17 MURRAY STREET RESIDENTIAL DEVELOPMENT

ENVIRONMENTAL NOISE ASSESSMENT

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AUDIT SHEET

REVISION	DESCRIPTION	DATE	ISSUED BY	REVIEWED BY
0	Environmental noise assessment	30/07/2007	MR	BJ

Contents

1 INTRODUCTION

An environmental noise assessment has been undertaken by Hoare Lea Acoustics on behalf of Damsonetti Construction Ltd in relation to the proposed 17 Murray Street residential development, in the London Borough of Camden.

The purpose of this report is to support the application for planning permission, having regard to existing guidelines. This report is suitable for informing the client, the design team and Local authority (Planners, Environmental Health, Building Control).

The report firstly offers a description of the site and the proposed development. A summary of relevant planning and design criteria is then provided, followed by a description of baseline surveys required to evaluate environmental conditions at the site. The findings of the surveys, including both qualitative observations and objective measurement data, are then used to assess the suitability of the development site for the proposed scheme. Subsequent sections then discuss the types of mitigation strategies that may be employed to control any potential noise impacts affecting the proposed development.

2 SITE AND ENVIRONS

2.1 Description of the site

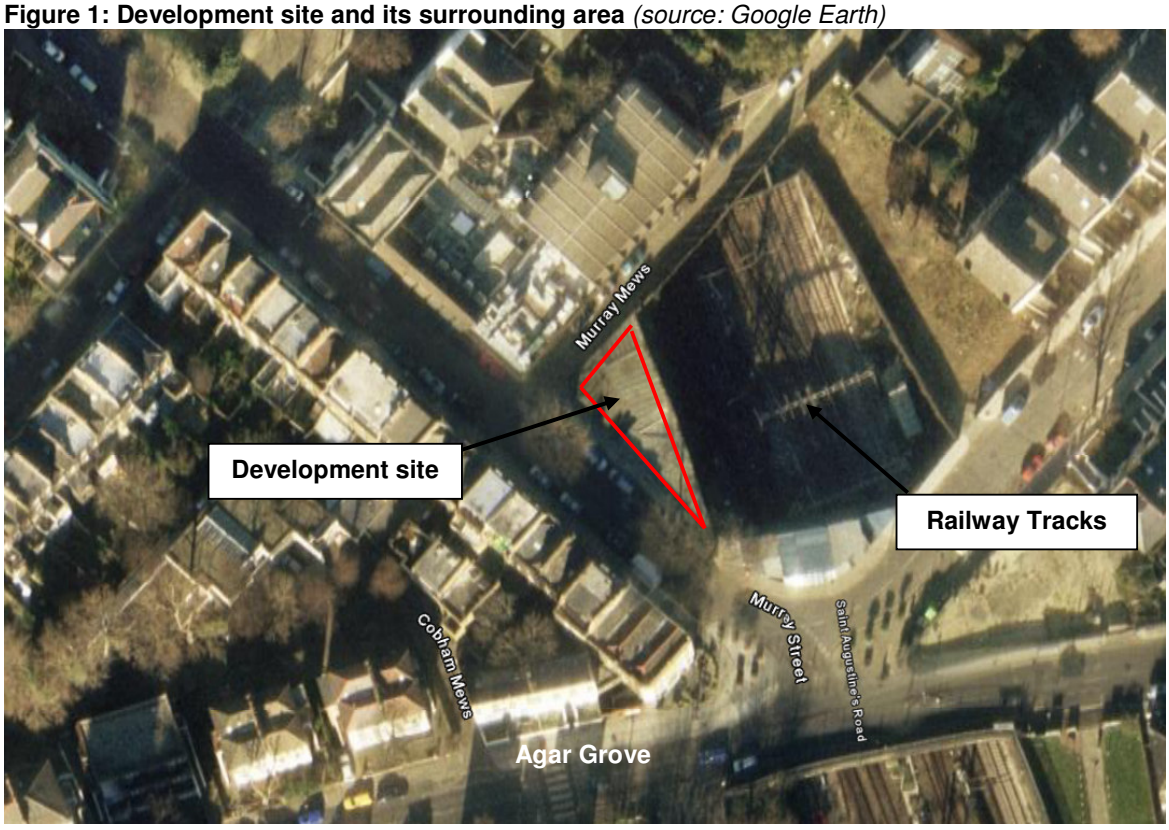
It is understood that the proposed development is a three storey building, which will comprise:

- Live work units along Murray Street at ground floor level.
- At first floor level and above, five residential dwellings

The site is bounded to the east by Murray Mews and Murray Street, to the west by railway lines, which are 8m below the pavement level. The proposed site is currently unoccupied. There is an existing 4m high boundary brick wall between the railway line and the proposed site. For aesthetic reason, it is understood that this wall is proposed to be reduced to 2.2m high.

The areas surrounding the development comprise mainly residential premises, retail units in Murray Street, and a public house at the junction of Agar Grove and Murray Street.

Figure 1: Development site and its surrounding area *(source: Google Earth)*



2.2 Local noise conditions

Environmental noise levels at the site are dominated by local road traffic movements, predominantly on Murray Street, with further contributions from Agar grove. Train movements increase the background noise for short periods. The railway lines are used by commercial trains serving St Pancras Station, which is located about 1 mile to the south.

3 ASSESSMENT CRITERIA

3.1 Environmental noise guidelines/standards

To assess issues relating to environmental noise levels impinging on the proposed development, reference is made to the following relevant criteria:

- PPG 24 1994 – Department of Environment – 'Planning Policy Guidance: Planning and Noise'. This document is the current Government advice to Local Planning Authorities concerning noise, and provides a means of gauging the suitability of new residential development within areas dominated by transport related noise sources.

- British Standard 8233:1999 'Sound insulation and noise reduction for buildings – Code of Practice'. The standard provides recommendations for the control of noise in and around buildings, and establishes internal noise criteria primarily intended for new or refurbished developments including residential dwellings. The internal noise criteria are applicable to internal noise levels arising from various sources, including road traffic noise. This standard is adopted as the most relevant British Standard for the consideration of internal noise levels, and is specifically referred to within PPG 24 for guidance on internal noise levels.

