floor Circulation Area	Floor/Ceiling	37 dB	36 dB	6

Table 5.1: Airborne Sound Insulation Tests Results

5.03 The results of Test 1, Existing Playroom to Meeting Room, show an airborne sound insulation performance of 52 dB $D_{nT,w}$ – this is in line with the derived minimum performances detailed in Section 3 required to minimise disturbance. The Meeting Room is expected to be of a similar or greater sensitivity to external noise ingress than the receiving staff offices, and so offers a suitably similar comparison for potential disturbance. Due to the assumed permitted operation of this existing nursery, it is expected that 50-55 dB $D_{nT,w}$ is therefore a suitable design target and should be achieved as a minimum throughout the proposed nursery premise.

5.04 This level of performance is already achieved for the Proposed Playroom (Test 2) and the Proposed Kitchen (Test 5). Any future works to the ceiling construction in these rooms should aim to not create open services penetrations or other structural weaknesses in order to maintain the acoustic performance.

5.05 Test 3, Proposed Playroom 2 to Office G21, did not achieve the 50-55 dB $D_{nT,w}$ design target. It was observed that this room had exposed services penetrations through the ceiling, and a covered/vented chimney, which were seen to run through to the above Office G21. It is expected therefore that these penetrations allow for an additional and onerous flanking path for airborne sound. The sound insulation offered by the ceiling construction in this room can be improved should the services penetrations and chimney stack be acoustically sealed and maintained as such.

5.06 Test 4, Proposed Staff Office to Kitchenette, achieved an airborne sound insulation of 40 dB $D_{nT,w}$. This is in line with the derived minimum performances for this room type and should therefore be suitable for the proposed change of use, assuming that the separating construction is maintained.

5.07 Test 6, Lower-ground Circulation Area to Ground Floor Circulation Area, displayed the lowest airborne sound insulation measured at the site. This is due to the two areas sharing a common emergency fire escape route separated by a security door acting as a flaking route. This door was of a lightweight construction in a standard frame which meant that sound was transferred easily through the partition. While the ingress of nursery noise into the circulation area may in itself not be an issue, it may cause additional disturbance to the staff working in the ground floor offices as well as having a significant impact on the existing soundscape within this element of the building. With this in mind, we recommend that the existing lightweight timber security door is replaced

with, as a minimum, a door-set offering an insulation of 35 dB R_w. This would lead to a composite sound insulation for this adjacent of approximately 40-45 dB $D_{nT,w}$.

5.08 35 dB R_w can typically be achieved using a solid-core door-set with effective perimeter seals in a substantial frame. A timber FD60 door will often meet these requirements based on a thickness of ≈54mm and a minimum superficial density of ≈29kg/m^2.

5.09 It is currently unknown at this point if any works are proposed to the existing ceiling constructions beyond surface level aesthetic repair and those outlined above. Should any further works be proposed, these should be reviewed by a suitably qualified acoustician to ensure that the overall acoustic performance of the separating construction is not negatively affected. If an acoustic performance greater than those outlined above is required by the Local Authority, an additional detailed review of design considerations will be required.

6 SUMMARY

6.01 A change of use is proposed for the currently unoccupied lower-ground floor premise of 55-59 Gordon Square from Residential to a Day Nursery. Guidance contained within the London Borough of Camden Supplementary Planning Documents states that the acoustic separation between the proposed Day Nursery and vertically adjacent staff offices should be assessed in accordance with BS8233 and other relevant design guidance to ensure that disturbance is minimised.

6.02 Using the guidance contained within BS8233, and additional acoustic data captured at the existing Day Nursery premise, the minimum required acoustic separation for the floor/ceiling's construction was derived for each of the receiving room types.

6.03 Testing was completed at the site to identify the existing airborne sound insulation offered by the floor/ceiling construction and to highlight any acoustic weaknesses at this pre-works stage. The analysis of the tests indicates that the refurbishment and change of use proposed for the lower-ground level of 55-59 Gordon Square is generally suitable, with the separating constructions meeting the minimum required airborne sound insulation to minimise disturbance to the above offices.

6.04 Where the separating constructions do not meet the required acoustic performance, remedial works have been suggested to improve the performance as appropriate. This includes the sealing of exposed services penetrations and the installation of an up-rated door-set for the emergency fire escape route.

