



Acoustic Planning Report

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Executive Summary

A new residential development is proposed on the 0.86 ha plot of land at The Cottage, Shripney Road, Bognor Regis. The proposed development will comprise 21 new homes, including flats and houses in over 10 buildings. The development site is currently occupied by a single dwelling and associated agricultural land.

Hilson Moran have been commissioned by Castle Property Developments Ltd to undertake a noise assessment of the development proposals in accordance with Arun District Council's noise requirements. The key outcomes of the assessment are as follows:

- The internal noise level requirements can be achieved on the worst-case residential façades with double glazing achieving a minimum laboratory sound reduction performance of R_w 34 dB.
- Rooms on all other facades may adopt a standard thermal double glazing achieving a minimum laboratory sound reduction performance of R_w 30 dB.
- Where trickle ventilators are proposed as part of the background ventilation strategy, these should be selected so as to achieve a minimum laboratory sound reduction performance of $D_{ne,w}$ 36 dB on the noisiest residential facades, and can be reduced to achieve $D_{ne,w}$ 32 dB on the other residential facades.
- The private gardens throughout the development are considered to provide adequate areas of external amenity that achieve the target criteria of Arun District Council, considering the development site's proximity with a busy transport link (Shripney Road).



1. Introduction

Hilson Moran Partnership was appointed by Castle Property Developments Ltd to undertake a noise assessment on the proposed residential development at The Cottage, Shripney Road, Bognor Regis, in support of the planning application.

The proposed development will include the demolition of the current single dwelling which occupies the site, and the erection of 21 new homes spanning 10 buildings, associated landscaping, car parking and other associated works.

The internal and external areas of the proposed residential development are required to achieve the noise standards specified by Arun District Council.

The purposes of this report are:

- a) To present the methodology and results of the environmental noise survey;
- b) Based on (a) to present predictions of the internal noise levels within the proposed residential dwellings, and determine the acoustic requirements of the external façade construction, and suitable ventilation strategy.
- c) Based on (a) to present predictions of the external noise levels in the proposed private external amenity areas, compared with the requirements of Arun District Council.

Appendix A presents an explanation of the acoustic terminology used in this report.

2. Description of Development Site

The proposed development site is a 0.86 ha site, which is currently occupied by a single residential dwelling and associated agricultural land. The development site is bounded by a hotel and car parking to the north, farmland to the east, residential dwellings to the south and Shripney Road to the west.

The surrounding buildings are predominantly residential, with a hotel near to the north boundary of the site.

Figure 2.1 below shows the existing site and its surroundings, with the approximate site boundary indicated in red.



Figure 3.1 Site plan indicating site boundaries



3. Planning Regulations, Standards and Guidance

3.1. National Planning Policy Framework

The National Planning Policy Framework (NPPF) is the main source for considering noise within the planning regime. The framework gives local authorities policies and guidance by which they can derive their own set of criteria relevant to their needs.

NPPF's aim is to prevent new or existing developments from contributing to existing noise pollution or from being excessively exposed to unacceptable levels of noise pollution.

It is also accepted that new or existing businesses should not have unreasonable restrictions put on them, so long as adverse impacts are mitigated.

3.2. Arun District Council Planning Requirements

3.2.1. Internal Noise Levels in Residential Dwellings

Following discussions with Fiona Fitzgerald of Arun District Council on Tuesday 18 April 2017, we understand that they require the proposed dwellings to achieve the internal ambient noise levels given in British Standard 8233:2014.

Table 3.1 below summarises the recommended internal noise criteria presented in BS 8233.

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

Table 3.1 Indoor Ambient Noise Criteria (BS 8233: 2014)

We note that BS 8233: 2014 also states 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 or $L_{Amax,f}$, depending on the character and number of events per night.”

In setting a suitable $L_{Amax,f}$ 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 4.1, the internal $L_{Amax,f}$ noise levels in the proposed bedrooms are controlled so as not to exceed 45 dB more than 10 – 15 times during any night-time period.