- World Health Organisation (WHO), Guidelines for Community noise, 1999, Geneva. The guidelines provide further guidance relating to the suitability of internal noise levels within a residential dwelling. This document is the result of numerous international studies relating to the effects of noise on humans, and is referenced internationally for guidance on the suitability of internal noise levels. In addition, PPG 24 makes reference to WHO guidelines in relation to internal noise criteria adopted in the formulation of PPG 24.

In order to assess the environmental noise impact on the proposed development, it is understood from the London borough of Camden Unitary Development Plan (Approved June 2006) that the guideline PPG 24 shall be followed.

3.2 PPG 24

The PPG 24 procedure is based on grouping typical day and night time noise levels into Noise Exposure Categories (NEC's) which may then be equated to planning guidance specific to each category. Annex 1 of PPG 24 defines four NEC's applicable to proposed residential development in areas dominated by transportation noise, with corresponding noise level ranges defined as follows:

Table 1. Noise levels corresponding to the noise exposure categories for new dwellings $L_{Aeq,T}$ dB

Noise Source	Noise Exposure Categories			
	A	B	C	D
Road Traffic 07:00 to 23:00 hours 23:00 to 07:00 hours*	<55 <45	55 - 63 45 - 57	63 - 72 57 - 66	>72 >66
Rail Traffic 07:00 to 23:00 hours 23:00 to 07:00 hours*	<55 <45	55 - 66 45 - 59	66 - 74 59 - 66	>74 >66
Mixed sources (Road and Rail Traffic) 07:00 to 23:00 hours 23:00 to 07:00 hours*	<55 <45	55 - 63 45 - 57	63 - 72 57 - 66	>72 >66

** Sites where individual noise events regularly exceed 82 dB L_{Amax} (S time weighting) several times in any hour should be treated as being in NEC C, regardless of the $L_{Aeq,8h}$ (except where the $L_{Aeq,8h}$ already puts the site in NEC D).*

Section 8 of Annex 1 defines the above tabled values as "noise levels measured on an open site at the position of the proposed dwellings, well away from any existing buildings, and 1.2m to 1.5m above the ground". The daytime level relates to an $L_{Aeq\ (16\ hour)}$ for the period between 07:00 hours and 23:00 hours and the night time level relates to an $L_{Aeq\ (8\ hour)}$ for the period between 23:00 hours and 07:00 hours.

Advice is provided in PPG 24 as to the extent to which external noise levels should influence the planning process. The advice given for each NEC is provided below:

- **NEC 'A'**: Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level.
- **NEC 'B'**: Noise should be taken into account when determining planning applications and where appropriate, conditions imposed to ensure an adequate level of protection against noise.
- **NEC 'C'**: Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
- **NEC 'D'**: Planning permission should normally be refused.

3.3 Internal noise standards

Local Authorities throughout the UK commonly recognise that the development in urban areas will as a consequence of transportation access demands be subject to noise particularly from roads. Indeed it is common for many town and city centres to be subject to transportation noise levels in NEC B and C. In response to this the general principle is for LA's to stipulate that these external noise levels are sufficiently reduced to reasonable internal levels in habitable rooms. Conditions made to protect dwellers will commonly be based on the guideline criteria offered in BS 8233:1999, "Sound Insulation and noise reduction for buildings".

BS 8233 offers guidance on suitable internal noise levels for dwellings to facilitate good and reasonable resting and sleeping conditions. The specified criteria are generally in line with guidance given by World Health Organisation (WHO). It is however noted that these criteria are based on satisfying the majority of the population accounting for noise from normally occurring external sources including road and rail

traffic, but exclude sources such as emergency vehicle sirens and train horns. The recommended levels are for unoccupied conditions.

Table 2 provides the internal noise levels for daytime and night-time living areas in line with BS8233 and WHO Guidelines.

Table 2. Required noise levels for resting/sleeping conditions

Area	Time	Noise Intrusion Criteria (dB)
Bedrooms	Night (2300-0700)	30 to 35 $L_{Aeq,T}$
		45 L_{Amax}
Other living areas	Day (0700-2300)	35 to 40 $L_{Aeq,T}$

It is noted that commonly accepted practice is to base the design of new buildings on achieving the criteria for living areas during the day time period (07:00 to 23:00) and the sleeping area criterion during night time hours only. The assessment, and the consideration of internal noise levels, has been based on this principle.