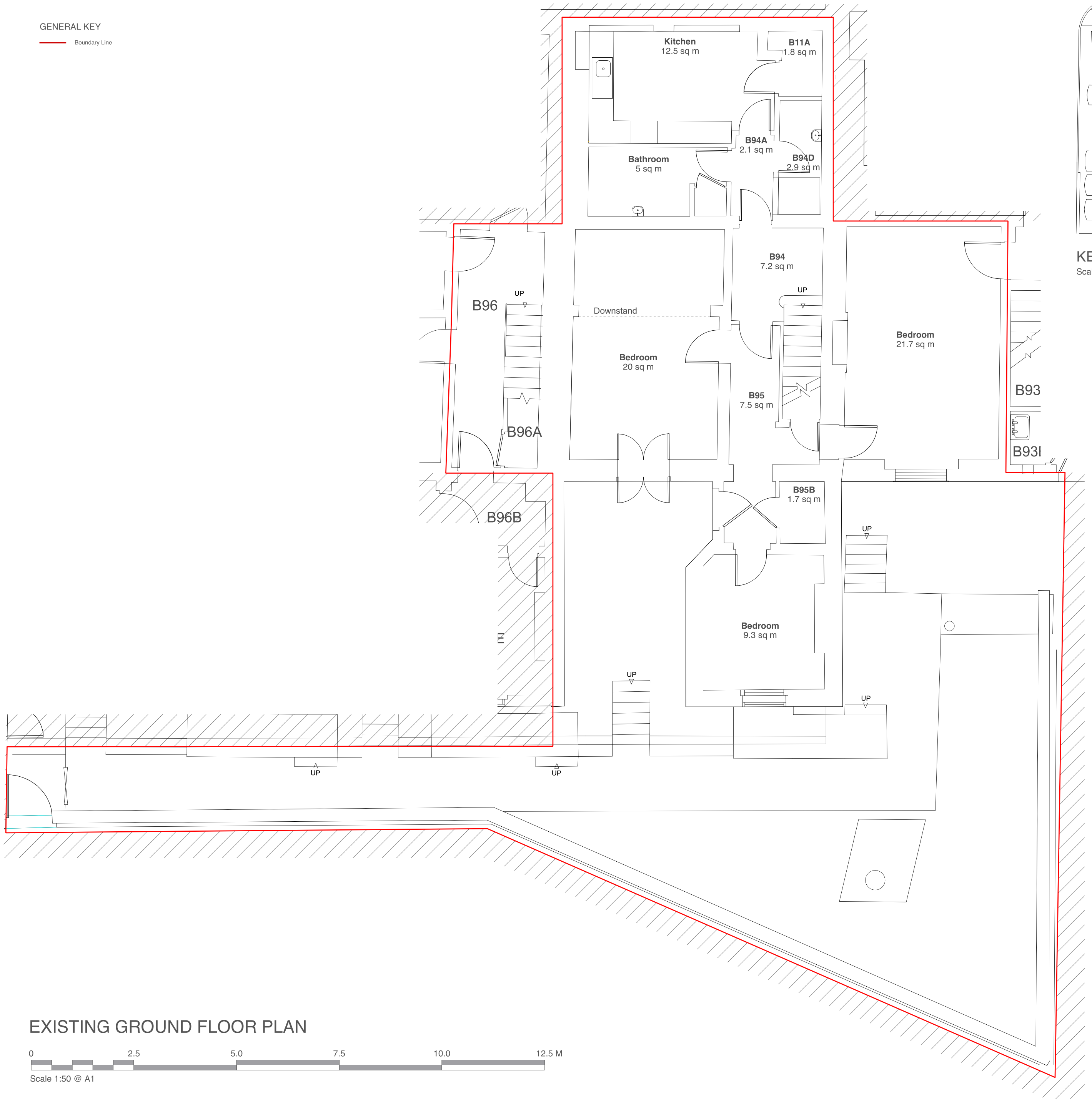
6.05 Assuming that the above outlined works are completed, we expect that noise egress will not offer a material constraint to the operation of the proposed lower-ground floor Day Nursery.

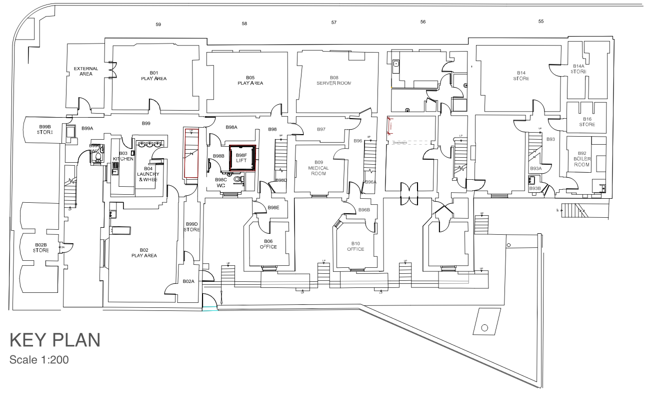
APPENDIX A

FLOOR PLANS

GENERAL KEY

Boundary Line





KEY PLAN

Scale 1:200

EXISTING GROUND FLOOR PLAN

0 2.5 5.0 7.5 10.0 12.5 M

Scale 1:50 @ A1

Kendall Kingscott

Chartered Architects
Chartered Building Surveyors
Interior Designers
CDM Services

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Rev Date By Ap Note

Project: 55-59 Gordon Square Day Nursery	Drawing Title: Existing GF Plan	
Client: University College London	Project Number: 190775	Drawing Number - Revision: 1200-P1
Scale: 1:50	Paper Size: A1	Filename: 190775.vwx
Date: 06/08/19	Drawn: AP	Checked: KS
Status: TENDER		

INTERNAL WALL TYPE NOTES:

INTERNAL WALL TYPE 1: General partition.

As Schedule of Works Item 4.02.

Partitions to be built off slab and taken to the underside of the soffit.

1 x 12.5mm Gyproc Wallboard
1 x 12mm Ply Lining
Gyproframe 48&60 studs at 600mm centres
50mm Isover Acoustic Insulation
1 x 18mm Ply Lining
1x12.5 Gyproc Wall Board

To achieve min 30mins fire protection.

Allow for adaptions/alterations to the existing ceiling to facilitate the installations.

INTERNAL WALL TYPE 2: Infill existing voids in Kitchen wall.

As Schedule of Works Item 4.03

Partitions to be built off slab and taken to the underside of the soffit.

Existing wall infill partition to line through seamlessly with existing adjacent surfaces.

1 x 12.5 Gyproc Wallboard
1 x 18mm Ply Lining
Gyproframe 48&60 studs at 600mm centres

INTERNAL WALL TYPE 3: Gyplyner system.

Provisionally allow to line walls with Gyplyner system following false wall removal as Schedule of Works Item 4.04.

FFE NOTES

GROUP 1:

Items are to be provided by the main contractor and fitted by the main contractor. Grp1 will have specification reference.

GROUP 2:

Items are to be provided by the client and fitted by the main contractor.

