

LENDLEASE

POTATO WHARF, MANCHESTER – BLOCKS 3 AND 4

REPORT ON EXISTING NOISE CLIMATE

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AUDIT SHEET

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R2	Updated site layout	13/12/2016	DM	AM

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EXECUTIVE SUMMARY

Hoare Lea Acoustics have been appointed by Lend Lease to undertake an environmental noise survey and planning assessment for the proposed Blocks 3 and 4 residential development at Potato Wharf in Manchester.

A detailed environmental noise survey has been carried out across the site and a noise egress and façade sound insulation assessment has been undertaken in accordance with Manchester City Council (MCC) planning requirements.

Based on MCC requirements, all plant, equipment and machinery associated with the development shall be controlled to ensure that the overall sound pressure level at 1 m from the façade of the adjacent residential block (Block 2) does not exceed L_{Aeq} 44 dB during the daytime (07:00 to 23:00 hrs) and L_{Aeq} 34 dB during the night-time (23:00 to 07:00 hrs). If the plant contains any tonal characteristics a further correction will be required.

In addition, the minimum sound insulation requirements of the building façade have been determined to enable noise ingress from road traffic and rail / tram noise to be adequately controlled in the apartment bedroom and living rooms to meet MCC internal planning criteria.

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1. INTRODUCTION

Hoare Lea Acoustics has been appointed by Lend Lease to undertake an environmental noise survey and acoustic planning assessment for the proposed Blocks 3 and 4 residential developments at Potato Wharf in Manchester.

An environmental noise survey has been carried out to determine the existing ambient and background noise levels around the proposed site.

Based on the results from the survey the maximum plant noise egress limits have been determined and guidance on the façade sound insulation requirements has been provided in accordance with the requirements specified in Manchester City Councils planning guidance.

2. SITE AND DEVELOPMENT DETAILS

The proposed residential Blocks 3 and 4 are located at Potato Wharf in Castlefield, Manchester. The development comprises seven storeys of residential accommodation arranged over two buildings with a two storey link building which provides common facilities.

The development will provide a total of 191 apartments whilst the link building will provide a gym and social and recreational space.

The nearest existing residential properties are an earlier phase of apartments (Block 2) located to the east of the site.

To the south of the site is a viaduct carrying tram and train lines into Deansgate Station and the City. To the west of the site is the A57 Dawson Street.

An aerial view of the site showing the noise survey measurement positions is provided at Figure 1 below.

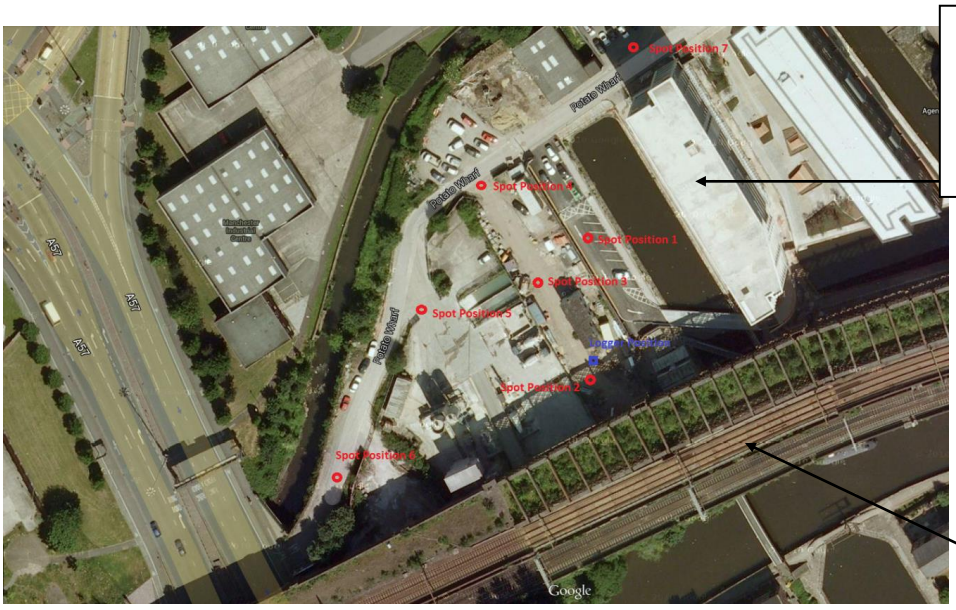


Figure 1 Site plan indicating location of Blocks 3 and 4 and environmental noise survey positions

3. ASSESSMENT CRITERIA

Guidance Document GD 03, entitled *'Public Protection Information for Developers (Version: 1.01)'* is the latest information on Manchester City Council policy with regards to the discharging of planning conditions imposed by the City Wide Environmental Protection Team. The guidance document is relied on here accordingly.

