REPORT REFERENCE:

SA – 4204/PCD 2 4

Planning Condition Discharge Report

British Standard 8233: 2014 (Condition 2)

British Standard 6472: 2008 (Condition 4)

CLIENT:

IDM Land Ltd

SITE:

1a Highgate Road, London, NW5 1JY

SURVEY DATES:

4th – 6th December 2015

Report By

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1 EXECUTIVE SUMMARY

1.1 Instruction

Sound Advice Acoustics Ltd have been instructed by IDM Land Ltd to undertake a review of the proposed design in order to satisfy planning conditions 2 & 4 of approval notice 2016/2279/P which state:-

Prior to commencement of the development, an up to date noise assessment shall be submitted to and approved by the Council. The report shall include external noise levels including reflected and re-radiated noise and details of the sound insulation of the building envelope, of orientation of habitable rooms away from major noise sources and of acoustically attenuated mechanical ventilation as necessary to achieve internal room noise standards in accordance with the criteria of BS8233:2014. The approved details shall be implemented prior to occupation of the development and thereafter be permanently retained.

Prior to commencement of the development, details of building vibration levels shall be submitted to and approved by the Council. The details shall refer to vibration levels generated by the adjacent railway and entertainment uses together with appropriate mitigation measures where necessary. The criteria to be met and the assessment method shall be as specified in BS 6472:2008. The approved details shall be implemented prior to occupation of the development and thereafter be permanently retained.

1.2 Scope of Report

The measurements will be undertaken in accordance with ISO 1996 – Part 2: 2007 to determine the existing background noise levels and British Standard 8233:2014 will be used to determine the impact of existing traffic on the internal noise environment within the proposed residential dwellings. This report aims to establish the following:

- Existing background noise levels within the area;
- Assess the potential internal noise levels on the proposed rooms;
- Provide specifications for the ventilation and window glazing with the proposed rooms.
- Review planning conditions 2 and 3.

1.3 Summary of Results

1.3.1 Background Noise Levels

A 72 hour background noise survey was undertaken from 4th – 6th December 2015 at two positions (front of site and rear of site) in order to establish the underlying background noise levels. The maximum day time levels were found to be $L_{Aeq,\ 16\ hour}$ 61.2 dB and the maximum night time levels were found to be $L_{Aeq,\ 8\ hours}$ 61.3 dB at position 1. The maximum day time levels were found to be $L_{Aeq,\ 16\ hour}$ 59.7 dB and the maximum night time levels were found to be $L_{Aeq,\ 8\ hours}$ 55.3 dB at position 2.

Assessment Position	Date Start	Date Finish	Daytime LAeq	Night Time LAeq
Position 1 Front	04/12/2015	06/12/2015	61.2	61.3
Position 2 Rear	04/12/2015	06/12/2015	59.7	55.3

1.3.2 Vibration

Ground borne vibration needs to be assessed with regard to the likelihood of disturbance to humans and damage to building structure. With regard to human disturbance, vibration criteria are specified in terms of Vibration Dose Values (VDV) in accordance with BS 64721. The following table shows the VDV with various degrees of adverse comment, which may be expected in residential buildings.

For residential buildings	Low probability of adverse comment	Adverse comment possible	Adverse comment probable
16 hr day 07:00 to 23:00	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6

Table 1 Vibration Dose Values (given in m/s1.75)

The vdv results are summarised in the table below for the daytime and night-time periods.

Time Period	Vibration Dose Value m/s1.75			Peak Particle Velocity mm/s
	L	T	V	Resultant Vector
4th December 2015 – 16 Hr	0.026	0.026	0.04	.350mm/s
5th December 2015 – 16 Hr	0.026	0.026	0.042	.350mm/s
4th – 5th December 2015 – 8 Hr	0.022	0.022	0.029	.150mm/s
5th – 6th December 2015 – 8 Hr	0.024	0.022	0.028	.350mm/s

Table 3 Summary of daily VDV and PPV

*Denotes initial set up values of vibration.

The above table demonstrates that no detrimental or structural vibration levels have been measured and therefore the probability of neighbouring building damage is low.

1.4 Conclusions

The development should be designed with a 4mm glass / 14mm air gap / 6mm glass double glazed windows and a MHVR to all rooms facing the railway line on the first floor to ensure the internal noise levels are acceptable in terms of the assessment to British Standard 8233: 2014. All other windows on the first and second floor should be designed with a 4mm glass / 16mm air gap / 4mm glass standard double glazing and MHVR.

Based on the calculations and assessments made within this report it is the professional opinion of Sound Advice Acoustics Ltd that the aforementioned planning condition can be discharged with the design proposed detailed within this report implemented accordingly.

[1] BS 6472:, Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz)
[1] BS 7385:, Evaluation and measurement for vibration in buildings

2 INTRODUCTION

Sound Advice Acoustics Ltd has been instructed by IDM Land Ltd to carry out the relevant noise assessments and calculations at 1a Highgate Road, London, NW5 1JY in order to satisfy the aforementioned planning conditions 2 and 4 respectively.

Ambient noise levels were measured between 4th – 6th December 2015. This report by Sound Advice Acoustics Ltd gives the results of these measurements and an assessment in accordance with government planning guidelines and relevant standards together with mitigation measures as required.

With regards to external ambient noise, environmental noise levels are be monitored at the site in accordance with British Standard 7445: 2003 'Description and measurement of environmental noise assessments and calculation made in accordance with BS 8233: 2014 Sound Insulation and Noise Reduction for Buildings Code of Practice.

BS 8233: 2014 set the following parameters as target levels that should be designed to within rooms such as Living Rooms and Bedrooms.

Indoor ambient noise levels in spaces when they are unoccupied and privacy is also important		
Objective	**Typical situations**	**Design Range $L_{Aeq,t}$ dB**
Typical noise levels for acoustic privacy in shared spaces	Living room	35 – 40
NOTE: See Noise control in building services [28] and BS EN ISO 3382.		

Indoor ambient noise levels for dwellings			
Activity	**Location**	**07:00 – 23:00**	**23:00 – 07:00**
Resting	Living Room	35 dB $L_{Aeq\ 16\ HOUR}$	--
Dining	Dining Room / Area	40 dB $L_{Aeq\ 16\ HOUR}$	--
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq\ 16\ HOUR}$	30 dB $L_{Aeq\ 8\ HOUR}$

Calculations and assessments are therefore to be carried out in order to satisfy the above requirements of BS8233: 2014.

References and evaluations are to be made to the National Planning Policy Framework 2012 (NPPF) and the Noise Policy Statement for England 2010 (NPSE). The purpose of this document is to include all aspects of environmental noise within assessments i.e. environmental noise, neighbour noise and neighbourhood noise. Noise is to be considered alongside other relevant issues relating to the site and should not be considered in isolation, according to the NPSE.

There are several key phrases within the NPSE aims and these are discussed below.

2.1 "Significant adverse" and "adverse"