3.2.2. Noise Levels in External Amenity Areas

Following discussions with Fiona Fitzgerald of Arun District Council on Tuesday 18 April 2017, we understand that Arun District Council seek to achieve daytime noise levels of 50 dB L_{Aeq} (16 hour) in outdoor living areas (gardens), however acknowledge that this may not be achievable in all areas,



and therefore have requested that where this is not achievable, a noise level of 55 dB $L_{Aeq,T}$ (16 hour) is targeted.

4. Environmental Noise Survey

4.1. Survey Methodology

Hilson Moran Acoustics has undertaken noise measurements at the existing site to measure the existing ambient noise levels affecting the site and its surroundings.

Unattended noise measurements were undertaken between approximately 10:00 hours on Wednesday 19th April and 10:00 hours on Friday 21 April 2017. Short, attended noise measurements were also undertaken at one location between approximately 10:15 and 10:30 hours on Wednesday 19th April 2017.

L_{Aeq} , L_{Amax} and L_{A90} noise levels were measured at each location throughout the entire survey periods.

The measurement positions are shown in Figure 4.1 below, with the unattended measurement locations highlighted in blue, and the attended measurement locations highlighted in green.



Figure 4.1 Site Plan Showing Approximate Measurement Locations

Measurement location 1 was chosen to be representative of road traffic noise along Shripney Road, and throughout the adjacent hotel development. At measurement location 1, the measurement microphone was secured to a perimeter fence, overlooking the junction between Shripney Road and the adjacent hotel access road. The measurement microphone was positioned approximately 1.5m above ground level.



Measurement location 2 was chosen to be representative of road traffic noise from Shripney Road at the rear of the site, as well as noise from the distant A29, approximately 750m southeast of the site. At measurement location 2, the measurement microphone was secured to a perimeter fence, overlooking the farmland to the east of the site, at a height of approximately 2m above ground level.

Attended measurement location A was used to observe the variation in noise levels along Shripney Road.

The equipment used for the noise survey is summarised in Table 4.1.

Measurement Location	Equipment	Description	Serial Number
1	01 dB DUO	Type 1 automated logging sound level meter	11063
	GRAS 40 CD	Type 1 ½" microphone	209837
2	01 dB DUO	Type 1 automated logging sound level meter	11083
	GRAS 40 CD	Type 1 ½" microphone	231567
All	Brüel & Kjær 4231	Calibrator	2583650

Table 4.1: Description of Equipment used for Noise Survey.

At each measurement location, the noise monitoring equipment was calibrated before and after the noise survey periods, with a negligible calibration drift observed. Calibration certificates can be provided upon request.

Due to the nature of the unattended noise survey we are unable to comment on the exact weather conditions throughout the entire noise survey period. However, at the beginning and end of the noise survey period, there was noted to be no rainfall, a minimally cloudy sky and a light wind. We note that no rainfall was forecast between the beginning and end of the survey and therefore we would anticipate that the weather conditions throughout the survey would be suitable for undertaking environmental noise measurements.

4.2. Noise Survey Results and Observations

Appendix B presents a time history graph showing the L_{Aeq} , L_{A90} and L_{Amax} noise levels measured at each measurement location throughout the noise survey. We consider the measured noise levels to be typical, considering the measurement locations and dominant nearby noise sources.

Table 4.2 below presents a summary of the daytime L_{Aeq} (16 hour), night-time L_{Aeq} (8 hour) and representative night-time L_{Amax} noise levels measured at each measurement location.

The $L_{Amax, (fast)}$ noise levels shown below have been selected such that, with the required glazing and ventilation sound reduction performances, the internal noise levels within the bedrooms of the development are predicted not to exceed 45 dB $L_{Amax, (fast)}$ more than 10 – 15 times per night, as per the World Health Organisation guidelines.



