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71 CAMDEN ROAD, LONDON

NOISE IMPACT ASSESSMENT

Report 13517.NIA.01

Prepared on 17 December 2015

For:

Racoty Alex Ltd

71 Camden Road

London

NW1 9EU

Registered in England Company No. 7947892
KP Acoustics is the Trading Name of KP Acoustics Limited

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1.0 INTRODUCTION

KP Acoustics Ltd, Britannia House, 11 Glenthorne Road, London, W6 0LH, has been commissioned by Racoty Alex Ltd, 71 Camden Road, London, NW1 9EU, to undertake a sound insulation investigation between a Ground Floor of the commercial space at 71 Camden Road, London, and the first floor flat situated above. The measured noise levels will be used to investigate and assess the noise impact from the Ground Floor commercial space to the above residential property.

This report presents the results of the environmental survey followed by an assessment of the measured performance of the building's internal and external fabric.

2.0 PROCEDURE AND EQUIPMENT

2.1 Environmental Noise Survey

Measurements of existing environmental noise were undertaken at the position shown on Site Plan 13517.SP1. The choice of this position was based both on accessibility and on collecting representative noise data in relation to the nearest noise sensitive receiver.

Continuous automated monitoring was undertaken for the duration of the survey between 5:30 pm on 13 November and 10:40am on 16 November 2015.

Weather conditions were generally dry with light winds, therefore deemed suitable for the measurement of environmental noise.

The measurement procedure complied with ISO 1996-2:2007 Acoustics "Description, measurement and assessment of environmental noise - Part 2: Determination of environmental noise levels".

The equipment calibration was verified before and after use and no abnormalities were observed.

The equipment used was as follows.

- 1 No. Svantek Type 957 Class 1 Sound Level Meter
- B&K Type 4231 Class 1 Calibrator

2.2 Noise Breakout Measurements

In order to assess the effectiveness of current elements of the external building fabric in attenuating noise break-out, a number of manual measurements were undertaken. To demonstrate the effectiveness of attenuation in the most robust method, white noise was used, providing equal energy in all frequencies.

An average of the resulting noise levels was obtained by using a moving microphone technique over a minimum period of 15 seconds at each of two positions within the main Commercial space area.

The same measurement procedure was repeated approximately 5m outside the windows of the main façade on the Camden Road Elevation, in order to assess the noise break-out from the Ground Floor space to the external environment. All measurements were corrected for existing background noise.

2.3 Direct Transfer Measurements

A similar method was followed for the assessment of the airborne sound insulation performance of the separating floor between the Ground Floor and First Floor spaces. High-level white noise was generated within the Ground Floor area and a spatial average was undertaken by means of a moving microphone technique.

The same measurement procedure was repeated in a bedroom and Living Room/Kitchen of the first floor flat in order to assess the direct noise transfer from the ground floor space to the proposed noise-sensitive spaces of the first floor.

The instrumentation used during the sound insulation investigation is shown in Table 2.1 below.

Instrument	Manufacturer and Type	Serial Number
Precision integrating sound level meter & analyser	Svantek type 957 class 1 sound level meter	12399
Calibrator	B&K Type 4231 Class 1 Calibrator	1897774
White Noise Source	Acoustic Solutions – 513/4043	N/A
Active Loudspeaker	RCF ART 310A	KLXF29324
Specialist Software	Svantek PC++	N/A

Table 2.3 Instrumentation used during testing

3.0 RESULTS

3.1 Environmental Noise Survey

The LAeq: 5min, LAmax: 5min, LA10: 5min and LA90: 5min acoustic parameters were measured and are shown as a time history in Figure 13517.TH1.

Minimum background (LA90) levels monitored for the duration of the survey are shown in Table 3.1.

