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47 MARCHMONT STREET, LONDON, WC1

Technical Note

Acoustic Assessment Report

21st November 2014

Peter Clark

1. INTRODUCTION

1.1 A noise survey has been carried out adjacent to the proposed residential property at 47 Marchmont Street, London, WC1. Currently there is a restaurant at ground floor level with lower ground floor below which also forms part of "restaurant" use although it is largely used for storage etc. The proposed re-development of the lower ground floor area includes a "change of use" for the space to become residential. Marchmont Street itself has little traffic, hence there is little traffic noise, and there are a number of cafes, bars, restaurants etc (including the restaurant at ground floor level above) nearby. The restaurant above has air conditioning and ventilation plant adjacent namely an air conditioning condenser unit in the front lightwell and kitchen ventilation/extraction plant to the rear. A noise survey and assessment report is required to accompany the Planning Application/Listed Building Consent for the proposed change of use. In addition to considering noise from adjacent plant on the proposed lower ground floor dwelling. The existing air conditioning condenser unit is to be relocated to the under pavement "coal" vault at the front of the property. Details are also contained in this report pertaining to the existing and proposed sound insulation requirements between the lower ground floor area and adjacent properties – most notably the restaurant above.

1.2 The measurements and assessment have shown that additional noise insulation measures are required to ensure that the proposed lower ground floor dwelling installation meets with the requirements of the London Borough of Camden (LBC) Noise Policies. Appropriate mitigation is specified in this report.

1.3 The site location and surroundings are given in Figure 1 below:

Figure 1: Site Location (© Google Maps)

2.0 NOISE MEASUREMENTS

Environmental Noise Measurements

2.1 Noise measurements were carried out by positioning noise monitors in both the front lightwell and the rear courtyard at the property. Measurements were carried out between from 1pm Monday 22nd and

2.30pm on Thursday 25th September 2014 and used to log noise levels over the three day period. The measurement equipment is listed below in Table 1.0. Photographs of noise monitors and their locations are shown in Figures A.1.1 and A.1.2 at the end of this report.

Table 1.0 Environmental Noise Measurement Instrumentation

No.	Description
1.	2 off Larson Davis Model 831 Sound Level Meter.
2.	2 off Larson Davis Model 377B02 1/2" Diameter Condenser Microphone.
3.	Larson Davis Model CAL200 Sound Level Meter Calibrator.

2.2 All acoustic equipment conforms to the relevant parts of BS EN 60651:1994 (equivalent to BS 5969:1981) for the requirements of Type 1 acoustic accuracy. Additionally, the relevant equipment conforms to the specifications contained within BS EN 60804:1994 (equivalent to BS 6698:1976) for integrating sound level meters.

2.3 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 0.1 dB(A) was noted, this can be considered as an insignificant change. The calibrator complies with the specifications of IEC 942:2003.

2.4 Fast meter response was used for all measurements carried out during the course of the survey.

2.5 Noise levels are expressed in terms of continuous equivalent noise levels (L_{Aeq}) over an appropriate time period. The use of L_{Aeq} allows non-steady and non-continuous noise to be assessed and compared to the existing noise climate. L_{Aeq} is referred to as the ambient noise level. In addition to this background noise levels have also been measured and are expressed as L_{A90}. A full explanation of terminology commonly used in the measurement and assessment of noise levels is given in Appendix B at the end of this report.

Sound Insulation Measurements

2.6 The sound insulation performance of the existing ceiling structure between the lower ground floor area and ground floor restaurant above were also determined. All measurements were carried out in accordance with the requirements laid down in International Standards BS EN ISO 140: 4 (1998) Acoustics – Measurement of Sound Insulation in buildings and of building elements Part 4 : Field measurements of airborne sound insulation between rooms; and Part 7: Field measurements of impact sound insulation of floors. The test equipment in situ in lower ground floor area for airborne test is shown in Figure A.1.3.

3.0 RESULTS

Environmental Noise Measurements

3.1 Noise level measurements were carried out at 5 minute intervals during the survey period. Ambient (L_{Aeq}) and background (L_{A90}) noise levels were measured. Minimum noise levels for the day-time (07:00 to 19:00 hrs), evening time period (19:00 to 23:00 hrs) and night time period (23:00 to 07:00 hrs) have been determined.

Table 2.1: Summary Results (Front)

	Day	Evening	Night
L_{A90}	49.4	49.6	36.9(35.2)*
L_{Aeq}	58.2	56.9	48.1

*Note: The lowest night time background noise level measured during the survey period was 35.2 dB(A) and occurred at 3.15am on Thursday 25th September 2014.

Table 2.2: Summary Results (Rear)

	Day	Evening	Night
L_{A90}	61.6	54.7	36.8(34.2)†
L_{Aeq}	68.9	67.8	42.8

†Note: The lowest night time background noise level measured during the survey period was 34.2 dB(A) and occurred at 1.45am on 25th September 2014.

3.2 A full listing of 5 minute interval data for the period is given in the graph at the end of this report (Figure A2.1 for the front and A2.2 for the rear noise measurements respectively).

3.3 The London Borough of Camden Replacement Unitary Development Plan – Appendix 1; Table E "Noise levels from plant and machinery at which planning permission will not be granted" is listed below.

Noise description and location of measurement	Period	Time	Noise Level
Noise at 1 metre external to noise sensitive façade	Day, evening & night	0000-2400	5dB(A)<L_{A90}
Noise that has a distinguishable discrete continuous note	Day, evening & night	0000-2400	10dB(A)<L_{A90}
Noise that has distinct impulses	Day, evening & night	0000-2400	10dB(A)<L_{A90}
Noise at 1 metre external to sensitive façade where L_{A90}>60dB	Day, evening & night	0000-2400	55dB L_{Aeq}

3.4 The proposed air conditioning equipment does not attract the + 5 dB(A) correction referred to in *" paragraph 8 of BS4142"* (i.e. contains no distinguishable discrete continuous note or distinct impulses)

3.5 It therefore follows that the criterion to meet is 30.2 dB(A) for equipment in the front lightwell. The external condenser units positioned in the front lightwell should be relocated to be internal to the existing pavement vaults. The internal walls and ceiling of these vaults would then be lined with acoustically absorbent material with the required ventilation air drawn in and extracted via acoustically treated louvres[1]. The condenser unit is Panasonic Model U-6LE1E8 with manufacturer's specified noise data of 55 dB(A) when measured at 1m (see Figure A.3 in Appendix A). Calculated noise levels at the front lower ground floor window are then (incorporating noise control measures):

[1] Specifications for typical noise control materials and products (louvres, silencers etc) are given in Figure A.5 at the end of this report

- Unit SPL at 1m: 55 dB(A)
- Attenuation from internal vault acoustic lining diffuse/free-field and partial screening correction: - 9 dB(A)
- Attenuation from acoustic louvre: - 14 dB(A)
- Distance correction (1.5m): -3.5 dB(A)
- Predicted noise level at lower ground floor window: 28.5 dB(A)

3.6 In addition to this, noise levels at the front of the property are also considered in terms of LBC noise policy for additional noise attenuation requirements. Table B below is an extract London Borough of Camden Replacement Unitary Development Plan – Appendix 1; Table B "Noise levels residential streets adjoining railways and roads at and above which attenuation measures will be required" such that:

Noise description and location of measurement	Period	Time	Sites adjoining roads
Noise at 1 metre external to a sensitive façade	Day	0700-1900	62dB $L_{Aeq,12h}$
Noise at 1 metre external to a sensitive façade	Evening	1900-2300	57dB $L_{Aeq,4h}$
Noise at 1 metre external to a sensitive façade	Night	2300-0700	52dB $L_{Aeq,1h}$
Individual noise events several times an hour	Night	2300-0700	>82 dB L_{ASmax}

3.7 Examination of Table 2.1 above and Figure A.2.1 at the end of this report shows that the current environmental noise levels specified in "Table B" (extract of LBC noise policy) are not exceeded and therefore no additional noise attenuation measures to mitigate traffic and/or other noise sources are required. Notwithstanding this, it is understood that secondary glazing will be installed to the front of the property.

3.8 Noise measurements taken in the rear courtyard are dominated by the extract/ventilation fan which exhausts into the courtyard via a louvre at lower ground floor level. The noise level spectrum, which represents an overall noise level of 68.5 dB(A), taken 1m from the louvre is given in Figure 2 below:

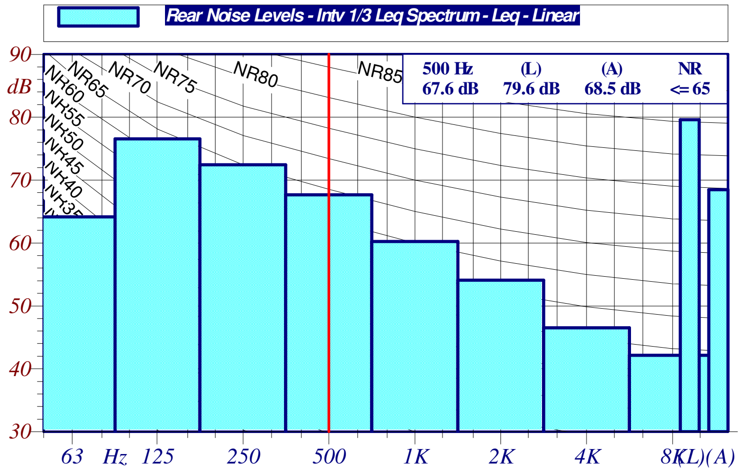


Figure 2: Noise from ventilation fan in Rear Courtyard

3.9 The noise level v. time plot (Figure A.2.2.) indicates that noise levels in the rear when the fan is not operational have a minimum background ($L_{A90,5min}$) of 34.2 dB. It therefore follows that to meet LBC noise criteria, the fan noise level should be reduced to 29.2 dB(A). A silencer, typically not less than 1200mm long, will need to be fitted into the extract system ductwork down-stream of the fan itself.