Measurement Location	Daytime (07:00 – 23:00 hours)	Night-time (23:00 – 07:00 hours)	
	L _{Aeq} (16 hour) dB	L _{Aeq} (8 hour) dB	L _{Amax} (fast) dB
1	68	60	78
2	51	51	71

Table 4.2 Summary of Noise Survey Results

The dominant noise source at both measurement locations was noted to be road traffic from Shripney Road. However, at measurement location 2 (rear position) some daytime noise contribution from road traffic along the A29 to the southeast of the site was noted. We would anticipate that during night-time periods, noise from the A29 would become the dominant noise source at measurement location 2.

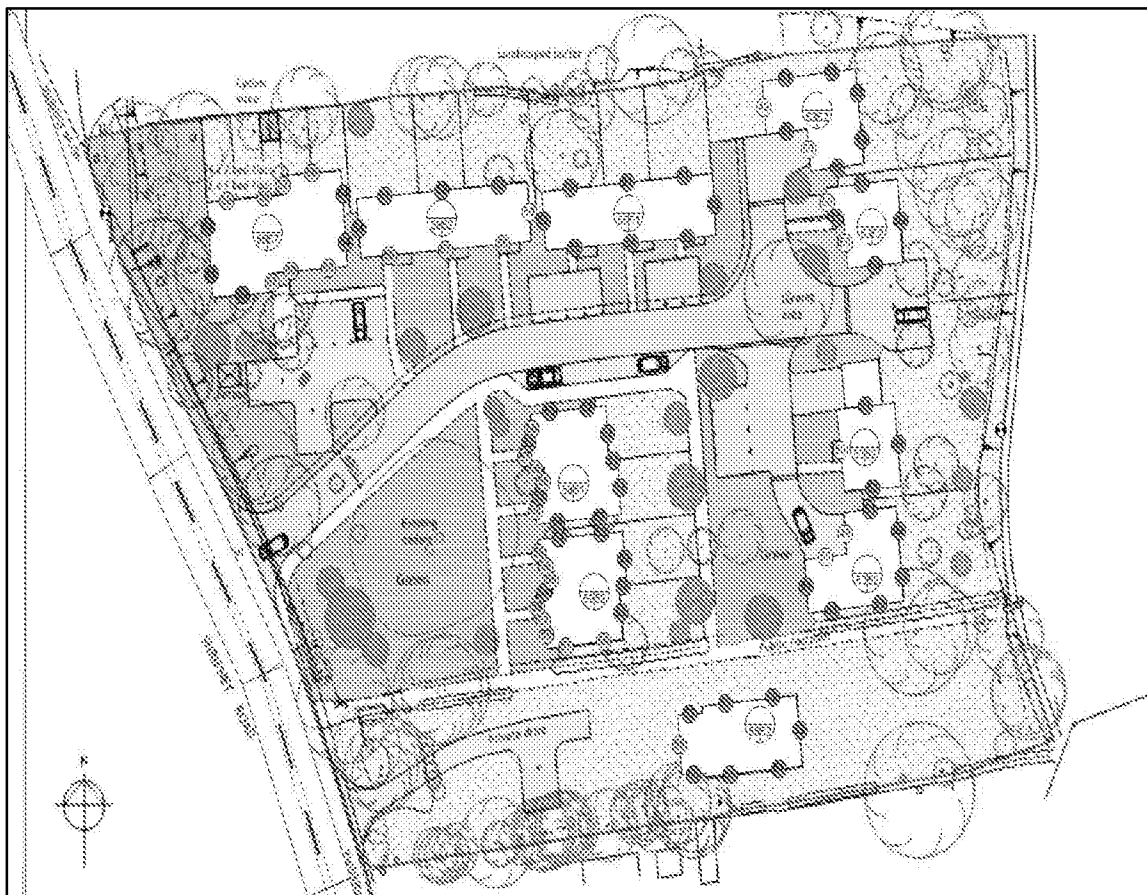
5. External Façade Noise Ingress Assessment

5.1. Basis of Calculations

Hilson Moran have produced an acoustic model of the proposed development using CadnaA noise mapping software, which calculates in accordance with ISO 9613-2:1996 “Acoustics – Attenuation of sound during propagation outdoors”. The noise model was calibrated using the noise data captured during the noise survey and MHD Architect’s site layout ref 334/F/01 rev B, dated March 2016.