4 ENVIRONMENTAL NOISE ASSESSMENT

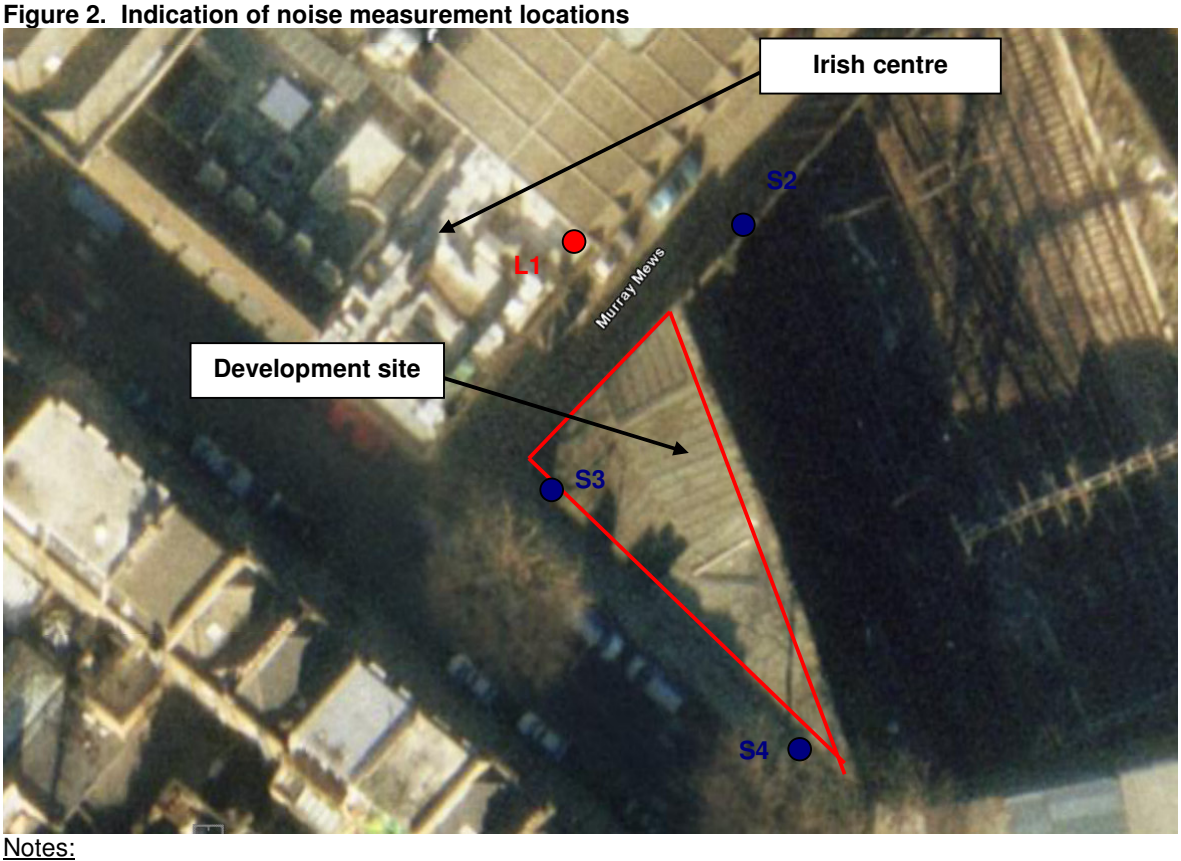
4.1 Survey

A survey of the existing ambient noise environment at the proposed development site was carried out from Monday 16th to Thursday 19th July 2007. The survey was undertaken to enable the Noise Exposure Category (NEC) of the site to be determined, and thus enable an assessment of the site's suitability for residential development according to the guidance of PPG 24.

Recognising the relatively close proximity of the site to the railway lines, consideration was given to the need to conduct vibration monitoring. The railway viaduct is about 8m below pavement level. Subjectively, at the nearest sensitive area of the site, no ground vibrations were discernible during several passing trains. Also, it should be pointed out that structure borne noise levels within dwelling are expected to be significantly lower than noise transmitted through the façade. For the above reasons, ground-borne rail vibration and noise were not considered significant issues for this development and monitoring was not considered necessary.

A noise monitoring system has been installed on the roof of the Irish centre. Figure 2 indicates the logger measurement location. Whilst this position was not in strict accordance with PPG24's recommendation that measurement be taken at 1.5m above ground, it was considered suitable to obtain data which would be representative of the typical noise conditions at the east façade of the proposed building. There was a clear line of sight to the railway track. Measurement at ground level would have been unrepresentative due to shielding from the 4m wall.

Figure 2. Indication of noise measurement locations



Notes:

(red circle) unattended fixed continuous position

(blue circles) attended short term measurement locations

Measurements were made for 5-minute contiguous samples over the entire duration with observations made at the start and end of the measurement survey. The instrument was also checked for sensitivity before and after the measurements and found to be within an acceptable range. Measurement details are given in Appendix B. The results of the 4 days of noise monitoring are presented in attached Appendix C.

Single value daytime and night-time noise levels have been derived from the total monitoring period and are summarised below in Table 3.

Table 3. Day and night average noise levels (free field values)

Period	Measured typical ambient noise level (at Position L1)
Day(0700-2300)	61 dB L_{Aeq}
Night (2300-0700)	54 dB L_{Aeq}
	77 dB L_{Amax} *

**Typical higher night time L_{Amax}*

To establish the distribution of noise across the site, a supplementary attended noise measurement survey was carried out on Monday 19th April at three locations (S2-4, Figure 2). At S2 measurement position, it should be noted that the sound level meter was at about 2.5m above ground level in order to be in direct view to the rail lines. Table 4 gives a summary of the results obtained from the short term measurement survey. It also presents the noise level differences between selected positions and logger position.

Table 4. Summary of short term measurement survey results

Start Time	Duration	Spot Measurement		Equivalent noise level at L1	Level differences in dB between selected positions and logger position (L1)
		Measurement position (Ref Fig 2)	Average ambient noise level L_{Aeq} dB	Average ambient noise level L_{Aeq} dB	
15:10	07:05	S2	64	61	+3
14:41	12:21	S3	59	59	0
14:54	12:43	S4	63	61	+2

Supplementary measurements around the site determine that the noise level at the faced line overlooking the railway can be expected to be 3dB higher that the data obtained at the fixed monitoring location on the Irish centre.

4.2 Façade noise levels

Figure 3 shows the proposed building outline. The normal occurring external noise generated by existing sources across all elevations, as categorized by Figure 3, shall be assumed to be as stated in Table 5 for daytime and night-time periods, respectively.