	Daytime **07:00 to 23:00**	**Night Time** **23:00 to 07:00**	**Operating Hours** **08:00 to 22:00***
Minimum background noise levels ($L_{A90,\ 5min}$)	56 dB(A)	56 dB(A)	59 dB(A)

Table 3.1: Minimum background noise levels measured during the environmental noise survey

***Assumed operating hours between 08:00am to 22:00pm**

4.0 NOISE CRITERIA

There is no specific criterion for noise emissions in this instance. However, for commercial dwellings in the majority of London Boroughs, the following statement applies:

"No music, amplified sound or preaching/chanting is audible beyond the site boundary (Leq 5min shall be 10dB below at 1/3 octaves 40Hz to 20 KHz)."

We therefore propose to set the noise criteria to the worst case scenario as shown in Table 4.1 in order to comply with the above requirement.

	Operational Hours **08:00 to 22:00**
Noise criterion at nearest residential receiver at Camden Road (10dB below average L_{Aeq})	49dB(A)

Table 4.1: Proposed Noise Emissions Criteria

As the Ground Floor commercial space will be open at daytime, we would recommend the adoption of the daytime criterion to ensure the amenity of the closest receivers will be protected.

4.1 Sound Insulation Investigation

The main parameter used throughout this document to express airborne sound insulation of separating constructions is D_w. All specifications in this report will therefore be given with respect to this descriptor.

Summarised results of the airborne tests are shown in Tables 4.2 and 4.3. Source noise levels were in the region of approximately 100 dB(A) within the main Ground Floor space. This amplitude enables us to investigate the maximum possible airborne sound insulation performance of the separating elements.

4.2 Breakout Measurements

Test Element	Source	Receiver	D_w Performance
External Façade	Commercial space	Location 1 – Windows of Commercial space entrance (External)	15 dB

Table 4.2 Breakout Test Results

4.3 Direct Transfer Measurements

Test Element	Source	Receiver	D_w Performance
Floor	Commercial space	Location 2 (Interior) – Bedroom	44 dB
Floor	Commercial space	Location 3 (Interior) – Living Room/Kitchen	44 dB

Table 4.3 Direct Transfer Results

5.0 DISCUSSION

It should be noted that the Commercial space will not be used for the purposes of amplified speech or music, and therefore a worst case scenario in terms of noise would be a maximum of 30-40 people talking simultaneously at normal conversational level.

Following a visual inspection of the site, the closest residential receiver to the commercial space has been identified as being the flat directly above. The aforementioned receiver would be potentially subjected to transmission through the breakout element of noise from the building's external façade, in addition to direct noise transmission through the floors.

5.1 Prediction for Noise Breakout through the main external Glazed Façade

The typical spectral noise levels for the activity of the Commercial space are shown in Table 5.1.

	Sound Pressure Level (dB) in each Frequency Band							
Source	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Sound Pressure Level of a typical bar environment with patrons and without music	77	90	84	89	85	79	70	62

Table 5.1 Typical source levels for a bar environment with people at speech level and without music

Using a typical source level of 90 dB(A) as shown in Table 5.1 and taking into account the measured D_w rating of the main building façade to Camden Road elevation, Table 5.2 shows the predicted sound pressure level at 1m from the bedroom window of the nearest noise sensitive receiver due to activity within the commercial space. This has been compared with the measured minimum background noise. Detailed calculations are shown in Appendix B1.

Receiver	Operating Noise Emissions Criterion	Noise Level at Receiver (1m from window)
Nearest Noise Sensitive Window (1st Floor Flat –Camden Road Elevation)	49 dB(A)	45 dB(A)

Table 5.2: Predicted noise level at 1m from the closest noise sensitive bedroom window

Furthermore, the value of 45dB(A) is to be considered outside of the building. Windows may be closed or partially closed leading to further attenuation, as follows.

British Standard 8233:2014 'Sound insulation and noise reduction for buildings – Code of Practice' gives recommendations for acceptable internal noise levels in residential properties. Assuming worst case conditions, of the closest window being for a bedroom, BS8233:2014 recommends 30-35dB(A) as being 'Good-Reasonable' internal resting/sleeping conditions.

With a calculated external level of 45 dB(A), the residential windows itself would provide a nominal attenuation in order for the conditions to be achieved. According to BS8233:2014, even a partially open window offers 10-15dB attenuation, thus leading to a further reduced interior noise level, thus leading to an acceptable interior noise level that meets this criterion. However, this is providing that the mitigation measures indicated in Section 5.3 are implemented.

