

18A WAYLEN STREET, READING

PLANNING COMPLIANCE REPORT

Report 15587.PCR.01

For:

BAGR

Central Jamme Mosque

18a Waylen Street

Reading

RG1 7UR

Site Address	Report Date	Revision History
18A Waylen Street, Reading RG1 7UR	17/10/2017	

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1.0 INTRODUCTION

KP Acoustics Ltd, Britannia House, 11 Glenthorne Road, London, W6 0LH, has been commissioned by BAGR, Central Jamme Mosque, 18a Waylen Street, Reading, Berkshire, RG1 7UR, to undertake an environmental noise survey and noise breakout assessment at 18A Waylen Street, Reading.

The background noise levels measured during the environmental noise survey will be used to determine daytime and night-time noise emission criteria for an air conditioning unit installation in compliance with the requirements of Reading Borough Council.

In addition, the background noise levels measured will also be used to assess any potential breakout noise due to mosque activity to the closest residential receiver.

This report presents the results of the environmental survey and sound insulation investigation undertaken in order to measure prevailing background noise levels and assess noise breakout from the space.

2.0 ENVIRONMENTAL NOISE SURVEY AND EQUIPMENT

2.1 Procedure

The external noise survey was undertaken on the site as shown in Figure 15587.SP1. The location was chosen in order to collect data representative of the worst-case levels expected on the site due to all nearby sources.

The site is bounded by Waylen Street to the East, and existing residential properties to the North, South, and West. At the time of the survey, the background noise climate was solely dominated by road traffic noise from the surrounding roads.

Continuous automated monitoring was undertaken for the duration of the survey between 11:15 on 13th October and 17:00 14th October 2016. Weather conditions were generally dry with light winds and therefore suitable for the measurement of environmental noise.

The measurement procedure complied with ISO 1996-2:2007 Acoustics *"Description, measurement and assessment of environmental noise - Part 2: Determination of environmental noise levels"*.

Noise measurements of internal community centre activity were undertaken above the Imam's address position, as shown in site photo 15587.SP2. The measurement process encapsulated the three key prayer times Zohr, Asr, and Isha during a Friday prayer period, which is understood to be the busiest day of the week.

2.2 Equipment

The equipment calibration was verified before and after the survey and no calibration irregularities were observed. The equipment used was as follows.

- 2 No. Svantek Type 957 Class 1 Sound Level Meter
- B&K Type 4231 Class 1 Calibrator

2.3 Results

The $L_{Aeq: 5min}$, $L_{Amax: 5min}$, $L_{A10: 5min}$ and $L_{A90: 5min}$ acoustic parameters were measured throughout the duration of the external noise survey. Measured levels are shown as a time history in Figure 15587.TH1. Average daytime and night time noise levels are shown in Table 2.1.

	Average L_{Aeq} Level dB(A)	Minimum L_{A90} Level dB(A)
Daytime 07:00-23:00	56	39
Night-time 23:00-07:00	47	35

Table 2.1 Site noise levels for daytime and night time

The $L_{Aeq: 5min}$ and $L_{Amax: 5min}$ acoustic parameters were measured throughout the duration of the internal noise survey. Measured levels are shown as a time history in Figure 15587.TH2. A spectrum of the highest measured L_{Aeq} event is shown in Table 2.2 below, which will be used to predict noise breakout to the external environment. Please note that, as shown in the time history, internal noise levels are reasonably low due to activity comprising of silent attendance during recitals from the Imam only. Furthermore, this activity noise level would be considered worst case with regards to mosque activity due to the survey being undertaken during the busiest attendance period.

Internal Noise Measurement	Octave band centre frequency SRI, dB								Overall SPL @1m
	63	125	250	500	1k	2k	4k	8k	
Worst case $L_{Aeq 5 min}$	54	60	68	72	68	57	46	33	71

Table 2.2 Worst case internal noise activity

3.0 SOUND INSULATION INVESTIGATION AND EQUIPMENT

In order to assess potential noise breakout from the mosque to the external environment, a sound insulation investigation was undertaken as described below.

3.1 Procedure

High volume pink noise was generated from two loudspeakers within the mosque, positioned to obtain a diffuse sound field. A spatial average of the resulting one-third octave band noise levels between 100 Hz and 3150 Hz was obtained by using a moving microphone technique over a minimum period of 15 seconds at each of two positions. Source noise measurements were also undertaken at 1 metre from the internal face of the windows and doors on the North façade, observed to be the worst case breakout point.