There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

2.2 NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

2.3 LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.
Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

2.4 SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

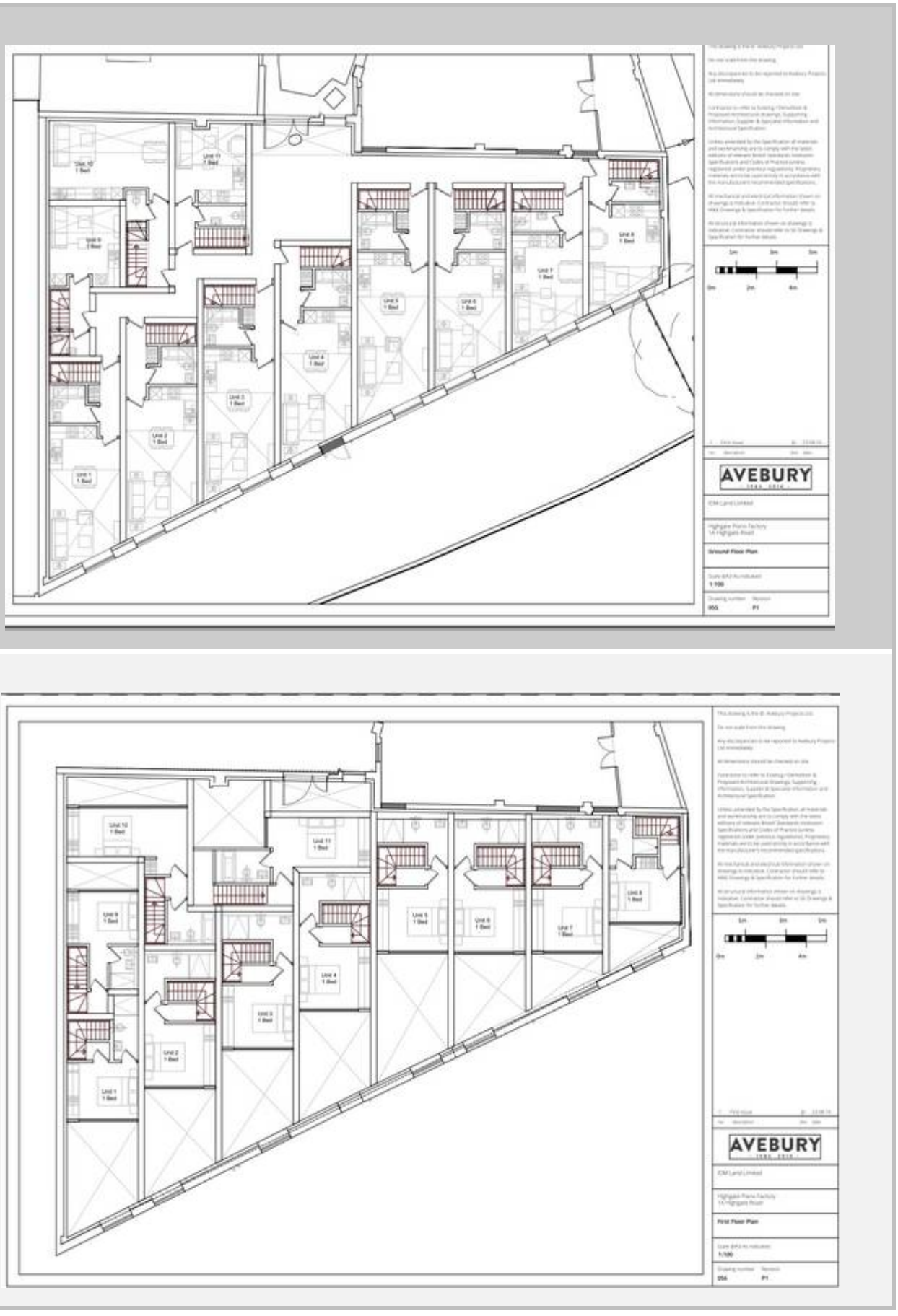
3 SITE LOCATION

Position of Site in Wider Area

The site is located in London. The dominant noise source is road traffic noise.

3.1 Proposed Development

The proposed development is shown below.



4 PROCEEDURE

External noise levels were recorded over a typical period and analysis date extrapolated between 07:00 hrs 4th – and 07:00 hrs on 6th December 2015 at positions 1 and 2 as detailed on the attached plan sketch layout.

Position 1 was located at the front façade of the site in order to capture the noise levels associated with the nearby roads, position 2 was located to the rear of the site in order to capture any noise associated with the nearby railway. Sample measurements were recorded over continuous 5 minute samples and from this data the hourly LAeq daytime values have been evaluated. Sound Pressure Levels were recorded on the following setting along with a full octave band frequency analysis measured simultaneously and between 31.5 Hz and 16.0 kHz.

Daytime 07:00 – 23:00		Night Time 23:00 – 07:00	
$L_{Aeq\ 1\ HOUR}$ dB	$L_{A10\ 1\ HOUR}$ dB	$L_{Aeq\ 5\ MINUTES}$ dB	$L_{A10\ 5\ MINUTES}$ dB
$L_{AMAX\ 1\ HOUR}$ dB	$L_{A50\ 1\ HOUR}$ dB	$L_{AMAX\ 5\ MINUTES}$ dB	$L_{A50\ 5\ MINUTES}$ dB
$L_{AMIN\ 1\ HOUR}$ dB	$L_{A90\ 1\ HOUR}$ dB	$L_{AMIN\ 5\ MINUTES}$ dB	$L_{A90\ 5\ MINUTES}$ dB

Calculations have been made in accordance with BS 8233: 2014 'Sound Insulation and Reduction of Buildings - Code of Practice'. Recommendations were made for any additional acoustics measures to conform to these standards.

From the downloaded recorded results, the daytime and night time periods were assessed and used within the above calculations as $L_{Aeq\ 16\ HOUR}$ dB levels for daytime and $L_{Aeq\ 8\ HOUR}$ dB levels for night time. These are detailed within this report. All data averaged throughout the day has been done so on a logarithmic basis to give accurate $L_{Aeq\ 16\ Hour}$ dB daytime and $L_{Aeq\ 8\ Hour}$ dB night time noise levels.

5 APPARATUS

The equipment was calibrated using a sound pressure level of 114.0 dB at an octave band centre frequency of 1000Hz with reference to 2 x 10^{-5} Nm^{-2} before and after the tests and the equipment set to have no inaccuracy greater than 0.2dB.

All the following equipment was calibrated in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service (UKAS) on the following dates. Calibration schedules are implemented within Sound Advice Acoustics Ltd in accordance with UKAS directive LAB 23.

5.1 118 noise meter s/n 11831471 environmental testing

Description	Make	Type	Serial No.	Calibration Intervals	Last Calibrated	Next Due Calibration
Integrated Sound Level Meter	Norsonic	118	11831471	2 YEARS	08.08.2014	08.08.2016
12.5mm Microphone (with windshield)	Norsonic	1220	41075	2 YEARS	08.08.2014	08.08.2016
Microphone Pre – Amplifier	Norsonic	1201	30327	2 YEARS	08.08.2014	08.08.2016

Description	Make	Type	Serial No.	Calibration Intervals	Last Calibrated	Next Due Calibration
Integrated Sound Level Meter	Rion	NL-52	00242696	2 YEARS	23.04.2014	23.04.2016
12.5mm Microphone (with windshield)	Rion	UC-59	06178	2 YEARS	23.04.2014	23.04.2016
Microphone Pre – Amplifier	Rion	NH-25	32724	2 YEARS	23.04.2014	23.04.2016

5.2 Rion noise meter s/n 00242696 environmental testing

Full calibration certificates are available upon request.

6 ENVIRONMENTAL CONDITIONS

START OF TEST	4th December 2015
Temperature	14.0 ^{0}C
Relative Humidity	62%
Average Wind Speed	<0.5 m/s
Cloud Cover	Clear
Road Surface	Dry
Atmospheric Pressure	996mb

END OF TEST	6th December 2015
Temperature	14.0 ^{0}C
Relative Humidity	58%
Average Wind Speed	<0.5 m/s
Cloud Cover	Moderate
Road Surface	Wet
Atmospheric Pressure	994mb

* Wind speed, temperature and relative humidity were all recorded using standard equipment supplied by RS Components, Hedge End, Southampton and are taken as an average over the designated time period.

7 RESULTS

$L_{Aeq,t}$ -	The equivalent A weighted sound pressure level recorded over a time interval of 5 minutes night time and 1 hourly daytime.
$L_{A90,t}$ -	The A weighted sound pressure level that is exceeded for 90% of the time period 5 minutes night time and 1 hourly daytime.
$L_{A50,t}$	The A weighted sound pressure level that is exceeded for 50% of the time period 5 minutes night time and 1 hourly daytime
$L_{A10,t}$ -	The A weighted sound pressure level that is exceeded for 10% of the time period 5 minutes night time and 1 hourly daytime
L_{Amax} -	The maximum A weighted sound pressure level recorded over a time interval of 5 minutes night time and 1 hourly daytime.
L_{Amin} -	The minimum A weighted sound pressure level recorded over a time interval of 5 minutes night time and 1 hourly daytime.

7.1 Downloaded results, and averages.

4th – 5th December 2015 – POSITION 1

Date / Time	LAeq	Lmax	Lmin	LA10	LA50	LA90	Octave Band Centre Frequency (Hz)									
							31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00																
DAYTIME AVERAGE $L_{Aeq\ 16\ HOUR}$	61.2	81.3	48.9	62.1	56.2	51.9	69.1	65.1	64.9	62.5	53.3	57.3	53.7	48.5	40.7	23.0
23:00 - 07:00																
NIGHT TIME AVERAGE $L_{Aeq\ 8\ HOUR}$	58.3	78.8	46.9	59.2	54.0	50.0	67.6	62.8	61.8	60.0	51.1	54.4	50.2	45.5	39.0	23.8

5th – 6th December 2015 – POSITION 1

Date / Time	LAeq	Lmax	Lmin	LA10	LA50	LA90	Octave Band Centre Frequency (Hz)									
							31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00																
DAYTIME AVERAGE $L_{Aeq\ 16\ HOUR}$	60.4	79.8	49.5	62.4	56.8	52.7	69.8	65.0	63.7	61.5	53.0	56.0	52.8	50.1	39.5	26.8
23:00 - 07:00																
NIGHT TIME AVERAGE $L_{Aeq\ 8\ HOUR}$	61.3	84.5	49.3	62.5	56.7	52.5	68.2	64.2	63.4	61.2	56.3	56.3	53.5	51.7	41.0	37.1

4th – 5th December 2015 – POSITION 2																
Date / Time	LAeq	Lmax	Lmin	LA10	LA50	LA90	Octave Band Centre Frequency (Hz)									
							31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00																
DAYTIME AVERAGE $L_{Aeq\ 16\ HOUR}$	56.3	72.4	47.3	59.1	51.3	48.9	73.1	68.2	61.4	57.8	53.8	50.8	45.8	41.3	38.2	26.8
23:00 - 07:00																
NIGHT TIME AVERAGE $L_{Aeq\ 8\ HOUR}$	55.3	73.9	44.2	58.4	49.5	46.2	79.9	73.5	64.8	55.6	51.2	48.4	44.2	40.7	37.4	31.4