Section 3.9.1 Residential Developments states the following:

BS 8233 and the World Health Organisation (WHO) have recommended specific limits for internal noise levels inside residential properties to allow appropriate living and sleeping conditions. MCC has adopted the following internal noise limits for residential properties:

• Bedrooms (Night time - 23:00 to 07:00): 30dB LAeq and individual noise events should not normally exceed 45 dB (LAmax).

• Living Rooms (Day time 07:00 to 23:00): 40 dB (LAeq)

• Gardens/External Amenity Areas (Not applicable for City Centre developments and housing near busy roads): 55 dB (LAeq)

Where it is necessary to keep windows closed to achieve the required internal noise levels it may be a requirement to provide additional mechanical ventilation to ensure that residential properties can be adequately ventilated if its occupants choose to keep their windows closed for noise reasons. Any ventilation will need to meet the requirements of Part F of the Building Regulations, which will be assessed by the Building Control Department. Where additional ventilation is required it should be capable of achieving the same noise reduction as the closed glazing and building structure.

Section 3.9.4 Noise and Vibration from Fixed Plant / Equipment states the following:

Noise from fixed plant, equipment or machinery can be very annoying and disruptive to people living nearby, particularly where that item involved emits a noise with impulsive or tonal characteristics. Many of the noise complaints EPP receive about noise from plant, equipment and machinery specifically concern the character of the noise emitted. Any noise survey needs to consider not only the overall level of noise emitted but also its particular characteristics.

Any application for fixed plant, equipment or machinery must demonstrate that the noise will:

a) Achieve a noise level (LAeq) of at least 5 dB below the background noise level (LA90) at the nearest noise sensitive location at the quietest time the equipment will be in operation; and

b) Not contain any discernable tonal characteristics at the nearest noise sensitive location at the quietest time the equipment will be in operation.

With respect to part b) this can be achieved by providing product information from the manufacturer or supplier of the equipment demonstrating the equipment does not contain any significant tonal

element. This information would ordinarily be in the form of octave band noise level data. Where information of this kind is not available a consultant may choose to measure the octave band noise levels generated by the equipment in question where the equipment has already been installed elsewhere.

Where neither of the above are possible the applicant will be required to demonstrate that the noise (LAeq) from the equipment in question will achieve a level of 10 dB below the background noise level (LA90) at the nearest noise sensitive location at the quietest time the equipment will be in operation.

Where product data suggests there may be a tonal element to the noise (i.e. the octave band noise data shows a peak at a particular frequency) additional work will be required. In these circumstances a consultant will be required to demonstrate that noise from the equipment will be at least 5 dB below the background noise level (L90) in each octave band at the nearest noise sensitive location at the quietest time the equipment will be in operation.

Any application for fixed plant/equipment near noise sensitive locations should be supported by information from its manufacturer or supplier confirming the level of noise emitted by the equipment and, where available, its particular noise characteristics.

Where fixed plant, equipment or machinery is attached to a building the vibration caused by it can pass through the building structure and cause structure borne noise elsewhere in the building. Where fixed plant, equipment or machinery is installed in or on a building containing a noise sensitive use, structure borne noise should be considered in the noise survey and adequate control measures should be proposed. An example of where this would be required is where there is a proposal to install fixed plant or equipment on the roof of a residential apartment block.

It is recognised that the target level may not be achievable in all cases. Where this is the case the various noise control measures considered when coming to this conclusion should be discussed (i.e. relocation of noise sources, use of quieter equipment, enclosures, screening, and restriction of the hours of operation) and the achievable noise level should be identified. This information will allow us to make a judgment concerning the application and its likely impact on the surrounding area.

4. ENVIRONMENTAL NOISE SURVEY

An environmental noise survey was carried out between Thursday 16th April 2015 and Friday 17th April 2015. Additional site measurements have previously been carried out for the phase 2 development on 29th November 2012.

The purpose of the survey was to establish the typical ambient noise levels and background noise levels on site to assess noise break-in via the proposed building facade and to determine the minimum background noise levels in order to set maximum noise egress limits for new plant and machinery.