Receiver measurements were undertaken using a fixed measurement position was undertaken at 1 metre from the external face of the aforementioned external building fabric elements

The results of the tests were rated in accordance with BS EN ISO 717-1: 1997 *“Rating of sound insulation in buildings and of building elements. Part 1 Airborne sound insulation”*.

3.2 Equipment

The instrumentation used during the sound insulation investigation is shown in Table 3.1 below.

Instrument	Manufacturer and Type	Serial Number
Precision integrating sound level meter & analyser	NTi XL2-TA Calibration No: 03087/1	A2A-09521-E0
Active Loudspeaker	RCF ART 310A	HAX20864
Active Loudspeaker	RCF ART 310A	NLFN00671
Pink Noise Source	NTi Audio Minirator MR-PRO	G2P-RACDR-G0
Pink Noise Source	NTi Audio Minirator MR-PRO	G2P-RABTR-F2
Calibrator	B&K Type 4231 Calibration No: 03086/2	1897774

Table 3.1 Instrumentation used during testing

3.3 Results

The main parameter used throughout this document to express airborne sound insulation of separating constructions is D_w . All specifications in this report will therefore be given with respect to this descriptor. Summarised results of the airborne tests are shown in Table 3.2.

Test Element	Source	Receiver	D_w Performance
Single Doorset	Mosque	1m from façade outside	32 dB
Double Doorset			32 dB
Window			31 dB

Table 3.2 Sound insulation test results

4.0 NOISE CRITERIA

4.1 New Plant Installations

The criterion of Reading Borough Council for noise emissions of new plant in this instance is as follows:

Within three months of the date of this Notice, an external noise assessment including details to show the external arrangement of air conditioning and ventilation systems to be installed/retained, shall have been submitted to and approved in writing by the Local Planning Authority. The details shall include location plans and relevant elevations of the equipment and noise rating levels.

The noise assessment shall have been submitted to and approved in writing by the Local Planning Authority. The assessment shall be carried out in accordance with BS4142:2014 methodology. The predicted rating level, $L_{Ar,Tr}$ (specific sound level plus any adjustment for the characteristic features of the sound) as measured at a point 1 metre external to sensitive facades shall be at least 10dB below the existing background sound level, $L_{A90,T}$ when all plant/equipment (or any part of it) is in operation. The plant and any required mitigation measures shall thereafter only be installed in accordance with the assessment within six months of this Notice and shall thereafter be maintained to the same standard.

Reason: to safeguard the amenities of the adjoining residential properties and the area generally

Policies: CS34, DM4

We therefore propose to set the noise criteria as shown in Table 4.1 in order to comply with the above requirement.

Night-time 23:00-07:00	
Noise criterion at nearest receiver due to plant installations	25dB(A)

Table 4.1: Proposed Noise Emissions Criterion

As the proposed air conditioning could be used during night-time hours, the criterion of 25dB(A) will be used to ensure the amenity of the closest residential receiver will be protected at all times.

4.2 Breakout Noise due to Mosque Activity

The criterion of Reading Borough Council for noise breakout of mosque activity is as follows:

Within three months of the date of this Notice, an external noise assessment shall have been submitted to and approved in writing by the Local Planning Authority. The assessment shall be

carried out by a qualified member of the Institute of Acoustics and shall include an assessment of noise breakout from activities taking place at the mosque at various times of full/classes services, or other meetings/congregations to cover representative times of operation of the mosque. The noise from activities at the mosque $LA_{eq, T}$ as measured at a point 1 metre external to sensitive facades shall be no greater than 0 dB above the existing background sound level, $LA_{90, T}$, and the report shall recommend whether any mitigation measures to control noise are required in order to meet this limit. The mitigation measures (if required) shall thereafter be undertaken within six months of this Notice and the use operated only with these mitigation measures in place.

Reason: as no noise assessment has been undertaken and in the interests of maintaining residential amenity.

Policies: CS34, DM4

We therefore propose to set the noise criteria as shown in Table 4.2 in order to comply with the above requirement.

Night-time 23:00-07:00	
Noise criterion at nearest receiver due to mosque activity breakout noise	35dB(A)

Table 4.2: Proposed Noise Emissions Criterion

As prayers could be during night-time hours, the criterion of 35dB(A) will be used to ensure the amenity of the closest residential receiver will be protected at all times due to breakout noise activity.