3.10 Noise levels internal to the lower ground floor area were also measured. Dominant noise at the time of the measurements arose from the extract fan installation (casing noise). Noise levels were shown to be typically 60 dB(A) with octave band spectrum as measured below:

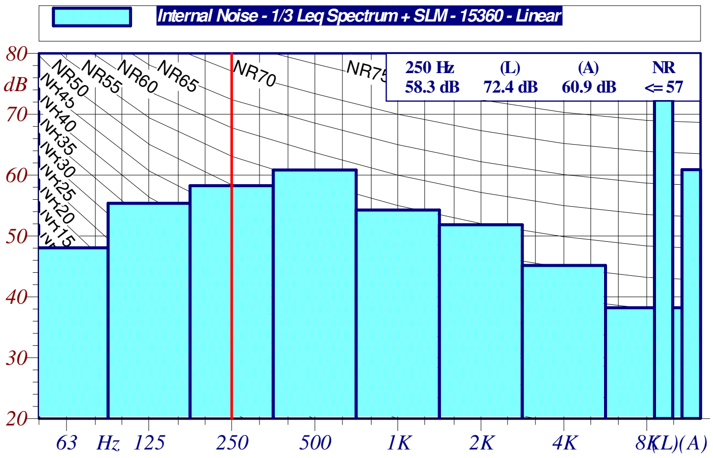


Figure 3: Internal noise level in lower ground floor (from extract fan)

3.9 Internal noise levels should be reduced to no less than 35 dB $L_{Aeq,T}$ to represent a "reasonable standard" as specified in BS8233: 1999[2]. To reduce noise levels by a minimum of 25 dBA, the party wall between dwelling space and ventilation fan plantroom should be constructed from either a heavy concrete block, rendered both sides or have a plasterboard and "stud-work" construction with "acoustic" or high density plasterboard on both sides, mineral fibre blanket sandwiched between and both internal and external plasterboard finishes skim plastered.

[2] BS8233: 1999 provides useful guidance on acceptable levels of internal noise for a variety room applications/uses.

Sound Insulation Measurements

3.10 The results of the sound insulation test results for the party ceiling/floor structure between lower ground floor and ground floor are given in Figure A.2.3 and A.2.4 at the end of this report. In summary, the measurement airborne insulation performance was found to be such that (D_{ntw}+C_{tr}) was 31 dB and the measured impact performance such that (L_{nTw}) was 74 dB. The minimum requirements as set out in Building Regulations "Approved Document E (2010)" are such that airborne insulation ($D_{nT,w}$ + C_{tr}) be 43 dB or greater and impact insulation ($L_{nT,w}$) be 64 dB for "material change of use" and therefore the existing construction is insufficient (12 dB shortfall for airborne insulation and 10 dB for impact insulation performance).

3.11 The existing construction detail is not known. In order for the proposed party ceiling/floor between lower ground floor and ground floor above to meet minimum requirements of Building Regulations, it is proposed that a secondary, resiliently mounted ceiling be incorporated (e.g. Ceiling Type B or C as given in Approved Document E) but incorporating a minimum of TWO layers of "acoustic" plasterboard. A number of bespoke products are commercially available and the overall design will be generally as shown in Figure 2 below[3]:

[3] In Figure 2, the majority of the additional sound insulation measures proposed are fitted into the floor void itself i.e. between the floor joists. As such that floor to ceiling height in the lower ground floor area will be kept to a maximum and the required "floor-to-ceiling" height in the lower ground floor area is maintained.

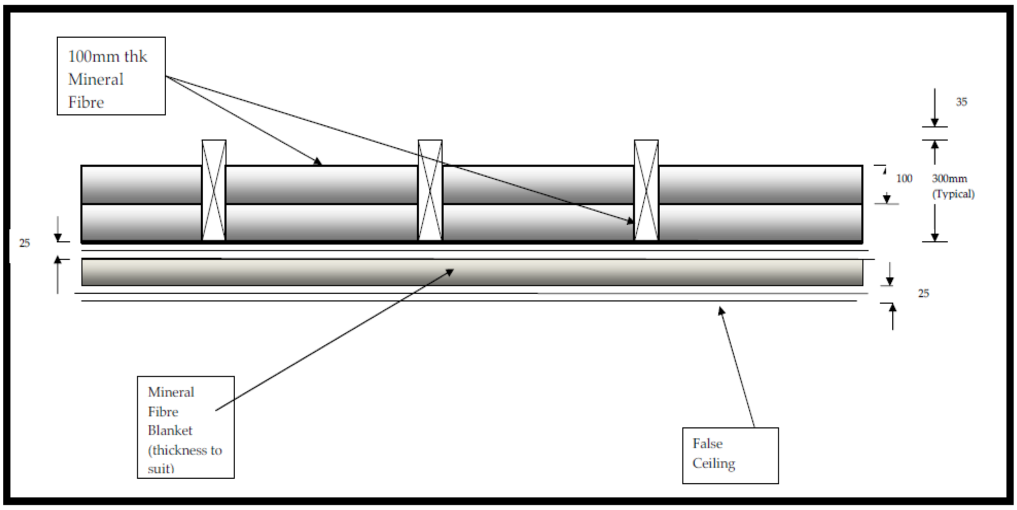


Figure 4: Acoustic Ceiling Specification

4.0 CONCLUSION

4.1 A noise measurement survey and assessment has been carried out at 47 Marchmont Street, London WC1. The surveys and assessments have been concerned with both internal and external noise levels as it is proposed that the existing lower ground floor area at the property be re-furbished and developed as a residential dwelling.