4.1 Attended measurements

Attended noise measurements were carried out around the site on Thursday 16 April 2015 and are indicated as Positions 1-7 in Figure 1. The measurements were undertaken to quantify the variation of noise around the development site.

Measurements were conducted over 5 minute periods with a RION NA-28 Sound Level Meter (SLM) mounted on a tripod approximately 1.2m above ground level and at least 3 m from any other reflective surface. The microphone was fitted with a windshield. The meter was calibrated before and after the survey and no significant drift was noted.

4.2 Unattended measurements

Unattended noise monitoring equipment was installed at the 'Logger position' indicated on Figure 1. The position was chosen to capture typical ambient noise levels and is considered representative of the background noise levels at the existing residential apartment block. A photo showing the unattended monitoring position in relation to the nearest dwelling is provided in Figure 2.

The equipment was set to record a continuous series of broadband and octave-band sound pressure levels between 14:44 hrs on Thursday 16 April 2015 and 13:34 hrs on Friday 17 April 2015.



Figure 2 Photo showing unattended monitoring position

4.3 Historical noise survey – Elevated monitoring position

The general noise climate on site is interrupted by higher, short duration, noise events attributable to the elevated tramway and railway line that lie approximately 20m and 30m respectively from the southernmost facades of the buildings. Tram movements occur every few minutes continuously throughout the day into the late evening whilst mainline railway activity is more intermittent but with occasional freight traffic in addition to the regular passenger services.

It was not possible to locate noise monitoring equipment at high level on the Block 3 and 4 site. However, during the design stages of the Block 2 (See Figure 2) a logging sound level meter was installed at Level 5 of development overlooking the tramway and railway lines. The meter was set to record continuously between 13:42 and 14:54 hrs on Thursday 29th November 2012 to determine typical pass-by sound levels for rail traffic.

4.4 Equipment Details

Table 1 summarises the details of the equipment used during the attended and unattended environmental noise survey. All equipment used was within dates of calibration and calibration certificates are available on request.

Table 1 Equipment used during environmental noise survey

ITEM	DESCRIPTION	SERIAL NUMBER	CALIBRATION DATE
Attended sound level meter	Rion - Sound Level Meter: NA-28 Rion - Pre-amplifier: NH-23 Rion - Microphone: UC-59	01260199 60102 05710	07/02/2014
Unattended Sound Level Meter	Svantek - Sound Level Meter: SVAN 949 Svantek - Microphone: 40AE Svantek - Pre-amplifier: SV-12	6749 49372 5916	11/11/2013

4.5 Weather Conditions

Weather reports for the area indicate that temperatures ranged between 5°C to 19°C, wind speeds were low and suggests that no rain occurred during the measurement period. The measured data is therefore considered suitable as being representative of typical conditions.

5. NOISE SURVEY RESULTS

5.1 Attended Survey

The results of the attended measurements are summarised in Table 2 below, with reference to the measurement positions shown in Figure 1.

The main sources of noise noted during the survey are described below:

- Frequent train and tram passes on the viaduct. This included passenger and freight trains.
- Road traffic noise from A57 and occasional vehicles from Potato Wharf and access to the adjacent residential block car park.

Position	Measurement period	L_{Aeq}	L_{Amax}	L_{A90}
1	14:55	56	69	48
	15:00	53	63	49
	15:05	54	64	49
2	15:13	56	69	50
	15:18	64	75	53
	15:23	58	71	51
3	15:35	54	64	49
	15:40	58	75	51
	15:45	54	65	49
4	15:54	53	61	48
	15:59	54	68	50
	16:04	53	61	49
5	16:18	57	66	53
	16:23	57	64	50
	16:28	58	66	53
6	16:36	67	72	59
7	16:44	57	69	50
	16:49	57	70	49

Table 2 Summary of results from attended noise survey on 16 April 2015

5.2 Unattended Survey

A graph showing the results from the unattended logging survey is provided in Appendix B.

The average noise levels measured during the unattended survey are presented in Table 3.

Table 3 Average noise levels measured during unattended survey

Date	Daytime (07:00-23:00)	Night (23:00-07:00)
	L_{Aeq} (dB)	L_{Aeq} (dB)
Thursday 16 April 15	57*	53
Friday 17 April 15	58*	-

*Measurement not made over full daytime period

The minimum noise levels measured during the survey are provided in Table 4.