5.0 PLANT NOISE ASSESSMENT

It is understood that the plant installation is comprised of the following units:

- 2 No. Mitsubishi FDC125VN External Condenser Unit

The units would be installed to the North façade of the property, as shown in indicative site plan 15587.SP1.

The closest noise sensitive receiver to the units' location will be a residential window located approximately 5.5 meters away from the proposed installation location at the adjacent property.

It should be noted that line of site between the units and the receiving window would be blocked by the boundary fence between the properties.

The sound pressure levels at 1m as provided by the manufacturer for the unit are shown in Table 5.1.

Unit	Sound Pressure Levels (dB) in each Frequency Band at 1m							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Mitsubishi FDC125VN External Condenser Unit	56	52	51	47	45	38	38	33

Table 5.1 Manufacturer's Sound Pressure Levels at 1m

5.1 Objective overview

Taking all acoustic corrections into consideration, including distance corrections, the noise level expected at the closest residential window would be as shown in Table 5.2. Detailed calculations are shown in Appendix B.

Receiver - Nearest Noise Sensitive Window	Criterion	Noise Level at Receiver (Residential Window)
Operating hours of plant	25dB(A)	25dB(A)

Table 5.2 Predicted noise level and criterion at nearest noise sensitive location

As shown in Appendix B and Table 5.2, transmission of noise to the nearest sensitive window due to the effects of the plant installation fully satisfies the emissions criteria set based on the requirements of Reading Borough Council, providing that the units are installed within an acoustic enclosure as detailed in Section 5.2.

5.2 Proposed Mitigation Measures for Plant Units

In order to reduce noise emissions from the proposed air conditioning units to within the criterion specified in Section 4.1, an acoustic enclosure should be installed providing the attenuation characteristics shown in Table 5.3.

Unit	Attenuation Levels (dB) in each Frequency Band							
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Acoustic Enclosure	4	6	13	20	25	20	20	15

Table 5.3 Required Attenuation Levels of Acoustic Enclosure

Such enclosures can be provided by Environmental Equipment Corporation Ltd (EEC Ltd), or similar providers of plant mitigation equipment.

5.3 BS8233 Assessment

The value of 25dB(A) is to be considered outside of the building. Windows may be closed or partially closed leading to further attenuation, as follows.

Further calculations have been undertaken to assess whether the noise emissions from the plant units installation would be expected to meet the recognised British Standard recommendations, in order to further ensure the amenity of nearby noise sensitive receivers.

British Standard 8233:2014 '*Sound insulation and noise reduction for buildings – Code of Practice*' gives recommendations for acceptable internal noise levels in residential properties. Assuming worst case conditions, of the closest window being for a bedroom, BS8233:2014 recommends 30dB(A) for internal resting/sleeping conditions.

With a calculated external level of 25dB(A), the residential window itself would need to provide no additional attenuation in order for this recommendation to be achieved. According to BS8233:2014, even a partially open window offers 10-15dB attenuation, thus leading to a further reduced interior noise level.

Receiver	Design Range – <i>For resting/sleeping conditions in a bedroom, in BS8233:2014</i>	Noise Level at Receiver (due to plant installation)
Inside Nearest Residential Space	30dB(A)	Non-significant

Table 5.4 Noise levels and criteria inside nearest residential space

Predicted levels are shown in Table 5.4, with detailed calculations shown in Appendix B. It can therefore be stated that, as well as complying with the requirements of Reading Borough Council, the noise emissions from the plant unit installation would be expected to comfortably meet the most stringent recommendations of the relevant British Standard.

6.0 NOISE BREAKOUT ASSESSMENT

It is understood that the mosque will feature amplified speech to support prayer activities. This sound source features mid-high frequency components, as shown in Table 2.2.

We would propose to base this assessment on predicted received noise levels due to breakout noise, compared with noise criterion outlined in Section 4.2.

It is understood that the external façade is comprised of brickwork and good quality double glazed windows. The weakest element of the external facade would be the glazed elements, which have been tested in-situ and shown to provide a sound insulation performance of 31-32dB R_w .