5.2 Direct Noise Transfer Through Separating Floor between the Commercial space and Flat

Using a typical source level described in Section 5.1, and taking into account the measured D_w rating of the separating floor, Table 5.3 shows predicted sound pressure levels within the Bedroom and Living room of the above flat due to activity within the Commercial space. Detailed calculations are shown in Appendix B2.

Receiver	Noise Level Inside Bedroom	Noise Level Inside Living Room
1st Floor Flat	35 dB(A)	35 dB(A)

Table 5.3: Predicted noise level within first floor flat on Bedroom and Living Room

As shown in Table 5.3, the direct noise transfer through the separating floor would be anticipated to generate internal noise levels which would be commensurate to BS8233:2014 for both spaces (bedroom and living room).

However, this is providing that the mitigation measures indicated in Section 5.3 are implemented.

5.3 Proposed Mitigation Measures

Separating floor construction

It is understood that the existing party floor on the first floor is comprised of the following elements:

- Timber floorboards fixed directly to timber joists
- Plasterboard forming a void of proximally 150mm
- Timber joists
- Plasterboard forming a void of proximally 100mm

In order to address the airborne sound insulation for the party floor system, we would recommend the following upgrade strategy:

- Remove the existing second ceiling
- Seal all gaps/holes on primary ceiling
- Fix 1x15mm Fermacell under the primary ceiling in order to create a monolithic surface
- Create an independent secondary ceiling, forming a void of 200mm with 2x15mm Fermacell as the main ceiling soffit(use GAH1 resilient hangers if the structural load is too high)
- Install 150mm of mineral wool insulation (RWA3, or any similar with 60kg/m^3 density) within the void of 200mm
- Around the perimeter, insert 7-9mm foam 'backer' rod in 3-5mm gap and finish silicone mastic
- Provided that there is a minimum ceiling void of 200mm, downlighters, or recessed lighting may be installed at no more than one unit per 2m^2 of ceiling area, at centres not less than 0.75m and into openings not exceeding 100mm diameter

Reverberation on the commercial space

In addition to the above recommendation we would recommend an installation of an acoustically absorptive material (Fotosorba, or any similar) in order to suppress the reverberant field within the commercial space. The coverage area would need to be approximately 15-20m^2 of the existing walls inside the commercial space.

External Building Fabric Specification

Following an inspection of the site plans, the closest residential receiver to the Commercial space has been identified as being at a distance of approximately 2m. The receiver would be potentially subjected to transmission through the breakout elements of noise from the Camden Road façade and will therefore be used as the most representative noise sensitive receiver.

The noise break-out predictions as shown on Table 5.2 have been derived by using measured, on-site data which inherently include the composite sound reduction index of the current building envelope.

To fully ensure that the activities will not affect the amenity of the receiver on the Camden Road façade, we would propose the following mitigation measures to further enhance the sound insulation performance of the main external Camden Road façade.

An upgrade of external building fabric to the nearest receiver (Camden Road façade) should be considered to protect the amenity of the closest noise sensitive receiver. We would therefore recommend the installation of a double glazing window system (e.g. 6/12/10). The acoustic performance of the recommended glazing is shown in Table 5.4.

Glazing Type	Octave band centre frequency SRI, dB					
	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz
Double glazing (6/12/10)	26	27	34	40	38	46

Table 5.4 Recommended glazing performance for the front facade

6.0 CONCLUSION

An environmental noise survey has been undertaken at 71 Camden Road, London. The results of the survey have enabled the assessment of noise propagation of typical activity to the nearest noise sensitive receiver.

Noise break-out and direct noise transfer investigations have also been undertaken in order to assess the performance of the external building fabric, and separating floor constructions.

Calculations show that providing that the mitigation measures indicated in Section 5.3 are implemented, no other measures would be deemed necessary in order to protect the amenity of the nearest noise sensitive receiver.