Table 4 Minimum measured background noise levels

Date	Daytime (07:00-23:00)	Night (23:00-07:00)
	$L_{A90,5min}$ (dB)	$L_{A90,5min}$ (dB)
Thursday 16 April 15	49	39
Friday 17 April 15	50	-

5.3 Historical noise data

The results from the logging sound level meter at Level 5 of Block 2 indicated typical daytime ambient noise levels in the order of L_{Aeq} 60-65dB but increasing significantly during tram and rail movements. At the southernmost facades of the buildings, event sound levels during tram/train movements can increase to L_{Aeq} 80-85dB with highest levels generated by mainline movements and particularly freight traffic. Typical maximum levels during tram/train pass-by were in the range L_{Amax} 85-90dB.

Scheduled tram and train services extend into the early morning and late evening periods. There will also be occasional night time movements on the main line. On this basis, the typical levels for rail activity given above can occur during night time.

For positions along the buildings that are further from the railway, event noise levels will reduce due to distance attenuation and reduced angle of view/screening.

6. EXTERNAL NOISE LIMIT REQUIREMENTS

Based on the criteria stipulated by Manchester City Council (Section 3) the overall maximum sound pressure levels for fixed plant, equipment and machinery associated with the development shall not exceed the levels presented in Table 5.

Table 5 Maximum sound pressure level at 1 m from the nearest residential facade

Period	Limit sound level at 1m from the nearest residential window *
07:00 to 23:00 hrs	L_{Aeq} 44dB
23:00 to 07:00 hrs	L_{Aeq} 34dB

*If plant noise contains any tonal characteristics a further tonal correction shall be applied based on Manchester City Councils requirements.

At this stage, the design is not sufficiently advanced to specify specific attenuation measures and will need to be assessed in detail as the design progresses. However, all noise generating plant and equipment associated with the development will be designed to ensure that the noise egress limits specified above are achieved. The specific attenuation measures will depend on the type and location of the plant items but typical measures to be considered include in-duct attenuation, acoustics screening or enclosures, low noise equipment, acoustic lagging, and acoustically rated louvres.

7. FACADE DESIGN REQUIREMENTS

7.1 Glazing

Based on the results from the environmental noise surveys carried out across the site, the acoustic performance requirements of the glazing has been determined to achieve the internal noise level requirements specified in Section 3.

Calculations assume an approximate 50/50 split between the wall and glazing area with a minimum sound reduction index (R_w) of 45 dB assumed for the wall (eg, masonry wall) and all windows are closed.

The positioning and orientation of the building relative to nearby roads and the railway will alter incident sound levels at the individual elevations of the building. Considered on a specific room by room basis, this would result in a large range of performance requirements and window types. It is considered that this would not be practicable or cost effective and, consequently, the proposals are to rationalise and minimise the number of window types on the basis of generic requirements.

The following three window types are recommended at this stage. The highest performance requirements will be for bedrooms and particularly those nearest to the railway.

Table 6 Recommended acoustic performance for glazing to various facades

Type	Location	R_w	Octave band Centre Frequency (Hz)						Example Pilkington type
			125	250	500	1k	2k	4k	
1	Bedrooms adjacent railway	41	24	26	40	48	46	54	6/20/8.8
3	Living rooms adjacent railway	38	23	24	34	42	43	52	6/20/6.8
3	All other bedrooms	38	23	24	34	42	43	52	6/20/6.8
4	All other living rooms	34	22	21	29	40	41	42	6/20/4

Where alternative window types are to be used, the manufacturer's performance data must be at least equal to all of the quoted values above.