Using the source level of 71dB(A) within the place of worship and the measured attenuation performance of the external building fabric, Table 6.1 shows the predicted sound pressure level at the nearest noise sensitive receiver, compared with the previously mentioned noise emissions criterion. Detailed calculations are shown in Appendix B2.

Receiver - Nearest Noise Sensitive Window	Criterion	Noise Level at Receiver (Residential Window)
Operating hours of plant	35dB(A)	25dB(A)

Table 6.1 Predicted noise level and criterion at nearest noise sensitive location due to breakout noise

As can be seen from Table 6.1 and Appendix B2, the breakout through the external façade at the closest residential receiver would be below the Local Authority's criterion, ensuring that residential amenity would be protected at all times.

Therefore, no additional upgrades would be required to the external building fabric.

7.0 CONCLUSION

An environmental noise survey has been undertaken at Ba18A Waylen Street, Reading, by KP Acoustics Ltd between 13 October and 14 October 2017. The results of the survey have enabled criteria to be set for noise emissions relating to the installation of a new plant unit.

Using manufacturer noise data, noise levels are predicted at the nearby noise sensitive receivers for compliance with current requirements.

Calculations show that noise emissions from the proposed air conditioning unit installation would meet the requirements of Reading Borough Council.

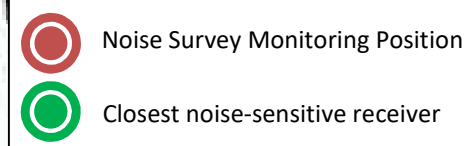
Further calculations have been undertaken with regards to the relevant British Standard and it has been ensured that the amenity of nearby residential receivers will be protected.

In addition, an assessment of breakout noise due to mosque activity has been undertaken. The calculations and assessment show that noise breakout would be non-significant, and there would be no negative impact on the occupiers of the nearby residential receivers.

No further mitigation measures would be required in order to protect the surrounding residences from noise due to mosque activity.

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Title:

Indicative site plan showing noise monitoring position and closest noise sensitive receiver

Date: 17 October 2017

FIGURE 15587.SP1



18A Waylen Street, Reading
Environmental Noise Time History
13th October to 14th October 2017