Based on the results of the acoustic modelling, Hilson Moran have undertaken calculations to determine the required acoustic performance of the external glazing and ventilation strategy throughout the site.

Figure 5.1 below provides an image of the acoustic model showing the predicted daytime L_{Aeq} (16 hour) noise levels incident on the façades of each proposed residential building.



- The bedrooms and living rooms will have typical room finishes (carpeted floor, plasterboard wall etc.);
- Bedrooms will have a minimum volume of 25m³, living rooms will have a minimum volume of 50m³.

We note that as part of the development, an internal road will be included which will provide access to and from the proposed dwellings. Considering the anticipated volume and speed of associated traffic movements, we would not expect the daytime and night-time noise levels to be increased as a result of traffic movements along the proposed internal road. Noise levels from this road have therefore not been included in our calculations.

5.2. External Façade Acoustic Requirements

Based on the above, Hilson Moran have undertaken preliminary calculations to predict the sound reduction requirement of the external glazing and trickle ventilators throughout the site, such that the internal noise standards of Arun District Council are achieved.

Glazing Reference Group	Minimum Glazing Performance (R _w dB)	Minimum Trickle Ventilator Performance (D _{tr,v} dB)
A	34	36
B	30	32

Table 5.3 Minimum Glazing Sound Reduction Performances

Figure 5.2 below highlights the areas of the development where each façade reference group apply.



Figure 5.2 Location of Recommended Glazing and Trickle Ventilator Performance



5.3. Further Investigation

The recommendations above are provided for planning guidance only and detailed assessment of noise ingress should be undertaken during the subsequent design stages.

Future design should incorporate an octave band acoustic specification detailing the minimum sound reduction indices to be achieved by the proposed glazing, including the effects of frames, seals, openings, lights etc. The acoustic specification should also detail the testing methodology and the results presentation format.

The tests will be required to be undertaken in accordance with BS EN ISO 10140-2:2010. This would involve testing in 1/3 octaves from at least 100Hz to 5000Hz inclusive, with the results suitably converted into octave bands for comparison with the acoustic specifications.

The glazing and trickle ventilator supplier will be required to submit laboratory test results for the proposed products, based on samples which are fully representative of the unit to be installed on site.

6. Outdoor Amenity Areas

There is currently no local or national planning policies that provide statutory noise requirements applicable to outdoor amenity spaces for residential developments. However based on guidance provided by the World Health Organisation, Arun District Council have requested that daytime noise levels of $L_{Aeq} (16 \text{ hour})$ 50 dB are targeted in the proposed gardens, where practicable.

We understand that private external amenity is to be provided in the form of gardens, at the rear of each house and ground floor apartment. Figure 6.1 below shows the predicted daytime $L_{Aeq} (16 \text{ hour})$ noise levels in each of the proposed private garden areas.