5th – 6th December 2015 – POSITION 2																
Date / Time	LAeq	Lmax	Lmin	LA10	LA50	LA90	Octave Band Centre Frequency (Hz)									
							31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00																
DAYTIME AVERAGE $L_{Aeq\ 16\ HOUR}$	59.7	76.6	52.0	62.5	56.0	53.6	82.4	76.5	68.6	60.1	55.7	53.4	49.3	46.5	43.2	34.4
23:00 - 07:00																
NIGHT TIME AVERAGE $L_{Aeq\ 8\ HOUR}$	54.4	73.1	45.4	56.8	50.1	47.5	78.8	73.0	64.2	54.9	51.0	47.3	42.5	39.1	36.5	30.8

The following noise levels have been corrected for the highest recorded façade levels and used within the BS 8233: 2014 calculations

4th – 6th December 2015 – POSITION 1																
Date / Time	LAeq	Lmax	Lmin	LA10	LA50	LA90	Octave Band Centre Frequency (Hz)									
							31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00																
DAYTIME AVERAGE $L_{Aeq\ 16\ HOUR}$	61.2	81.3	48.9	62.1	56.2	51.9	69.1	65.1	64.9	62.5	53.3	57.3	53.7	48.5	40.7	23.0
23:00 - 07:00																
NIGHT TIME AVERAGE $L_{Aeq\ 8\ HOUR}$	61.3	84.5	49.3	62.5	56.7	52.5	68.2	64.2	63.4	61.2	56.3	56.3	53.5	51.7	41.0	37.1

4th – 6th December 2015 – POSITION 2																
Date / Time	LAeq	Lmax	Lmin	LA10	LA50	LA90	Octave Band Centre Frequency (Hz)									
							31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00																
DAYTIME AVERAGE $L_{Aeq\ 16\ HOUR}$	59.7	76.6	52.0	62.5	56.0	53.6	82.4	76.5	68.6	60.1	55.7	53.4	49.3	46.5	43.2	34.4
23:00 - 07:00																
NIGHT TIME AVERAGE $L_{Aeq\ 8\ HOUR}$	55.3	73.9	44.2	58.4	49.5	46.2	79.9	73.5	64.8	55.6	51.2	48.4	44.2	40.7	37.4	31.4

8 RECOMMENDATIONS

For the purpose of this assessment, the corresponding façade levels will be used within the BS 8233: 2014 calculations in order evaluate the worst case scenario and select the correct window specification.

Therefore, in order to achieve the required noise levels of $L_{Aeq\ 16\ HOUR}$ 35 dB for habitable rooms daytime and $L_{Aeq\ 8\ HOUR}$ 30 dB for Bedroom at night within the proposed, the following additional acoustic measures have been calculated.

It should be noted that the calculations have been made with the proposed windows closed. Additional calculations were made for the top floor due to the influence of sound transmission into the various rooms via the roof / ceiling i.e. an increased impeding façade. Inputted levels into the calculation sheets have been corrected for distance attenuation and free field in accordance with the aforementioned British Standard.

8.1 Calculation Procedure to BS 8233: 2014

The following calculations have been carried out in order to determine the required window and ventilation specification in order to meet the requirements of BS 8233: 2014.

8.2 Unit 1 – Living/Kitchen

Proposed Window Configuration	**4 / 16 / 4 with MVHR**
Leqff	*The equivalent continuous sound pressure level outside the room elements under consideration*
A0	*The reference absorption area of 10m2 and is independent of frequency*
Sf	*The total façade area of the room in question*
Swi	*The area of the windows in the room*
Sew	*The area of the external wall of the room*
Srr	*The area of the ceiling of the room (if applicable)*
S	*The total area of the elements through which sound enters the room*
Dne	*The insulation value of the trickle ventilator (if applicable)*
Rwi	*The sound reduction index of the window*
Rew	*The sound reduction index of the external wall*
Rrr	*The sound reduction index of the ceiling/roof (if applicable)*
A	*The equivalent absorption area of the receiving room where A=0.163V/T*
Formula	Leq2=Leqff+10log[A0/S*10^(-Dne/10)+Swi/S*10^(-Rwi/10)+Sew/10*10^(-Rew/10)+Srr/S*10^(-Rrr/10)] +10log(S/A) +3

	Octave Band Centre Frequency (Hz)					
	125	**250**	**500**	**1000**	**2000**	**4000**
Sf	11	11	11	11	11	11
Sr	0	0	0	0	0	0
Swi	3.2	3.2	3.2	3.2	3.2	3.2
Sew	7.8	7.8	7.8	7.8	7.8	7.8
Srr	0	0	0	0	0	0
S	11	11	11	11	11	11
A0	10	10	10	10	10	10
V	100	100	100	100	100	100
T (BS8233)	0.50	0.50	0.50	0.50	0.50	0.50
A	32	32	32	32	32	32
Daytime Leqff	68.6	60.1	55.7	53.4	49.3	46.5
Night time Leqff	64.8	57.8	53.8	50.8	45.8	41.3
Dne	40.0	44.0	45.0	51.0	56.0	61.0
Rwi	21.1	19.7	31.1	38.2	41.3	38.7
Rew	40.0	44.0	45.0	51.0	56.0	61.0
Rrr	28.0	34.0	40.0	45.0	49.0	53.0

Predicted dB(A) Level Within The Above Room During Daytime Hours (07:00-23:00)	$L_{Aeq\ 16\ HOUR}$	**28.0**	**dB(A)**
Predicted dB(A) Level Within The Above Room During Night Time Hours (23:00-07:00)	$L_{Aeq\ 8\ HOUR}$	**25.1**	**dB(A)**

8.3 Unit 1 – Bedroom 1

Proposed Window Configuration	**4 / 14 / 6 with MVHR**

Leqff	*The equivalent continuous sound pressure level outside the room elements under consideration*
A0	*The reference absorption area of 10m2 and is independent of frequency*
Sf	*The total façade area of the room in question*
Swi	*The area of the windows in the room*
Sew	*The area of the external wall of the room*
Srr	*The area of the ceiling of the room (if applicable)*
S	*The total area of the elements through which sound enters the room*
Dne	*The insulation value of the trickle ventilator (if applicable)*
Rwi	*The sound reduction index of the window*
Rew	*The sound reduction index of the external wall*
Rrr	*The sound reduction index of the ceiling/roof (if applicable)*
A	*The equivalent absorption area of the receiving room where A=0.163V/T*

Formula	Leq2=Leqff+10log[A0/S*10^(-Dne/10)+Swi/S*10^(-Rwi/10)+Sew/10*10^(-Rew/10)+Srr/S*10^(-Rrr/10)] +10log(S/A) +3

	Octave Band Centre Frequency (Hz)					
	125	**250**	**500**	**1000**	**2000**	**4000**
Sf	9	9	9	9	9	9
Sr	15	15	15	15	15	15
Swi	1.5	1.5	1.5	1.5	1.5	1.5
Sew	7.5	7.5	7.5	7.5	7.5	7.5
Srr	15	15	15	15	15	15
S	24	24	24	24	24	24
A0	10	10	10	10	10	10
V	43	43	43	43	43	43
T (BS8233)	0.50	0.50	0.50	0.50	0.50	0.50
A	14	14	14	14	14	14
Daytime Leqff	68.6	60.1	55.7	53.4	49.3	46.5
Night time Leqff	64.8	57.8	53.8	50.8	45.8	41.3
Dne	40.0	44.0	45.0	51.0	56.0	61.0
Rwi	24.4	26.5	36.2	41.7	40.3	42.6
Rew	40.0	44.0	45.0	51.0	56.0	61.0
Rrr	28.0	34.0	40.0	45.0	49.0	53.0

Predicted dB(A) Level Within The Above Room During Daytime Hours (07:00-23:00)	$L_{Aeq\ 16\ HOUR}$	**30.4**	**dB(A)**
Predicted dB(A) Level Within The Above Room During Night Time Hours (23:00-07:00)	$L_{Aeq\ 8\ HOUR}$	**27.1**	**dB(A)**

8.4 Unit 5 – Living/Kitchen

Proposed Window Configuration	**4 / 16 / 4 with MVHR**

Leqff	*The equivalent continuous sound pressure level outside the room elements under consideration*
A0	*The reference absorption area of 10m2 and is independent of frequency*
Sf	*The total façade area of the room in question*
Swi	*The area of the windows in the room*
Sew	*The area of the external wall of the room*
Srr	*The area of the ceiling of the room (if applicable)*
S	*The total area of the elements through which sound enters the room*
Dne	*The insulation value of the trickle ventilator (if applicable)*
Rwi	*The sound reduction index of the window*
Rew	*The sound reduction index of the external wall*
Rrr	*The sound reduction index of the ceiling/roof (if applicable)*
A	*The equivalent absorption area of the receiving room where A=0.163V/T*

Formula	Leq2=Leqff+10log[A0/S*10^(-Dne/10)+Swi/S*10^(-Rwi/10)+Sew/10*10^(-Rew/10)+Srr/S*10^(-Rrr/10)] +10log(S/A) +3