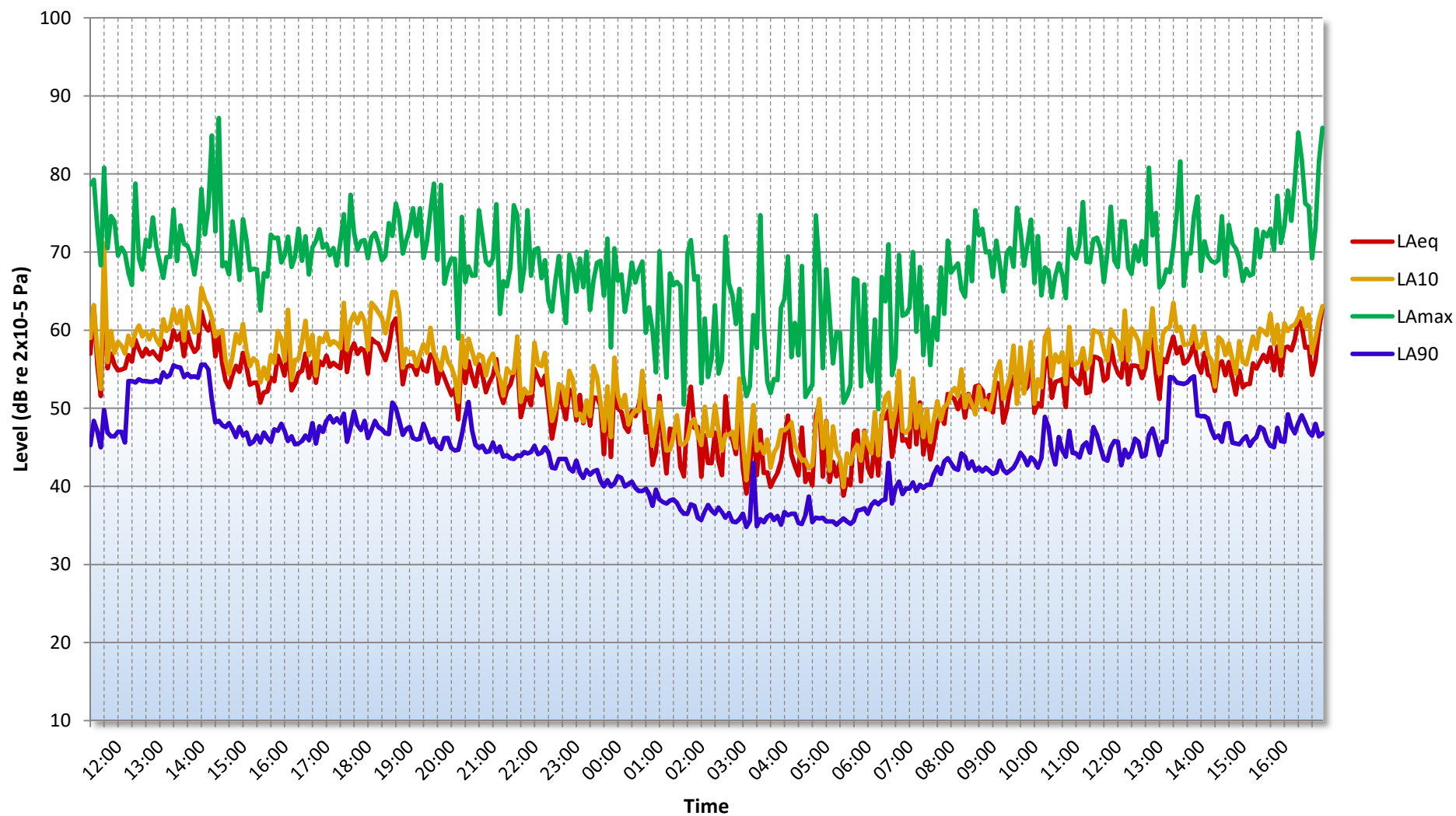


Figure 14988.TH1

18A Waylen Street, Reading
Internal Environmental Noise Time History
13th October 14th October 2017