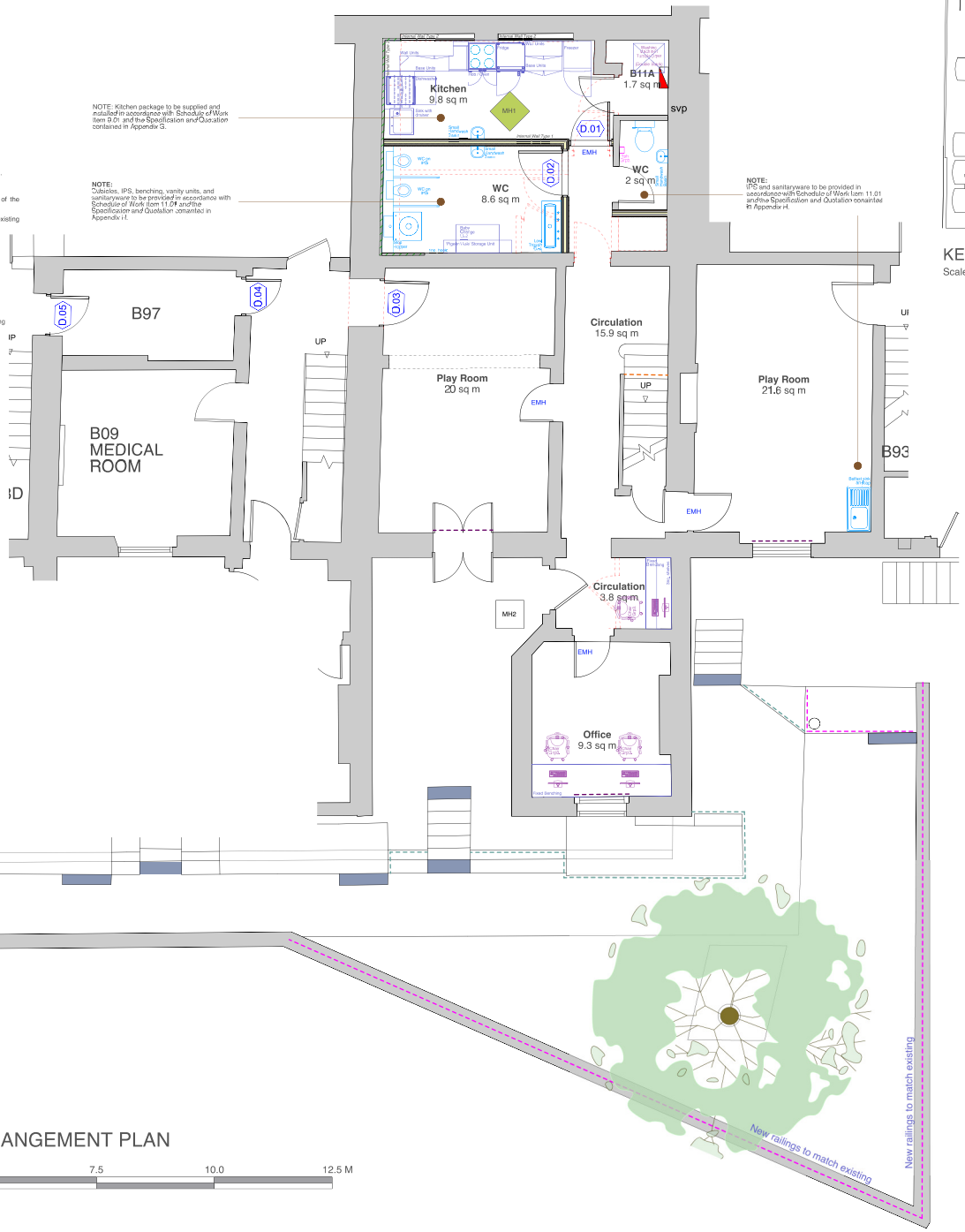
GROUP 3:

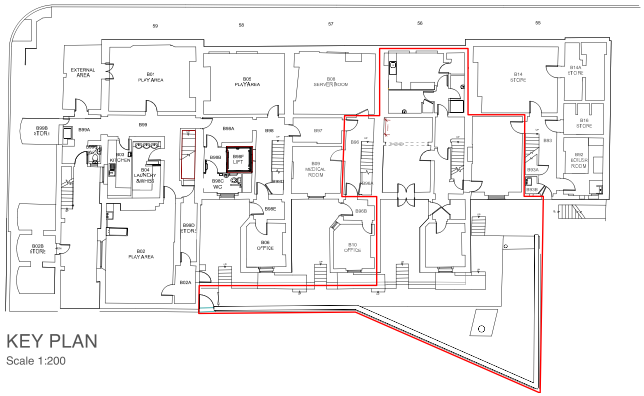
Items are to be provided by the client and fitted by the client.

NOTE: Kitchen package to be supplied and installed in accordance with Schedule of Work Item 9.01 and the Specification and Quotation contained in Appendix G.

NOTE: Cubicles, IPS, benching, vanity units, and sanitaryware to be provided in accordance with Schedule of Work Item 11.01 and the Specification and Quotation contained in Appendix H.

NOTE: IPS and sanitaryware to be provided in accordance with Schedule of Work Item 11.01 and the Specification and Quotation contained in Appendix H.





KEY PLAN
Scale 1:200

PROPOSED WORKS KEY

Supply and fit new spring loaded self-closing safety gates as Schedule of Works Item 14.07.

MH1 — Provide and install new double manhole cover as Schedule of Works item 12.03.

Provide and install new roller blinds as Schedule of Work Item 8.01.

Supply and fit new stair gate as Schedule of Work Item 8.04.

Existing railings to receive safety mesh as Schedule of Works Item 14.05.

Provide and install new railings as Schedule of Works Item 14.06.

FFE NOTES

GROUP 1:

Items are to be provided by the main contractor and fitted by the main contractor. Grp1 will have specification reference.

GROUP 2:

Items are to be provided by the client and fitted by the main contractor as clause C90/-E3.

GROUP 3:

Items are to be provided by the client and fitted by the client.