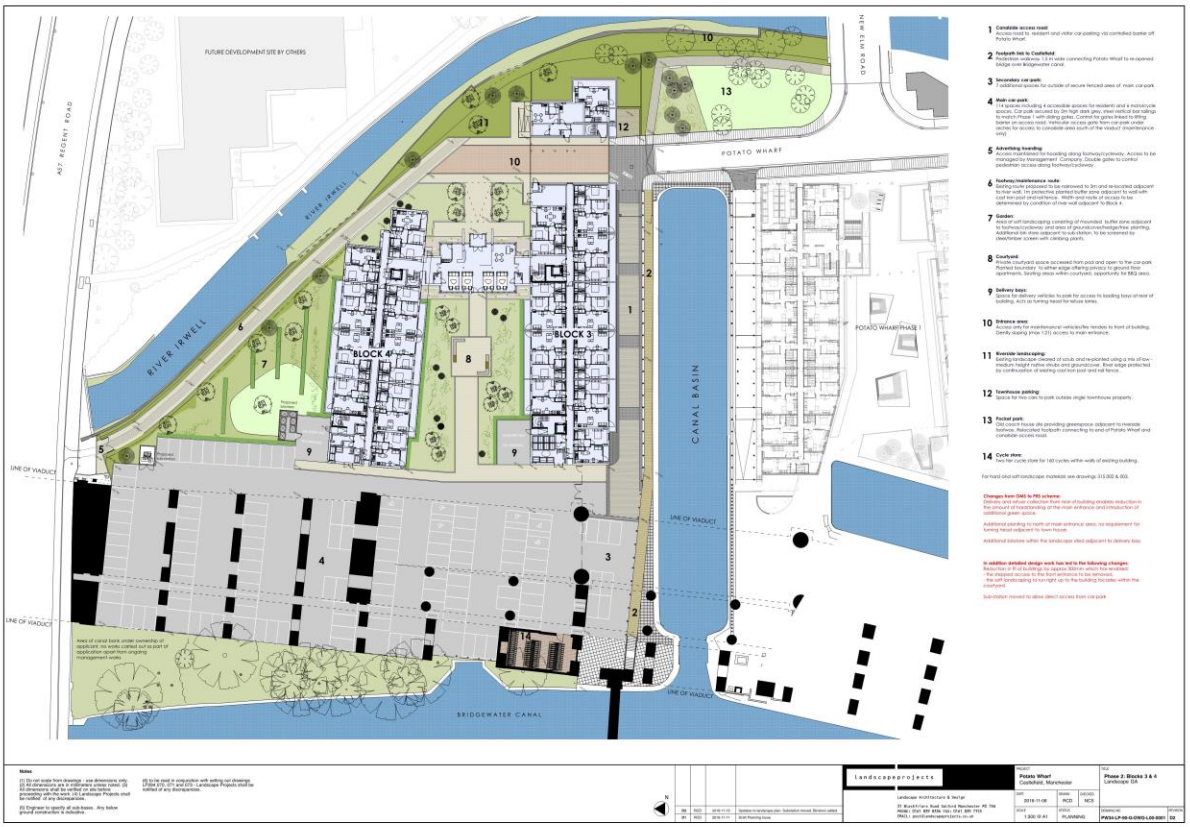
7.2 Forced Ventilation System

All mechanically assisted ventilation systems located within the external building envelopes, whether located in walls or glazing, shall not, when added to the intrusive noise components, result in any exceedance of the internal noise level criteria given in Section 3.

Individual (i.e. supplying only one dwelling) ventilation systems shall be selected and installed such that internal noise level criteria given in Section 3 above are not exceeded.