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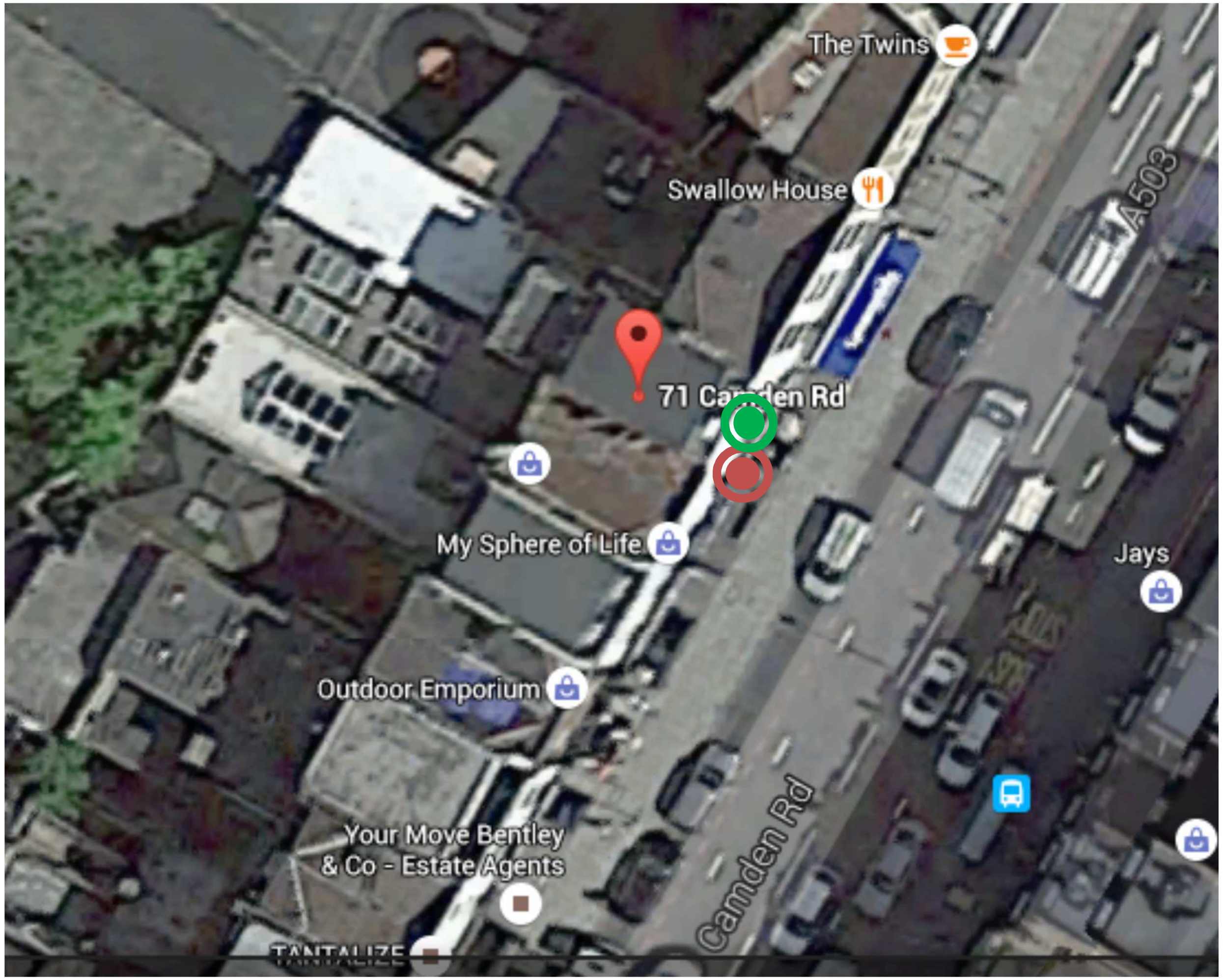

Noise Measurement Position

Closest Noise Sensitive Receiver at Camden Road Façade

Title:
Indicative site plan showing noise measurement positions(*Ref: Google Earth*)

Date: 17 December 2015

FIGURE 13517.SP1

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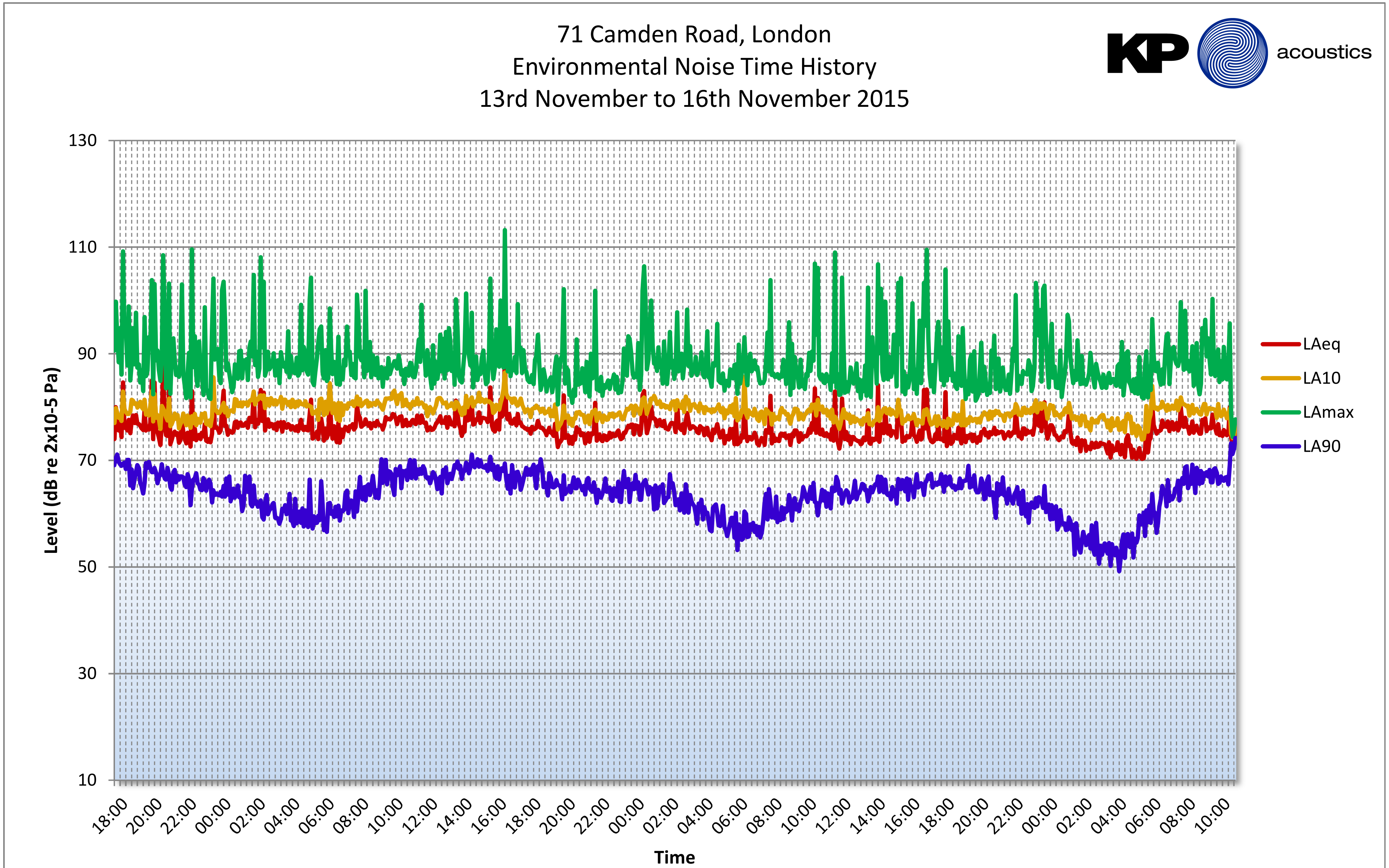


Figure 13517.TH1

Appendix A

General Acoustic Terminology

Decibel scale - dB

In practice, when sound intensity or sound pressure is measured, a logarithmic scale is used in which the unit is the 'decibel', dB. This is derived from the human auditory system, where the dynamic range of human hearing is so large, in the order of 10^{13} units, that only a logarithmic scale is the sensible solution for displaying such a range.