PROPOSED GENERAL ARRANGEMENT PLAN

0 2.5 5.0 7.5 10.0 12.5 M

Scale 1:50 @ A1

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Rev | Date | By | Ap | Note

Project
55-59 Gordon Square
Day Nursery

Client
University College London

Drawing Title
Proposed GA Plan

Project Number
190775

Drawing Number - Revision
1410-P1

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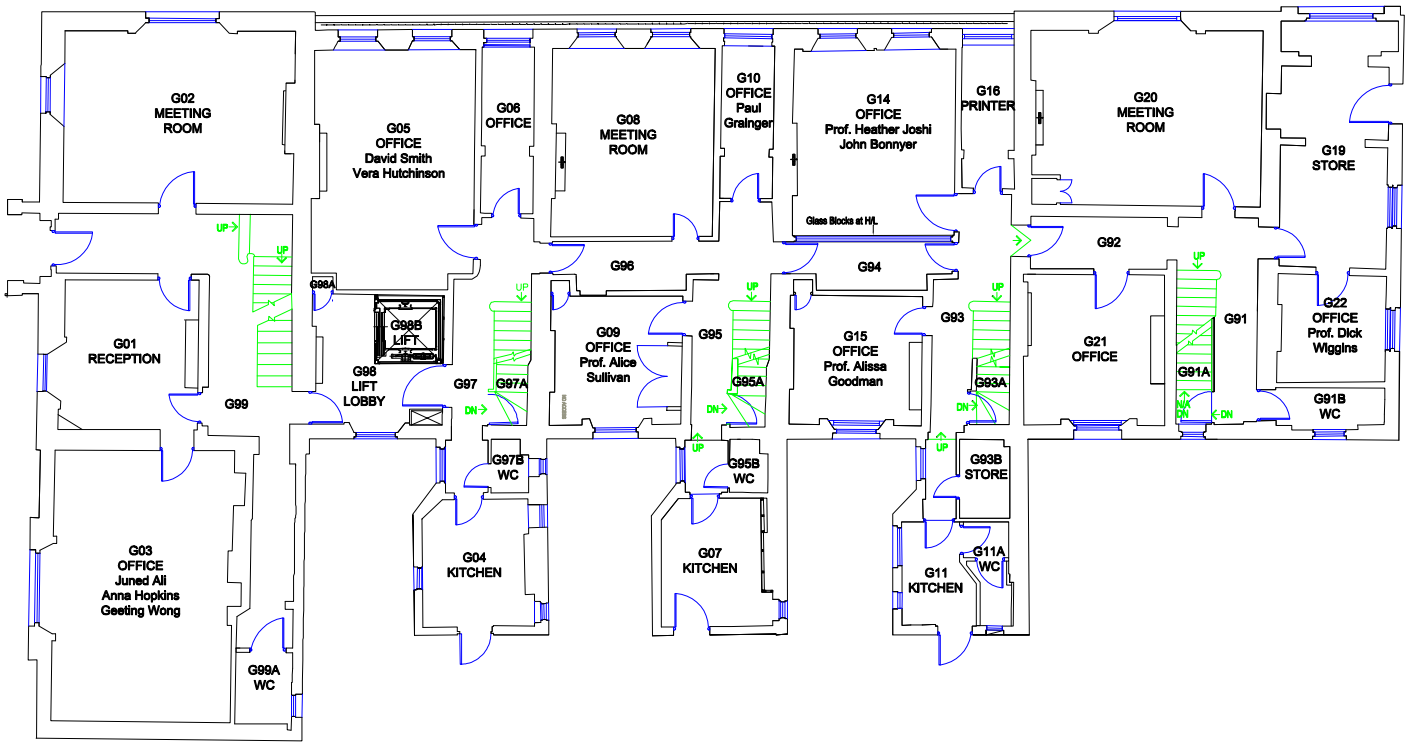


UCL ESTATES
GOWER STREET, LONDON WC1E 6BT

UCL

BASE FLOOR PLAN

INSTITUTE OF EDUCATION
GORDON SQUARE, 55-59

GROUND FLOOR
Building No. 394

N

Print Date:

Last Modified Date: May 2019

APPENDIX B

TEST RESULT CERTIFICATES
(GRAPHICAL)

Standardized level difference measured in accordance with ISO 16283-1
Field measurements of airborne sound insulation between rooms

Client: Fowler Martin

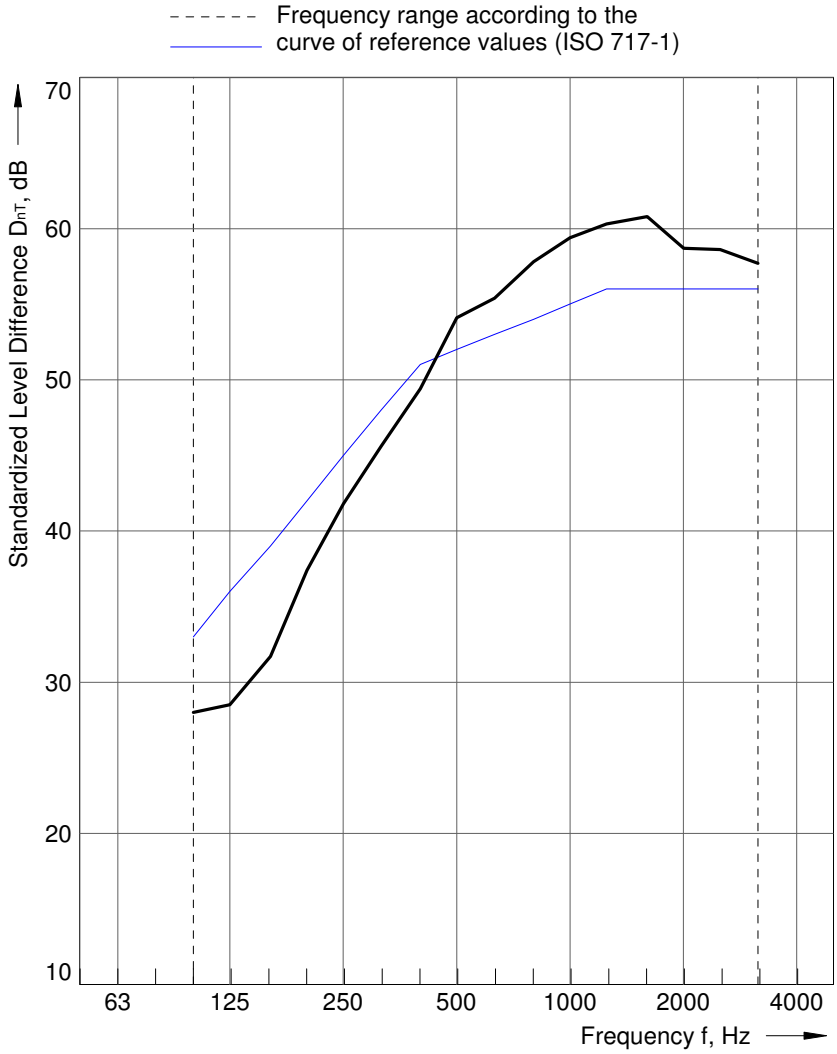
Date of test: 01/10/2019

Description and identification of the building construction and test arrangement, direction of measurement etc.:

Existing Nursery Playroom to Meeting Room

Area of common partition : 28.80 m²
Receiving room volume: 97.92 m³
Source room volume: 73.44 m³