Figure 3. Façade categorisation for acoustic performance specification

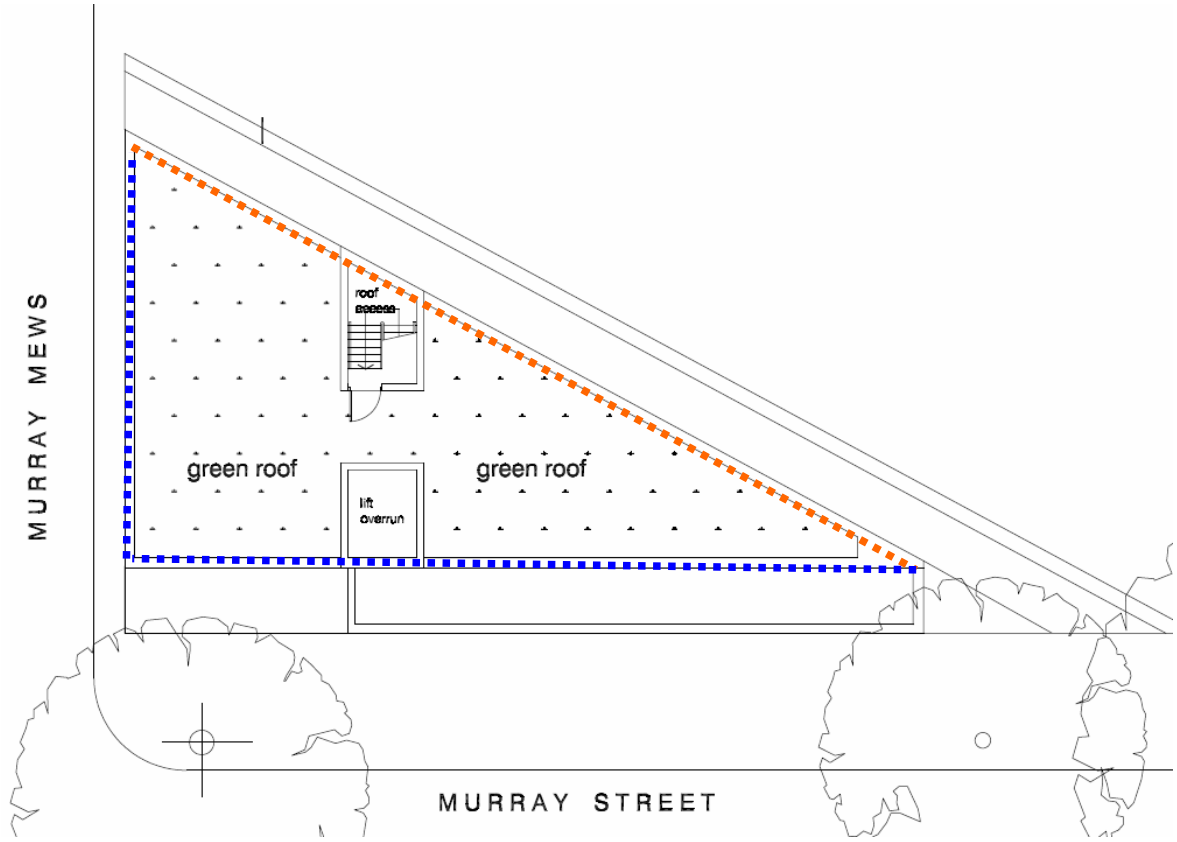


Table 5. External noise levels (L_{eq}) incident on residential facades

Facade	Period	Ambient noise level dB ($L_{Aeq,T}$)	Typical short duration noise events dB ($L_{Amax,}$)
▪▪▪▪▪▪▪▪	Day (0700-2300)	64	-
	Night (2300-0700)	57	77
▪▪▪▪▪▪▪▪	Day (0700-2300)	61	-
	Night (2300-0700)	54	70

4.3 PPG 24 assessment

4.3.1 PPG 24 Noise Exposure Classifications

The logged measurement data, in conjunction with measurement of the variation in noise across the site enable evaluation of the 16 and 8 hour equivalent noise levels required for assessment against the NEC rating scheme set out in PPG 24.

In accordance with PPG 24 and the noise level corrections described in the previous sections, the following provides a summary of environmental noise levels at the positions of the proposed residential dwellings for rail and traffic noise affected areas.

Table 6: Ground level PPG 24 noise levels and NEC's

Elevation	Noise source category	Day		Night		
		$L_{Aeq,16hr}$ dB	NEC	$L_{Aeq,8hr}$ dB	L_{Amax} dB	NEC
	Rail traffic	64	B	57	80	B
	Road traffic	61	B	54	77	B

4.3.2 PPG 24 NEC Analysis

The noise levels presented above are considered representative of the noise levels that would be expected across the development site. The above levels indicate the site to be NEC B. Accordingly, under PPG 24 the site can be demonstrated to be suitable for residential development; however planning approval of the scheme should take account of environmental noise issues, and may require the implementation of planning conditions to ensure the building fabric is designed to provide appropriate internal noise levels within residential dwellings.

To provide a context to the relevant NEC's under consideration, reference is made to PPG 24 Annex 2 which provides an explanation of the basis upon which the noise ranges were defined for the four NEC's. The defining noise levels at the boundaries of the NEC's were derived on the basis of internal noise criteria and the maximum level of sound reduction that would be expected from a standard facade construction. These internal design criteria are based on the WHO Guideline levels outlined earlier in this report, and closely correspond to internal criteria suggested by BS 8233. It is highlighted that the derivation of this external level makes no reference to the suitability of the noise level ranges for external amenities, and is based solely on the attainment of satisfactory internal noise levels.

5 CONTROL OF NOISE INTRUSION

Based on the results of the noise survey, consideration has been given to the types of ventilation and window construction that will facilitate internal noise levels within the recommended internal design criteria.

5.1 Acoustic implications of ventilation

Approved Document F (ADF) 2006 establishes minimum air flow rates for new dwellings and describes four ventilation systems:

- System 1: Background ventilators and intermittent extract fans
- System 2: Passive stack ventilation
- System 3: Continuous mechanical extract
- System 4: Continuous mechanical supply and extract with heat recovery

It is understood that the system 1 is proposed. It should be pointed out that this system requires relatively high equivalent ventilator areas to achieve the minimum air flow rates (e.g. 45000 mm^2 for a two-bedroom dwelling). Such areas significantly decrease the overall façade sound insulation.

Calculations have been undertaken with the following equivalent area:

- 20000 mm2 in living room with only a single exposed façade
- 40000 mm2 in living room with two exposed façade (20 000 mm2 for each facade)
- 20000 mm2 in bedrooms viewing Murray Street
- 10000 mm2 in bedrooms viewing railway lines.

According to ADF, it has been assumed that the free area of a trickle ventilator is typically 25% greater than its equivalent area.