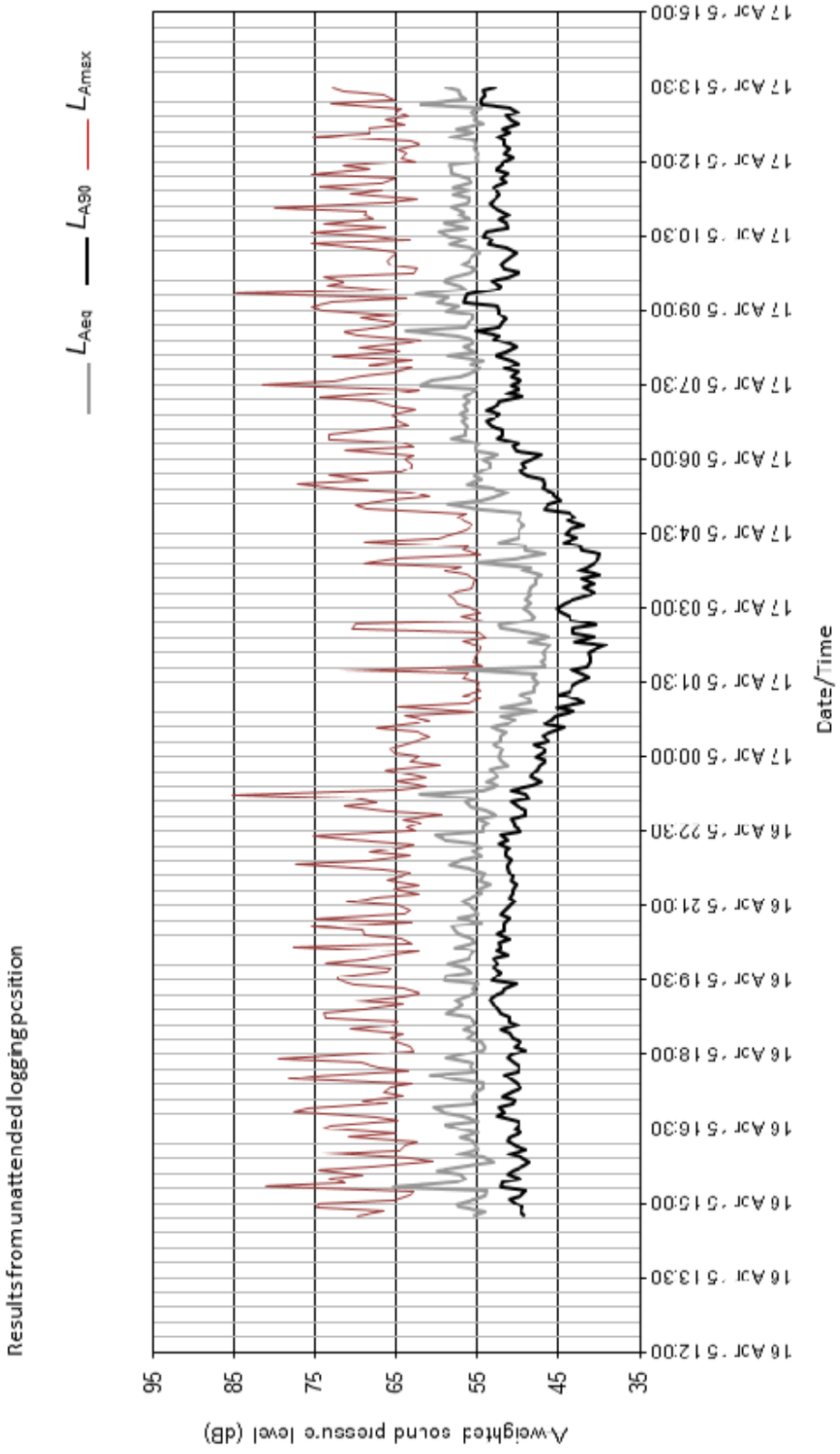
The requirements of BS6472:2008 ‘Guide to evaluation of human exposure to vibration in buildings (1Hz to 80Hz)’ as applied to residential dwellings shall be complied with as a maximum for all forced ventilation systems.

FIGURE 1 - PROPOSED SITE LAYOUT



APPENDIX A: UNATTENDED SITE MEASUREMENTS

A graph showing the results from the unattended measurement position is provided below.



APPENDIX B: GLOSSARY OF ACOUSTICAL TERMS USED

Decibel (dB)

The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithm is taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

Octave and Third Octave Bands

The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands. For example third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

A-Weighting

The 'A' weighting is a correction term applied to the frequency range in order to mimic the sensitivity of the human ear to noise. It is generally used to obtain an overall noise level from octave or third octave band frequencies. An 'A' weighted value would be written as dB(A).

$L_{eq,T}$

The $L_{eq,T}$ is a parameter defined as the equivalent continuous sound pressure level. Over a defined time period 'T', it is the sound pressure level equivalent to the acoustic energy of the fluctuating sound signal. The $L_{eq,T}$ can be seen to be an "average" sound pressure level over a given time period (although it is not an arithmetic average). Typically the $L_{eq,T}$ will be an 'A' weighted noise level in dB(A). It is commonly used to describe all types of environmental noise sources.

$L_{90,T}$

The $L_{90,T}$ is a parameter defined as the sound pressure level exceeded for 90% of the measurement period 'T'. It is a statistical parameter and can not be directly combined to other acoustic parameters. It is generally used to describe the prevailing background noise level or underlying noise level.

$L_{max,T}$

The $L_{max,T}$ is a parameter defined as the maximum sound pressure level that occurred during the time period 'T'. It is commonly used to describe the highest noise level that occurred during an event such as a vehicle pass-by.

Sound Reduction Index, R

This is defined mathematically as ten times the common logarithm (to base 10) of the ratio of the incident sound power on the building element under test to the transmitted sound power level. It is used to commonly describe the sound insulation of building products. The sound reduction index, is a laboratory measured value. The field measured value would be denoted as R'. There is often a significant difference between the R and R' values due to flanking noise and site workmanship. It is measured in decibels.