Frequency f Hz	D_{nT} 1/3 Octave dB
50	
63	
80	
100	28.0
125	28.5
160	31.7
200	37.4
250	41.8
315	45.6
400	49.4
500	54.1
630	55.4
800	57.8
1000	59.4
1250	60.3
1600	60.8
2000	58.7
2500	58.6
3150	57.7
4000	
5000	



Rating according to ISO 717-1
$D_{nT,w}(C;C_{tr})$ = 52 (-3; -9) dB

$C_{50\text{-}3150}$ = N/A dB; $C_{50\text{-}5000}$ = N/A dB; $C_{100\text{-}5000}$ = N/A dB;
$C_{tr,50\text{-}3150}$ = N/A dB; $C_{tr,50\text{-}5000}$ = N/A dB; $C_{tr,100\text{-}5000}$ = N/A dB;

Evaluation based on field measurement results obtained by an engineering method

No. of test report: 1

Name of test institute: EEC Ltd

Date: 14/10/2019

Signature:

Standardized level difference measured in accordance with ISO 16283-1
Field measurements of airborne sound insulation between rooms

Client: Fowler Martin

Date of test: 01/10/2019

Description and identification of the building construction and test arrangement, direction of measurement etc.:

Proposed Play Room 1 to Office G15

Area of common partition : 11.52 m²
Receiving room volume: 39.00 m³
Source room volume: 60.00 m³

Frequency f Hz	D_{nT} 1/3 Octave dB
50	
63	
80	
100	31.8
125	29.0
160	29.3
200	36.4
250	41.1
315	44.2
400	46.7
500	49.6
630	50.0
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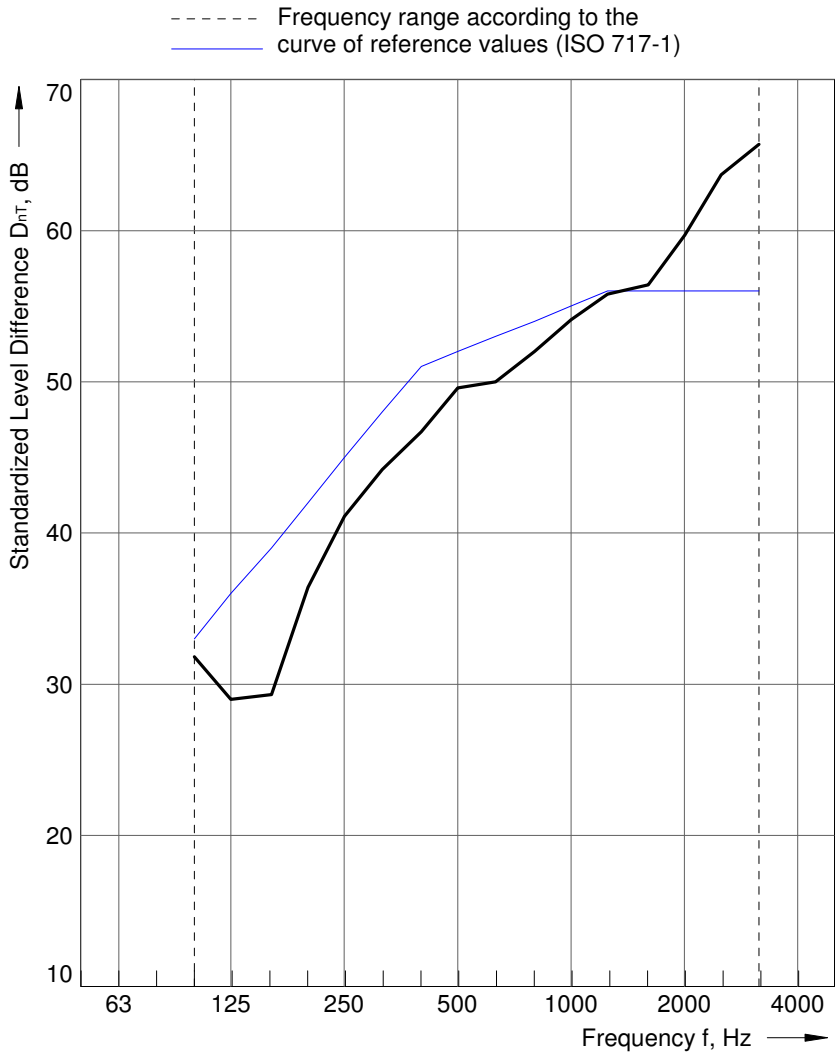
2000	59.7
2500	63.7
3150	65.7
4000	
5000	



Rating according to ISO 717-1
$D_{nT,w}(C;C_{tr})$ = 50 (-2; -7) dB

$C_{50\text{-}3150}$ = N/A dB; $C_{50\text{-}5000}$ = N/A dB; $C_{100\text{-}5000}$ = N/A dB;
$C_{tr,50\text{-}3150}$ = N/A dB; $C_{tr,50\text{-}5000}$ = N/A dB; $C_{tr,100\text{-}5000}$ = N/A dB;

Evaluation based on field measurement results obtained by an engineering method

No. of test report: 2

Name of test institute: EEC Ltd

Date: 14/10/2019

Signature:

Standardized level difference measured in accordance with ISO 16283-1
Field measurements of airborne sound insulation between rooms

Client: Fowler Martin

Date of test: 01/10/2019

Description and identification of the building construction and test arrangement, direction of measurement etc.:

Proposed Play Room 2 to Office G21

Area of common partition : 15.54 m²
Receiving room volume: 54.39 m³
Source room volume: 57.20 m³