5.2 Minimum requirement to achieve reasonable average internal noise levels

The following construction options have been evaluated for closed windows composing up to 100% of the façade area for the Murray Street facade, and up to 15% for the other facades (based on current elevation proposals). These construction options apply to both sleeping and living areas. For the Murray Street and Murray Mews facades, calculations have been undertaken with the standard traffic noise spectrum defined in BS 8233. Regarding the east façade, a measured rail traffic noise spectrum has been used. The octave band data are provided in Appendix C. The assessment of various constructions has been based on published technical data contained within acoustic texts and manufacturers (such as 'St Gobain' glass) test data.

Table 6: Indicative window and vent sound reduction performance to achieve reasonable internal noise levels

Elevation	Glazing Unit		Trickle vent	
	Sound reduction performance	***Nominally suitable glazing configuration***	**Minimum acoustic performance**	***Vent Type***
	R_w 33 dB	*Thermal double glazing e.g 6/12/6.*	$D_{ne,w}$ 38 dB	*Acoustic trickle trickle vent*
	R_w 33 dB	*Thermal double glazing e.g 6/12/6.*	$D_{ne,w}$ 38 dB	*Acoustic trickle trickle vent*

In addition to the above window requirements, it is noted that single skin blockwork walls or concrete wall would be expected to afford sufficient acoustic isolation for all areas of the development.

5.3 Minimum requirement to achieve reasonable night time maximum noise levels in bedrooms

Further consideration has also been given to night time maximum noise levels in bedrooms. BS 8233 states that: *"For a reasonable standard in bedrooms at night, individual noise events (measured with F time-weighting) should not normally exceed 45 dB L_{Amax})"*. This is considered to be guide and not a requirement.

It was identified that train movements pose a source of short term noise events. Measurements were made during the daytime to determine the typical maximum noise level due to train passby's. Maximum noise events were than measured over two nights, the highest level being obtained every 5 minutes.

Appendix D provides the chart of the predicted night time maximum noise levels in bedrooms for window and vent system indicated in Table 6. It shows that whilst the majority of noise events are below 45 dB L_{Amax} (65%), there could be significant exceedences, regularly greater than 50dB and on occasion more than 55dB. There is a risk that these noise events could lead to disturbance.

As such, consideration has been given to how night-time noise events could be reduced. There are two approaches:

- to increase glazing and vent acoustic performances, and
- to reduce equivalent ventilation area and/or implement a continuous ventilation extract system

On this basis, the effectiveness of two solutions has been tested. The first is idealistic, to reduce exceedences to almost nil. The second is a more practical solution, reducing the impact significantly for future occupants, but not attempting to limit all events to less than the guide level of 45dB. The second option would equate to controlling 80% of maximum noise events to within the guide value.

The following provides indicative window performance and ventilation strategy/performance for both options.

Table 7: Indicative window and vent sound reduction performance to achieve lower night time maximum noise levels in bedrooms

Elevation	Option	Glazing Unit		Trickle vent	
		Sound reduction performance	***Nominally suitable glazing configuration***	**Minimum acoustic performance**	***Vent Type***
	Practical option	R_w 38 dB	*Thermal/Acoustic double glazing e.g 10/12/6.*	$D_{ne,w}$ 47 dB	*High acoustic performance trickle vent.* *The equivalent area shall be less than 5000mm^2.*
	Idealistic option	R_w 40 dB	*High acoustic performance double glazing with laminated layer, e.g. 10/12/6.4*	Continuous mechanical extract system with air intake on Murray Street only.	

Appendix D provides charts of the predicted night time maximum noise levels in bedrooms for the above construction options.

It is considered that the idealistic option is overly onerous and unnecessary. The basic option presented in Table 6 would however risk excessive night-time noise events. It is recommended therefore that the practical option presented in Table 7 should form the basis of the façade acoustic strategy.

Finally, it should be noted that that these proposed constructions are only preliminary solutions for the purpose of demonstrating that acceptable internal noise standards can be achieved.

6 CONCLUSIONS

A comprehensive investigation of environmental noise levels in the vicinity of the proposed development site has been made to enable assessment of the proposed development against relevant environmental noise criteria used to gauge the suitability of the environment for residential development, and establish appropriate noise limits for the development.

The results of measurements across the site indicate noise levels at measurement positions defined by the PPG 24 NEC scheme to be NEC B. The implications of this category are such that residential development can be accommodated at the site provided. Appropriate planning conditions may require to be implemented to ensure environmental noise issues are adequately addressed throughout the design phase of the development.

Based on the measured environmental noise levels and accepted predictive techniques, it has been shown that that proprietary acoustic glazing system in conjunction with acoustically rated passive air intake systems can enable the internal noise criteria to be achieved.

Based on the above findings, we conclude that the proposed residential development is acoustically viable when considered in the context of nationally and internationally accepted noise criteria relevant to the development.

APPENDIX A 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's are 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 20Hz to 20 000Hz (20kHz), and is generally more sensitive to medium and high frequencies than to low frequencies. In order to define the frequency content of a noise, the spectrum is divided into frequency bands, and the sound pressure level is measured in each band. The most commonly used frequency bands are octave bands, in which the mid-frequency of each band is twice that of the band below it. For instance, the octave bands above and below the 500Hz octave band are 1kHz and 250 Hz respectively. For finer analysis, each octave band may be split into three one-third octave bands or in some cases, finer frequency bands (e.g. 1/12 octaves).

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).

Equivalent Continuous Sound Level, L_{Aeq}
The A-Weighted equivalent continuous sound level – the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). $L_{Aeq,T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter.

Background noise level $L_{A90,T}$
The A-Weighted noise level exceeded for 90% of the specified measurement period (T).

Rating Level
The specific noise level of the noise source plus any adjustment for characteristic features of the noise.

APPENDIX B - DETAILS OF ENVIRONMENTAL NOISE SURVEY

Details of measurement instrumentation

Background noise survey measurements

Rion NL-31 Sound level meter (SN 00841830)
The instrument was checked for sensitivity both before and after the survey and found to be within the acceptable tolerance.