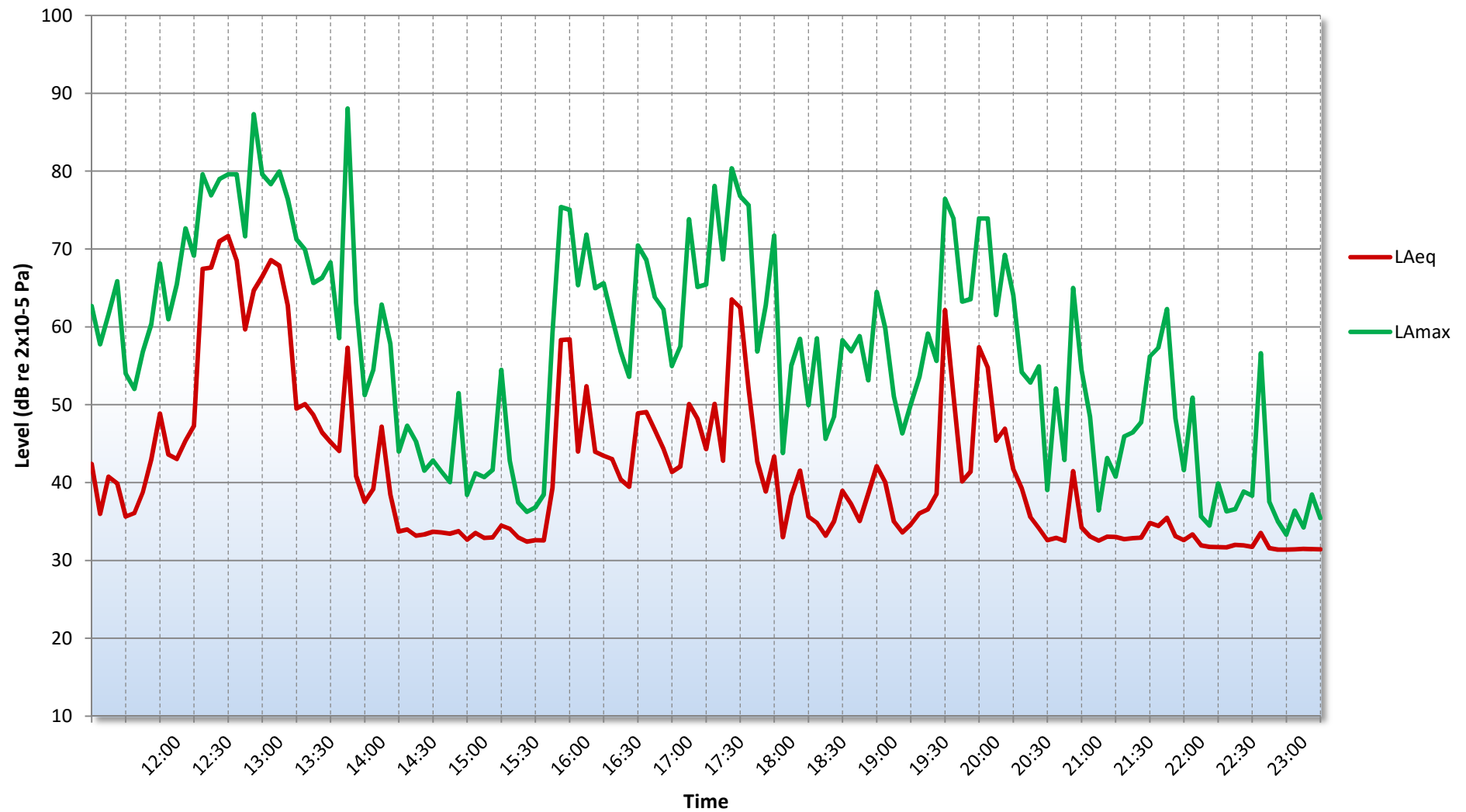


Figure 15587.TH2

GENERAL ACOUSTIC TERMINOLOGY

Decibel scale - dB

In practice, when sound intensity or sound pressure is measured, a logarithmic scale is used in which the unit is the 'decibel', dB. This is derived from the human auditory system, where the dynamic range of human hearing is so large, in the order of 10^{13} units, that only a logarithmic scale is the sensible solution for displaying such a range.

Decibel scale, 'A' weighted - dB(A)

The human ear is less sensitive at frequency extremes, below 125Hz and above 16Khz. A sound level meter models the ears variable sensitivity to sound at different frequencies. This is achieved by building a filter into the Sound Level Meter with a similar frequency response to that of the ear, an A-weighted filter where the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq} . The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for no more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise.

L_{90}

This is the level exceeded for no more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 11 such octave bands whose centre frequencies are defined in accordance with international standards. These centre frequencies are: 16, 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000 and 16000 Hertz.

Environmental noise terms are defined in BS7445, *Description and Measurement of Environmental Noise*.

APPLIED ACOUSTIC TERMINOLOGY

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than a single source and 4 sources produce a 6dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Hearing perception is highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a guide to explain increases or decreases in sound levels for many scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud

Transmission path(s)

The transmission path is the path the sound takes from the source to the receiver. Where multiple paths exist in parallel, the reduction in each path should be calculated and summed at the receiving point. Outdoor barriers can block transmission paths, for example traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and construction.

Ground-borne vibration

In addition to airborne noise levels caused by transportation, construction, and industrial sources there is also the generation of ground-borne vibration to consider. This can lead to structure-borne noise, perceptible vibration, or in rare cases, building damage.

Sound insulation - Absorption within porous materials

Upon encountering a porous material, sound energy is absorbed. Porous materials which are intended to absorb sound are known as absorbents, and usually absorb 50 to 90% of the energy and are frequency dependent. Some are designed to absorb low frequencies, some for high frequencies and more exotic designs being able to absorb very wide ranges of frequencies. The energy is converted into both mechanical movement and heat within the material; both the stiffness and mass of panels affect the sound insulation performance.

APPENDIX B1

18A Waylen Street, Reading

AIR CONDITIONING UNIT EMISSIONS CALCULATIONS

Source: Air Conditioning Unit Installations

Receiver: Closest Residential Window

	Frequency, Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Mitsubishi FDC125VN SPL@1m	56	52	51	47	45	38	38	33	
Correction for number of units (2)	3	3	3	3	3	3	3	3	
Correction for surface reflections (2)	6	6	6	6	6	6	6	6	
Minimum attenuation provided by boundary fence, dB	-5	-5	-5	-5	-5	-5	-5	-5	
Minimum attenuation provided by distance (4.5m)	-13	-13	-13	-13	-13	-13	-13	-13	
Minimum attenuation provided by proposed acoustic enclosure, dB	-4	-6	-13	-20	-25	-20	-20	-15	
Sound Pressure level at receiver due to source	43	37	29	18	11	9	9	9	25