	Octave Band Centre Frequency (Hz)					
	125	**250**	**500**	**1000**	**2000**	**4000**
Sf	9	9	9	9	9	9
Sr	0	0	0	0	0	0
Swi	4.2	4.2	4.2	4.2	4.2	4.2
Sew	4.8	4.8	4.8	4.8	4.8	4.8
Srr	0	0	0	0	0	0
S	9	9	9	9	9	9
A0	10	10	10	10	10	10
V	74	74	74	74	74	74
T (BS8233)	0.50	0.50	0.50	0.50	0.50	0.50
A	24	24	24	24	24	24
Daytime Leqff	64.9	62.5	53.3	57.3	53.7	48.5
Night time Leqff	63.4	61.2	56.3	56.3	53.5	51.7
Dne	40.0	44.0	45.0	51.0	56.0	61.0
Rwi	21.1	19.7	31.1	38.2	41.3	38.7
Rew	40.0	44.0	45.0	51.0	56.0	61.0
Rrr	28.0	34.0	40.0	45.0	49.0	53.0

Predicted dB(A) Level Within The Above Room During Daytime Hours (07:00-23:00)	$L_{Aeq\ 16\ HOUR}$	**30.7**	**dB(A)**
Predicted dB(A) Level Within The Above Room During Night Time Hours (23:00-07:00)	$L_{Aeq\ 8\ HOUR}$	**29.6**	**dB(A)**

8.5 Unit 5 – Bedroom 1

Proposed Window Configuration	**4 / 14 / 6 with MVHR**

Leqff	*The equivalent continuous sound pressure level outside the room elements under consideration*
A0	*The reference absorption area of 10m2 and is independent of frequency*
Sf	*The total façade area of the room in question*
Swi	*The area of the windows in the room*
Sew	*The area of the external wall of the room*
Srr	*The area of the ceiling of the room (if applicable)*
S	*The total area of the elements through which sound enters the room*
Dne	*The insulation value of the trickle ventilator (if applicable)*
Rwi	*The sound reduction index of the window*
Rew	*The sound reduction index of the external wall*
Rrr	*The sound reduction index of the ceiling/roof (if applicable)*
A	*The equivalent absorption area of the receiving room where A=0.163V/T*

Formula	Leq2=Leqff+10log[A0/S*10^(-Dne/10)+Swi/S*10^(-Rwi/10)+Sew/10*10^(-Rew/10)+Srr/S*10^(-Rrr/10)] +10log(S/A) +3

	Octave Band Centre Frequency (Hz)					
	125	**250**	**500**	**1000**	**2000**	**4000**
Sf	9	9	9	9	9	9
Sr	15	15	15	15	15	15
Swi	1.3	1.3	1.3	1.3	1.3	1.3
Sew	7.7	7.7	7.7	7.7	7.7	7.7
Srr	15	15	15	15	15	15
S	24	24	24	24	24	24
A0	10	10	10	10	10	10
V	35	35	35	35	35	35
T (BS8233)	0.50	0.50	0.50	0.50	0.50	0.50
A	11	11	11	11	11	11
Daytime Leqff	64.9	62.5	53.3	57.3	53.7	48.5
Night time Leqff	63.4	61.2	56.3	56.3	53.5	51.7
Dne	40.0	44.0	45.0	51.0	56.0	61.0
Rwi	24.4	26.5	36.2	41.7	40.3	42.6
Rew	40.0	44.0	45.0	51.0	56.0	61.0
Rrr	28.0	34.0	40.0	45.0	49.0	53.0

Predicted dB(A) Level Within The Above Room During Daytime Hours (07:00-23:00)	$L_{Aeq\ 16\ HOUR}$	**29.7**	**dB(A)**
Predicted dB(A) Level Within The Above Room During Night Time Hours (23:00-07:00)	$L_{Aeq\ 8\ HOUR}$	**28.7**	**dB(A)**

8.6 Unit 8 – Living/Kitchen

Proposed Window Configuration	**4 / 16 / 4 with MVHR**

Leqff	*The equivalent continuous sound pressure level outside the room elements under consideration*
A0	*The reference absorption area of 10m2 and is independent of frequency*
Sf	*The total façade area of the room in question*
Swi	*The area of the windows in the room*
Sew	*The area of the external wall of the room*
Srr	*The area of the ceiling of the room (if applicable)*
S	*The total area of the elements through which sound enters the room*
Dne	*The insulation value of the trickle ventilator (if applicable)*
Rwi	*The sound reduction index of the window*
Rew	*The sound reduction index of the external wall*
Rrr	*The sound reduction index of the ceiling/roof (if applicable)*
A	*The equivalent absorption area of the receiving room where A=0.163V/T*

Formula	Leq2=Leqff+10log[A0/S*10^(-Dne/10)+Swi/S*10^(-Rwi/10)+Sew/10*10^(-Rew/10)+Srr/S*10^(-Rrr/10)] +10log(S/A) +3

	Octave Band Centre Frequency (Hz)					
	125	**250**	**500**	**1000**	**2000**	**4000**
Sf	9	9	9	9	9	9
Sr	0	0	0	0	0	0
Swi	4.2	4.2	4.2	4.2	4.2	4.2
Sew	4.8	4.8	4.8	4.8	4.8	4.8
Srr	0	0	0	0	0	0
S	9	9	9	9	9	9
A0	10	10	10	10	10	10
V	50	50	50	50	50	50
T (BS8233)	0.50	0.50	0.50	0.50	0.50	0.50
A	16	16	16	16	16	16
Daytime Leqff	68.6	60.1	55.7	53.4	49.3	46.5
Night time Leqff	64.8	55.6	51.2	48.4	44.2	40.7
Dne	40.0	44.0	45.0	51.0	56.0	61.0
Rwi	21.1	19.7	31.1	38.2	41.3	38.7
Rew	40.0	44.0	45.0	51.0	56.0	61.0
Rrr	28.0	34.0	40.0	45.0	49.0	53.0

Predicted dB(A) Level Within The Above Room During Daytime Hours (07:00-23:00)	$L_{Aeq\ 16\ HOUR}$	**32.1**	**dB(A)**
Predicted dB(A) Level Within The Above Room During Night Time Hours (23:00-07:00)	$L_{Aeq\ 8\ HOUR}$	**27.9**	**dB(A)**

8.7 Unit 8 – Bedroom 1

Proposed Window Configuration	**4 / 14 / 6 with MVHR**

Leqff	*The equivalent continuous sound pressure level outside the room elements under consideration*
A0	*The reference absorption area of 10m2 and is independent of frequency*
Sf	*The total façade area of the room in question*
Swi	*The area of the windows in the room*
Sew	*The area of the external wall of the room*
Srr	*The area of the ceiling of the room (if applicable)*
S	*The total area of the elements through which sound enters the room*
Dne	*The insulation value of the trickle ventilator (if applicable)*
Rwi	*The sound reduction index of the window*
Rew	*The sound reduction index of the external wall*
Rrr	*The sound reduction index of the ceiling/roof (if applicable)*
A	*The equivalent absorption area of the receiving room where A=0.163V/T*

Formula	Leq2=Leqff+10log[A0/S*10^(-Dne/10)+Swi/S*10^(-Rwi/10)+Sew/10*10^(-Rew/10)+Srr/S*10^(-Rrr/10)] +10log(S/A) +3

	Octave Band Centre Frequency (Hz)					
	125	**250**	**500**	**1000**	**2000**	**4000**
Sf	9	9	9	9	9	9
Sr	15	15	15	15	15	15
Swi	1.3	1.3	1.3	1.3	1.3	1.3
Sew	7.7	7.7	7.7	7.7	7.7	7.7
Srr	15	15	15	15	15	15
S	24	24	24	24	24	24
A0	10	10	10	10	10	10
V	35	35	35	35	35	35
T (BS8233)	0.50	0.50	0.50	0.50	0.50	0.50
A	11	11	11	11	11	11
Daytime Leqff	68.6	60.1	55.7	53.4	49.3	46.5
Night time Leqff	64.8	55.6	51.2	48.4	44.2	40.7
Dne	40.0	44.0	45.0	51.0	56.0	61.0
Rwi	24.4	26.5	36.2	41.7	40.3	42.6
Rew	40.0	44.0	45.0	51.0	56.0	61.0
Rrr	28.0	34.0	40.0	45.0	49.0	53.0

Predicted dB(A) Level Within The Above Room During Daytime Hours (07:00-23:00)	$L_{Aeq\ 16\ HOUR}$	**31.2**	**dB(A)**
Predicted dB(A) Level Within The Above Room During Night Time Hours (23:00-07:00)	$L_{Aeq\ 8\ HOUR}$	**27.2**	**dB(A)**

8.8 Ventilation (D_{ne})

Mechanical Ventilation Heat Recovery

8.9 Glazing (R_{wi})

Octave Band Frequency	125	250	500	1000	2000	4000
4mm glass / 14mm air gap / 6mm glass	24.4	26.5	36.2	41.7	40.3	42.6
4mm glass / 16mm air gap / 4mm glass	21.1	19.7	31.1	38.2	41.3	38.7

8.10 Walls (R_{ew})

Octave Band Frequency	125	250	500	1000	2000	4000
Brick and Concrete Block	40.0	44.0	45.0	51.0	56.0	61.0

8.11 Roof (R_{rr})

Octave Band Frequency	125	250	500	1000	2000	4000
Minimum Value	28.0	34.0	40.0	45.0	49.0	53.0

The above are minimum construction attenuation values and should alternative methods be selected; these should be equal to or greater than the above corresponding values. Calculations carried out have indicated the following specifications should be installed for this site

9 ASSESSMENT

PROPOSED VENTILATION AND GLAZING PLAN

4MM GLASS / 14MM AIR GAP / 6MM GLASS & MVHR

4MM GLASS / 16MM AIR GAP / 4MM GLASS & MVHR

The development should be designed with a 4mm glass / 14mm air gap / 6mm glass double glazed windows and a MHVR to all rooms facing the railway line on the first floor to ensure the internal noise levels are acceptable in terms of the assessment to British Standard 8233: 2014. All other windows on the first and second floor should be designed with a 4mm glass / 16mm air gap / 4mm glass standard double glazing and MHVR.