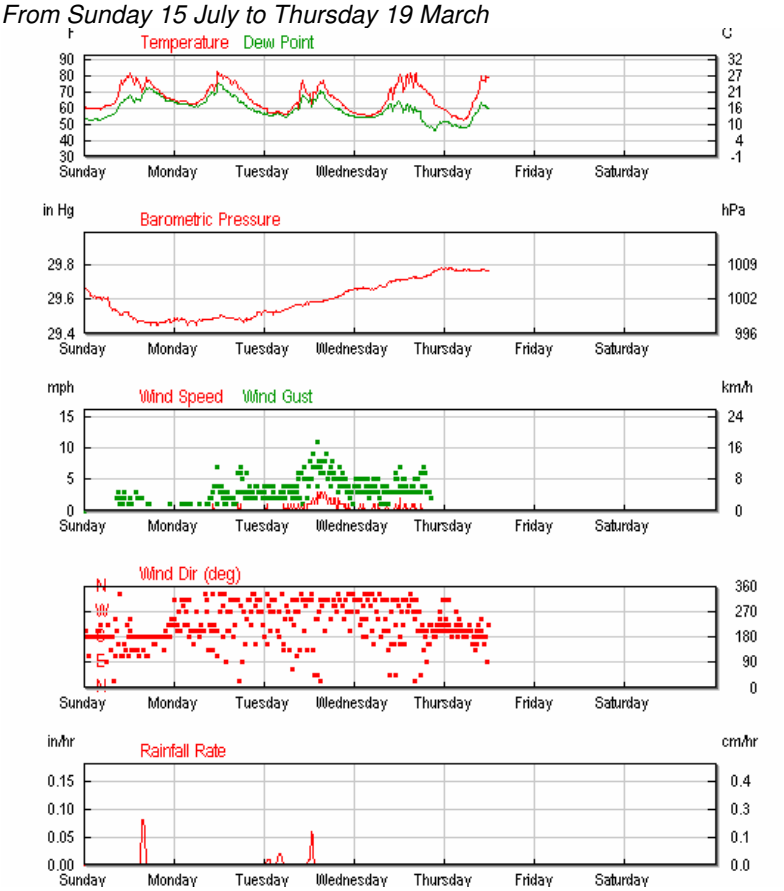
Equipment sound level survey measurements

Bruel & Kjaer 2260 Real time analyser (SN 2447600)
The instrument was checked for sensitivity both before and after the survey and found to be within the acceptable tolerance.

Weather conditions

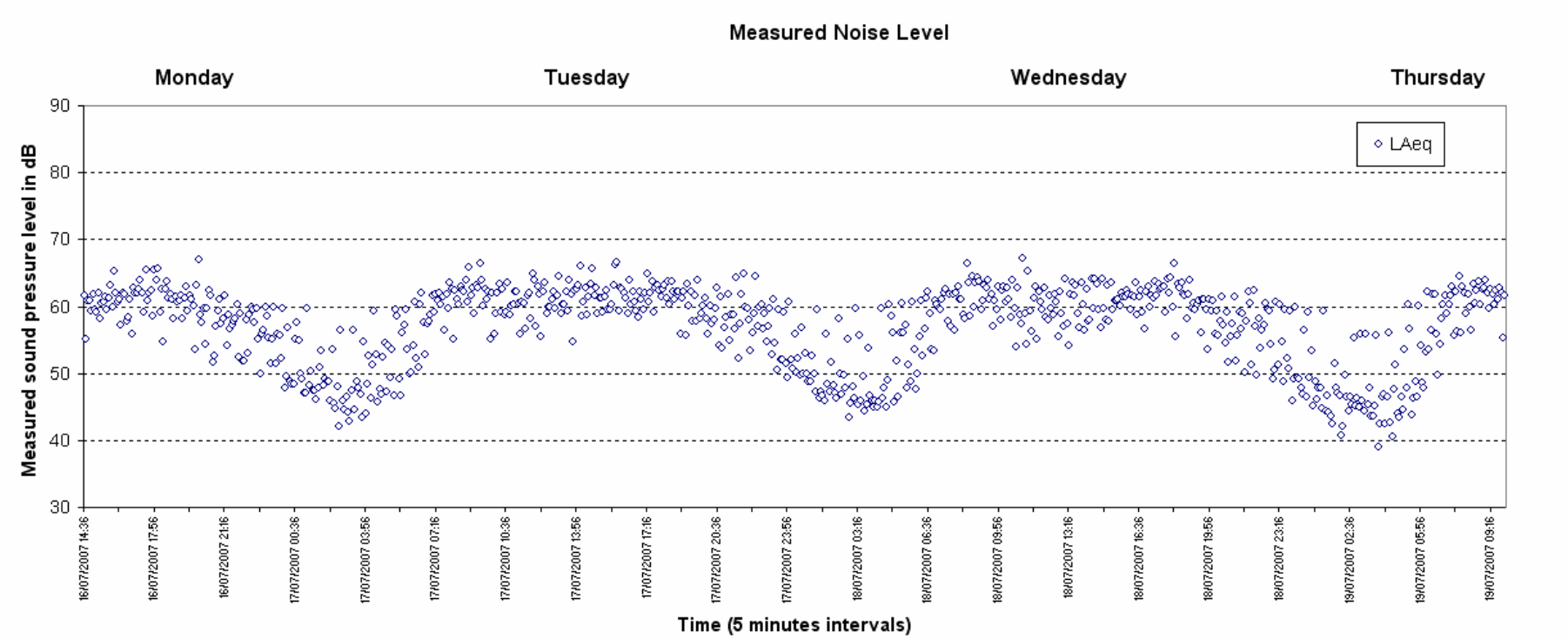
From 14:00 on Monday 16/07/07 to 16:00 on Tuesday 17/07/07, meteorological conditions were wet with cloud cover and occasional showers. These conditions are not suitable for environmental noise measurements and this period was excluded. From 16:00 on Tuesday 17/07/07 to 10:00 on Thursday 19/06/07, meteorological conditions were dry with light cloud cover and occasional light breezes. These conditions were deemed suitable for environmental noise measurements and in accordance with the guidance given in BS 4142.