Decibel scale, 'A' weighted - dB(A)

The human ear is less sensitive at frequency extremes, below 125Hz and above 16Khz. A sound level meter models the ears variable sensitivity to sound at different frequencies. This is achieved by building a filter into the Sound Level Meter with a similar frequency response to that of the ear, an A-weighted filter where the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq}. The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for no more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise.

L_{90}

This is the level exceeded for no more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 11 such octave bands whose centre frequencies are defined in accordance with international standards. These centre frequencies are: 16, 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000 and 16000 Hertz.

Environmental noise terms are defined in BS7445, *Description and Measurement of Environmental Noise*.

APPENDIX A

APPLIED ACOUSTIC TERMINOLOGY

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than a single source and 4 sources produce a 6dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Hearing perception is highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a guide to explain increases or decreases in sound levels for many scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud

Transmission path(s)

The transmission path is the path the sound takes from the source to the receiver. Where multiple paths exist in parallel, the reduction in each path should be calculated and summed at the receiving point. Outdoor barriers can block transmission paths, for example traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and construction.

Ground-borne vibration

In addition to airborne noise levels caused by transportation, construction, and industrial sources there is also the generation of ground-borne vibration to consider. This can lead to structure-borne noise, perceptible vibration, or in rare cases, building damage.

Sound insulation - Absorption within porous materials

Upon encountering a porous material, sound energy is absorbed. Porous materials which are intended to absorb sound are known as absorbents, and usually absorb 50 to 90% of the energy and are frequency dependent. Some are designed to absorb low frequencies, some for high frequencies and more exotic designs being able to absorb very wide ranges of frequencies. The energy is converted into both mechanical movement and heat within the material; both the stiffness and mass of panels affect the sound insulation performance.

APPENDIX B1

71 Camden Road, London

Noise Impact Assessment Calculation

The main model was designed around the following formula:
$SPL2=SPL1 - SRI + 10\log(S) + 10\log(Q/4\pi r^2) - 6$

where:
SPL2 is the sound pressure level at the receiver's facade
SPL1 is the sound pressure level within the source room
S is the area of the main wall
Q/4pr^2 are the directivity and distance corrections
SRI is the sound reduction index of the break-out facade
The 6dB term occurs because there is no reverberant sound field in the open

Receiver Level due to noise source in Commercial space

Measured SPL 1 (dB)	90
Approximate area S of the facade looking onto the closest residence (sq.m)	12
Correction for area 10log(S)	11
On-site measured SRI (dB)	15
Distance r to closest residence (m)	2
Directivity factor Q for wall transmission	3
Combined correction for directivity and distance (dB)	-10
Attenuation provided by proposed glazing	-25
Current Resultant Predicted Receiver Level SPL 2 (dB)	45
Measured background noise level (dB)	**49**

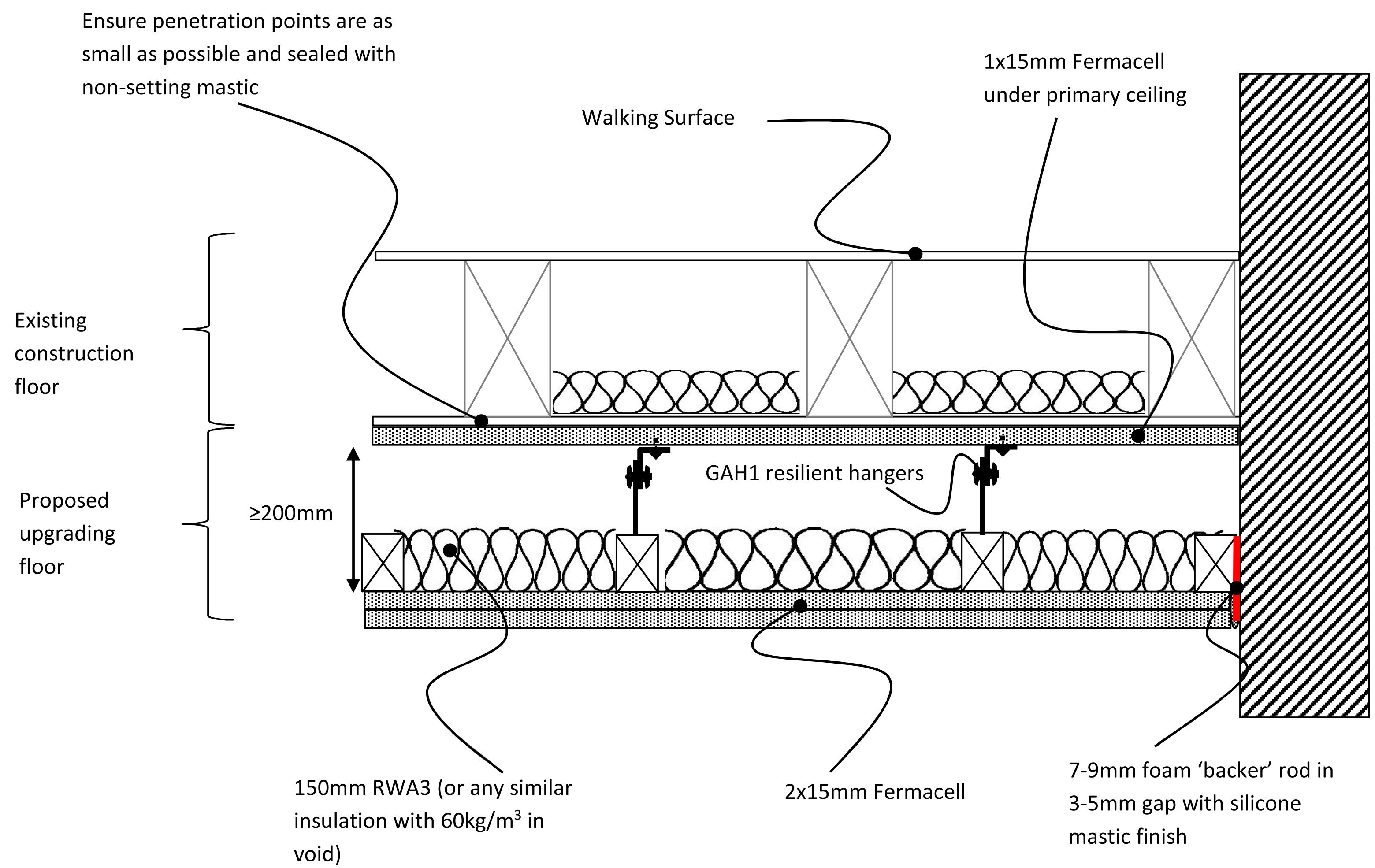
APPENDIX B2

COMMERCIAL SPACE NOISE EMISSIONS BREAK-IN to FIRST FLOOR FLAT

Calculation 1: Direct path to Flat Bedroom and Living Room through separating floor

	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB(A)**
Sound Pressure Level of a typical bar environment with people at speech level and without music	77	90	84	89	85	79	70	62	90
Separating construction	-23	-28	-34	-42	-47	-46	-44	-44	
+ 10 log Sp (10m2)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
Bedroom absorption co-eff.	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	
Surface area (56m2)	28	28	28	28	28	28	28	28	
-10 log A	-14	-14	-14	-14	-14	-14	-14	-14	
Improvement provided by the proposed upgrade measures	-10	-10	-10	-10	-10	-10	-10	-10	
Sound Pressure Level at receiver	**40**	**47**	**35**	**33**	**24**	**18**	**12**	**4**	**35**

Design criteria	**35**



Title:

Diagram Showing Independent Ceiling Construction

Date: 17 December 2015

FIGURE 13517.DWG1

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