H&H Acoustic Consultancy Division

Exeter, Glasgow, Hadleigh, High Wycombe, Northwich, Old Dalby

Our Ref : HHACY/9218/01/RN

Date : 05th December 2008

Noise Survey, Assessment & Report
Royal Masonic Trust for Girls & Boys
31 Great Queen Street, London

Client: Royal Masonic Trust for Girls & Boys
31 Great Queen Street
London
WC2B 5AG

Report Prepared by: .....

Renjish K. Narayan BEng MSc AMIOA
Graduate Consultant

Report Authorised by: .....

Nick Barber BSc (Hons) AMIOA
Consultant

Summary

It is proposed by the 'Royal Masonic Trust for Girls & Boys' to install 9 items of plant at the existing site located at 31 Great Queen Street, London.

An external noise survey was carried out between Thursday 13th December 2007 and Friday 14th December 2007 to establish the current noise climate during the daytime and night time periods.

Analysis of the monitored noise levels has been undertaken along with an impact assessment of noise from proposed units of plant machinery upon the nearest noise sensitive properties.

Noise level predictions indicate that the combined noise level of the proposed plant at the nearest residential properties is at least 10 dB(A) below the existing background noise levels, and therefore complies with the requirements set out by Camden Council.

CONTENTS

1. INTRODUCTION

1.1 It is proposed by The Royal Masonic Trust for Boys & Girls to install air conditioning units at external locations within the boundary of 31 Great Queen Street, London. The proposed installation will comprise of 9 items of plant in two different locations.

1.2 Hodgson & Hodgson Acoustics Consultancy Division (HHACY) have been commissioned by The Royal Masonic Trust for Boys & Girls, to undertake a noise impact assessment of the existing noise climate of the area, to consider whether noise from the proposed installations would be within acceptable levels and, if required, recommend suitable mitigation measures.

1.3 This report describes the results of a noise survey undertaken at the site and the subsequent analysis to classify the noise environment against national standards and criteria. Furthermore, recommendations will be also made where appropriate with respect to the design of the development if required.

2 BRIEF FOR CONSULTANCY

2.1 Liaise with local Environmental Health Officer to establish a suitable noise monitoring scheme prior to site survey being undertaken.

2.2 Visit site at 31 Great Queen Street, London, to set up automatic noise monitoring equipment to measure noise levels over a typical 24hr period. Take further noise sample measurements as required.

2.3 Analyse noise survey data to determine the prevailing noise climate of the site.

2.4 Predict external noise levels at the nearest residential dwellings with regard to the *'Camden Council Noise Standards in Respect of Planning and Licensing Applications'* document.

2.5 Where necessary make recommendations for noise attenuation to be included in the design of the proposed development.

2.6 Provide a technical report for submission to the Local Authority detailing findings of the noise survey and where appropriate include any recommendations necessary to meet relevant noise criteria at the closest receptors.

2.7 Definitions of the terminology used within the body of this report have been provided in Appendix 2.

3 STANDARDS AND GUIDANCE

3.1 Further to a telephone conversation with the Dr John Anani (Environmental Health Officer) at Camden Council, it has been established that noise from the proposed installations should be assessed in accordance with the guidance given in BS4142:1997.

British Standard 4142:1997

3.2 B.S.4142 provides a method for rating industrial noise affecting mixed residential and industrial areas and has been extensively used by local authorities and consultants to rate noise from fixed installations, such as plant noise. The standard advocates the use of L_{Aeq}. The L_{Aeq} is either measured or calculated at a receptor location and this is termed the "Specific Noise Level". The Specific Noise Level may then be corrected for the character of the noise and is then termed the "Rating Level". A correction of +5 dB is made if the noise contains any discrete tones e.g. hums or whistles, or any impulsive characteristics such as crashes, bangs or thumps.

3.3 When used to rate the likelihood of complaints, the Rating Level is determined and the L_{A90} background noise level is subtracted from it. The greater the difference, the greater the likelihood of complaints. A difference of around +10 dB or higher indicates that complaints are likely. A difference of around +5 dB is of marginal significance. A difference of -10 dB is a positive indication that complaints are unlikely.

3.4 It has been considered to compare the impact of plant noise sources at the closest residential dwellings to the existing lowest background level during the daytime and night time period.

Local Policy

3.5 The Camden Council Acoustic Report Guidance (which refers to The Replacement Unitary Development plan under ***SD7B - Noise and Vibration Pollution***) provides details of acceptable noise criteria for the installation of plant unit. The document lists the following requirements with regard to the installation of mechanical services:

- *"Identification of the lowest background noise levels at the nearest noise sensitive premises.*

- *The assessment shall be sufficient to identify the lowest background level over the operational period of the plant.*

- *Details of the proposed plant including manufacturers' product specification shall be attached which should include noise output.*

- *Assessment to determine whether cumulative noise levels of the proposed plant would comply with Camden's noise standards in relation to the nearest noise sensitive facades (I.e. can it achieve either 5dBA or 10dBA below background levels at the nearest noise sensitive windows in residential properties).*

- *In the event the plant does not comply with Camden's planning criteria details of required noise reduction strategies including means of attenuation or isolation necessary to ensure that the proposed plant complies with noise standards.*

- *Details of methods and examples of any calculations and assumptions used should be included in the report."*

3.6 Further to a telephone conversation on Wednesday 26th November 2008 with Dr. John Anani of Camden Council[1], it is confirmed Camden Council's noise standards in relation to the nearest noise sensitive facades is as follows:

- *"Noise levels at a point 1 metre external to sensitive facades shall be at least 5dB(A) less than the existing background measurement (L_{A90}), expressed in dB(A) when all plant/equipment are in operation.*
- *Where it is anticipated that any plant/equipment will have a noise that has a distinguishable, discrete continuous note (whine, hiss, screech, hum) and/or if there are distinct impulses (bangs, clicks, clatters, thumps) special attention should be given to reducing the noise levels from that piece of plant/equipment at any sensitive façade to at least 10dB (A) below the L_{A90}, expressed in dB(A)".*

[1] Telephone conversation between Environmental Health Officer Dr John Anani of Camden Council and Renjish Narayan of HHACY on 26th November 2007 at 12:32 to confirm assessment methodology.

3.7 As advised by the Local Authority the assessment will be carried out in accordance with the assessment methodology and criteria as stated within BS 4142.

4. SITE DESCRIPTION

4.1 The proposed subject site is located within the Camden borough of London on 31 Great Queen Street.

4.2 The site as a whole is bounded to the north and west by Parker Street and by Great Queen Street to the east and south.

4.3 The general character of the area is that of a residential and commercial setting.

Development Proposals

a) 1st Floor Level

4.4 It is proposed by the client to install 4no. outdoor units at the site to serve the associated offices located within 31 Great Queen Street.

4.5 It is proposed by the client to install the plant approximately 7 metres away from the nearest sensitive receptor (NSR) location, which is considered to be the rear of the student accommodation building which is accessible from Parker Street.

4.6 Whilst onsite it was observed there are existing operational plant which serve commercial units at ground floor level not associated with The Royal Masonic Trust for Boys & Girls. The plant, which was operational at the time of the survey, include two large kitchen extract fans, condensers and a chiller unit.

4.7 Habitable rooms associated with the student accommodation building have direct views of the proposed installation area. It is considered that the existing plant is approximately between 3 to 7 metres away from the nearest façade of the student accommodation building.

b) 3rd Floor Level

4.8 It is proposed to install a further 5no. units on the 3rd floor level roof top. The air conditioning plants will be located approximately 6 metres from the Parker Street build line and screened within full height enclosures.

4.9 The plant on the 3rd floor roof serving the offices will operate between 08:00hours – 18:00hours and plant serving the residential dwellings (situated within 31 Great Queen Street) will operate 24 hours. The NSR to the proposed third floor plant will be dwellings on Parker Street with views of the 3rd floor roof which are approximately 17m away.

4.10 The detailed description and the working hours of the proposed air conditioning units have been presented in table 4.1 as follows:

Table 4.1- Proposed Air Conditioning Units

Unit	Model	Position	SPL at 1m dB(A)	Working Hours
Rotary heat exchanger (AHU)	Swegon Gold RX	Roof Level	57	8AM - 6PM
VRV Heat Recovery outdoor unit	Daikin REYQ8P	Roof Level	58	8AM - 6PM
VRV Heat Recovery outdoor unit	Daikin REYQ20P	Roof Level	62	8AM - 6PM
Heat Pump Outdoor Unit	Daikin RZQ125	Roof Level	53	24 Hours
Heat Pump Outdoor Unit	Daikin RZQ125	Roof Level	53	24 Hours
VRV Heat Recovery outdoor unit	Daikin REYQ14P	First Floor Level	62	8AM - 6PM
VRV Heat Recovery outdoor unit	Daikin REYQ28P	First Floor Level	65	8AM - 6PM
Heat Pump Outdoor Unit	Daikin RZQ100	First Floor Level	55	8AM - 6PM
Heat Pump Outdoor Unit	Daikin RZQ100	First Floor Level	55	8AM - 6PM

4.11 A noise monitoring location map has been included within Figure 1.

5 ANALYSIS OF EXISTING NOISE CLIMATE

5.1 In order to determine the existing noise climate of the area, a 24-hour noise survey has been undertaken at two locations representative of the current noise climate between Thursday 13th December 2007 and Friday 14th December 2007.

5.2 The two monitoring locations are as follows:

- Rear of 31 Great Queen Street – 2nd floor roof. Location selected as considered to be least affected by the existing plant noise located on the 1st floor roof and representative of the noise climate in this area.

- Rear of 31 Great Queen Street – 3rd floor roof. Location selected as best representative location of the dwellings on Parker Street with views of the 3rd floor roof.

5.3 The instrumentation used during the survey is as detailed below:

Table 5.1 - Instrumentation

Manufacturer	Description	Type	Serial Numbers
SLM Kit 1			
Cirrus	Data logging sound level meter	821B	C17174FE
SLM Kit 3			
Cirrus	Data logging sound level meter	811B	C17900FD

5.4 All sound level meter equipment was calibrated before and after each survey and no significant deviations in calibration levels were noted.

5.5 During all measurements the sound level meters were mounted in free field positions, with the microphone located at a height of 1.5m above the site ground level. The sound level meters were all set to a "fast" time response and set to measure L_{Aeq}, L_{Amax}, and L_{A90} levels over a 24 hour period.

5.6 As required by BS 4142 the sound level meters were set to monitor at 1 hourly intervals during the daytime period (07:00 – 23:00 hours) and at 5min intervals during the night time period (23:00 – 07:00 hours).

5.7 Full survey details are presented in Appendix 1 of this report.

5.8 Figure 1 details the monitoring locations.

5.9 The weather conditions during the monitoring surveys were noted to be mainly dry with temperatures around 5°C and slight breeze, wind speeds of less than 5 ms^{-1}. All monitoring was undertaken by competently trained HHACY employee.

5.10 The following table 5.2 summarises the levels recorded on site during the survey period:

Table 5.2: Monitored Data – Location 1*

Date	Location	Average $L_{Aeq,1hr}$ dB	Highest L_{AFmax} dB	Lowest $L_{A90,1hr}$ dB
16 hour Daytime Period – On site monitoring				
13.12.08 – 14.12.08	2nd floor roof	61.3	75.7	60.5

* Noise levels during the night time period are not detailed within table 5.2 as the proposed plant at location 1 will not operate during this period. The full dataset is presented within Appendix 3.

5.11 Subjectively, it was noted during the survey that the dominant source of noise at location 1 during the daytime was that of existing plant as well as general activity within the surrounding area.

Table 5.3: Monitored Data – Location 2

Date	Location	Average $L_{Aeq,T}$ dB	Highest L_{AFmax} dB	Lowest $L_{A90,T}$ dB
16 hour Daytime Period – On site monitoring				
13.12.08 – 14.12.08	3rd floor roof	57.3	78.7	53.0
8 hour Night time Period – On site monitoring				
14.12.08	3rd floor roof	48.0	55.0	45.0

5.12 At location 2 it was noted the principal source of noise during both the daytime and night time periods was that of traffic movements along Parker Street and general activity noise within the surrounding area.

6 NOISE IMPACT ASSESSMENT

6.1 The closest sensitive receptors to noise emissions from the proposals will be the residential properties to the rear of student accommodation building (north west of the site) and dwelling on Parker Street (north of the site) and therefore the assessment will consequently address these areas.

6.2 The results of the assessment have been presented in terms of the compliance requirements of Camden County Council as stated in condition 1a of the *'Camden council noise standards in respect of planning and licensing applications'* document. These assessments have been labelled

6.3 In respect of point 2 of the same document, an additional assessment has also been undertaken in accordance with *'BS 4142:1997 Method for rating noise affecting mixed residential and industrial areas'*.

6.4 Table 6.1 presents a summary of results for both assessment types.

Table 6.1 – Assessment results summary

NSR Location	Time Period	Plant Noise below Background (dB)	Camden Council Noise Requirement Met
1	08:00–18:00	10.3	Yes
2	08:00–18:00	13.0	Yes
2	18:00–23:00	18.6	Yes
2	23:00–07:00	13.6	Yes

6.5 The calculation of each of the results presented in Table 6.1 is detailed below.

i) Location 1 - Noise from the Operation of Proposed Plant

Daytime operational hours of 08:00 – 18:00 hours

6.6 It is proposed to install 4 no. outdoor units within the 1st floor roof area.

6.7 The following table 6.2 details the unit types, which have been proposed:

Table 6.2 – Location 1 proposed units

Type	Model	Quantity	dB(A)
VRV Heat Recovery Outdoor Unit	Daikin REYQ14P	1	62
VRV Heat Recovery Outdoor Unit	Daikin REYQ28P	1	65
Heat Pump Outdoor Unit	Daikin RZQ100	2	58

6.8 To establish the level of noise experienced at the façade of NSR, the level of noise emitted from the proposed units has to be calculated.

6.9 The combined sound pressure level generated by multiple units has been found using equation 1 given below;

Equation 1..... $L_{total} = 10 \text{ Log } [10^{(L1/10)} + 10^{(L2/10)} + 10^{(L3/10)} + \ldots\ldots\ldots\ldots + 10^{(Ln/10)}]$

6.10 Where L1, L2, L3 and Ln are the individual sound pressure levels of each unit, the level of noise emitted by 4no. units will be 67.0dB(A) at 1metre.

6.11 Information taken from the architects drawing (Drawing No. 0727_1116 Rev C) the distance between the building and the receptor points have been established. This will provide a level of attenuation and subsequently reduce the level of noise received at the residential dwellings to the north west of the site.

6.12 In order to comply with requirements of the Camden Council noise standards it must be shown that the noise level of the combined plant L_{Aeq} must be at least 10 dB(A) below the existing background noise level. This assumes that the plant noise will have tonal features for the purpose of a worst case assessment, though it is anticipated that all the proposed plant units will emit noise that is broadband in nature with no significant tonal features.

6.13 The proposed plant that has the potential to affect the NSR at location 1 is approximately 7m from the NSR. The predicted noise level of the combined plant at this location is 50.2 dB L_{Aeq}. The measured background noise level at the same position is 60.5 dB L_{A90}. These levels indicate that the combined noise level of the proposed units will be around 10.3 dB(A) below the existing background noise levels.

6.14 It is anticipated that the combined noise levels of the proposed units will comply fully with the requirements of Camden Council noise standards at this location.

6.15 A BS 4142:1997 assessment carried out at this location resulted in the excess of noise rating level over background level to be an indication that complaints are unlikely to arise due to the operation of the proposed units.

ii) Location 2 - Noise from the Operation of Proposed Plant

Daytime operational hours of 08:00 – 18:00 hours

6.16 It is proposed to install 5no. outdoor units within the 3rd floor roof area. The following table 6.4 details the unit types, which have been proposed:

Table 6.4 – Location 2- proposed daytime operational units

Type	Model	Quantity	dB(A)
Proposed Operational 08:00- 18 :00 hours			
Rotary Heat Exchanger (AHU)	Sewgon Gold RX	**1**	**57**
VRV Heat Recovery Outdoor Unit	Daikin REYQ8P	**1**	**58**
VRV Heat Recovery Outdoor Unit	Daikin REYQ20P	**1**	**62**
Proposed 24-hour Operation			
Heat Pump Outdoor Unit	Daikin RZQ125	**2**	**53**

6.17 The combined sound pressure level generated by multiple units has been found using the formula given above. The level of noise emitted by 5no. units will be 64.0dB(A) at 1metre.

6.18 The distance between the proposed installation point and the receptor point have been estimated at 17metres (taken whilst onsite and online mapping program). This will provide a level of attenuation and subsequently reduce the level of noise received at the residential dwellings on Parker Street with views of the proposed installation point.

6.19 In order to comply with requirements of the Camden Council noise standards it must be shown that the noise level of the combined plant L_{Aeq} must be at least 10 dB(A) below the existing background noise level. This assumes that the plant noise will have tonal features for the purpose of a worst case assessment, though it is anticipated that all the proposed plant units will emit noise that is broadband in nature with no significant tonal features.

6.20 The proposed plant that has the potential to affect the NSR at location 2 is approximately 17m from the NSR. The predicted noise level of the combined plant at this location during the day time period is 40.0 dB L_{Aeq}. The measured background noise level at the same position is 53.0 dB L_{A90}. These levels indicate that noise level of the proposed units will be around 13 dB(A) below the existing background noise levels.

6.21 It is anticipated that the combined noise levels of the proposed units will comply fully with the requirements of Camden Council noise standards at this location.

6.22 A BS 4142:1997 assessment carried out at this location resulted in the excess of noise rating level over background level to be an indication that complaints are unlikely to arise due to the operation of the proposed units.

Evening operational hours of 18:00 – 23:00 hours

6.23 During the evening period 18:00 – 23:00hours 2no units serving the residential dwellings will be operational; therefore an assessment of the late evening operations has been undertaken.

6.24 Table 6.6 below details the unit types, which will be operating during the night time period.

Table 6.6 – Location 2- proposed night time operational units

Type	Model	Quantity	dB(A)
Heat Pump Outdoor Unit	Daikin RZQ125	2	53

6.25 In order to comply with requirements of the Camden Council noise standards it must be shown that the noise level of the combined plant L_{Aeq} must be at least 10 dB(A) below the existing background noise level. This assumes that the plant noise will have tonal features for the purpose of a worst case assessment, though it is anticipated that all the proposed plant units will emit noise that is broadband in nature with no significant tonal features.

6.26 The proposed plant that has the potential to affect the NSR at location 2 is approximately 17m from the NSR. The predicted noise level of the combined plant at this location during the evening period is 31.4 dB L_{Aeq}. The measured background noise level at the same position is 50.0 dB L_{A90}. These levels indicate that noise level of the proposed units will be around 18.6 dB(A) below the existing background noise levels.

6.27 It is anticipated that the combined noise levels of the proposed units will comply fully with the requirements of Camden Council noise standards at this location.

6.28 A BS 4142:1997 assessment carried out at this location resulted in the excess of noise rating level over background level to be an indication that complaints are unlikely to arise due to the operation of the proposed units.

Night time operational hours of 23:00 - 07:00 hours

6.29 HHACY have been advised by the client that 2no. units will be operational during the night time period. The following table 6.8 details the unit types, which have will be operating during the night time period.

Table 6.8 – Location 2- proposed night time operational units

Type	Model	Quantity	dB(A)
Heat Pump Outdoor Unit	Daikin RZQ125	**2**	**53**

6.30 The combined sound pressure level generated by multiple units has been found using the formula given above. The level of noise emitted by 2no. units will be 56.0dB(A) at 1metre.

6.31 In order to comply with requirements of the Camden Council noise standards it must be shown that the noise level of the combined plant L_{Aeq} must be at least 10 dB(A) below the existing background noise level. This assumes that the plant noise will have tonal features for the purpose of a worst case assessment, though it is anticipated that all the proposed plant units will emit noise that is broadband in nature with no significant tonal features.

6.32 The proposed plant that has the potential to affect the NSR at location 2 is approximately 17m from the NSR. The predicted noise level of the combined plant at this location during the night time is 31.4 dB L_{Aeq}. The measured background noise level at the same position is 45.0 dB L_{A90}. These levels indicate that noise level of the proposed units will be around 13.6 dB(A) below the existing background noise levels.

6.33 It is anticipated that the combined noise levels of the proposed units will comply fully with the requirements of Camden Council noise standards at this location.

6.34 A BS 4142:1997 assessment carried out at this location resulted in the excess of noise rating level over background level to be an indication that complaints are unlikely to arise due to the operation of the proposed units.

7 CONCLUSION

7.1 The measurement of daytime and night time background noise levels during a weekday period was undertaken between 13th December 2007 and Friday 14th December 2007.

7.2 The noise survey was undertaken at two locations representative of existing noise climate. The resulting survey data has been used in conjunction with manufacturer data sheets for the proposed new air conditioning plant in order to assess the likely noise impact on the nearest noise sensitive receptors.

7.3 It has been established that the predicted combined noise levels of the proposed plant at locations 1 and 2 are at least 10.3 dB below the existing background noise levels and as such fully comply with the requirements set by Camden Council.

7.4 In addition, the noise impact of the proposed plant has been carried out in accordance with the BS4142 method of assessment in order to assess the likelihood of the complaints due to the noise generated from the proposed new air conditioning plant. The result of this assessment indicated that complaints are unlikely to arise during the daytime, evening and night time periods.

APPENDIX 1
SURVEY DETAILS

1. SITE LOCATION

Royal Masonic Trust for Girls & Boys
31 Great Queen Street
LONDON
WC2B 5AG

2. SURVEY DATE

Thursday 13th December 2007 - Friday 14th December 2007

3. PERSONNEL PRESENT

Renjish K Narayan, Hodgson & Hodgson Acoustic Consultancy Division
Sima Bangue, Hodgson & Hodgson Acoustic Consultancy Division

4. EQUIPMENT

2 x	Cirrus Research plc	Noise Analyser
1 x	Norsonic 118	Real-time Analyser
2 x	Portable Cailbrator	

5. CALIBRATION

All equipment was checked before and after use with a pure tone electronic calibrator. Calibration is checked regularly and is traceable via NAMAS to National Standards held at NPL.

6. WEATHER

Daytime: Cold and dry, Temperature 5°C.
Wind-speeds of less than 5 m/s.

APPENDIX 2
TERMINOLOGY

Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure (measured in pascals, Pa). Because of this wide range a noise level scale based on logarithms is used in noise measurement called the decibel (dB) scale. Audibility of sound covers a range of approximately 0 to 140 dB.

The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure noise is weighted to represent the performance of the ear. This is known as the 'A weighting' and annotated as dB(A).

The following lists the sound pressure level in dB(A) for common situations.

Table 1: Noise Levels for Common Situations

Typical Noise Level, dB(A)	Example
0	Threshold of hearing
30	Rural area at night, still air
40	Public library Refrigerator humming at 2m
50	Quiet office, no machinery Boiling kettle at 0.5m
60	Normal conversation
70	Telephone ringing at 2m Vacuum cleaner at 3m
80	General factory noise level
90	Heavy goods vehicle from pavement Powered lawnmower, operator's ear
100	Pneumatic drill at 5m
120	Discotheque - 1m in front of loudspeaker
140	Threshold of pain

The noise level at a measurement point is rarely steady, even in rural areas, and varies over a range dependent upon the effects of local noise sources. Close to a busy motorway, the noise level may vary over a range of 5 dB(A), whereas in a suburban area this may increase up to 40 dB(A) and more due to the multitude of noise sources in such areas (cars, dogs, aircraft etc.) and their variable operation. Furthermore, the range of night-time noise levels will often be smaller and the levels significantly reduced compared to daytime levels. When considering environmental noise, it is necessary to consider how to quantify the existing noise (the ambient noise) to account for these second to second variations.

A parameter that is widely accepted as reflecting human perception of the ambient noise is the background noise level, L_{A90}. This is the noise level exceeded for 90% of the measurement period and generally reflects the noise level in the lulls between individual noise events. Over a 1-hour period the L_{A90} will be the noise level exceeded for 54 minutes.

The equivalent continuous A-weighted sound pressure level, L_{Aeq}, is the single number that represents the total sound energy measured over that period. The L_{Aeq} is the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period. It is commonly used to express the energy level from individual sources that vary in level over their operational cycle.

Human subjects, under laboratory conditions, are generally only capable of noticing changes in steady levels of no less than 3 dB(A). It is generally accepted that a change of 10 dB(A) in an overall, steady noise level is perceived to the human ear as a doubling (or halving) of the noise level. (These findings do not necessarily apply to transient or non-steady noise sources such as changes in noise due to changes in road traffic flow, or intermittent noise sources).

Perception - Frequency

Frequency is the rate at which the air particles vibrate. The more rapid the vibrations, the higher the frequency and perceived pitch. Frequency is measured in Hertz (Hz).

A young person with average hearing can generally detect sounds in the range 20 Hz to 20,000 Hz (20 kHz). Human speech is predominantly in the range 250 Hz - 3000 Hz.

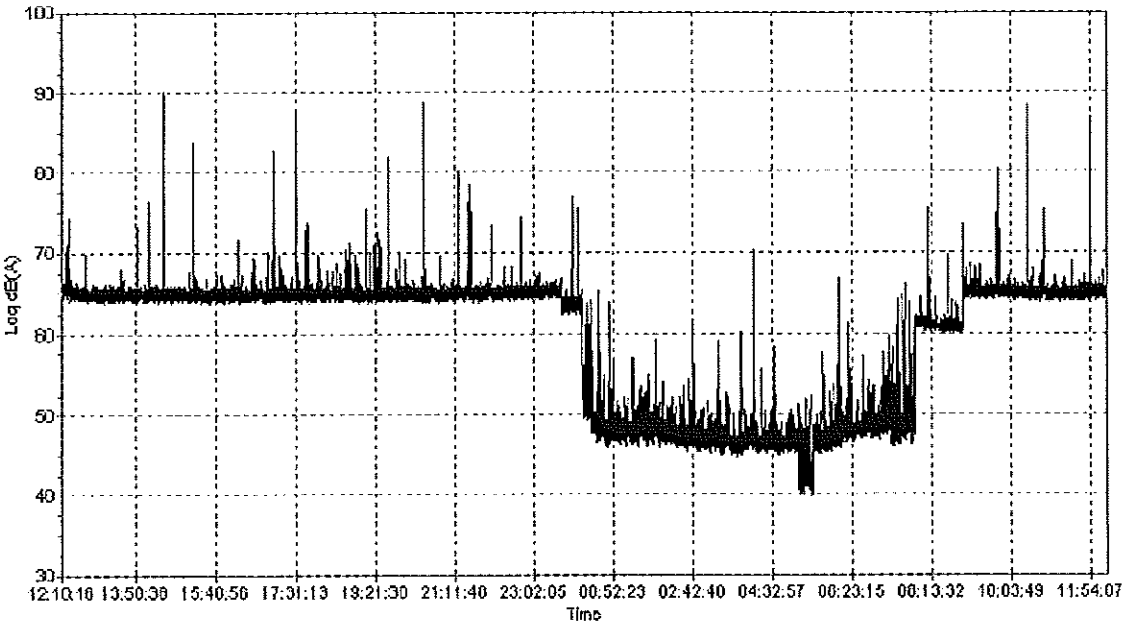
The musical term 'octave' is the interval between the first and eighth note in a scale and represents a doubling of frequency. A series of octave and one-third octave bands have been derived and these are commonly used in noise measurements where it is necessary to describe not only the level of the source noise but also the frequency content. The frequency content of a noise source can be useful for identifying acoustic features such as a whine, hiss or screech.

In most instances it is necessary only to specify and use the overall A-weighted noise values, for example when assessing noise from fixed plant (pumps, motors, refrigeration plant etc.), road traffic and general industrial sources. However, in certain circumstances it is necessary to consider the contribution to the overall A-weighted noise level in individual octave frequency bands, such as when assessing architectural acoustics or noise from amplified music events.

The Royal Masonic Trust for Boys & Girls
31 Great Queen Street, London
WC2B 5AG

APPENDIX 3
24 HOURS SURVEY DATA

LOCATION 1 – 2ND FLOOR ROOF LEVEL



Start	13/12/2007 12:15	Day Time		
End	13/12/2007 23:00			
Period	1h			
Period start	Leq	Lmin	Lmax	L90
13/12/2007 12:15	65.3	63.9	74.5	64.5
13/12/2007 13:15	65.2	64	76.4	64.5
13/12/2007 14:15	65.5	64	90.1	64.5
13/12/2007 15:15	64.9	63.8	71.7	64.5
13/12/2007 16:15	65.1	63.8	82.6	64.5
13/12/2007 17:15	65.7	64	87.6	64.5
13/12/2007 18:15	65.2	63.9	75.5	64.5
13/12/2007 19:15	65.3	64	82.1	64.5
13/12/2007 20:15	65.3	63.9	88.9	64.5
13/12/2007 21:15	65.5	63.9	80.3	64.5
13/12/2007 22:15	65.2	64.2	74.5	64.5
Start	14/12/2007 07:00	Day Time		
End	14/12/2007 12:15			
Period	1h			
Period start	Leq	Lmin	Lmax	L90
14/12/2007 07:00	54.6	46.1	66	47
14/12/2007 08:00	61.3	60.1	75.7	60.5
14/12/2007 09:00	65.4	64.3	80.5	65
14/12/2007 10:00	65.8	64	88.5	64.5
14/12/2007 11:00	65.1	63.9	86	64.5
14/12/2007 12:00	65.1	64.2	67.7	64.5

Start	13/12/2007 23:00	Night Time		
End	14/12/2007 07:00			
Period	5min			
Period start	Leq	Lmin	Lmax	L90
13/12/2007 23:00	65.1	64.4	67.2	65
13/12/2007 23:05	65.3	64.4	66.7	64.5
13/12/2007 23:10	65.3	64.3	67.4	65
13/12/2007 23:15	65.2	64.3	66	65
13/12/2007 23:20	65.2	64.4	66.2	65
13/12/2007 23:25	65.3	64.5	66.2	65
13/12/2007 23:30	65.3	64.6	66.3	65
13/12/2007 23:35	65.3	64.5	66.4	65
13/12/2007 23:40	64.5	62.5	66.8	63.5
13/12/2007 23:45	63.7	62.7	65.5	63
13/12/2007 23:50	63.6	62.6	64.8	63
13/12/2007 23:55	65.1	62.8	76.8	63
14/12/2007 00:00	63.9	62.5	75.5	63
14/12/2007 00:05	63.5	62.5	65.4	63
14/12/2007 00:10	60.5	49.6	64.3	50.5
14/12/2007 00:15	52	49.4	63.7	50
14/12/2007 00:20	51.7	47.7	64.1	48.5
14/12/2007 00:25	49.8	47.5	57.9	48
14/12/2007 00:30	49.3	46.6	65.1	47
14/12/2007 00:35	48.3	46.8	57.8	47
14/12/2007 00:40	47.9	46.2	55	46.5
14/12/2007 00:45	48.3	46	64	46.5
14/12/2007 00:50	48.2	46.7	56.6	47
14/12/2007 00:55	48	46.5	51.6	47
14/12/2007 01:00	48	46.4	50.9	47
14/12/2007 01:05	48	46.6	52.1	47
14/12/2007 01:10	47.8	46.2	51	46.5
14/12/2007 01:15	48.6	46.5	56.9	47
14/12/2007 01:20	48.6	46.3	56.9	47
14/12/2007 01:25	47.7	46	52.9	46.5
14/12/2007 01:30	48.4	46.7	53.4	47
14/12/2007 01:35	48.4	46.3	52.6	47
14/12/2007 01:40	48.7	46.2	55	47
14/12/2007 01:45	47.9	46.4	50.2	47
14/12/2007 01:50	49.4	46.4	59.1	47.5
14/12/2007 01:55	47.5	46	51.4	46.5
14/12/2007 02:00	48.3	46.6	54	47
14/12/2007 02:05	47.6	46.3	50.9	46.5
14/12/2007 02:10	47.7	46.3	50.9	46.5
14/12/2007 02:15	47.8	46.5	52.2	46.5
14/12/2007 02:20	47.2	45.9	51	46.5
14/12/2007 02:25	47.9	46.1	53.5	46.5
14/12/2007 02:30	47.2	45.7	50.4	46
14/12/2007 02:35	47.3	45.4	54.4	46
14/12/2007 02:40	48.4	45.8	61.2	46
14/12/2007 02:45	47.8	45.6	56.2	46
14/12/2007 02:50	46.7	45.4	50.4	46

14/12/2007 02:55	47.1	45.4	50.7	46
14/12/2007 03:00	47.1	45.6	51.5	46
14/12/2007 03:05	46.8	45.2	50	45.5
14/12/2007 03:10	46.7	45.4	49.3	45.5
14/12/2007 03:15	47	45.4	52.9	46
14/12/2007 03:20	48.2	45	59.2	45.5
14/12/2007 03:25	46.8	45	52.6	45.5
14/12/2007 03:30	47.7	45.6	52.1	46
14/12/2007 03:35	46.3	45	50.8	45.5
14/12/2007 03:40	46.3	45.1	49.9	45.5
14/12/2007 03:45	46.8	44.7	60.1	45
14/12/2007 03:50	46.3	45	53.1	45.5
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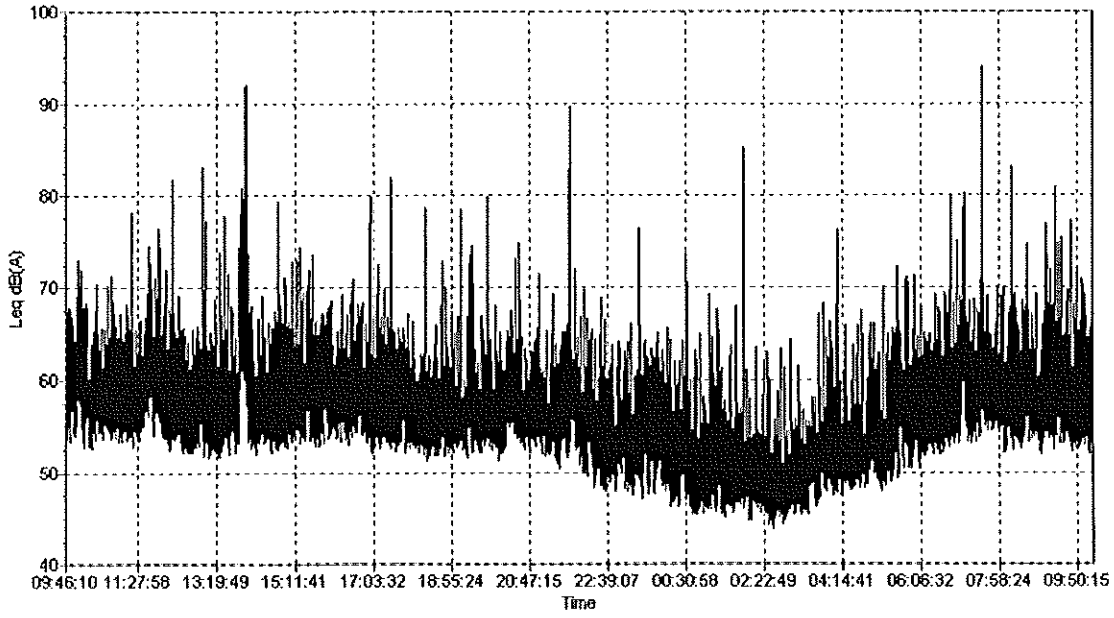
14/12/2007 04:00	47	45.6	49.7	46
14/12/2007 04:05	55.7	45.5	70.2	46
14/12/2007 04:10	46.7	45.3	49.2	45.5
14/12/2007 04:15	46.3	45.2	55.5	45.5
14/12/2007 04:20	46.6	45.4	50.5	46
14/12/2007 04:25	46.3	45.2	48.7	45.5
14/12/2007 04:30	46.6	45.5	50.7	45.5
14/12/2007 04:35	46.9	45.4	58.4	45.5
14/12/2007 04:40	46.2	45	52.4	45.5
14/12/2007 04:45	46.1	45.1	48.9	45.5
14/12/2007 04:50	46.4	45.2	48.8	45.5
14/12/2007 04:55	46.2	45.3	49.9	45.5
14/12/2007 05:00	46.5	45.4	50.5	45.5
14/12/2007 05:05	46.5	45.2	51.1	45.5
14/12/2007 05:10	42.6	40	51.2	40.5
14/12/2007 05:15	42.7	39.9	51.7	40.5
14/12/2007 05:20	43.6	40.7	48.4	41.5
14/12/2007 05:25	43.8	39.8	52.4	40
14/12/2007 05:30	45.7	39.9	48.8	41
14/12/2007 05:35	46.5	45.2	49.8	45.5
14/12/2007 05:40	46.4	45.2	51.5	45.5
14/12/2007 05:45	47.8	45.4	57.5	45.5
14/12/2007 05:50	46.9	45.4	52.8	45.5
14/12/2007 05:55	46.9	45.5	51.4	46
14/12/2007 06:00	47.3	45.8	53.7	46.5
14/12/2007 06:05	49.2	45.8	66.9	46
14/12/2007 06:10	47.6	46.5	50.9	47
14/12/2007 06:15	49	46.6	61.4	47
14/12/2007 06:20	52.7	46.7	55.6	48.5
14/12/2007 06:25	47.4	46.5	50.2	47
14/12/2007 06:30	48.3	47	51.5	47.5
14/12/2007 06:35	48	46.9	50.1	47.5
14/12/2007 06:40	48.4	47.1	57.1	47.5
14/12/2007 06:45	49	47.1	54.2	48
14/12/2007 06:50	48.6	46.9	53.6	47
14/12/2007 06:55	48.5	47.1	51.6	47.5

LOCATION 2 – 3RD FLOOR ROOF LEVEL

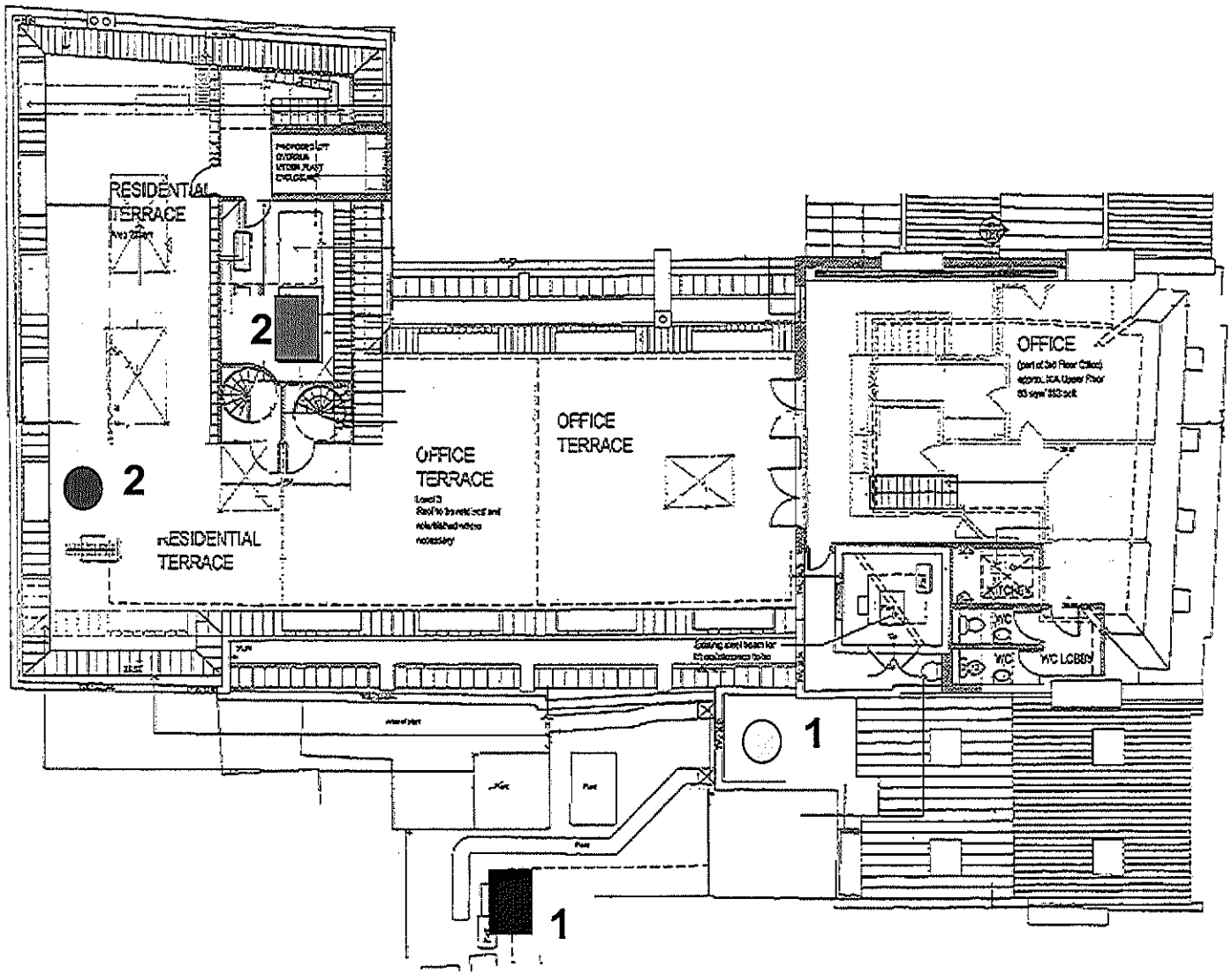


Start	13/12/2007 10:00	Day Time		
End	13/12/2007 23:00			
Period	1h			
Period start	Leq	Lmin	Lmax	L90
13/12/2007 10:00	60.8	52.7	73	55
13/12/2007 11:00	60.9	52.9	78.2	55
13/12/2007 12:00	59.7	52.1	83	53.5
13/12/2007 13:00	60.6	51.7	80.9	53.5
13/12/2007 14:00	63.8	52	91.9	53.5
13/12/2007 15:00	59.5	52.6	74.3	54.5
13/12/2007 16:00	60.3	53	79.9	55
13/12/2007 17:00	58.8	52.1	81.9	53.5
13/12/2007 18:00	57.3	51.2	78.7	53
13/12/2007 19:00	58.8	51.6	79.8	53.5
13/12/2007 20:00	57.3	51.3	74.8	53.5
13/12/2007 21:00	63.6	50.5	89.5	53
13/12/2007 22:00	54.8	48	69.7	50
Start	14/12/2007 07:00	Day Time		
End	14/12/2007 10:00			
Period	1h			
Period start	Leq	Lmin	Lmax	L90
14/12/2007 07:00	64.4	53.1	94.1	55.5
14/12/2007 08:00	60.3	52	83	54.5
14/12/2007 09:00	61.5	52.3	80.8	54.5
Start	13/12/2007 23:00	Night Time		
End	14/12/2007 07:00			
Period	5min			
Period start	Leq	Lmin	Lmax	L90

13/12/2007 23:00	55.2	50	63.1	51.5
13/12/2007 23:05	53.4	48	62.2	49.5
13/12/2007 23:10	54.3	48.3	66.1	50.5
13/12/2007 23:15	52.6	47.6	60.4	49.5
13/12/2007 23:20	56.8	49.5	76.4	51
13/12/2007 23:25	55.3	47.2	65.8	49.5
13/12/2007 23:30	55.5	48.5	64.3	51
13/12/2007 23:35	55.2	47.7	62.6	50
13/12/2007 23:40	55.6	49.3	63.5	51
13/12/2007 23:45	54.5	47.7	62.5	50
13/12/2007 23:50	56	50.4	65.2	52
13/12/2007 23:55	53.6	48.6	63.3	50
14/12/2007 00:00	54	48	62.5	49
14/12/2007 00:05	53.1	46.3	65.7	47.5
14/12/2007 00:10	52.5	46.8	64.4	48
14/12/2007 00:15	53.2	47	62.1	48.5
14/12/2007 00:20	52.3	46.4	62.1	47.5
14/12/2007 00:25	53.9	49.5	64.3	50
14/12/2007 00:30	57.1	47	73.6	48
14/12/2007 00:35	50.3	46.2	60	47.5
14/12/2007 00:40	49.8	45.4	60.2	46.5
14/12/2007 00:45	52.4	45.4	63.2	46.5
14/12/2007 00:50	52.2	45.9	64.9	47
14/12/2007 00:55	49.4	45.6	58.2	46.5
14/12/2007 01:00	49.5	45.9	56.6	46.5
14/12/2007 01:05	54.5	45.9	69.2	47
14/12/2007 01:10	51.4	45.8	64.6	46.5
14/12/2007 01:15	56.3	46.3	67.7	48
14/12/2007 01:20	51.5	45.5	61.3	46.5
14/12/2007 01:25	49.1	45.1	57.7	46
14/12/2007 01:30	48.6	46.3	55.6	46.5
14/12/2007 01:35	51	45.7	63.7	47
14/12/2007 01:40	52.2	46.2	68.1	47
14/12/2007 01:45	49.9	46.7	57.4	47
14/12/2007 01:50	49.4	46.2	56.4	47
14/12/2007 01:55	64.9	46.8	85.2	48
14/12/2007 02:00	49.7	44.8	60.3	46
14/12/2007 02:05	48.2	44.8	54.1	46
14/12/2007 02:10	50.2	46.4	63.6	47
14/12/2007 02:15	48.4	45.9	54.6	46.5
14/12/2007 02:20	52	45.7	62.2	46.5
14/12/2007 02:25	49.3	45.4	63	46
14/12/2007 02:30	49.8	44.2	60.2	45
14/12/2007 02:35	47.9	44	55.2	45
14/12/2007 02:40	48.4	45.3	58.8	46
14/12/2007 02:45	50.3	45.2	63.4	46
14/12/2007 02:50	49.1	44.4	61.3	45.5
14/12/2007 02:55	48.1	45.1	54.6	46
14/12/2007 03:00	50.6	46	64.5	47
14/12/2007 03:05	48.4	45.4	55.7	46
14/12/2007 03:10	51	46.5	61.5	47.5
14/12/2007 03:15	47.7	45.4	56.1	46
14/12/2007 03:20	48.9	45.8	56.8	46.5

14/12/2007 03:25	49.3	45.5	55.5	46
14/12/2007 03:30	51.7	48.5	58.2	49
14/12/2007 03:35	50.4	46.3	58.1	47
14/12/2007 03:40	53.4	46.7	67.2	47.5
14/12/2007 03:45	54.3	48.2	68.4	50
14/12/2007 03:50	53.9	48	64.6	49.5
14/12/2007 03:55	54	48.8	66.4	49.5
14/12/2007 04:00	53.3	47.5	63.4	48.5
14/12/2007 04:05	59.9	47.8	76.2	49
14/12/2007 04:10	56.1	47.6	59.8	48.5
14/12/2007 04:15	51.5	48	60.9	49
14/12/2007 04:20	54.7	48.6	65.9	49.5
14/12/2007 04:25	51.1	48.2	60	49
14/12/2007 04:30	52.3	48.3	63.7	49
14/12/2007 04:35	55.6	48.3	66	49.5
14/12/2007 04:40	55.4	48.3	67.6	49
14/12/2007 04:45	51.3	48.3	57.6	49.5
14/12/2007 04:50	53.8	48.7	65	50
14/12/2007 04:55	55.8	50.2	66.1	51.5
14/12/2007 05:00	55.5	49.9	66.2	50.5
14/12/2007 05:05	54.1	48.4	62.9	49.5
14/12/2007 05:10	54.7	48	70.1	49
14/12/2007 05:15	54.3	48.6	62.8	49.5
14/12/2007 05:20	55.3	49	64.9	50
14/12/2007 05:25	55.8	49.6	65.7	50.5
14/12/2007 05:30	58.9	49.4	72.3	52
14/12/2007 05:35	57.6	49.7	66.3	51.5
14/12/2007 05:40	56	50.5	64	52
14/12/2007 05:45	62.2	50.8	71.1	53.5
14/12/2007 05:50	54.6	50.4	61.6	51.5
14/12/2007 05:55	57.5	51.7	71.3	53
14/12/2007 06:00	57.1	50.5	64.8	53
14/12/2007 06:05	57	50.9	68.1	52.5
14/12/2007 06:10	57.4	51.8	65.1	53.5
14/12/2007 06:15	57.1	52	65	53.5
14/12/2007 06:20	57.6	52.6	65	53.5
14/12/2007 06:25	58.7	52	69.3	54
14/12/2007 06:30	57.6	52	67.8	53.5
14/12/2007 06:35	58.6	52.2	67.4	53.5
14/12/2007 06:40	60.8	52.9	69.4	54.5
14/12/2007 06:45	58.7	52.9	69.5	54
14/12/2007 06:50	61.5	53.9	80	55.5
14/12/2007 06:55	58.4	53.2	65.9	54.5

FIGURE 1
NOISE MONITORING LOCATION MAP



Monitoring Location 1

Monitoring Location 2

Proposed Installation Location 1

Proposed Installation Location 2

H&H Acoustic Consultancy Division

Exeter. Glasgow. Hadleigh. High Wycombe. Northwich. Old Dalby

H&H Acoustic Consultancy Division
Crown Business Park, Old Dalby, Melton Mowbray, Leicestershire, U.K.,
LE14 3NQ, Tel: +44 (0)1664 821847 Fax: +44 (0)1664 823071
Email: consultancy@hodgsongroup.co.uk

Client: Morgan Ashurst Plc

Project: 31 Great Queen Street, London, WC2B 5AG

Title: Noise Monitoring Location Map

Date: 03rd December 2008

Scale: NTS **Drawn:** S.P

Checked: NB **Project Ref:** 9218

Figure Number: 1 **Rev:** A