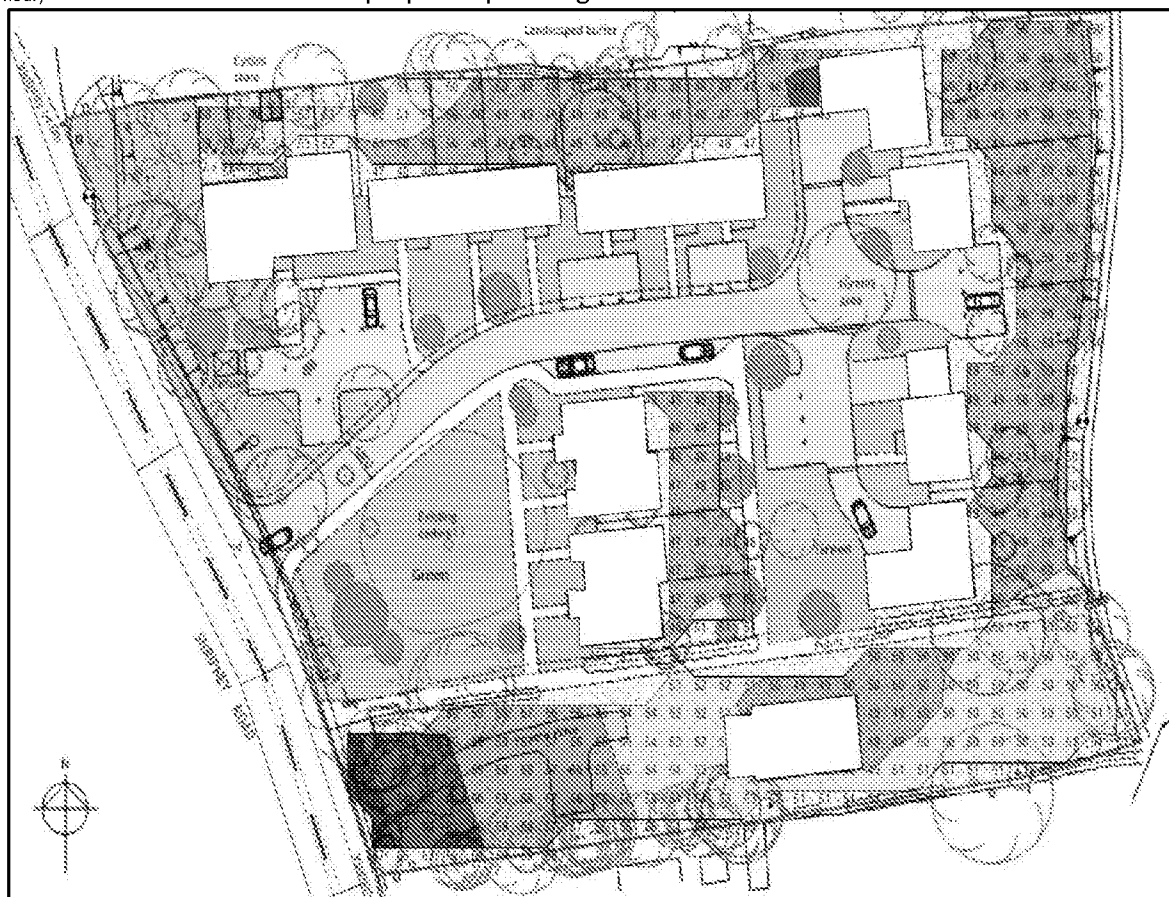


Figure 6.1 Daytime $L_{Aeq} (16 \text{ hour})$ Noise Levels in External Amenity Areas

The table below provides a breakdown of the approximate areas of private amenity that are predicted to achieve L_{Aeq} 50 dB, L_{Aeq} 55 dB, and above.

Daytime Noise Level Range ($L_{Aeq} (16 \text{ hour})$ dB)	Approximate Predicted Area (m^2)
< or equal to 50	231
51 – 55	53
> 55	50

Table 6.1 Approximate External Amenity Areas



We understand that a gardens fences will be used to provide visual privacy to the proposed private gardens. We would anticipate that the presence of a typical timber garden fence of 1.5m height would provide around 3 dB of acoustic attenuation, particularly when located near to the main noise source. As such, we anticipate that garden fences will further increase the areas in which daytime noise levels achieve the preferred 50 dB.

It is important to acknowledge that the development site is located close to a busy transport link (Shripney Road) and therefore it would not be practicable to achieve external noise levels of less than L_{Aeq} 55 dB in all proposed areas, without costly environmental noise mitigation measures.

We note that BS 8233: 2014 states:

"...these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted"

Based on the above, the development should be considered to provide adequate areas of private amenity areas compliant with the requirements of Arun District Council.



APPENDIX A – ACOUSTIC TERMINOLOGY

This document provides a layperson's explanation of the acoustics terms that commonly appear in reports. It is not intended to give full scientific definitions and explanations or go into detail on how and why things are as they are. Some obsolete terms and abbreviations have been included as they still appear in documents from time to time.

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, L_p	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 (2×10^{-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 (1×10^{-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,T_r}	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/s²). 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/s² 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 – Graphical Noise Survey Results

