THE EQUUS PARTNERSHIP
Member of the Association of Noise Consultants
CONSULTANTS IN ACOUSTICS

33 ALFRED PLACE, LONDON

ENVIRONMENTAL NOISE ASSESSMENT OF PROPOSED CONDENSER UNITS

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1 INTRODUCTION

The commercial property at No. 33 Alfred Place is currently under refurbishment at second and third floor levels for occupation by G-Research. The surrounding area is mainly commercial although there are residential properties known as Rossetti Court overlooked from the rear of the subject premises.

In connection with this refurbishment, it is proposed to install 6 no. condenser units externally on an existing flat roof area at the rear of the subject premises at fifth floor level. This roof area is currently occupied by a number of condenser units serving other tenants within the building.

The EQUUS Partnership has been commissioned to assess the likely environmental noise impact of the proposed condenser units on nearby noise-sensitive properties. This report presents the results of daytime and night-time environmental noise surveys undertaken to establish the ambient/background noise conditions prevailing at the rear of the subject premises, confirms London Borough of Camden's environmental noise control requirements, and assesses noise emissions from the proposed condenser plant.

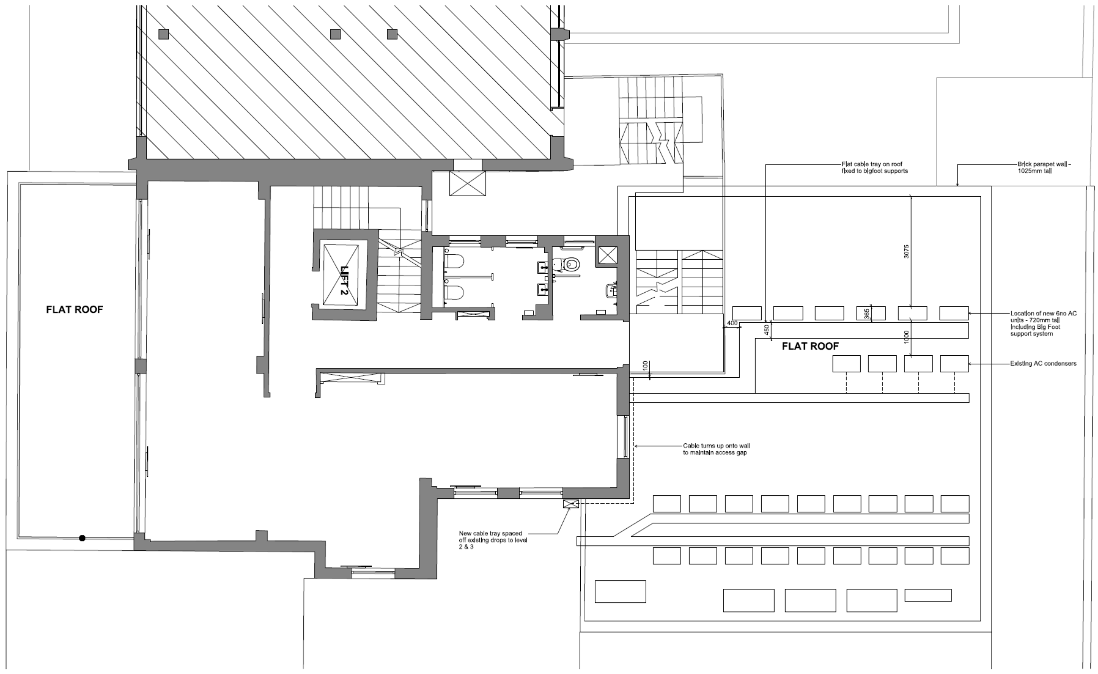
2 SUBJECT PREMISES AND SURROUNDING ENVIRONMENT

The subject property is located on Alfred Place within a terrace of medium rise commercial properties with a branch of 'The Co-operative food' located nearby to the south-east at the junction with South Crescent. Alfred Place runs parallel with Tottenham Court Road and falls within the jurisdiction of London Borough of Camden Local Planning Authority.

The rear of the subject premises overlooks a number of commercial properties, some of which have large items of mechanical plant on the building roofs, and also a five storey - i.e. ground plus four floors maximum height - residential development known as Rossetti Court.

The proposed location for the 6 no. new condenser units is a flat roof area at the rear of the subject premises at fifth floor level. This roof area is currently occupied by a number of existing condenser units serving other tenants within the building. It is intended that the 6 no. new condenser units will be arranged in a single line positioned at 1m from (and parallel) to the existing condenser units. Please refer to Figure 1 below which is a plan of the subject roof area showing the proposed locations of the existing and proposed condenser units.

Figure 1



Based on visual site observations, and by reference to satellite imagery mapping software, the nearest dwelling balcony/window to the closest of the proposed condenser units is approximately 27m distant and at a lower elevation to the proposed condenser plant. As such, there will be a reasonable degree of 'natural' acoustic screening afforded by the 1m high brick parapet wall surrounding the roof plant.

3 PLANT MANUFACTURER'S NOISE DATA

3.1 Proposed Comfort Cooling Condenser Units

It is proposed that 2 no. condenser units (Mitsubishi PUHZ-ZRP35VKA) will be installed to serve the G-Research offices and it is understood these will only operate during 'office hours' - i.e. 08.00 to 18.00 hours. The units are approximately 720mm tall including Big Foot anti-vibration support system.

The following manufacturer's 'free-field' sound pressure levels have been obtained for these condenser units. The tabulated noise data relate to the measured noise level at 1m from the side of each unit:

Condenser Unit Noise Levels: Octave Band Sound Pressure Levels (dB re: $2x10^{-5}$ Pa)									
Operating Mode	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**(A)**
PUHZ-ZRP35VKA (Cooling Mode)	50	45	43	42	39	36	28	23	**(44)**
PUHZ-ZRP35VKA (Heating Mode)	58	51	45	44	40	37	32	31	**(46)**

3.2 Proposed Comms Room Condenser Units

It is proposed that 4 no. condenser units (Mitsubishi PUHZ-ZRP35VKA) will be installed to serve the G-Research data rooms and will operate during daytime and night-time periods. These units will be operated in pairs in a duty/share arrangement. This means that all four units will be designed to operate together, albeit at a reduced load, but that one of each pair of units could satisfy the design load in the event of any unit failures.

The following manufacturer's 'free-field' sound pressure levels have been obtained for these condenser units. The tabulated noise data relate to the measured noise level at 1m from the side of each unit:

Condenser Unit Noise Levels: Octave Band Sound Pressure Levels (dB re: $2x10^{-5}$ Pa)									
Operating Mode	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**(A)**
PUHZ-ZRP35VKA (Cooling Mode)	50	45	43	42	39	36	28	23	**(44)**

4 ENVIRONMENTAL NOISE SURVEY

4.1 Noise Survey Periods

As indicated in Section 3 above, it is understood the proposed Comms Room condenser units will operate on demand during daytime and night-time periods, but that the office comfort cooling condenser units will only need to operate during ‘office hours’ - i.e. 08.00 to 18.00 hours. In order to establish typical prevailing daytime and night-time ambient/background noise levels fully manned ‘critical period’ environmental noise surveys were undertaken during the afternoon of Tuesday 13 June 2017, and during the early hours of Wednesday 14 June 2017.

4.2 Noise Measurement Location

An initial inspection of the site environs indicated the most suitable noise measurement location to be on the external fire escape stairs between second and third floor level facing towards Rossetti Court. The ambient/background noise levels at this location were the lowest in the immediate area and were judged to be reasonably indicative of the ambient noise climate that would be prevailing outside the closest exposed façade of these dwellings.

4.3 Noise Measurement Conditions

The existing plant on the fifth floor flat roof area - i.e. the condenser units belonging to other tenants of the subject premises - were all switched off for the duration of the daytime and night-time environmental noise surveys. This was to ensure that any nearby plant noises were not affecting the ambient noise climate.

4.4 Weather Conditions

The weather conditions during the daytime noise survey were dry, warm and slightly humid, with around 4-6 oktas cloud cover (approximately 50-75%) and generally calm with an occasional light breeze. During the night-time survey the weather conditions were also dry and fairly calm, with just an occasional light breeze, but with a clear sky. These weather conditions are considered acceptable for the purposes of this environmental noise assessment.

4.5 Noise Survey Procedure

Sample measurements of the L_{A90}, L_{Aeq} and L_{Amax} sound levels were made periodically between 14.00 and 16.00 hours and also between 02.00 and 03.00 hours. The noise levels obtained during these measurement samples are taken to be representative of the typical noise climate in that period. The noise measuring instrumentation was fully manned such that any noise sources that could have been construed as unrepresentative were excluded from the measurement samples. As such, the 'back erase' facility of the real time analyser was employed to eliminate short term extraneous noise 'events' from the results, such as 'noisy' aircraft and helicopter flyovers etc.

Please refer to ***Appendix A*** for an explanation of the acoustic terminology used in this Report.

4.6 Instrumentation

The following instrumentation was used for the environmental noise surveys:

Brüel and Kjær Precision Real Time Analyser	Type 2260B
Brüel and Kjær ½" Condenser Microphone	Type 4189
Brüel and Kjær Sound Level Calibrator	Type 4230
Brüel and Kjær ½" Windshield	Type UA 0237

The real time analyser was calibrated prior to each survey and the calibration was checked again upon completion. No drift was found to have occurred.

4.7 Ambient Noise Climate

The ambient noise climate outside the rear of the subject premises was principally controlled by existing plant noise emissions with occasional noises from traffic movements along Ridgmount Street and other surrounding roads. It was noted that the ambient/background noise levels remained virtually identical during daytime and night-time periods due to the continuous plant noises emanating from neighbouring buildings.

4.8 Noise Survey Results

The following environmental noise levels were measured at the selected noise monitoring position:

Fire Escape Stairs at Rear of Subject Premises (Between 2nd and 3rd Floor Levels):

Measurement Period	Measured Sound Pressure Level, dB re 20µPa		
	L_{A90}	L_{Aeq}	L_{Amax}
Daytime Periods:			
14.00 – 14.30 hours	50.6	51.4	57.1
14.30 – 15.00 hours	50.4	51.3	59.5
15.00 – 15.30 hours	50.2	51.0	57.0
15.30 – 16.00 hours	51.0	52.0	59.4

Measurement Period	Measured Sound Pressure Level, dB re 20µPa		
	L_{A90}	L_{Aeq}	L_{Amax}
Night-Time Periods:			
02.00 – 02.30 hours	50.2	51.3	54.0
02.30 – 03.00 hours	50.2	51.3	54.1

5 PLANT NOISE EMISSION CRITERIA

It is understood that the London Borough of Camden Local Planning Authority has advised that the proposed new condensing units should comply with the following environmental noise emission criteria:

> The development would need to not worsen the existing situation. However, the technical standard is as follows: *the external noise level emitted from plant, machinery or equipment at the development hereby approved shall be lower than the lowest existing background noise level by at least 5dBA, by 10dBA where the source is tonal, as assessed according to BS4142:2014 at the nearest and/or most affected noise sensitive premises, with all machinery operating together at maximum capacity.* The noise survey will need to include background noise measurements taken on site and we will also please need details of the hours of operation for the equipment.

Given the existence of noise emissions from much larger mechanical plant in the vicinity we would contend that it is unlikely the proposed small condenser units would be audibly tonal at the dwellings in Rossetti Court. However, in order to provide a robust noise assessment, this report assumes they may exhibit tonal acoustic qualities.

In view of the Council's requirement and other comments made above, the following *'Cumulative Mechanical Plant Noise Emission Limits'* are to be adopted in this instance. These noise limits are applicable to the proposed condenser units running together at their proposed operating duties during daytime and night-time periods as indicated in Section 3 of this report:

Receiver Location (Outside Façade)	**Cumulative Condenser Unit Noise Emission Limits (dB re 2 x 10^{-5} Pa.)**	
	Daytime - Office Hours (08.00 - 18.00 hours)	**Evening / Night-Time (18.00 - 08.00 hours)**
Rear Elevation of 'Rossetti Court' (Visible from Roof of Subject Premises)	40 dB L_{Aeq}	40 dB L_{Aeq}

6 PLANT NOISE ASSESSMENTS

6.1 Discussion

Calculations have been undertaken to assess the cumulative environmental noise emissions due to operation of the proposed condenser units during daytime and night-time periods based on the manufacturer's noise data confirmed in Section 3 of this report.

Due allowance has been made for the proposed condenser unit locations, the distances between the proposed plant and 1m from the closest noise-sensitive balcony/windows (Rosetti Court), typical plant directivity characteristics, geometrical spreading, and acoustic screening / reflection effects due to the building features and rooftop parapet wall etc.

6.2 Top Floor Balcony / Windows of Rossetti Court

Calculations indicate the following 'worst case' cumulative condenser unit noise level outside the closest windows in the rear elevation of Rossetti Court - i.e. with all 6 no. condenser units operating together at maximum duty during the daytime at maximum duty.

'Worst case' daytime condenser unit noise level outside Rosetti Court - 24 dB L_{Aeq}.

Please note:
In practice the 4 no. Comms Room condenser units would normally operate at reduced duty due to their duty /share design.

Further calculations indicate the following 'worst case' cumulative condenser unit noise level outside the closest windows in the rear elevation of Rossetti Court - i.e. with 4 no. Comms Room condenser units operating together at maximum duty during the night-time at maximum duty.

'Worst case' night-time condenser unit noise level outside Rosetti Court - 22 dB L_{Aeq}.

Please note:
In practice these units would normally operate at reduced duty due to their duty /share design.

It may be seen that the calculated 'worst case' condenser unit plant noise emission levels at 1m from the closest windows in the rear elevation of Rossetti Court readily accord with the daytime and night-time *'Cumulative Plant Noise Emission Target'* of 40 dB L_{Aeq} referred to in Section 5 of this Report, and should therefore be satisfactory without the need for any additional noise mitigation measures.

Please refer to ***Appendix B*** for summary daytime and night-time environmental noise emission calculation sheets demonstrating the above findings.

7 CONCLUSIONS

Environmental noise surveys have been undertaken to establish the prevailing daytime and night-time ambient / background noise levels at the rear of No. 33 Alfred Place.

Based on manufacturer's noise data for the proposed condenser units, and considering the measured background noise levels, cumulative environmental noise emissions to the closest noise-sensitive property have been assessed (residential property known as Rossetti Court).

The calculations demonstrate that cumulative daytime and night-time environmental noise emissions from the proposed condenser units to the closest noise-sensitive property would be expected to comply with the acoustic design criteria specified by London Borough of Camden's Local Planning Authority without the need for any additional noise mitigation measures. In fact, the 'worst case' cumulative condenser unit noise emissions are expected to be substantially below the specified criteria.

Any subsequent changes to the proposed plant selections, operating conditions and/or unit positions, should be referred back to The EQUUS Partnership for further advice.

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APPENDIX A

GLOSSARY OF ACOUSTIC TERMINOLOGY

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General

A vibrating surface or turbulent fluid flow will cause pressure fluctuations in the surrounding air. These pressure fluctuations are perceived by the human ear as "sound".

Measurement Units

The human ear can detect sound pressures as low as about 20 μPa, and can tolerate (for short periods) sound pressures as high as 200 Pa, an amplitude range of 10 million times. To take account of this huge amplitude range, sound pressure levels (often written in "acoustic shorthand" as SPL or Lp) are quantified using a logarithmic scale, the decibel (dB) scale. This is based on a reference pressure of 20μPa, thus a sound pressure of 20μPa would equate to 0dB and a pressure of 200Pa would equate to 140dB.