From Sunday 15 July to Thursday 19 March

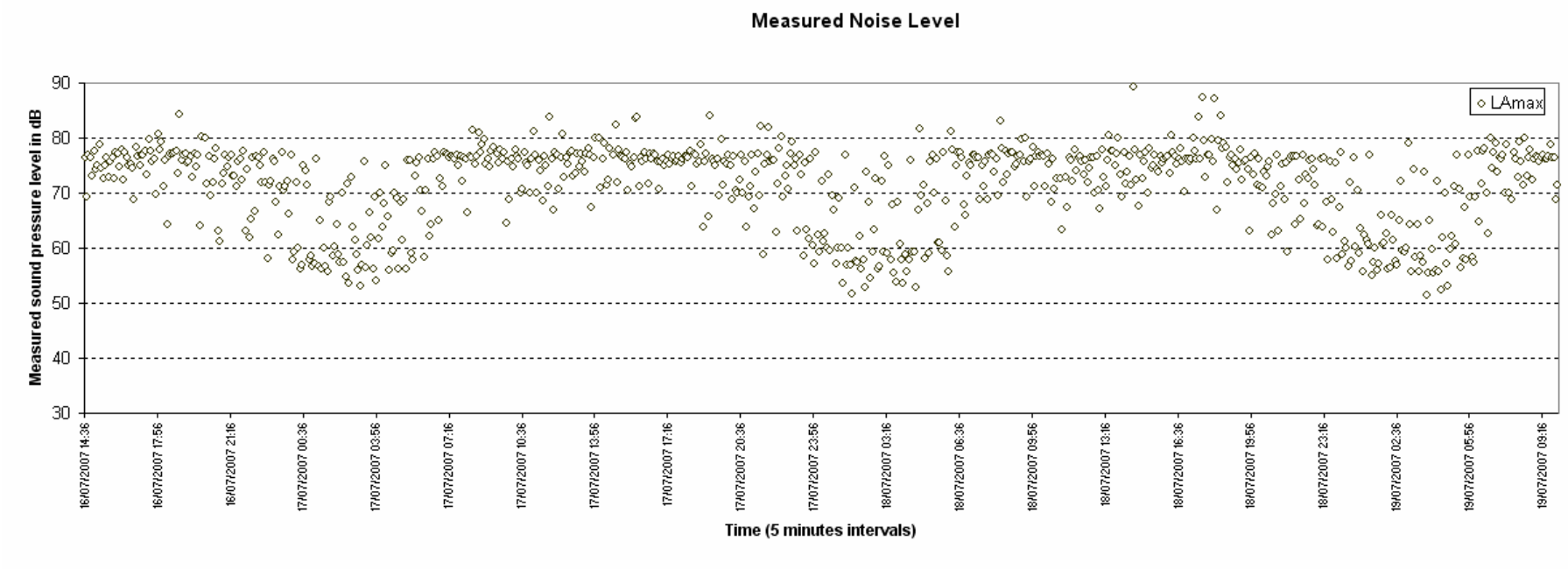


APPENDIX C – MEASUREMENT RESULTS

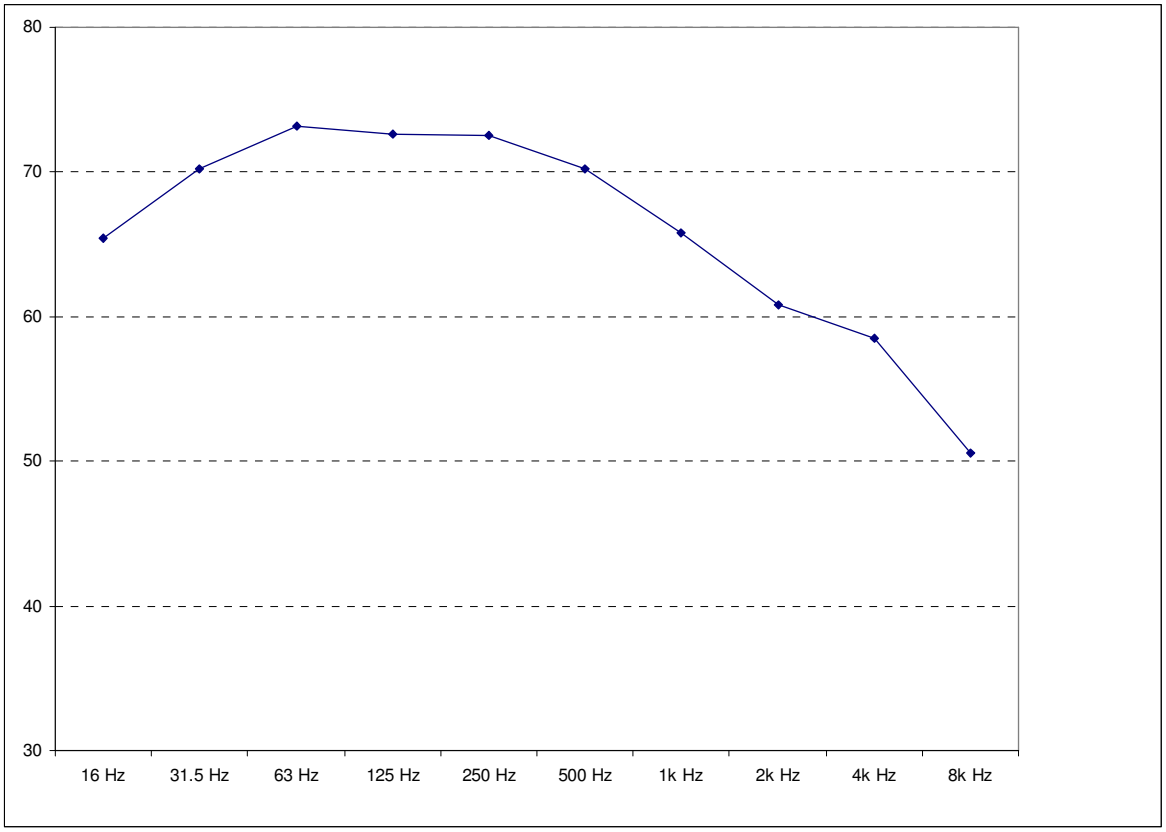
Logging measurements (L1 in Figure 2): Ambient noise level