Frequency f Hz	D_{nT} 1/3 Octave dB
50	
63	
80	
100	22.7
125	30.5
160	33.2
200	35.2
250	39.7
315	42.4
400	44.4
500	47.0
630	48.8
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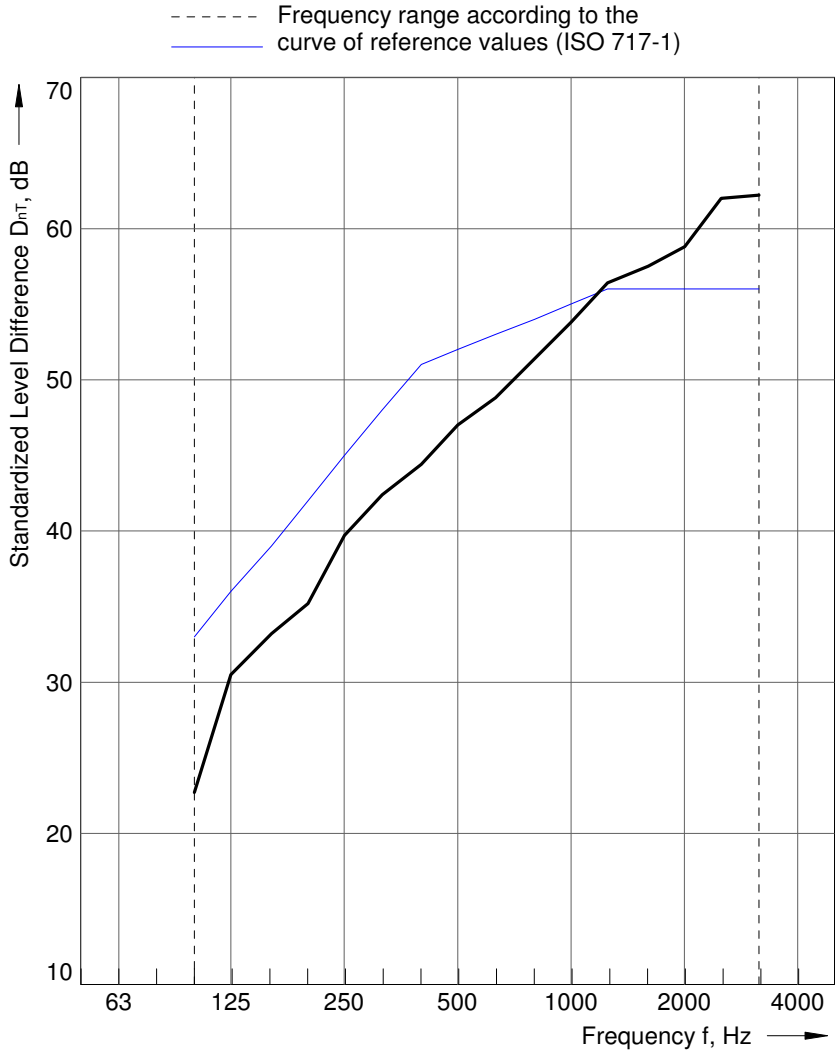
2000	58.8
2500	62.0
3150	62.2
4000	
5000	



Rating according to ISO 717-1
$D_{nT,w}(C;C_{tr})$ = 49 (-2; -9) dB

$C_{50\text{-}3150}$ = N/A dB; $C_{50\text{-}5000}$ = N/A dB; $C_{100\text{-}5000}$ = N/A dB;
$C_{tr,50\text{-}3150}$ = N/A dB; $C_{tr,50\text{-}5000}$ = N/A dB; $C_{tr,100\text{-}5000}$ = N/A dB;

Evaluation based on field measurement results obtained by an engineering method

No. of test report: 3

Name of test institute: EEC Ltd

Date: 14/10/2019

Signature:

Standardized level difference measured in accordance with ISO 16283-1
Field measurements of airborne sound insulation between rooms

Client: Fowler Martin

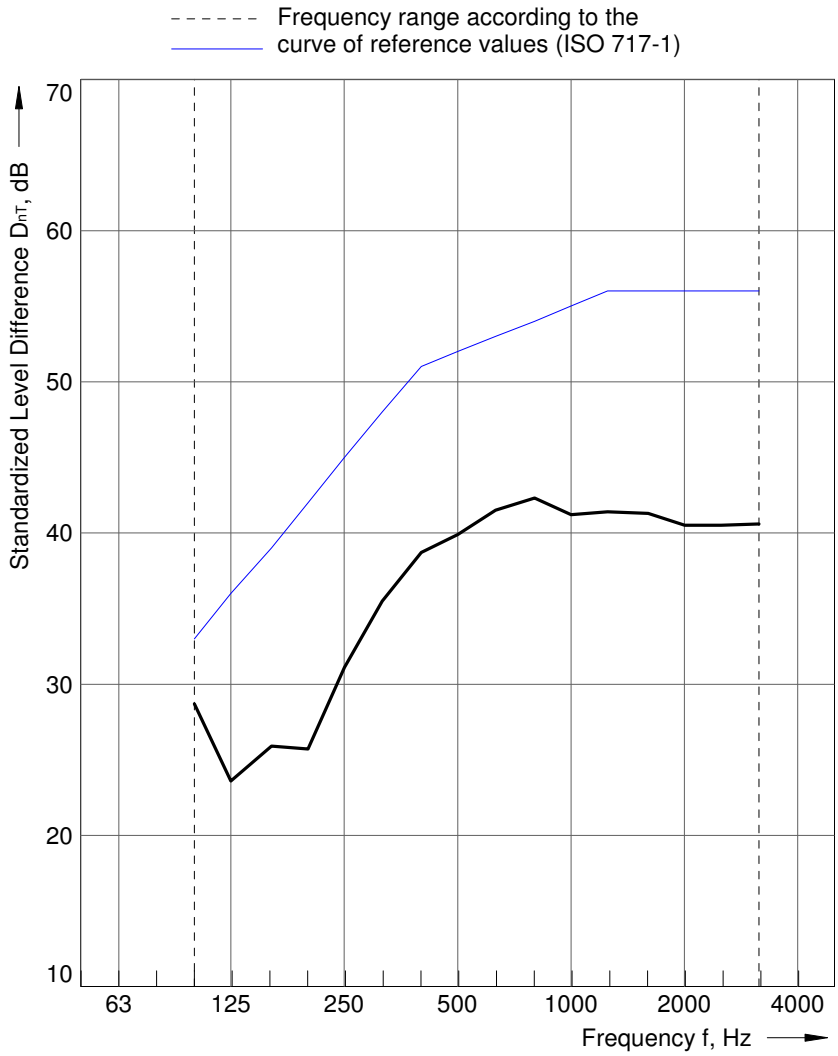
Date of test: 01/10/2019

Description and identification of the building construction and test arrangement, direction of measurement etc.:

Proposed Staff Office to Kitchenette

Area of common partition : 5.80 m²
Receiving room volume: 15.00 m³
Source room volume: 75.00 m³

Frequency f Hz	D_{nT} 1/3 Octave dB
50	
63	
80	
100	28.7
125	23.6
160	25.9
200	25.7
250	31.1
315	35.5
400	38.7
500	39.9
630	41.5
800	42.3
1000	41.2
1250	41.4
1600	41.3
2000	40.5
2500	40.5
3150	40.6
4000	
5000	



Rating according to ISO 717-1
$D_{nT,w}(C;C_{tr})$ = 40 (-1; -4) dB

$C_{50\text{-}3150}$ = N/A dB; $C_{50\text{-}5000}$ = N/A dB; $C_{100\text{-}5000}$ = N/A dB;
$C_{tr,50\text{-}3150}$ = N/A dB; $C_{tr,50\text{-}5000}$ = N/A dB; $C_{tr,100\text{-}5000}$ = N/A dB;

Evaluation based on field measurement results obtained by an engineering method

No. of test report: 4

Name of test institute: EEC Ltd

Date: 14/10/2019

Signature:

Standardized level difference measured in accordance with ISO 16283-1
Field measurements of airborne sound insulation between rooms

Client: Fowler Martin

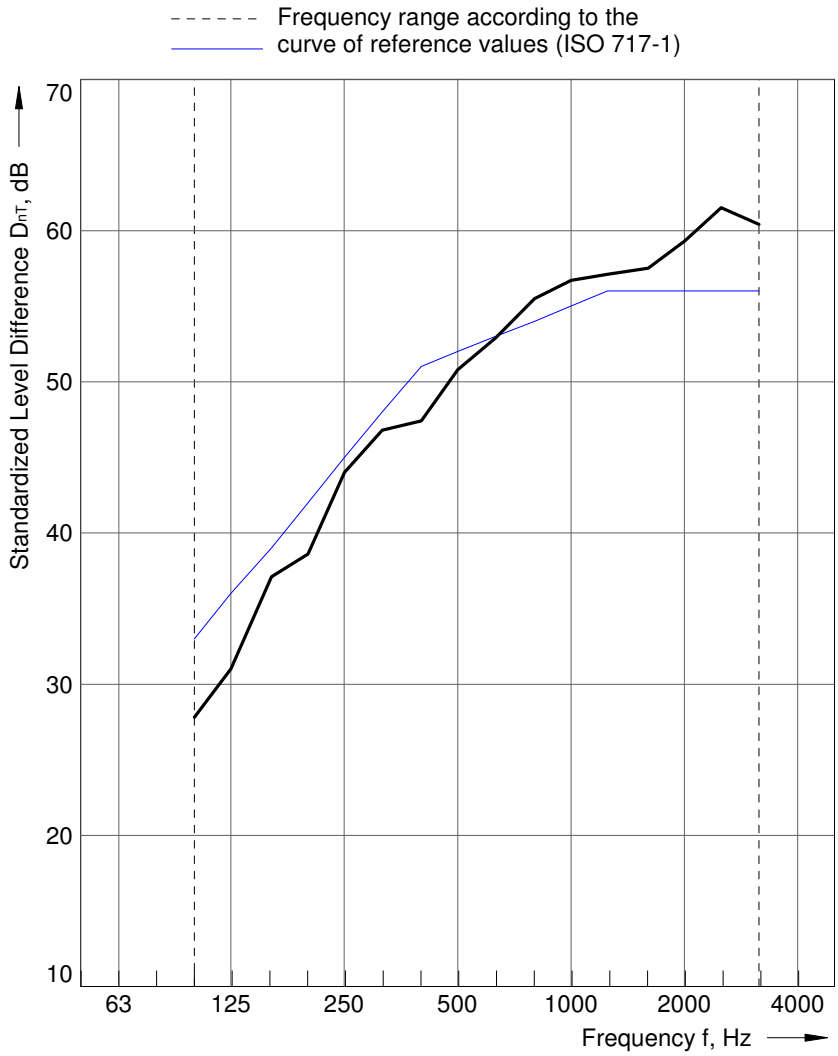
Date of test: 01/10/2019

Description and identification of the building construction and test arrangement, direction of measurement etc.:

Proposed Kitchen to Office G14

Area of common partition : 12.54 m²
Receiving room volume: 74.25 m³
Source room volume: 34.00 m³

Frequency f Hz	D_{nT} 1/3 Octave dB
50	
63	
80	
100	27.8
125	31.0
160	37.1
200	38.6
250	44.0
315	46.8
400	47.4
500	50.8
630	52.9
800	55.5
1000	56.7
1250	57.1
1600	57.5
2000	59.3
2500	61.5
3150	60.4
4000	
5000	



Rating according to ISO 717-1
$D_{nT,w}(C;C_{tr})$ = 53 (-3; -9) dB

$C_{50\text{-}3150}$ = N/A dB; $C_{50\text{-}5000}$ = N/A dB; $C_{100\text{-}5000}$ = N/A dB;
$C_{tr,50\text{-}3150}$ = N/A dB; $C_{tr,50\text{-}5000}$ = N/A dB; $C_{tr,100\text{-}5000}$ = N/A dB;

Evaluation based on field measurement results obtained by an engineering method

No. of test report: 5

Name of test institute: EEC Ltd

Date: 14/10/2019

Signature:

Standardized level difference measured in accordance with ISO 16283-1
Field measurements of airborne sound insulation between rooms

Client: Fowler Martin

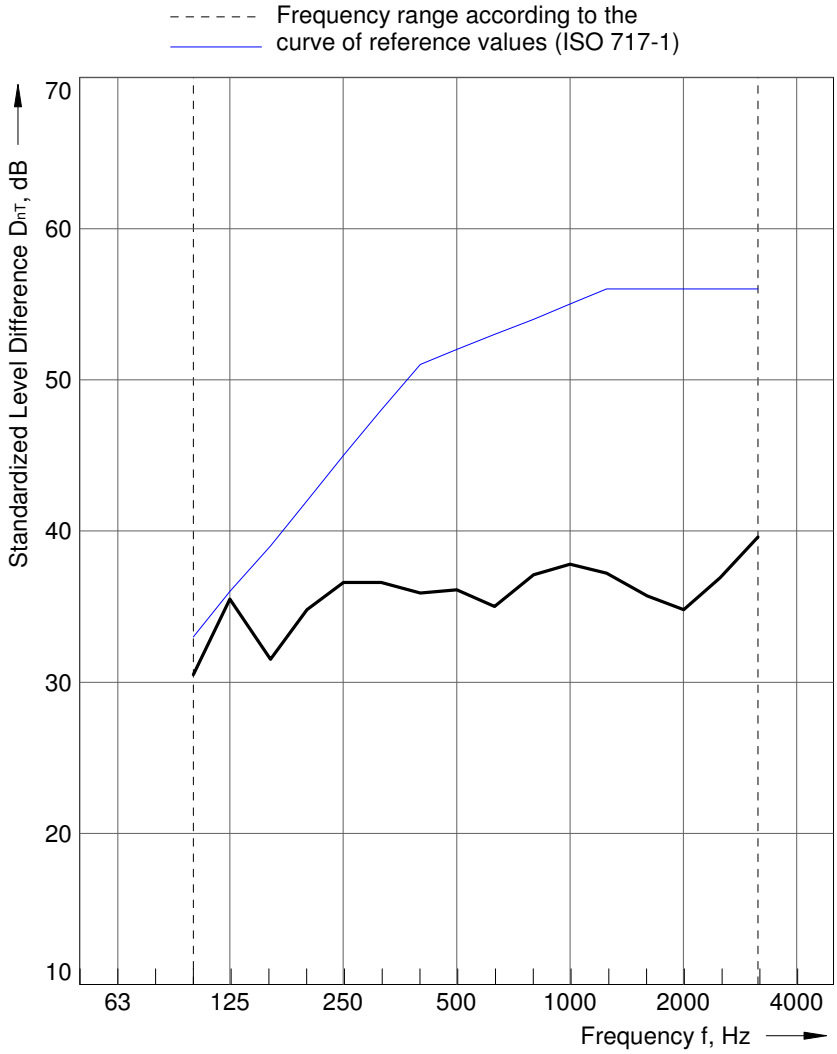
Date of test: 01/10/2019

Description and identification of the building construction and test arrangement, direction of measurement etc.:

Circulation Area to Circulation Area

Area of common partition : 10.00 m²
Receiving room volume: 45.00 m³
Source room volume: 23.20 m³

Frequency f Hz	D_{nT} 1/3 Octave dB
50	
63	
80	
100	30.5
125	35.5
160	31.5
200	34.8
250	36.6
315	36.6
400	35.9
500	36.1
630	35.0
800	37.1
1000	37.8
1250	37.2
1600	35.7
2000	34.8
2500	36.9
3150	39.6
4000	
5000	



Rating according to ISO 717-1
$D_{nT,w}(C;C_{tr})$ = 37 (-1; -1) dB

$C_{50\text{-}3150}$ = N/A dB; $C_{50\text{-}5000}$ = N/A dB; $C_{100\text{-}5000}$ = N/A dB;
$C_{tr,50\text{-}3150}$ = N/A dB; $C_{tr,50\text{-}5000}$ = N/A dB; $C_{tr,100\text{-}5000}$ = N/A dB;

Evaluation based on field measurement results obtained by an engineering method

No. of test report: 6

Name of test institute: EEC Ltd

Date: 14/10/2019

Signature:

APPENDIX C

GLOSSARY OF TECHNICAL TERMS

TECHNICAL TERMS AND UNITS

Decibel (dB) - This is the unit used to measure sound. The human ear has an approximately logarithmic response to sound over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). We therefore use a logarithmic scale to describe sound pressure levels, intensities and power levels. The logarithms used are to base 10; hence, an increase of 10 dB in sound pressure level corresponds to a doubling in perceived loudness of the sound.

Sound Power Level (PWL) - This is a function of the noise source alone and is independent of its surroundings. It is a measure of the amount of sound power output measured in decibels.

Sound Pressure Level (SPL) - This is a function of the source and its surroundings and is a measure of the sound pressure at a point in space. For example, a sound pressure level measured at 1 metre from a sound source of certain sound power in reverberant room will not be the same as the sound pressure level a 1 metre from the sound source measured in open space.

Octave and One-Third Octave Bands - The human ear is sensitive to sound over a range of approximately 20 Hz to 20 KHz and is generally more sensitive to medium and high frequencies than to low frequencies. In order to define the frequency content of a noise, the spectrum is divided into frequency bands and the sound pressure level is measured in each band. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For finer analysis, each octave band may be split into one-third octave bands.

"A" Weighting - A number of frequency weightings have been developed to imitate the ear's varying sensitivity to sound of different frequencies. The most commonly used weighting is the "A" weighting. The "A" weighted SPL can be measured directly or derived from octave or one-third octave band SPLs. The result is a single figure index which gives some idea of the subjective loudness of the sound, but which contains no information as to its frequency content.

Noise Rating (NR) Curves - The "A" weighted sound pressure level cannot be used to define a spectrum or to compare sounds of different frequencies. NR curves convey frequency information in a single-figure index. This is done by defining the maximum permissible sound pressure level at each frequency for each curve. To measure the noise rating of a given environment, the SPL is measured in octave or one-third octave bands and the noise rating is then the highest NR curve touched by the measured levels.

Intermittency and Time-Weighting - The degree of annoyance caused by a noise also depends on its duration and intermittency of a noise. Intermittent, impulsive or repetitive noises tend to be more annoying than continuous noises. Various time-weightings have been derived to measure sounds of differing intermittences and these can be measured directly on modern equipment. The most common time-weightings in use are as follows:-

L_{90} This is the sound pressure level exceeded for 90% of the measurement period. It is widely used to measure background noise levels.

L_{10} This is the sound pressure level exceeded for 10% of the measurement period. It is widely used to measure traffic noise. For a given measurement period, the L_{10} level is by definition greater than or equal to the L_{90} level.

L_{eq} The equivalent continuous noise level is often used to measure intermittent noise. It is defined as the notional steady noise level that would contain the same acoustic energy as the varying noise. Because the averaging process used is logarithmic, the L_{eq} level tends to be dominated by the higher noise levels measured.