Frequency (Pitch) Characteristics

The sound received at any particular location is not solely influenced by the sound pressure level, the frequency characteristics (pitch) of the noise is also an important factor. Noise audible to a human (with "normal" hearing), typically covers the frequency range 20 Hertz to 20,000 Hertz. Hertz (Hz) are defined as the number of times the sound pressure fluctuates in one second. "Low" pitched sounds fluctuate less times per second than "high" pitched sounds. Whilst humans are capable of detecting a wide range of frequencies, the ear is not equally sensitive to all frequencies – the ear is most sensitive at frequencies towards the middle of the audible range and less sensitive to the lower and higher frequencies.

To take account of this frequency response, sound pressure fluctuations are normally quantified by applying a frequency-weighting network or filter which simulates the frequency response of the ear. In essence, this means that more significance is given to the frequencies at which the ear is most sensitive and less significance to those at which the ear is less sensitive. Noise measurements relating to human reaction are generally made using an "A-weighting" network. These measurements are reported as A-weighted decibels or dB(A). The A-weighted sound pressure level is written in "acoustic shorthand" as L_A.

Variation of Sound with Time

It will be appreciated that the sound pressure level of most noise sources will fluctuate with time. In order to take account of the way in which the human ear perceives noise, it is normal for the sound pressure level to be quantified using a time weighting network, to mimic the speed of response of the human ear. The standardised setting for most types of noise is a "Fast" time weighting.

The manner in which sound fluctuates with time can also influence the subjective manner in which noise is perceived. Noise can be continuous (showing no significant variation with time as in the case of a fan), intermittent (i.e. the noise is transient in it's nature, such as a train pass-by) or impulsive (i.e. there is a sudden build up of noise - this can range from "clanking" types sounds as might be experienced next to railway goods yard or a high energy discharge such as an explosion)

Measurement of Sound

Sound pressure levels are measured using equipment comprising a pressure-sensitive microphone, associated amplifier, frequency weighting network, time weighted network and output indicator. In its simplest form this is a small hand-held instrument called a sound level meter. More sophisticated instrumentation (a sound level analyser) is also available which allows the real-time output of the frequency characteristics of the sound to be quantified.

Comparison of Sound Levels

To put the significance of noise measurement into context, the following Table presents the A-weighted sound pressure level of some typical sources:

Sound Pressure Level, dB(A)	Typical Noise Source . Activity
160	Saturn Rocket Taking Off
140	Military Jet Taking Off at 30m
100	Nightclub
90	Heavy goods vehicle driving past at 7m
80	Busy urban road
70	Domestic vacuum cleaner at 3m
60	Busy office environment
55	Normal speech at 1m
40	Whispered conversation at 2m
30	Bedroom at night (BS 8233: 1999)
20	Remote country location
0	Threshold of hearing – a very eery silence

Addition of Sound Levels

It is important to note that the use of a logarithmic scale to describe noise does not allow normal arithmetic addition. This means that two noise sources each generating a level of, say, 60dB(A) will not generate a combined sound level of 120dB(A). The values must be added logarithmically, which would actually yield a combined sound level of 63dB(A) in this example.

Subjective Perception of Sound Levels Changes

With regard to the human perception of sound level changes, the human ear:

- Cannot generally perceive a sound level difference of less than 3dB(A)
- Will perceive a sound level difference of 4-5dB(A) as "noticeable"
- Will perceive a sound level difference of 10dB(A) as a doubling (or halving) of loudness.

GLOSSARY OF ACOUSTIC TERMINOLOGY

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Acoustic Terminology

As stated previously, most sources of noise will fluctuate with time. In order to characterize such noise, it is therefore normal to represent the noise climate using a variety of noise parameters and statistical indices. The most commonly adopted noise parameters are described below:

$L_{Aeq,T}$ This is the equivalent continuous A-weighted sound level measured over a specified time period "T". This is the notional continuous sound level which, over the time T, contains the same amount of energy as the actual fluctuating sound being measured. This parameter is widely accepted as being the most appropriate noise descriptor for most environmental noise and the effects of noise on humans.

$L_{Amax,fast}$ This is maximum A-weighted sound pressure measured with a fast frequency response recorded during the stated measurement period. It is typically used to characterise the highest sound level caused during a noise event.

$L_{A90,T}$ This is the A-weighted sound pressure level exceeded for 90% of the specified time period "T". It is normally used to describe the underlying background noise level of an environment since it inherently excludes the effects of transient noise sources.

Noise Rating (NR) Level

When describing noise from building services installations, it is common to express noise levels in terms of a Noise Rating (NR) Level. The NR level is determined by plotting the measured frequency spectrum of a noise against a series of reference curves, which roughly approximate to equal loudness values. This method permits higher sound levels at low frequencies corresponding to the sensitivity of the human ear. The NR level is defined as the value of the highest curve "touched" by the plotted frequency spectrum. For typical sources of building services noise, the overall A-weighted sound level is numerically around 5-6dB higher than the NR level of the noise.

Airborne Sound Insulation Measurement Parameters

The ability of a building element to reduce airborne noise can be described by a number of different parameters relevant to both laboratory and on-site performance evaluation. In general, the higher these values, the better the resistance of the construction to the transmission of airborne sound. The most commonly used parameters include:

R_w The **"Weighted Sound Reduction Index"** (R_w) is a single value measure of the intrinsic sound reduction capabilities of a construction, as measured in an acoustic laboratory. Measurement values are determined in accordance with the BS EN ISO 10140 series of standards and weighted in accordance with BS EN ISO 717-1: 1997.

R'_w The **"Weighted Apparent Sound Reduction Index"** (R'_w) is a single value measure of the apparent sound reduction capabilities of a construction, when installed on-site (which will normally be some way lower than the laboratory value due to less favourable installation conditions, the quality of workmanship, etc.). Measurement values are determined in accordance with the BS EN ISO 140-4: 1998 and weighted in accordance with BS EN ISO 717-1: 1997. In practice, the R'_w of a construction can only be reliably determined if "direct" sound transfer through the partition can confidently be taken as the dominant noise transfer path (i.e. there is no "flanking" sound transmission.

D_w The **"Weighted Sound Level Difference"** (D_w) is a single value measure of the on-site sound reduction between two rooms. This value inherently includes "direct" sound transmission through any separating construction and "flanking" transmission through other building elements. Measurement values are determined in accordance with BS EN ISO 140-4: 1998 and weighted in accordance with BS EN ISO 717-1: 1997.

$D_{n,fw}$ The "**Weighted Normalised Flanking Level Difference**" ($D_{nf,w}$) is a single figure measure of the sound reduction between two rooms solely due to sound transmission through a specified flanking path. This parameter is frequently used to provide an indication of the sound reduction capabilities of suspended ceiling and raised access floor constructions where there is common void between adjacent rooms or as a measure of sound that may be transmitted between rooms through external curtain walling. Measurements are undertaken in accordance with BS EN ISO 10848-2: 2006 and weighted in accordance with BS EN ISO 717-1: 1997

Impact Sound Insulation Measurement Parameters

Some building elements also have the potential to generate "impact" noise, for example due to human "footfall" on floor structures, or the impact of rainfall on lightweight roofing components. A variety of parameters are again available to define the amount of noise likely to be generated. In general, the lower these values, the less sound the construction will generate as a result of impacts. Typical measurements parameters include:

$L_{nT,w}$ The "**Standardised Impact Sound Pressure Level**" is a "single number" rating describing the intrinsic impact sound insulation capabilities of a construction (such as a floor system) as measured in an acoustics laboratory. Values are determined in a vertical sound transmission suite by locating a "tapping machine" in the upper room of the suite and measuring the amount of sound radiated by the floor in the room below. Measurement values are determined in accordance with the BS EN ISO 10140 series of standards and weighted in accordance with BS EN ISO 717-2: 1997.

$L_{nf,w}$ The "**Normalised Flanking Impact Sound Pressure Level**" is a "single number" rating describing the amount of flanking sound that would be transmitted to an adjoining space (separated by a partition) due to impacts on the test sample. It is, for example, used to indicate the amount of noise that may be generated due to footfall noise on a raised access floor system. Values are determined in a horizontal sound transmission suite by locating a "tapping machine" one side of a separating partition built off the test sample and measuring the amount of noise radiated by the floor in the adjoining space on the other side of the partition. Measurement values are determined in accordance with BS EN ISO 10848-2: 2006 and weighted in accordance with BS EN ISO 717-2: 1997.

Room Acoustic Measurements

T The "**Reverberation Time**" (T) of a room is defined as the time taken for the sound energy produced by a source Time (RT)to decay by 60 dB after the source has been switched off. The reverberation time of a space can be calculated by considering the volume of the room and the areas and sound absorption qualities of room surface finishes. Small, "soft" rooms tend to give low reverberation times, whilst large, "hard" rooms tend to give long reverberation times.

α_p The "**Practical Acoustic Absorption Coefficient**" (α_p) is a measure of how much sound energy is absorbed by a building element at a particular frequency, as measured in accordance with BS EN ISO 354: 2003.

α_w The "**Weighted Absorption Coefficient**" (α_w) is a single figure measure of the overall sound absorption capabilities of a building element determined in accordance with BS EN ISO 11654: 1997.

APPENDIX B

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SUMMARY CALCULATION SHEET (DAYTIME)

Project: **33 ALFRED PLACE, LONDON**

EPL: **6585** | Date: **16/06/2017** | No of Pages: 1

Condenser Units to Balcony /Window (Dwellings in Rossetti Court)	63	125	250	500	1k	2k	4k	8k	"A"
Unit 1 - Mitsubishi PUHZ-ZRP35VKA (Lp @ 1m)	50	45	43	42	39	36	28	23	44
Correction 'free-field' to site conditions	5	5	5	5	5	5	5	5	
Nominal acoustic screening due to 1m high parapet wall*	-5	-5	-5	-5	-5	-5	-5	-5	
Distance loss to 26m	-28	-28	-28	-28	-28	-28	-28	-28	
Effective Lp's @ 1m from window	22	17	15	14	11	8	0	-5	16
Unit 2 - Mitsubishi PUHZ-ZRP35VKA (Lp @ 1m)	50	45	43	42	39	36	28	23	44
Correction 'free-field' to site conditions	5	5	5	5	5	5	5	5	
Nominal acoustic screening due to 1m high parapet wall*	-5	-5	-5	-5	-5	-5	-5	-5	
Distance loss to 26m	-28	-28	-28	-28	-28	-28	-28	-28	
Effective Lp's @ 1m from window	22	17	15	14	11	8	0	-5	16
Unit 3 - Mitsubishi PUHZ-ZRP35VKA (Lp @ 1m)	50	45	43	42	39	36	28	23	44
Correction 'free-field' to site conditions	5	5	5	5	5	5	5	5	
Nominal acoustic screening due to 1m high parapet wall*	-5	-5	-5	-5	-5	-5	-5	-5	
Distance loss to 27m	-28	-28	-28	-28	-28	-28	-28	-28	
Effective Lp's @ 1m from window	22	17	15	14	11	8	0	-5	16
Unit 4 - Mitsubishi PUHZ-ZRP35VKA (Lp @ 1m)	50	45	43	42	39	36	28	23	44
Correction 'free-field' to site conditions	5	5	5	5	5	5	5	5	
Nominal acoustic screening due to 1m high parapet wall*	-5	-5	-5	-5	-5	-5	-5	-5	
Distance loss to 28m	-29	-29	-29	-29	-29	-29	-29	-29	
Effective Lp's @ 1m from window	21	16	14	13	10	7	-1	-6	15
Unit 5 - Mitsubishi PUHZ-ZRP35VKA (Lp @ 1m)	58	51	45	44	40	37	32	31	46
Correction 'free-field' to site conditions	5	5	5	5	5	5	5	5	
Nominal acoustic screening due to 1m high parapet wall*	-5	-5	-5	-5	-5	-5	-5	-5	
Distance loss to 29m	-29	-29	-29	-29	-29	-29	-29	-29	
Effective Lp's @ 1m from window	29	22	16	15	11	8	3	2	17
Unit 6 - Mitsubishi PUHZ-ZRP35VKA (Lp @ 1m)	58	51	45	44	40	37	32	31	46
Correction 'free-field' to site conditions	5	5	5	5	5	5	5	5	
Nominal acoustic screening due to 1m high parapet wall*	-5	-5	-5	-5	-5	-5	-5	-5	
Distance loss to 30m	-30	-30	-30	-30	-30	-30	-30	-30	
Effective Lp's @ 1m from window	28	21	15	14	10	7	2	1	16
Resultant Cumulative Lp @ 1m from balcony/window	**33**	**27**	**23**	**22**	**18**	**15**	**9**	**6**	**24**

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SUMMARY CALCULATION SHEET (NIGHT-TIME)

Project: **33 ALFRED PLACE, LONDON**

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Condenser Units to Balcony /Window (Dwellings in Rossetti Court)	63	125	250	500	1k	2k	4k	8k	"A"
Unit 1 - Mitsubishi PUHZ-ZRP35VKA (Lp @ 1m)	50	45	43	42	39	36	28	23	44
Correction 'free-field' to site conditions	5	5	5	5	5	5	5	5	
Nominal acoustic screening due to 1m high parapet wall*	-5	-5	-5	-5	-5	-5	-5	-5	
Distance loss to 26m	-28	-28	-28	-28	-28	-28	-28	-28	
Effective Lp's @ 1m from window	22	17	15	14	11	8	0	-5	16
Unit 2 - Mitsubishi PUHZ-ZRP35VKA (Lp @ 1m)	50	45	43	42	39	36	28	23	44
Correction 'free-field' to site conditions	5	5	5	5	5	5	5	5	
Nominal acoustic screening due to 1m high parapet wall*	-5	-5	-5	-5	-5	-5	-5	-5	
Distance loss to 26m	-28	-28	-28	-28	-28	-28	-28	-28	
Effective Lp's @ 1m from window	22	17	15	14	11	8	0	-5	16
Unit 3 - Mitsubishi PUHZ-ZRP35VKA (Lp @ 1m)	50	45	43	42	39	36	28	23	44
Correction 'free-field' to site conditions	5	5	5	5	5	5	5	5	
Nominal acoustic screening due to 1m high parapet wall*	-5	-5	-5	-5	-5	-5	-5	-5	
Distance loss to 27m	-28	-28	-28	-28	-28	-28	-28	-28	
Effective Lp's @ 1m from window	22	17	15	14	11	8	0	-5	16
Unit 4 - Mitsubishi PUHZ-ZRP35VKA (Lp @ 1m)	50	45	43	42	39	36	28	23	44
Correction 'free-field' to site conditions	5	5	5	5	5	5	5	5	
Nominal acoustic screening due to 1m high parapet wall*	-5	-5	-5	-5	-5	-5	-5	-5	
Distance loss to 28m	-29	-29	-29	-29	-29	-29	-29	-29	
Effective Lp's @ 1m from window	21	16	14	13	10	7	-1	-6	15
Unit 5 - Mitsubishi PUHZ-ZRP35VKA (Lp @ 1m)	UNIT NOT OPERATING AT NIGHT								
Correction 'free-field' to site conditions									
Nominal acoustic screening due to 1m high parapet wall*									
Distance loss to 29m									
Effective Lp's @ 1m from window									
Unit 6 - Mitsubishi PUHZ-ZRP35VKA (Lp @ 1m)	UNIT NOT OPERATING AT NIGHT								
Correction 'free-field' to site conditions									
Nominal acoustic screening due to 1m high parapet wall*									
Distance loss to 30m									
Effective Lp's @ 1m from window									
Resultant Cumulative Lp @ 1m from balcony/window	**28**	**23**	**21**	**20**	**17**	**14**	**8**	**5**	**22**