Logging measurements (L1 in Figure 2): Maximum noise level

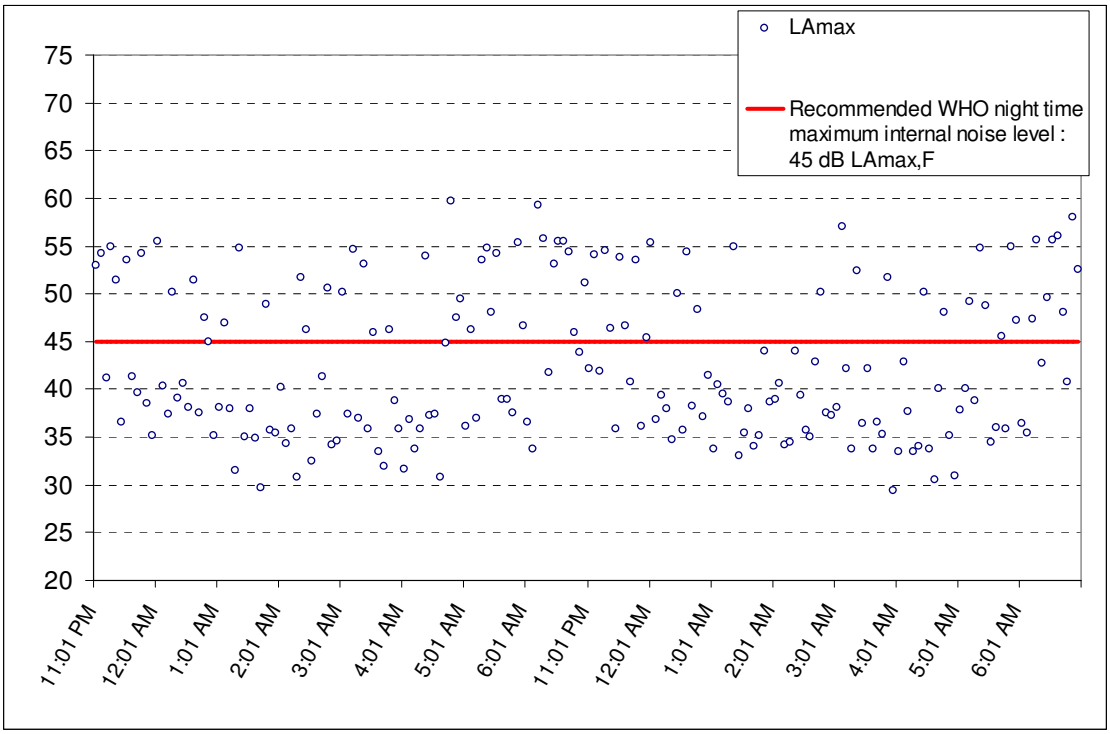


TYPICAL OCTAVE FREQUENCY BAND SPECTRUM – (Day-time 64 dB L_{Aeq})

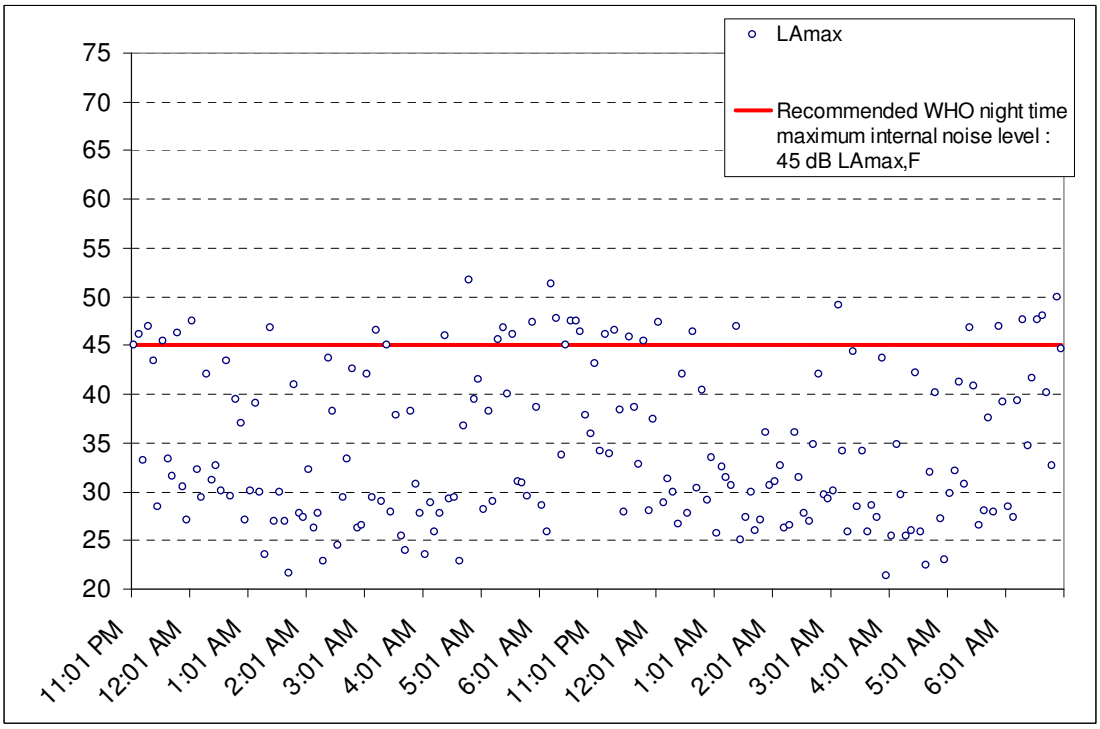


APPENDIX D - NIGHT TIME MAXIMUM NOISE LEVELS IN BEDROOMS

Base construction option:



Practical construction option:



Idealistic construction option: