Acoustic Planning Report

DATE OF ISSUE: **5 JANUARY 2018**

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PROJECT:

WHITE BEAR YARD
144A CLERKENWELL ROAD
LONDON
EC1R 5DF

CLIENT:

CASSIDY + ASHTON
7 EAST CLIFF
PRESTON
PR1 3JE

ONE DISCOVERY PLACE | COLUMBUS DRIVE
FARNBOROUGH | HAMPSHIRE | GU14 0NZ
T: +44 (0)1252 550 500 | F: +44 (0)1252 550 501
www.hilsonmoran.com | info@hilsonmoran.com

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AUTHOR: **PHIL SOFTLEY**

CHECKER: **JACK RICHARDSON**

APPROVER: **JON WILLMOTT**

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Contents

1. Introduction

It is proposed to redevelop White Bear Yard, London into a mixed use development consisting of office space and penthouse residential accommodation.

The site is affected predominantly by noise from traffic on Clerkenwell Road (A201), which may affect the internal noise levels within the proposed development. In addition, new or replaced items of building services plant will be installed on the roof, noise from which will be subject to limits specified by the Local Authority.

Hilson Moran has undertaken an environmental noise survey at the existing site, in order to determine prevailing levels affecting the building and its surroundings.

The purposes of this report are to present the following:

a) The prevailing environmental noise levels affecting the site due to nearby noise sources (e.g. road & traffic).

b) The assessment of external noise intrusion for the residential areas and preliminary guidance for the external facades in terms of sound insulation.

c) The assessment of the external plant noise limits in accordance with the Local Authority's requirements.

Supporting information is provided in appendices at the end of this document.

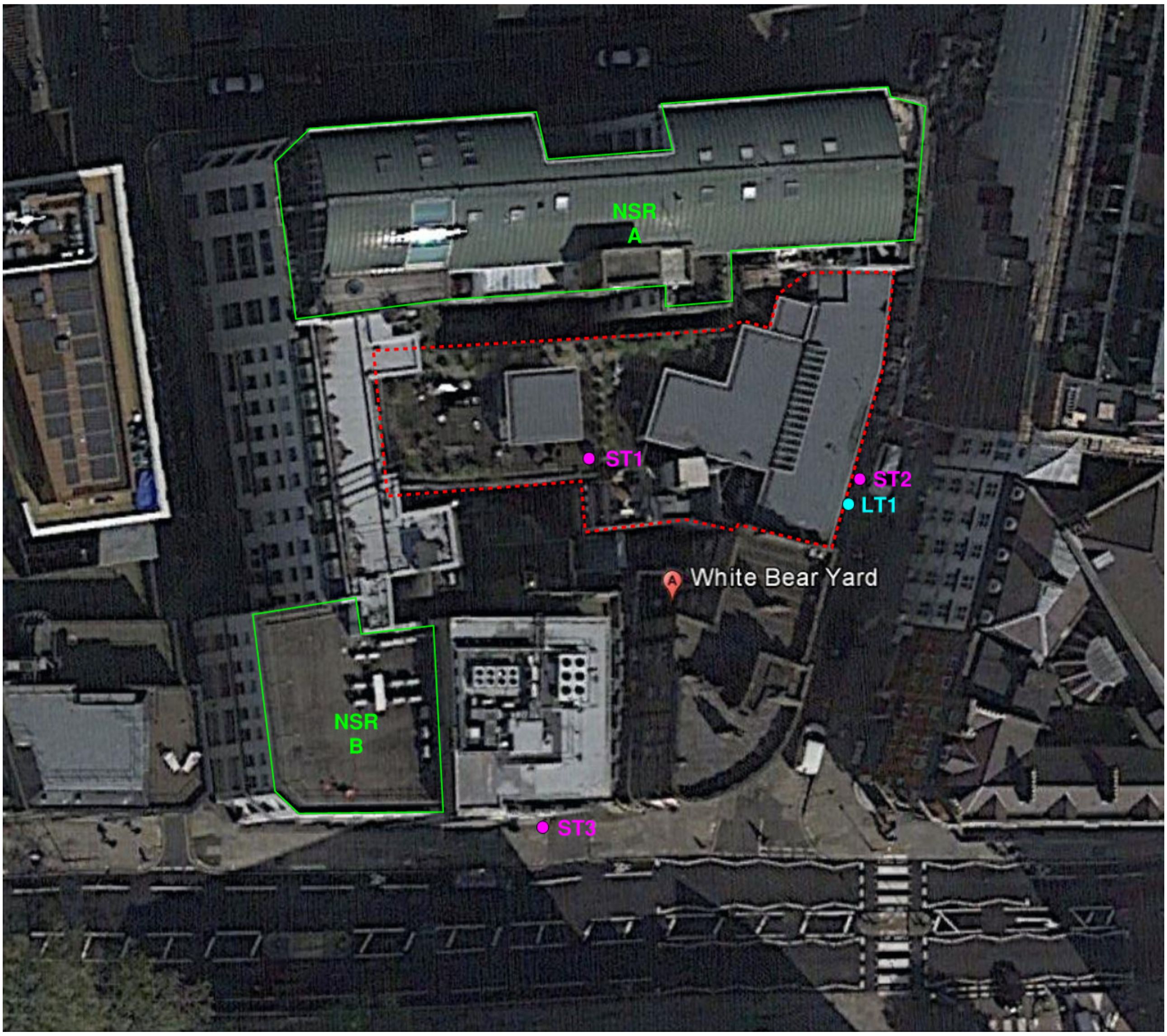
2. The Site, Site Setting and Proposed Development

2.1. The Site

The proposed site is an existing office building on Clerkenwell Road (A201) in London. The site is bound by a serviced apartments to the north, commercial property to the west, Back Hill Road to the east and mixed use commercial buildings to the south.

Figure 2.1 below shows the existing site and its surroundings, with the site highlighted in **red** and the nearest identified residential properties highlighted in **green**.

Figure 2.1: Site location plan



2.2. Noise Sensitive Receptors

The closest noise sensitive receptors (NSRs) are described in Table 2.1 and illustrated on the site plan in Figure 2.1.

Table 2.1: Noise Sensitive Receptors

Receptor Location (Figure 1)	Type of Receptor	Name / Description	Approximate Distance to Site Boundary (m)
NSR A	Residential	1-10 Summers St	Partly adjoined
NSR B	Residential	2 Eyre St	10m

2.3. Proposed Development

The proposed Development includes re-development and reorganisation of the existing office space at ground to fourth floors and erection of a 5^{th} and 6^{th} floor extension to provide B1a uses and C3 residential spaces. It is understood that the proposed development will include the replacement of the existing external building services with new plant items, including those situated at roof level.

3. Environmental Noise Survey

3.1. Methodology

A comprehensive environmental noise survey has been conducted on site by Hilson Moran between Monday 18th December and Tuesday 19th December 2017. The survey comprised 24-hour unattended long term measurements at one measurement location (LT1), starting at approximately 11:00am on the 18th December, and was supplemented with three attended 15-minute short term measurements undertaken at three locations synchronously between 11:00 and 13:00 on Monday 18th December 2017.

The monitoring locations are described in Table 3.1 below and illustrated on the site plan as Figure 2.1.

Table 3.1: Description of noise monitoring locations

Measurement Position (Figure 2.1)	Description	Dominant Noise Sources
LT1	Fourth floor terrace, on the east side of the building (Back Hill Rd), microphone fixed 1 meter from building façade. Chosen as being representative of the noise level at the most exposed façade.	Road traffic noise from the A201 and building works on Warner St (adjoining Back Hill Rd to the north).
ST1	Third floor terrace, on the western side of the building, microphone 2 meters from floor. Chosen as being representative of the noise level at the south side of 1 – 10 Summers St (NSR A).	Road traffic noise from the A201.
ST2	Back Hill Rd, ground level, microphone placed 2 meters from building front.	Road traffic noise from the A201 and Back Hill Rd, plus building works on Warner St (adjoining Back Hill Rd to the north).
ST3	Clerkenwell Road, near the second entrance to White Bear Yard. Microphone placed 2.5 meters from the curbside.	Road traffic noise from the A201.

All noise measurements were taken with a calibrated precision grade (Class 1) frequency (one-third-octave band) sound level meter. The sound level meter used for the long term measurement was set-up to record over consecutive 30-second periods the L_{eq}, L_{90}, L_{10} and L_{max} noise indices in the A-weighting network over 125 ms fast response time constant intervals for the duration of the survey. The short term meter was setup similarly, recording over a shorter time period of 1-second.

The indices are described in Appendix A of this report, but roughly translated they describe in turn the average, background, road traffic and maximum noise levels. Full details of the instrumentation used for the noise measurements, including equipment calibration certificates can be provided upon request.

Weather conditions were not actively measured during the survey period, however remote monitoring revealed that conditions remained consistent; cool but clear with low winds (< 5 mph). These conditions were considered ideal for site measurements.

3.2. Survey Results

A summary of the measured daytime (07:00 to 23:00 hours) and night-time (23:00 to 07:00) noise levels on site for the survey period are tabulated in the tables below.

Appendix B presents a time history graph showing the L_{Aeq}, L_{AFmax} and L_{A90} noise levels at measurement LT1 throughout the noise survey period.

Table 3.2: Summary of Baseline Noise Monitoring Results at LT1

Period	Duration	$L_{Aeq,T}$ dB	$L_{A10,T}$ dB	$L_{A90,T}$ dB	$L_{AFmax,T}$ dB
		Ave[1]	Ave[2]	10th %ile[3]	Min – Max (95th %ile[4])
Day	16 hr	64	61	52	51 – 100 (77)
Night	8 hr	59	52	46	47 – 91 (73)

Notes: *[1] Logarithmic average over the day / night periods; [2] Arithmetic average over the day / night periods; [3] The lowest 10th percentile value of all 30-second measurements during the day / night; [4] The 95th percentile L_{AFmax} value presented and considered representative of typical L_{AFmax} levels experienced. All figures are rounded to the nearest whole decibel.*

Table 3.3: Octave Band Data at LT1

Period	Parameter	Octave Band Centre Frequency (Hz)								dB L_A
		63	125	250	500	1K	2K	4K	8K	
Day	dB $L_{eq\ 16\ hr}$	67	65	62	59	60	58	51	41	64
Night	dB $L_{eq\ 8\ hr}$	62	62	57	54	56	52	46	38	59
Night	dB L_{Fmax}[1]	80	78	73	72	74	69	63	52	77

Notes: *[1] Values based on 10 occurrences per night time.*

Table 3.4: Summary of Baseline Noise Monitoring Results at Short Term Positions

Position	Duration	$L_{Aeq,T}$ dB	$L_{A10,T}$ dB	$L_{A90,T}$ dB	$L_{AFmax,T}$ dB
		Ave[1]	Ave[2]	Ave[2]	Min – Max (95th %ile[3])
ST1	15 min	55	58	52	49 – 79 (62)
ST2	15 min	63	65	58	56 – 77 (70)
ST3	15 min	68	71	63	60 – 83 (76)

Notes: *[1] Logarithmic average over the day / night periods; [2] Arithmetic average over the day / night periods; [3] The 95th percentile L_{AFmax} value presented and considered representative of typical L_{AFmax} levels experienced. All figures are rounded to the nearest whole decibel.*

4. External Plant Noise Emissions

It is understood that the ground to fourth floor areas of the development will include commercial uses, which are likely to include items of external building services noise, and therefore will be required to achieve the external noise emission requirements of Camden London Borough Council.

4.1. Local Authority Requirements

Following correspondence with Camden London Borough Council, we understand that they require noise from plant and machinery to achieve a BS 4142 Rating Level of 5 dB below the representative L_{A90} background noise level, or 10 dB below where noise source is tonal, at the nearest noise sensitive properties. The background noise levels and plant Rating Level should be established in full accordance with BS 4142: 2014.

4.1.1. British Standard 4142: 2014

BS 4142 *"Method for rating and assessing industrial and commercial sound"* presents a method for assessing the level of impact due to a noise source, based on a comparison of the plant Rating Level with the background noise levels, both of which are measured, or predicted at a noise sensitive receiver e.g. a residential property.

The Rating Level is determined applying decibel corrections to the source noise levels, if it is tonal, intermittent, impulsive, or contains any other acoustic characteristics. The Rating Level is then compared to the background noise level and the levels of impact can be estimated, depending on context, in accordance with the following advice:

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact;
- A difference of around +5 dB is likely to be an indication of an adverse impact
- Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.

The plant Rating Level is expressed as $L_{Ar,Tr}$ dB, where T = 1 hour during daytime periods (07:00 – 23:00 hours) and T = 15 minutes during night-time periods (23:00 – 07:00h hours).

4.2. External Plant Noise Limits

Based on Camden London Borough Council's requirements, and the results of the environmental noise survey, the plant noise limits shown in Table 4.1 are proposed, to be achieved during the relevant plant operating period. The total noise emission from all external building services associated with the commercial units should be controlled so as not to exceed the following plant noise limits, when measured 1m external to windows of the respective existing and proposed noise sensitive properties.

The noise limits presented below are based on the measured background noise levels established at the LT1 measurement position, with corrections applied for the typical difference in noise levels between locations LT1 and ST1, as location ST1 is considered to provide a good representation of the quietest NSR façades and as such the assessment approach can be considered worst case.

Noise levels emanating from the building services should be expressed as a BS 4142 Rating Level, including acoustic feature corrections where applicable. The limits should be reduced by 5 dB if the plant is tonal.

Table 4.1: Proposed External Building Services Noise Limits

Location	External Building Services Plant Noise Limit ($L_{Ar,Tr}$) dB	
	Daytime, T = 1 hour (07:00 – 23:00 hours)	Night-time, T = 15 minutes (23:00 – 07:00 hours)
ALL NSRs	40	34

4.3. Acoustic Plant Mitigation

During a later design stage, when exact location and technical details of the external building services plant are known, a detailed acoustic mitigation assessment should be undertaken to accurately assess compliance with the plant noise limits specified in the above section.

At this stage in the design process, it is considered that the plant design is sufficiently flexible to ensure that suitably quiet non-tonal plant can be procured and/or mitigation options can be included (e.g. enclosures, screening) to ensure the noise limits are not exceeded.

Measures that shall be employed to ensure the external plant noise level limits are not exceeded might include:

- Selection of low-noise plant
- Use of appropriate external screens/enclosures/acoustic linings around plant areas where necessary
- Use of appropriate atmospheric duct-mounted attenuators, where necessary, on air moving plant

5. External Façade Acoustic Performance

5.1. Internal Ambient Noise Levels in Dwellings

We propose that in order to safeguard the amenity of the residents of the proposed dwellings, the internal noise levels within habitable rooms should achieve the internal noise standards given in British Standard 8233: 2014, subject to the approval of Camden London Borough Council, which are as follows:

Table 5.1: Internal ambient noise criteria – (BS 8233: 2014)

Location	Indoor Ambient Noise Criteria ($L_{Aeq,T}$ dB)	
	Daytime (07:00 – 23:00 hours)	Night-time (23:00 – 07:00 hours)
Living Rooms	35	-
Bedrooms	35	30

BS 8233: 2014 also suggests the following,

"Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL of $L_{Amax,F}$, depending on the character and number of events per night."

In setting a suitable L_{Amax} noise limit, we have considered the following guidance from the World Health Organisation document *"Guidelines for Community Noise"* (1990):

"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB $L_{Amax,F}$ more than 10 – 15 times per night."

We would therefore recommend that, in addition to the internal ambient noise criteria in Table 5.1, the internal L_{Amax} noise levels in the proposed bedrooms are controlled so as not to exceed 45 dB L_{AFmax} more than 10 – 15 times during any night-time period.

5.2. Preliminary Façade Sound Insulation Assessment

Indicative calculations have been undertaken to determine the sound insulation requirement applicable to the proposed development's worst-case (noisiest) residential façade, in accordance with BS 8233:2014.

The measured noise levels obtained at position LT1 of the environmental noise survey (displayed in Tables 4.1 and 4.2) were chosen to be representative of the highest environmental noise levels incident on the proposed residential façades (facing Back Hill Road).

Calculations to derive the minimum acceptable glazing and ventilation specification assume the following conditions:

- The calculation methodology provided in BS 8233: 2014.
- Apartment facades will comprise 100% glazing to all habitable rooms.
- Ventilation will be provided via trickle vents, comprising 1no. ventilator per bedroom and 2no. ventilator per living / dining room.

Based on the results of the preliminary calculations, the minimum glazing sound insulation specification for the worst-case façade is as follows.

Table 5.2: Indicative façade specification

Acoustic Rating, R_w	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1K	2K	4K	8K
40	22	27	29	36	41	42	49	58

The specification in Table 5.2 is based on lab tested results of a glazing unit comprising 10 mm pane, 12 mm airgap, 6.4 mm pane.

The above performance should be achieved by the whole glazing system including frames and seals.

Where trickle ventilators are required to provide whole-dwelling ventilation, they should be selected to achieve a minimum sound reduction performance of $D_{ne,w}$ 42 dB along the worst-case façade. As such, whole-dwelling ventilation via passive trickle ventilators is expected to be feasible for the other residential facades.

Please note that the above specification is only preliminary, based on factors that may change. Furthermore, a full, detailed assessment of the glazing will be required as part of the design process.

Please note that if it is essential that windows are opened for the purposes of providing thermal comfort, the level of noise may increase considerably. However, the extent of noise ingress would depend upon the extent of the window opening and this would be at the users' discretion.

Appendix A – Glossary of Acoustic Terms

The following table contains a list of some of the most frequently used acoustic terms we use in our reports. An explanation of what each of the terms means is also provided.

Term	Description
Decibel, dB	The decibel is a logarithmic unit of measurement used for quantifying sound. It is derived from the logarithm to base 10 of the ratio of two quantities. Use of a logarithmic scale has the advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers.
Frequency, Hz	In sound, the number of cycles per second of a pressure fluctuation and frequency in sound is proportional to its pitch. Different frequencies are divided into octave and one third octave bands.
Sound Pressure Level, *Lp*	This is the unweighted or linear level which is measured prior to any weightings being applied. The sound pressure level is 20 times the logarithm to base 10 of the ratio of the reference sound pressure ($2x10^{-5}$) and the measured sound pressure.
Sound Power Level, L_w	This is the total sound energy radiated from a given source. The sound power Level is 10 times the logarithm to base 10 of the ratio of the reference sound power level ($1x10^{-12}$) and the measured power.
Frequency Weightings	Weightings can be applied to a spectrum of sound and act as a filter to account for different sensitivities and conditions.
Time Weightings	A time weighting to denote the response of the sound level meter. For most measurements the Fast time weighting is selected (F) however, a slow time weighting (S) is often used to for the measurement train noise and vibration.
A-weighted sound pressure level, L_{pA}	The sound pressure level with the A-weighting applied. The A-weighting is used for most environmental noise measurements and is used to weight a spectrum of sound to match the sensitivity of the human ear.
Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$	The L_{Aeq} is an energy average and defined as the level of sound which, over a given period of time, would equate to the same A-weighted sound energy as the actual fluctuating sound.
Octave Bands	A band of frequencies in which the upper limit of the band is twice the frequency of the lower limit.
Maximum noise Level, L_{AFmax}	The maximum instantaneous noise level measured during a given period of time. The time weighting to which the meter is set for this measurement parameter is always indicated by either an F or S.
Minimum Noise level, L_{AFmin}	The minimum instantaneous noise level measured during a given period of time. The time weighting to which the meter is set for this measurement parameter is always indicated by either an F or S.
Percentile level, $L_{AN,T}$	A-weighted sound pressure level obtained using time-weighting F, which is exceeded for N% of a specified time interval. An example of this is background noise which is quantified with the L_{A90} descriptor, which is the A-weighted level which is exceeded for 90% of the measurement period.

Sound exposure level L_{AE}	A level of a sound, of 1 s duration, that has the same sound energy as the actual noise event considered.
Rating Level, $L_{Ar,Tr}$	The equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise.
Ambient Noise Level	The noise level in a given environment whilst it is subject to all of its normal sources of noise.
Background Sound / Noise Level, L_{A90}	These are amongst the lowest noise levels measured over a given period of time and exclude short term, intermittent noise sources. The background noise level is quantified by the L_{A90} descriptor and is therefore the level which is exceeded for 90% of a given period of time.
Reverberation Time, T	The time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped. The descriptor T, often includes other nomenclature to describe the type of reverberation time measurement or if the reverberation time is an average taken for specific frequencies. For example a T_{mf} is the mid-frequency reverberation time.
Absorption Coefficient, α	The fraction of reverberant sound energy absorbed by a material. It is expressed as a value between 1.0 which equates to perfect absorption and 0 which equates to zero absorption.
Absorption, A	The acoustic absorption derived from the multiplication of the absorption coefficient by the surface area of a given material.
Acoustic Class, A - E	Classification of sound absorbers into Sound Absorption Classes A-E, according to BS EN ISO 11654, including frequencies 200-5000 Hz
NRC	A single-number rating system used to compare the sound-absorbing characteristics of building materials. A measurement of the acoustical absorption performance of a material, calculated by averaging its Sound Absorption Coefficients at 250, 500, 1000 and 2000 Hz
Sound Reduction Index, R	The laboratory measured sound insulation properties of a material or building element in octave or third octave bands.
Weighted Sound Reduction Index, R_w	A single number which represents the sound reduction of a material. It is derived by plotting the sound reduction index against a set of reference curves. The curves are shifted until a best-fit is established and the curve which best fits the sound reduction spectrum is used to represent the single figure value.
Weighted Level Difference, D_w	The weighted level difference between a pair of rooms, stated as a single figure.
Standardized Weighted Level Difference, $D_{nT'w}$	The standardized, weighted difference in sound level between a pair of rooms, stated as a single figure. The level difference in octave bands is first normalized to a reference reverberation time and then plotted against a set of reference curves to establish a single figure value.
Weighted, Normalised Flanking Level Difference, D_{nFw}	The normalised, weighted difference in sound level between a pair of rooms via a flanking element, such as mullion or ceiling detail. The level difference in octave bands is first normalized to a reference amount of absorption and then plotted against a set of reference curves to establish a single figure value.

Normalised Element Level Difference D_{ne}	The normalised difference in sound level between a pair of rooms via a small element such as a trickle ventilator. The level difference in octave bands is normalized to a reference amount of absorption.
Weighted, Normalised Element Level Difference, D_{new}	The normalised, weighted difference in sound level between a pair of rooms via a small element such as a trickle ventilator, stated as a single figure. The level difference in octave bands is normalized to a reference amount of absorption and then plotted against a set of reference curves to establish a single figure value.
C_{tr}	A correction term applied to the sound insulation single-number values (R_w, D_w, and $D_{nT,w}$). Applying the C_{tr} penalises a construction's performance if its low frequency performance is poor in relation its performance at higher frequencies.
Impact Sound	The noise generated by an impact on a structure. This is normally used to describe the noise created by people walking on a floor structure.
Weighted standardized impact sound pressure level, $L_{nT,w}$	A single-number quantity used to characterize the impact sound insulation of floors over a range of frequencies.
Cross-talk	Noise transmission between one room and another room or space via a duct or other path.
Insertion Loss, IL	The reduction of noise level due to the presence of a noise control device such as an attenuator, excluding any regeneration noise created by its presence.
Dynamic Insertion Loss, DIL	The reduction of noise level due to the presence of a noise control device such as an attenuator, including any regeneration noise created by its presence.
NR	The Noise Rating level. This is a single figure value derived by plotting a noise spectrum against a set of curves. The curve under which the spectrum fits is the resulting NR level.
Vibration	The vibratory motion of a surface can be characterised by: (a) displacement (m), (b) velocity (m/s), or (c) acceleration (m/s^2). The magnitude of the vibration can be quantified in several ways: **Peak to Peak** - The total excursion of the oscillation about the zero datum. **Peak** - This value gives the maximum excursion of the oscillation above or below the zero datum. **r.m.s.** - This value gives the root mean square of the time history over a specific time interval (time constant). **dB** - Vibration levels can be expressed in dB. A reference level of 10-6 m/s^2 r.m.s. is usually used for acceleration.
Ground borne noise	Audible noise caused by the vibration of elements of a structure, for which the vibration propagation path from the source is partially or wholly through the ground
Structure borne noise	Audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements.

V.D.V,	The VDV is the Vibration Dose a person is expected to be exposed to over the course of the day or night. The VDV is given by the fourth root of the time integral of the fourth power of the acceleration after it has been frequency-weighted.
eVDV	The estimated vibration dose value based on short duration measurements of transients with known durations and occurrences

Appendix B – Time History Graph