10 VIBRATION ASSESSMENT

10.1 ASSESSMENT CRITERIA

Ground borne vibration needs to be assessed with regard to the likelihood of disturbance to humans and damage to building structure. With regard to human disturbance, vibration criteria are specified in terms of Vibration Dose Values (VDV) in accordance with BS 64722. The following table shows the VDV with various degrees of adverse comment, which may be expected in residential buildings.

For residential buildings	Low probability of adverse comment	Adverse comment possible	Adverse comment probable
16 hr day 07:00 to 23:00	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6

Table 1 Vibration Dose Values (given in m/s1.75)

The vibration dose reflects the accumulated acceleration vibration value over a given time period, integrated by time on a root mean quad basis, hence the unit m/s1.75.

Human beings have different sensitivity to vibration in different directions, and it is relevant to consider vibration in all three axes together as a resultant value.

In terms of the likelihood of damage to buildings, vibration is measured in peak particle velocity (ppv) mm/s and assessed in accordance with BS 73853. In this particular case, the main sources of vibration are trains and these are considered to cause transient vibration. The BS7385 standard states that for transient vibration, guide values at which cosmetic damage could occur to residential buildings are 15 mm/s at 4 Hz, rising to 20 mm/s at 15 Hz and rising further to 50 mm/s at 40 Hz and above for new buildings. These limits can be reduced by 50% for older buildings.

[2] BS 6472:, Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz)
[2] BS 7385:, Evaluation and measurement for vibration in buildings

10.2 RESULTS & ASSESSMENT OF VIBRATION MEASUREMENTS

The vibration monitor was set to record ppv and vdv and left unattended for the duration of the survey. Full measurement results are given in the table below.

4th December 2015 – DAYTIME										
Ev 001	Vibration Dose Value							Peak Particle Velocity		
16 Hour	**X**	**Y**	**Z**	**X**	**Y**	**Z**		**Max**	**Time**	**Date**
	0.026	0.026	0.04					.350mm/s	07:49:30	04/12/2015
1 Hour	**X**	**Y**	**Z**	**X**	**Y**	**Z**		**Max**	**Time**	**Date**
Hour 1	0.013	0.013	0.02	0.013	0.013	0.02		.350mm/s	07:49:30	04/12/2015
Hour 2	0.013	0.013	0.02	0.015	0.015	0.024		.150mm/s	08:00:10	04/12/2015
Hour 3	0.013	0.013	0.02	0.017	0.017	0.027		.175mm/s	09:02:10	04/12/2015
Hour 4	0.013	0.013	0.02	0.018	0.018	0.029		.150mm/s	10:00:10	04/12/2015
Hour 5	0.013	0.013	0.018	0.02	0.019	0.03		.175mm/s	11:45:00	04/12/2015
Hour 6	0.013	0.013	0.019	0.021	0.02	0.031		.150mm/s	12:00:10	04/12/2015
Hour 7	0.013	0.013	0.019	0.021	0.021	0.032		.175mm/s	13:02:40	04/12/2015
Hour 8	0.013	0.013	0.019	0.022	0.022	0.033		.150mm/s	14:00:10	04/12/2015
Hour 9	0.013	0.013	0.02	0.023	0.023	0.034		.350mm/s	15:21:00	04/12/2015
Hour 10	0.013	0.013	0.021	0.023	0.023	0.035		.175mm/s	16:59:20	04/12/2015
Hour 11	0.013	0.013	0.021	0.024	0.024	0.036		.175mm/s	17:41:10	04/12/2015
Hour 12	0.013	0.013	0.021	0.025	0.024	0.037		.150mm/s	18:00:10	04/12/2015
Hour 13	0.013	0.013	0.02	0.025	0.025	0.038		.150mm/s	19:00:10	04/12/2015
Hour 14	0.013	0.013	0.021	0.025	0.025	0.039		.150mm/s	20:00:10	04/12/2015
Hour 15	0.013	0.013	0.02	0.026	0.026	0.04		.350mm/s	21:52:20	04/12/2015
Hour 16	0.013	0.013	0.02	0.026	0.026	0.04		.350mm/s	22:30:50	04/12/2015

4th – 5th December 2015 – NIGHT TIME										
Ev 002	Vibration Dose Value							Peak Particle Velocity		
8 Hour	X	Y	Z	X	Y	Z		Max	Time	Date
	0.022	0.022	0.029					.150mm/s	23:00:10	04/12/2015
1 Hour	X	Y	Z	X	Y	Z		Max	Time	Date
Hour 1	0.013	0.013	0.017	0.013	0.013	0.017		.150mm/s	23:00:40	04/12/2015
Hour 2	0.013	0.013	0.017	0.016	0.015	0.02		.150mm/s	00:00:10	05/12/2015
Hour 3	0.013	0.013	0.017	0.017	0.017	0.023		.150mm/s	01:00:10	05/12/2015
Hour 4	0.013	0.013	0.017	0.019	0.018	0.024		.150mm/s	02:00:10	05/12/2015
Hour 5	0.013	0.013	0.017	0.02	0.019	0.026		.150mm/s	03:00:10	05/12/2015
Hour 6	0.013	0.013	0.017	0.021	0.02	0.027		.150mm/s	04:00:10	05/12/2015
Hour 7	0.013	0.013	0.017	0.022	0.021	0.028		.150mm/s	05:00:10	05/12/2015
Hour 8	0.013	0.013	0.018	0.022	0.022	0.029		.150mm/s	06:00:10	05/12/2015

5th December 2015 – DAYTIME										
Ev 003	Vibration Dose Value							Peak Particle Velocity		
16 Hour	X	Y	Z	X	Y	Z		Max	Time	Date
	0.026	0.026	0.042					.350mm/s	14:03:40	05/12/2015
1 Hour	X	Y	Z	X	Y	Z		Max	Time	Date
Hour 1	0.013	0.013	0.019	0.013	0.013	0.019		.150mm/s	07:00:40	05/12/2015
Hour 2	0.013	0.013	0.021	0.015	0.015	0.024		.250mm/s	08:51:10	05/12/2015
Hour 3	0.013	0.013	0.02	0.017	0.017	0.027		.150mm/s	09:00:10	05/12/2015
Hour 4	0.013	0.013	0.021	0.018	0.018	0.029		.175mm/s	10:55:40	05/12/2015
Hour 5	0.013	0.013	0.021	0.02	0.019	0.031		.150mm/s	11:00:10	05/12/2015
Hour 6	0.013	0.013	0.021	0.021	0.02	0.032		.150mm/s	12:00:10	05/12/2015
Hour 7	0.013	0.013	0.02	0.021	0.021	0.034		.150mm/s	13:00:10	05/12/2015
Hour 8	0.013	0.013	0.021	0.022	0.022	0.035		.350mm/s	14:03:40	05/12/2015
Hour 9	0.013	0.013	0.021	0.023	0.023	0.036		.150mm/s	15:00:10	05/12/2015
Hour 10	0.013	0.013	0.021	0.023	0.023	0.037		.200mm/s	16:32:00	05/12/2015
Hour 11	0.013	0.013	0.021	0.024	0.024	0.038		.150mm/s	17:00:10	05/12/2015
Hour 12	0.013	0.013	0.021	0.024	0.024	0.039		.350mm/s	18:24:20	05/12/2015
Hour 13	0.013	0.013	0.02	0.025	0.025	0.04		.175mm/s	19:22:00	05/12/2015
Hour 14	0.013	0.013	0.02	0.025	0.025	0.04		.150mm/s	20:00:10	05/12/2015
Hour 15	0.013	0.013	0.02	0.026	0.026	0.041		.150mm/s	21:00:10	05/12/2015
Hour 16	0.013	0.013	0.021	0.026	0.026	0.042		.175mm/s	22:07:00	05/12/2015

5th – 6th December 2015 – NIGHT TIME										
Ev 004	Vibration Dose Value							Peak Particle Velocity		
8 Hour	X	Y	Z	X	Y	Z		Max	Time	Date
	0.024	0.022	0.028					.350mm/s	23:05:20	06/12/2015
1 Hour	X	Y	Z	X	Y	Z		Max	Time	Date
Hour 1	0.014	0.013	0.017	0.014	0.013	0.017		.350mm/s	23:05:20	05/12/2015
Hour 2	0.014	0.013	0.017	0.017	0.015	0.02		.150mm/s	00:00:10	06/12/2015
Hour 3	0.014	0.013	0.017	0.019	0.017	0.022		.150mm/s	01:00:10	06/12/2015
Hour 4	0.014	0.013	0.016	0.02	0.018	0.024		.150mm/s	02:00:10	06/12/2015
Hour 5	0.014	0.013	0.016	0.021	0.019	0.025		.150mm/s	03:00:10	06/12/2015
Hour 6	0.014	0.013	0.016	0.022	0.02	0.026		.150mm/s	04:00:10	06/12/2015
Hour 7	0.014	0.013	0.016	0.023	0.021	0.027		.150mm/s	05:00:10	06/12/2015
Hour 8	0.014	0.013	0.016	0.024	0.022	0.028		.200mm/s	06:04:20	06/12/2015

Table 2 Results of ppv and vdv measurements

Detailed results of the PPV and VDV long term vibration measurements are given in Table 1 above.

The vdv results are summarised in the table below for the daytime and night-time periods.

Time Period	Vibration Dose Value m/s1.75			Peak Particle Velocity mm/s
	L	T	V	Resultant Vector
4th December 2015 – 16 Hr	0.026	0.026	0.04	.350mm/s
5th December 2015 – 16 Hr	0.026	0.026	0.042	.350mm/s
4th – 5th December 2015 – 8 Hr	0.022	0.022	0.029	.150mm/s
5th – 6th December 2015 – 8 Hr	0.024	0.022	0.028	.350mm/s

Table 3 Summary of daily VDV and PPV

*Denotes initial set up values of vibration.

The above table demonstrates that no detrimental or structural vibration levels have been measured and therefore the probability of neighbouring building damage is low. However, to further protect residents, the replacement of the slab is to be incorporated into the proposed development programme.

11 NPPF & NPSE

The National Planning Policy Framework 2012 (NPPF) and assessments to the Noise Policy Statement for England 2010 (NPSE) should be made in conjunction with each other. Paragraph 123 of the National Planning Policy Framework (NPPF) states the following:

Planning polices and decisions should aim to:

- avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;
- recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and
- Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

The Noise Policy Statement for England gives various levels of effect as detailed within this report.

With the glazing / ventilation specifications achieved within this report, the development can be implemented within the guidelines of the aforementioned documents and ensure a development conclusion of **NOEL – No Observed Effect Level** This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

12 CONCLUSION

Levels have been recorded and assessments made in accordance with the relevant standards. Internal criteria's have been set and calculations made in order to determine the minimum construction details required in order to meet the desired level within the proposed residential dwellings and satisfy the local council's requirements.

The development should be designed with a 4mm glass / 14mm air gap / 6mm glass double glazed windows and a MHVR to all rooms facing the railway line on the first floor to ensure the internal noise levels are acceptable in terms of the assessment to British Standard 8233: 2014. All other windows on the first and second floor should be designed with a 4mm glass / 16mm air gap / 4mm glass standard double glazing and MHVR.

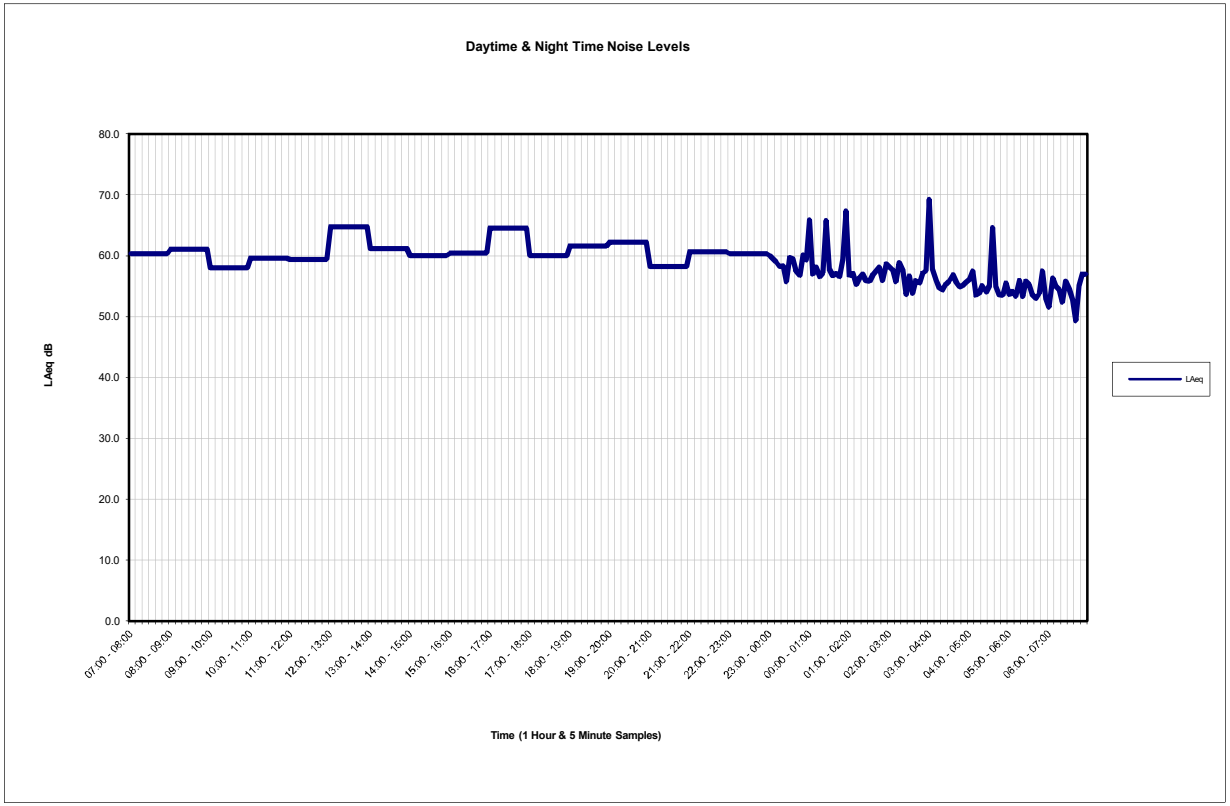
This report and subsequent calculations and assessments have demonstrated that mitigation measures can be introduced to the site in order to ensure compliance with BS 8233: 2014 for predicted internal noise levels within dwellings.

The results of the vibration levels measured, which would have a firm foundation, are below the range associated with 'low probability of adverse comment' and below the limit at which cosmetic damage to buildings is likely. Consequently, vibration of these magnitudes is not considered to cause any adverse comments from existing residents. However, to further protect residents, the replacement of the slab is to be incorporated into the proposed development programme.

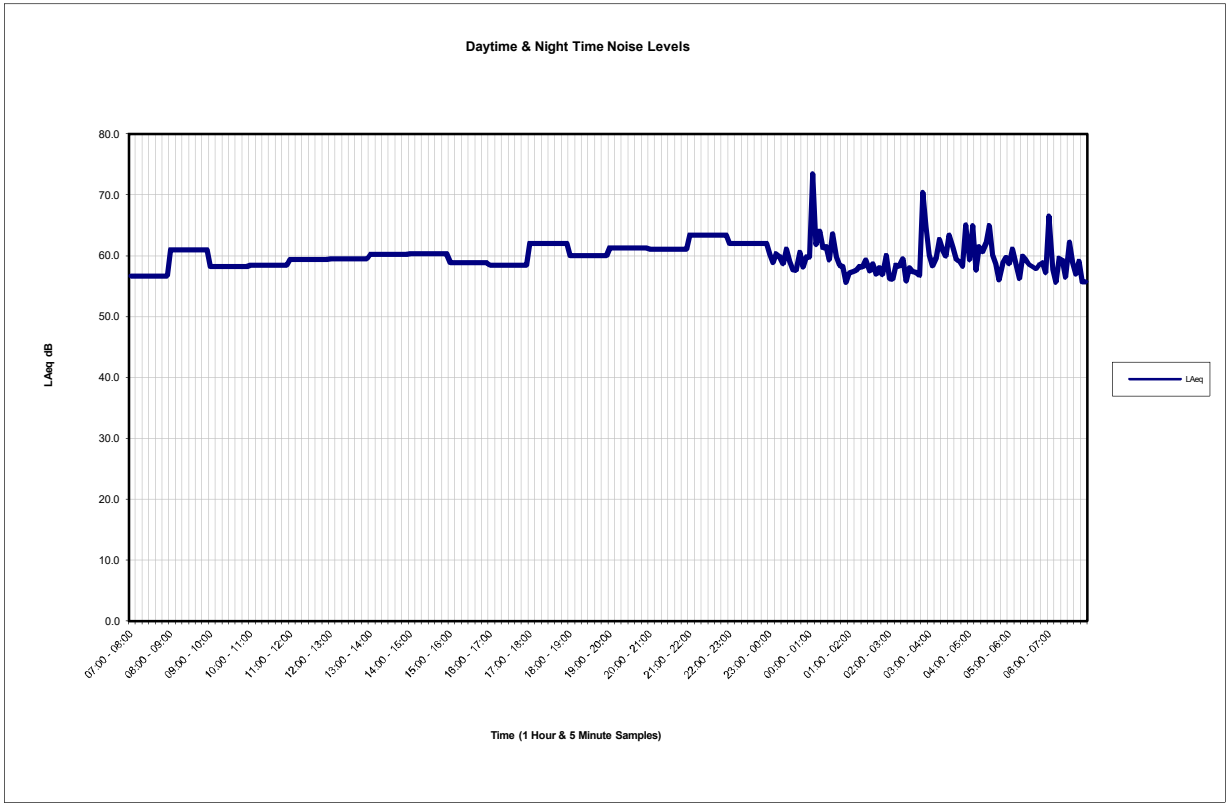
Based on the calculations and assessments made within this report it is the professional opinion of Sound Advice Acoustics Ltd that the aforementioned planning condition can be discharged with the design proposed detailed within this report implemented accordingly.

#END OF REPORT#

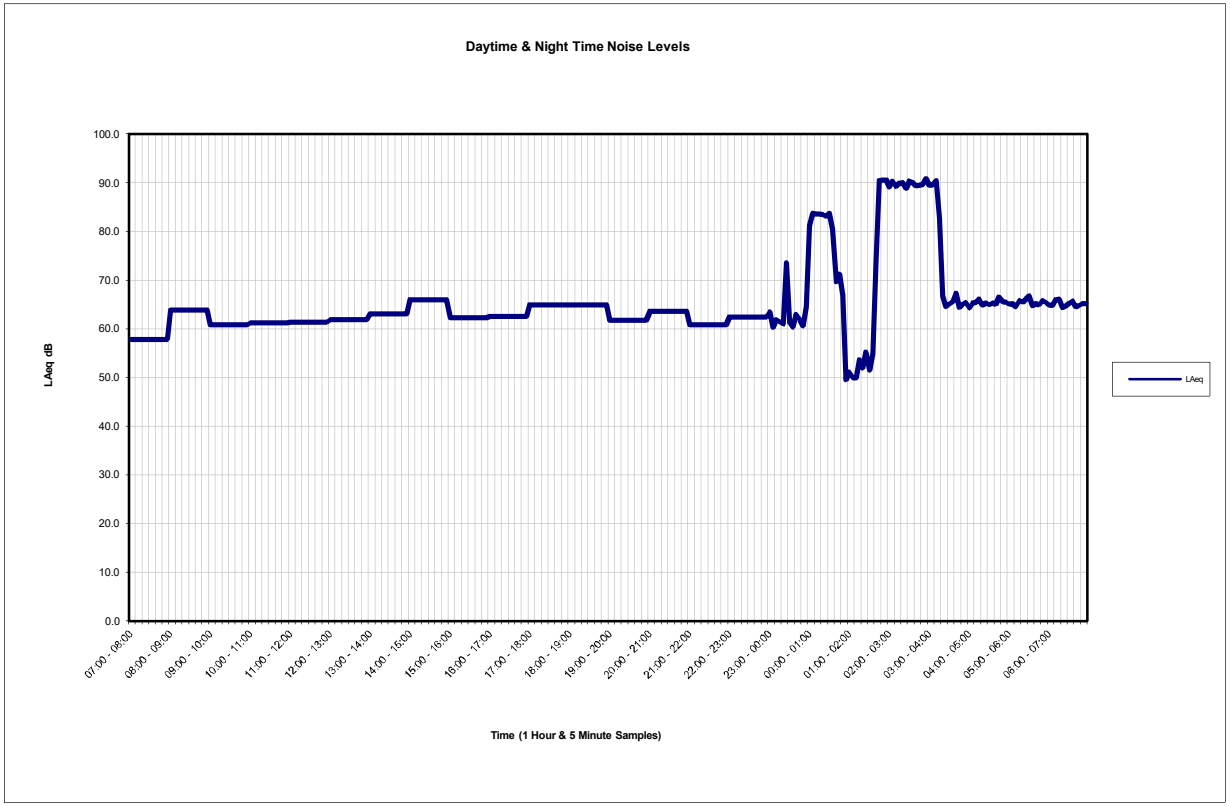
NOISE LEVEL SUMMARY ASSESSMENT																
Date / Time	LAeq	Lmax	Lmin	LA10	LA50	LA90	Octave Band Centre Frequency (Hz) 31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00 DAYTIME AVERAGE $L_{Aeq\ 16\ HOUR}$	61.2	81.3	48.9	62.1	56.2	51.9	69.1	65.1	64.9	62.5	53.3	57.3	53.7	48.5	40.7	23.0
23:00 - 07:00 NIGHT TIME AVERAGE $L_{Aeq\ 8\ HOUR}$	58.3	78.8	46.9	59.2	54.0	50.0	67.6	62.8	61.8	60.0	51.1	54.4	50.2	45.5	39.0	23.8



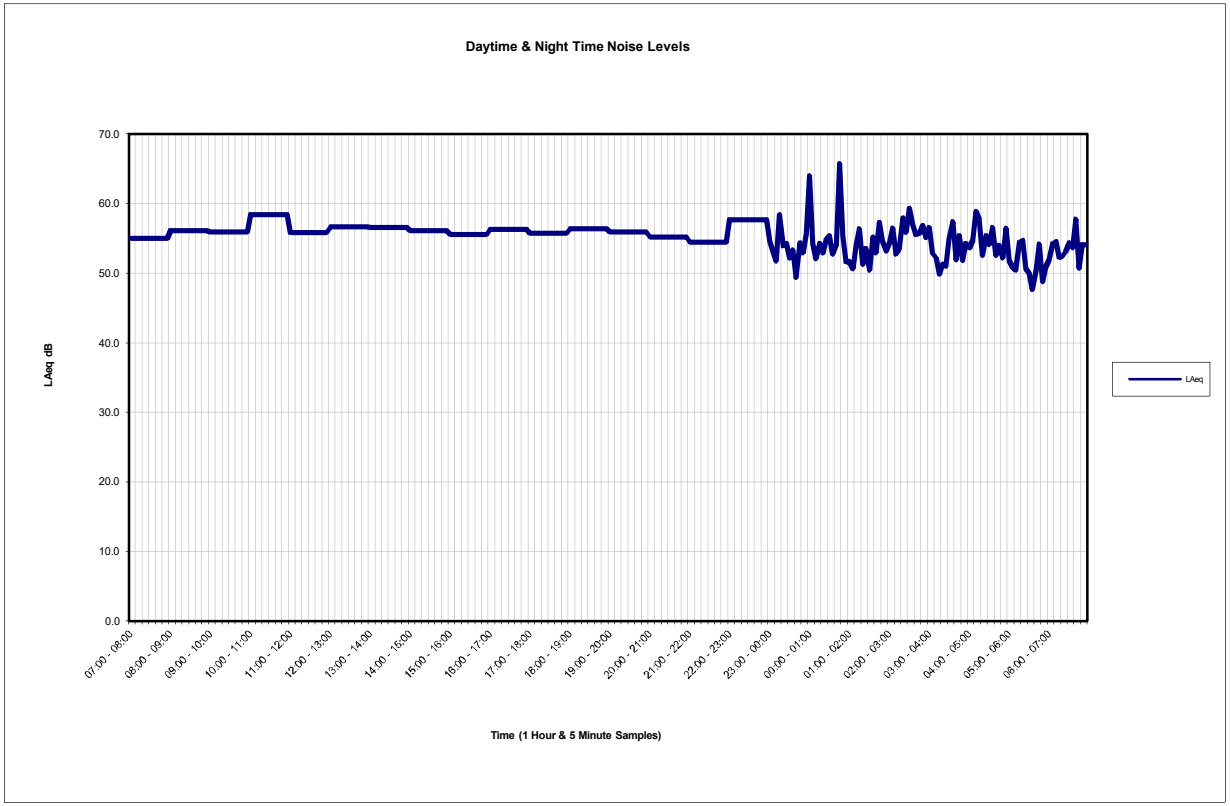
NOISE LEVEL SUMMARY ASSESSMENT																
Date / Time	LAeq	Lmax	Lmin	LA10	LA50	LA90	Octave Band Centre Frequency (Hz) 31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00 DAYTIME AVERAGE $L_{Aeq\ 16\ HOUR}$	60.4	79.8	49.5	62.4	56.8	52.7	69.8	65.0	63.7	61.5	53.0	56.0	52.8	50.1	39.5	26.8
23:00 - 07:00 NIGHT TIME AVERAGE $L_{Aeq\ 8\ HOUR}$	61.3	84.5	49.3	62.5	56.7	52.5	68.2	64.2	63.4	61.2	56.3	56.3	53.5	51.7	41.0	37.1



NOISE LEVEL SUMMARY ASSESSMENT																
Date / Time	LAeq	Lmax	Lmin	LA10	LA50	LA90	Octave Band Centre Frequency (Hz) 31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00 DAYTIME AVERAGE $L_{Aeq\ 16\ HOUR}$	62.9	83.2	49.9	64.9	58.8	53.4	68.5	65.6	64.0	63.0	58.7	59.5	53.9	48.3	31.8	20.9
23:00 - 07:00 NIGHT TIME AVERAGE $L_{Aeq\ 8\ HOUR}$	83.2	94.3	67.6	85.5	82.7	78.0	59.0	57.5	65.4	76.3	74.9	76.3	79.2	73.7	61.5	48.6

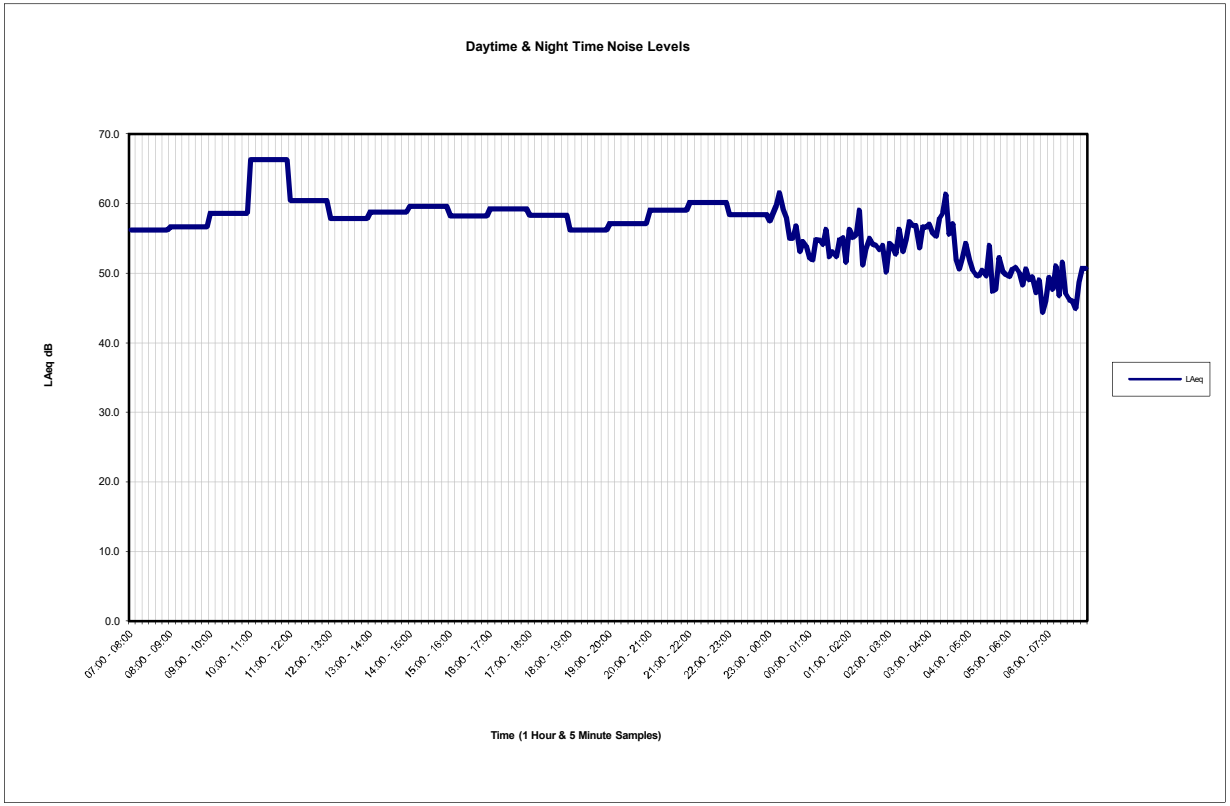


NOISE LEVEL SUMMARY ASSESSMENT																
Date / Time	LAeq	Lmax	Lmin	LA10	LA50	LA90	Octave Band Centre Frequency (Hz) 31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00 DAYTIME AVERAGE $L_{Aeq\ 16\ HOUR}$	56.3	72.4	47.3	59.1	51.3	48.9	73.1	68.2	61.4	57.8	53.8	50.8	45.8	41.3	38.2	26.8
23:00 - 07:00 NIGHT TIME AVERAGE $L_{Aeq\ 8\ HOUR}$	55.3	73.9	44.2	58.4	49.5	46.2	79.9	73.5	64.8	55.6	51.2	48.4	44.2	40.7	37.4	31.4

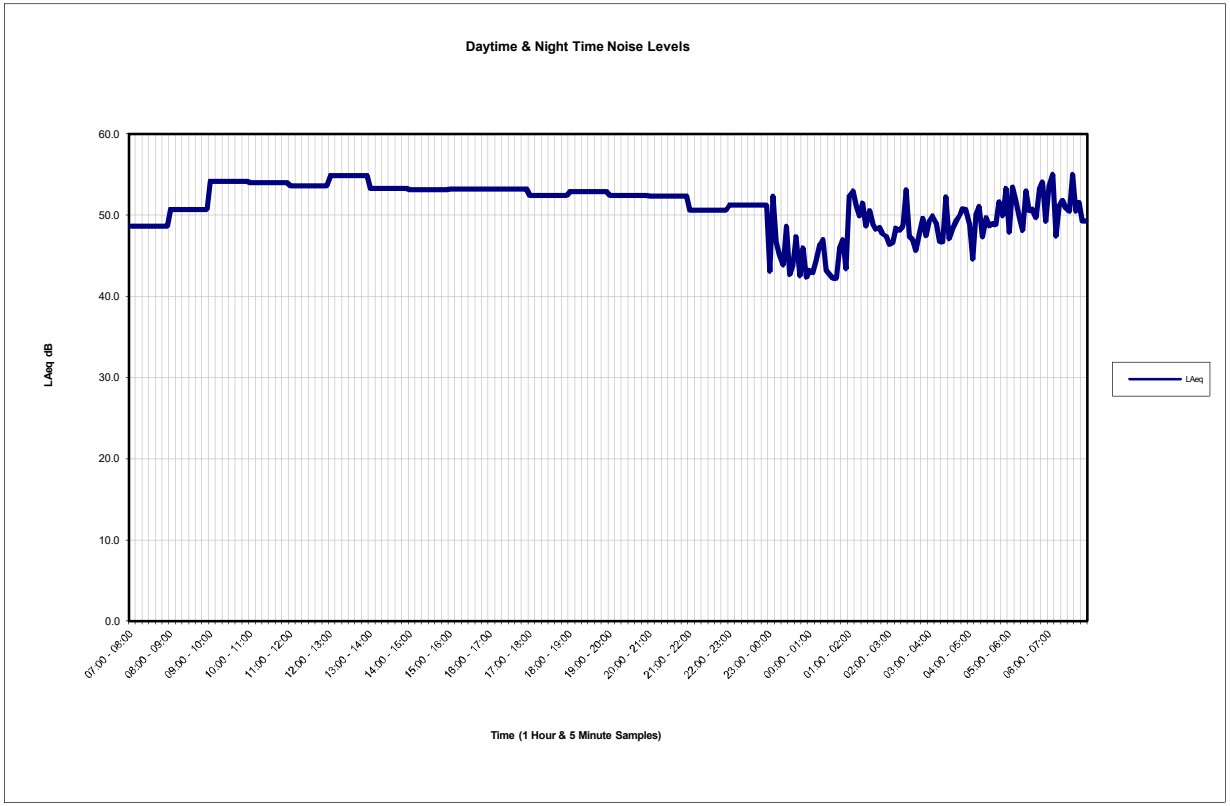


LUCY - REAR

NOISE LEVEL SUMMARY ASSESSMENT																
Date / Time	LAeq	Lmax	Lmin	LA10	LA50	LA90	Octave Band Centre Frequency (Hz) 31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00 DAYTIME AVERAGE $L_{Aeq\ 16\ HOUR}$	59.7	76.6	52.0	62.5	56.0	53.6	82.4	76.5	68.6	60.1	55.7	53.4	49.3	46.5	43.2	34.4
23:00 - 07:00 NIGHT TIME AVERAGE $L_{Aeq\ 8\ HOUR}$	54.4	73.1	45.4	56.8	50.1	47.5	78.8	73.0	64.2	54.9	51.0	47.3	42.5	39.1	36.5	30.8



NOISE LEVEL SUMMARY ASSESSMENT																
Date / Time	LAeq	Lmax	Lmin	LA10	LA50	LA90	Octave Band Centre Frequency (Hz) 31.5	63	125	250	500	1.0 k	2.0 k	4.0 k	8.0 k	16.0 k
07:00 - 23:00 DAYTIME AVERAGE $L_{Aeq\ 16\ HOUR}$	52.8	69.6	43.5	55.2	46.9	44.9	72.8	67.3	59.3	54.1	48.8	47.9	42.1	39.1	37.2	25.9
23:00 - 07:00 NIGHT TIME AVERAGE $L_{Aeq\ 8\ HOUR}$	49.7	63.2	43.4	52.1	46.9	45.0	64.7	58.1	53.9	50.6	45.2	45.6	40.7	35.5	28.3	15.6



LUCY - REAR