4.2 The noise measurements have shown that additional noise attenuation measures are required to meet nationally accepted acoustic design criteria and LBC specific requirements. These measures include additional acoustic treatments to the lower ground floor ceiling structure, which will be incorporated whilst maintaining the minimum required floor-to ceiling height, relocation and noise control measures for the air conditioning unit in the front lightwell, additional noise control for the ventilation/extract fan at the rear and the specification of appropriate party wall construction to separate the extract fan plantroom from the proposed dwelling.

APPENDIX A: GRAPHS AND FIGURES.

Figure A1.1: Noise Monitor in Front Lightwell

Figure A1.2: Noise Monitor in Rear Courtyard

Figure A1.3 Airborne Sound Insulation Test Equipment

Figure A2.1 Environmental Noise Data (Front Lightwell) – Monday 22nd to Thursday 25th September 2014.

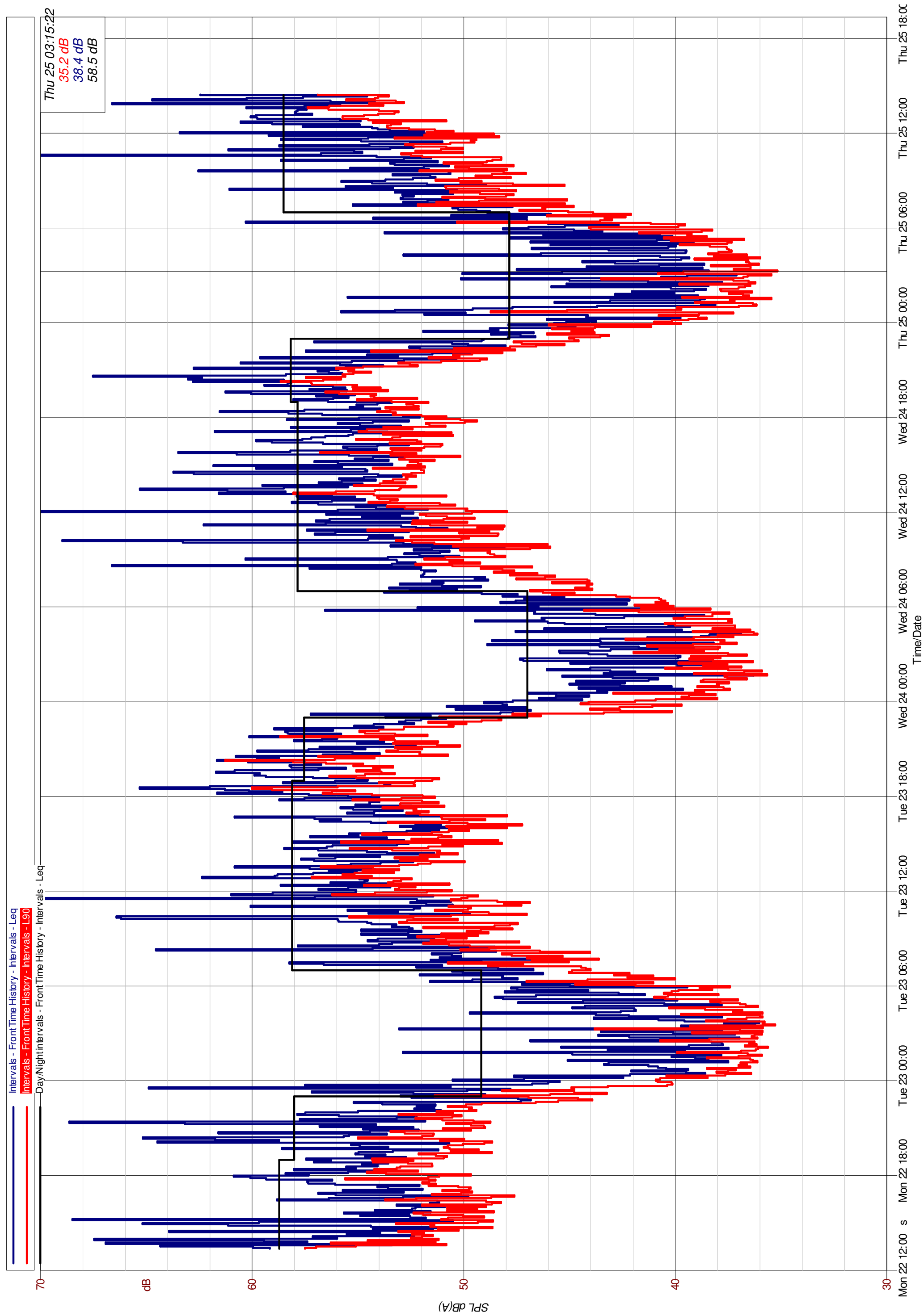


Figure A2.2 Environmental Noise Data (Rear Courtyard) – Monday 22nd to Thursday 25th September 2014.

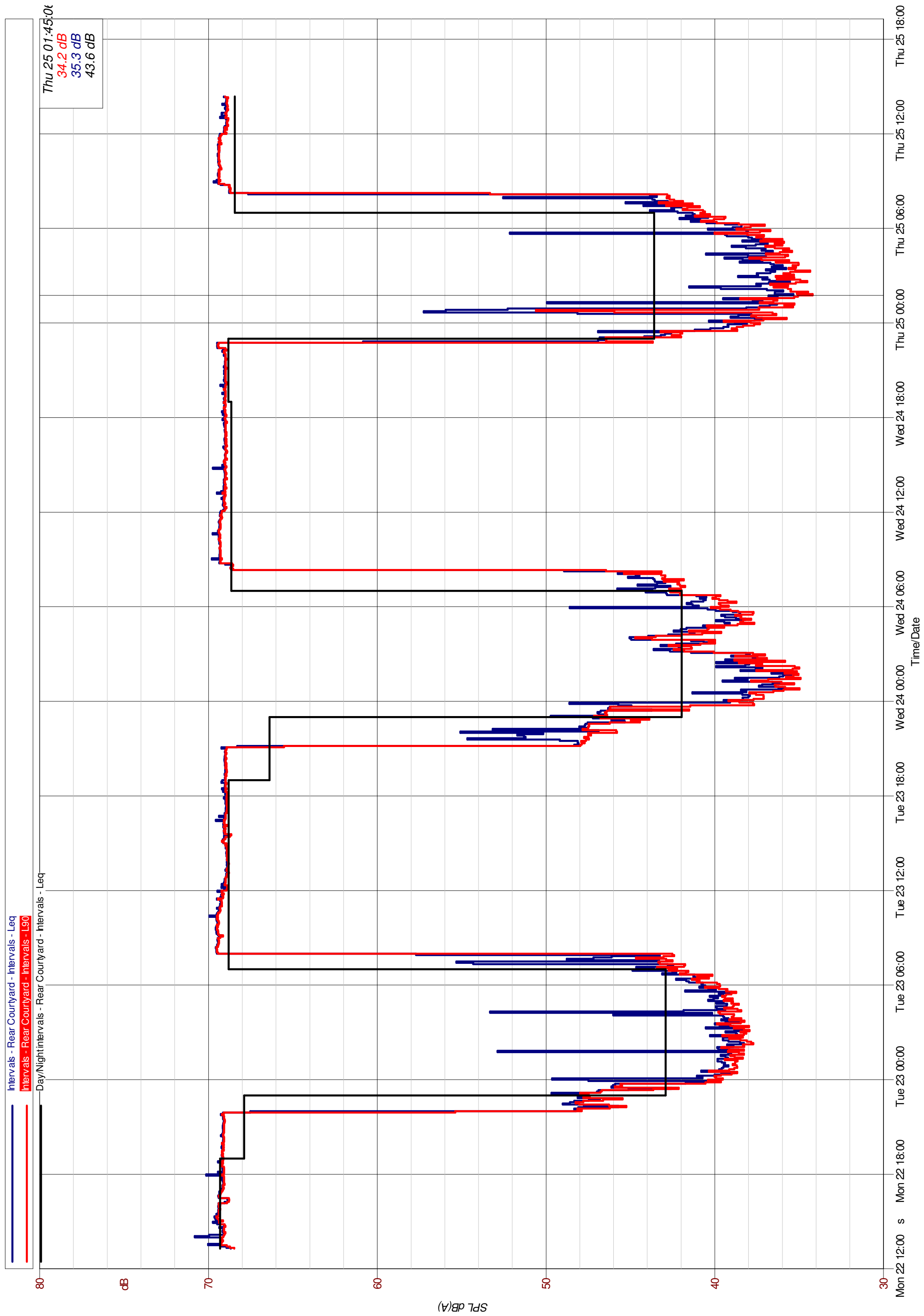


Figure A2.3 Airborne Sound Insulation Test Result (Lower Ground to Ground Floor)

Standardized level difference according to ISO140-4: 1998
Field measurements of airborne sound insulation between rooms

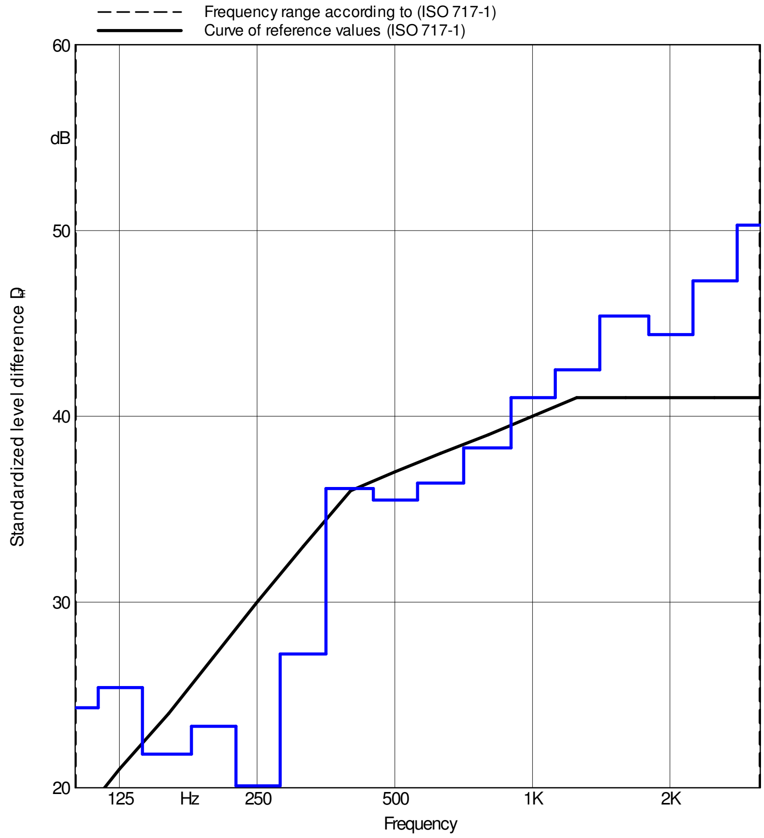
Client: Marc Abomnes

Site Address: 47 Marchmont Street, LONDON WC1

Source Room: Basement
Receiving Room: Ground Floor Cafe

Sum of unfavourable deviations: 25.4 dB

Frequency Hz	D_{nT} dB
100	24.3
125	25.4
160	21.8
200	23.3
250	20.1
315	27.2
400	36.1
500	35.5
630	36.4
800	38.3
1000	41.0
1250	42.5
1600	45.4
2000	44.4
2500	47.3
3150	50.3



Rating based on ISO 717-1

$D_{nT,w}$ (C; C_{tr}) = 37 (-2; -6) dB

Evaluation based on field measurement
results obtained by an engineering method

Test carried out on Thursday 25th September 2014

Date:28/09/2014 Signature:

Figure A2.4 Impact Sound Insulation Test Result (Ground Floor to Lower Ground Floor)

Standardized impact sound pressure levels according to ISO140-7: 1998
Field measurements of impact sound insulation of floors

Client: Marc Abomnes

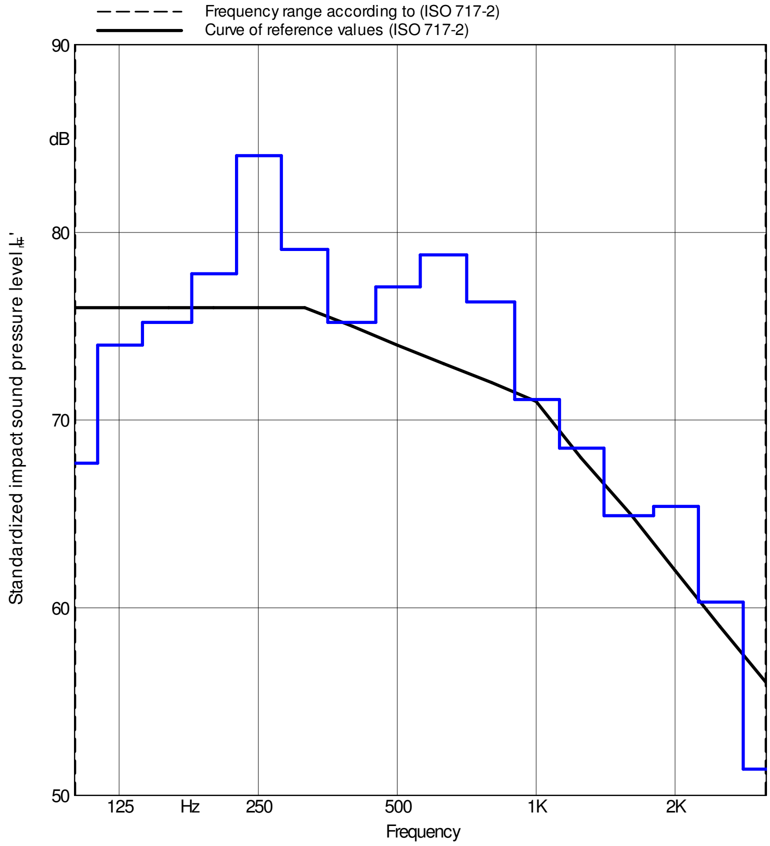
Site Address: 47 Marchmont Street, LONDON WC1

Source Room: Basement
Receiving Room: Ground Floor Cafe

Test carried out on wooden floor

Sum of unfavourable deviations: 31.7 dB

Frequency Hz	L'_{nT} dB
100	67.7
125	74.0
160	75.2
200	77.8
250	84.1
315	79.1
400	75.2
500	77.1
630	78.8
800	76.3
1000	71.1
1250	68.5
1600	64.9
2000	65.4
2500	60.3
3150	51.4



Rating based on ISO 717-2

$L'_{nT,w}$ (C) = 74 (-1) dB

Evaluation based on field measurement results obtained by an engineering method

Test carried out on Thursday 25th September 2014

Date:28/09/2014 Signature:

Figure A.3: External Condenser Unit Noise Data

Panasonic U-6LE1E8

Panasonic

MINI ECOi HIGH EFFICIENCY

FOR LIGHT COMMERCIAL USE

Panasonic's Mini ECOi, the 2-Pipe heat pump small VRF system, is specifically designed for the most demanding applications. Offering between 11 kW and 16 kW cooling capacity in 3 sizes and up to 9 indoor units connected, the Mini ECOi sets standards of performance and flexibility. Utilising R410A and DC inverter technology, Panasonic offers VRF to a new and growing market. Forming a new key part of the Panasonic VRF line up, the Mini ECOi is compatible with the same indoor units and controls as the rest of the ECOi range.

AUTHORISED INSTALLERS ONLY

TECHNICAL FOCUS

- SINGLE PHASE OR THREE PHASE POWER SUPPLY
- ONE AMP START CURRENT
- DC INVERTER TECHNOLOGY COMBINED WITH R410A
- DIVERSITY RATIO 50-130%
- COOLING OPERATION TO -10 ºC
- COMPACT OUTDOOR UNIT 1,330 x 940 x 410 mm

HP			4.0 HP		5.0 HP		6.0 HP	
Model name			U-4LE1E5	U-4LE1E8	U-5LE1E5	U-5LE1E8	U-6LE1E5	U-6LE1E8
Power supply			220/230/240 V, 50 Hz	380/400/415 V, 50 Hz	220/230/240 V, 50 Hz	380/400/415 V, 50 Hz	220/230/240 V, 50 Hz	380/400/415 V, 50 Hz
Cooling capacity		kW	12.1	12.1	14.0	14.0	15.5	15.5
		BTU/h	41,300	41,300	47,800	47,800	52,900	52,900
EER		W/W	4.30	4.30	4.20	4.20	3.45	3.45
Heating capacity		kW	12.5	12.5	16.0	16.0	18.0	18.0
		BTU/h	42,700	42,700	54,600	54,600	61,400	61,500
COP		W/W	4.62	4.62	4.30	4.30	3.95	3.95
Dimensions	H x W x D	mm	1,330 x 940 x 340 (410)	1,330 x 940 x 340 (410)	1,330 x 940 x 340 (410)	1,330 x 940 x 340 (410)	1,330 x 940 x 340 (410)	1,330 x 940 x 340 (410)
Piping connection	Gas	mm	15.88	15.88	15.88	15.88	19.05	19.05
	Liquid	mm	9.52	9.52	9.52	9.52	9.52	9.52
Sound pressure level	Cooling	dB(A)	50	50	51	51	52	52
	Heating	dB(A)	52	52	53	53	55	55
Maximum number of indoor units			6	6	8	8	9	9

Preliminary specifications, subject to change without notice.

GLOBAL REMARKS

Rated conditions:	Cooling	Heating
Indoor air temperature	[illegible]	20 °C DB
Outdoor air temperature	[illegible]	[illegible]

Specifications subject to change without notice.

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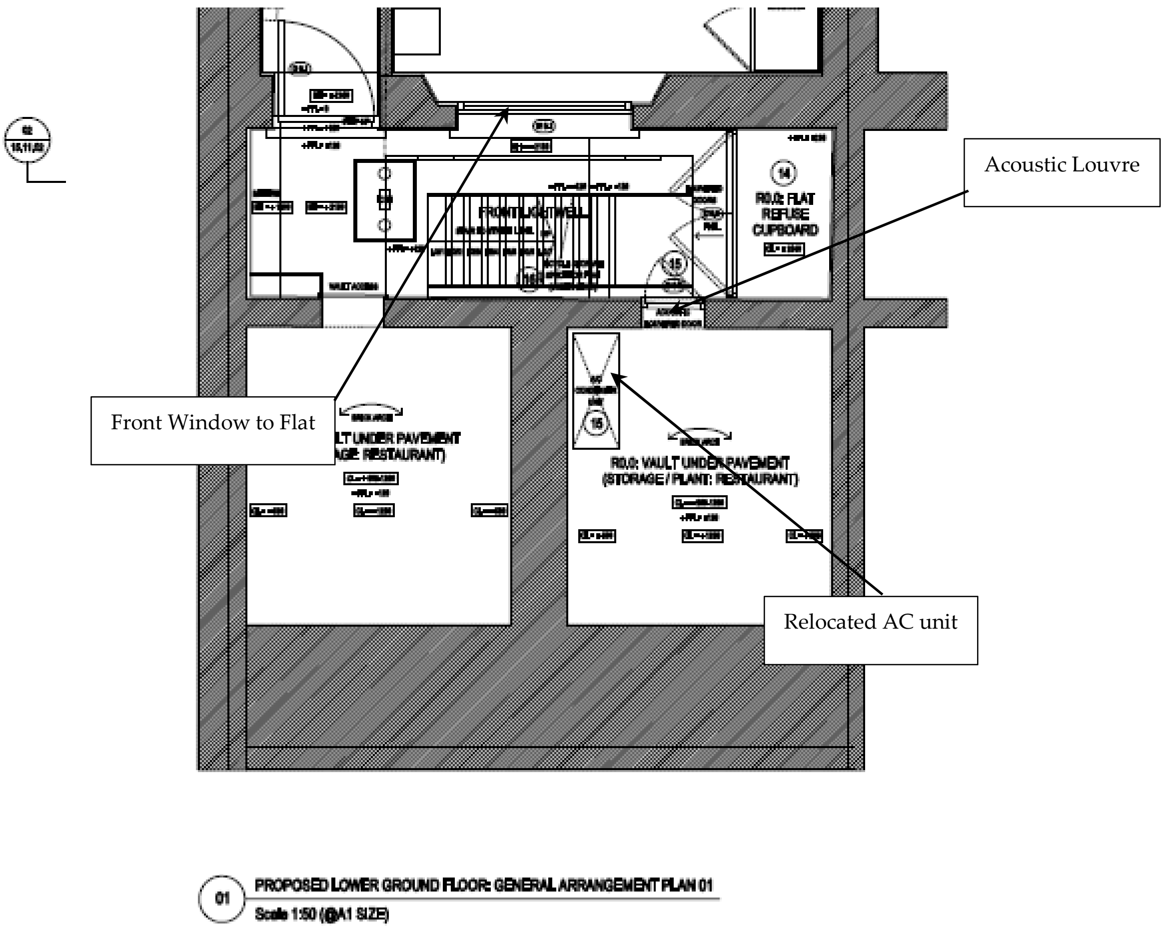
Figure A.4: Layout Drawings

Front Lightwell Area



Extract from Seary Architects Drawing 15-11-01 dated 10.11.14

Figure A.5: Typical Acoustic Louvre Performance Data

EEC Acoustic Louvres

APPEARANCE

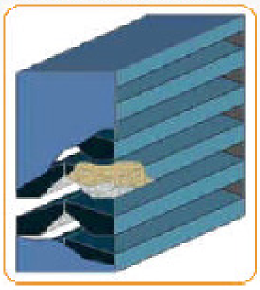
EEC Acoustic Louvres can be manufactured to accommodate the various dimensional and appearance requirements a building project may demand.

The louvres can be designed and constructed to be installed in the exterior fabric of buildings or as complete acoustic enclosures to house noise emitting plant. Also supplied are acoustic louvred fully openable single and double doors.

Special materials and finishes available include stainless steel, anodised aluminium and painted to the complete BS colour range.

Louvres are supplied, in single bank modules (LA1) or back-to-back "chevron" modules (LA2) ranging from 150mm to 600mm deep.

CONSTRUCTION



Built to the highest quality and specification, all EEC acoustic weather louvres will have outer casings of not less than 1.2mm galvanised mild steel sheet.

The louvre blades and outer faces of the top and bottom support sections will not be less than 0.7mm galvanised mild steel sheet. The inner absorptive faces will not be less than 0.7mm galvanised perforated mild steel sheet.

The acoustic infill will be in-organic, non-hydroscopic, flame, moisture and vermin proof mineral wool with a minimum density of 48Kg/m 3 and packed under compression to prevent voids due to settlement.

PERFORMANCE

The overall acoustic performance for single and double bank acoustic louvres varies depending on the free area, louvre blade design and the noise spectrum from the attenuated plant item.

Typical SRI figures for standard Acoustic Louvre configurations are presented below

Frequency - Hz	63	125	250	500	1K	2K	4K	8K
LA1 SRI - dB	6	7	10	13	17	19	13	11
LA2 SRI - dB	9	10	14	20	30	33	32	30

AERODYNAMICS

It is generally recommended to avoid excessive regenerative noise from the louvres that air flow pressure losses across the louvres be kept below 20 Pa. This again varies on the final specification of each louvres, however no acoustic louvre should be run faster than 2.5 m/s.

NOISE AND VIBRATION CONTROL SPECIALISTS

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t: 01932 230940 f: 01932 230941 e:info@eecnoisecontrol.co.uk www.eecnoisecontrol.co.uk

quietly moving forward

APPENDIX B: GLOSSARY OF NOISE TERMS AND UNITS.

1.0 Noise

1.1 The sounds that we hear are as a result of successive air pressure changes. These air pressure changes are generated by vibrating sources, such as train engines or wheels, and they travel to a receiver, i.e. the human ear, as air pressure waves.

1.2. The human ear is capable of detecting a vast range of air pressures, from the lowest sound intensity that the normal ear can detect (about 10^{-12} watts/m^2) to the highest that can be withstood without physical pain (about 10 watts/m^2). If we were to use a linear scale to represent this range of human sensitivity it would encompass more than a billion units. Clearly this would be an unmanageable scale yielding unwieldy numbers.

1.3. The scale can be compressed by converting it to a logarithmic or Bel scale, the number of Bels being the logarithm to the base 10 of one value to another (as applied by Alexander Graham Bell to measure the intensity of electric currents). The Bel scale gives a compressed range of 0 to 12 units which in practice is a little too compressed. A more practical operating range of 0 to 120 is obtained by multiplying by 10, ie. 10 x Bel, which produces the scale units known as decibels or dB.

1.4. Examples of typical sound intensity levels within the decibel range of 0 to 120 dB are listed below:

Commercial four-engine jet aircraft at 100m	120dB
Riveting of steel plate at 10m	105dB
Pneumatic drill at 10m	90dB
Circular wood saw at 10m	80dB
Heavy road traffic at 10m	75dB

Male speech, average, at 10m	50dB
Whisper at 10m	25dB
Threshold of hearing, 1000Hz	0dB

1.5. Due to this logarithmic scale noise levels have to be combined logarithmically rather than arithmetically. For example, two equal sound sources of 70 dB each, when operated simultaneously, do not produce a combined level of 140 dB but instead result in a level of 73 dB, ie. A rise of 3dB for each doubling of sound intensity. Subjectively, a 3dB change does not represent a doubling or halving of loudness; to make a sound appear twice as loud requires an increase in sound pressure level of about 10dB.

1.6. The subjective loudness of noise can be measured by applying a filter or weighting which equates to the frequency response of the human ear. This is referred to as an A-weighting and when applied results in noise levels expressed as dB(A).

1.7. dB(A) noise levels can be measured using a variety of noise indices. The index which correlates best with human response due to machinery noise is the L_{Aeq} this is the A-weighted L_{eq} which is referred to as the 'equivalent continuous noise level' and is a measure of the total sound energy generated by a fluctuating sound signal within a given time period.