Design Criterion	25
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APPENDIX B2

18A Waylen Street, Reading

NOISE BREAKOUT DUE TO MOSQUE ACTIVITY ACOUSTIC CALCULATIONS

The main model was designed around the following formula:

$$SPL2 = SPL1 - SRI + 10\log(S) + 10\log(Q/4\pi r^2) - 6$$

where:

SPL2 is the sound pressure level at the receiver's facade

SPL1 is the sound pressure level within the source room

S is the area of the main wall

$Q/4\pi r^2$ are the directivity and distance corrections

SRI is the sound reduction index of the break-out facade

The 6dB term occurs because there is no reverberant sound field in the open

Receiver Level due to noise source in community centre

Measured SPL 1 (dB)	71
Approximate area S of the facade looking onto the closest residence (sq.m)	25
Correction for area $10\log(S)$	14
On-site SRI of façade* (dB)	31
Distance r to closest residence (m)	5.5
Directivity factor Q for wall transmission	2
Combined correction for directivity and distance (dB)	-23
Current Resultant Predicted Receiver Level SPL 2 (dB)	25
Measured background noise level (dB)	35

*SRI of door and window systems (worst case breakout elements)

ANTI-VIBRATION MOUNTING SPECIFICATION REFERENCE DOCUMENT

1.0 General

- 1.1 All mountings shall provide the static deflection, under the equipment weight, shown in the schedules. Mounting selection should allow for any eccentric load distribution or torque reaction, so that the design deflection is achieved on all mountings under the equipment, under operating conditions.
- 1.2 It is the supplier's responsibility to ensure that all mountings offered are suitable for the loads, operating and environmental conditions which will prevail. Particular attention should be paid to mountings which will be exposed to atmospheric conditions to prevent corrosion.
- 1.3 All mountings shall be colour coded, or otherwise marked, to indicate their load capacity, to facilitate identification during installation.

Where use of resilient supports allows omission of pipe flexible connections for vibration/noise isolation, it shall be the Mechanical Service Consultant's or Contractor's responsibility to decide whether such devices are required to compensate for misalignment or thermal strain.

2.1 Type A Mounting (Caged Spring Type)

- 2.1.1 Each mounting shall consist of cast or fabricated telescopic top and bottom housings enclosing one or more helical steel springs as the principle isolation elements, and shall incorporate a built-in levelling device. The housing should be designed to permit visual inspection of the springs after installation, i.e. the spring must not be totally enclosed.
- 2.1.2 The springs shall have an outside diameter of not less than 75% of the operating height, and be selected to have at least 50% overload capacity before becoming coil-bound.
- 2.1.3 The bottom plate of each mounting shall have bonded to it a rubber/neoprene pad designed to attenuate any high frequency energy transmitted by the springs.
- 2.1.4 Mountings incorporating snubbers or restraining devices shall be designed so that the snubbing, damping or restraining mechanism is capable of being adjusted to have no significant effect during the normal running of the isolated machine.
- 2.1.5 All nuts, bolts or other elements used for adjustment of a mounting shall incorporate locking mechanisms to prevent the isolator going out of adjustment as a result of vibration or accidental or unauthorised tampering.

2.2 Type B Mounting (Open Spring Type)

- 2.2.1 Each mounting shall consist of one or more helical steel springs as the principal isolation elements, and shall incorporate a built-in levelling device.
- 2.2.2 The springs shall be fixed or otherwise securely located to cast or fabricated top and bottom plates, shall have an outside diameter of not less than 75% of the operating height, and shall be selected to have at least 50% overload capacity before becoming coil-bound.
- 2.2.3 The bottom plate shall have bonded to it a rubber/ neoprene pad designed to attenuate any high frequency energy transmitted by the springs.

2.3 Type C Mounting (Rubber/Neoprene Type)

Each mounting shall consist of a steel top plate and base plate completely embedded in oil resistant rubber/neoprene. Each mounting shall be capable of being fitted with a levelling device, and should have bolt holes in the base plate and a threaded metal insert in the top plate so that they can be bolted to the floor and equipment where required.

3.0 Plant Bases

3.1 Type A Bases (A.V. Rails)

An A.V. Rail shall comprise a steel beam with two or more height-saving brackets. The steel sections must be sufficiently rigid to prevent undue strain in the equipment and if necessary should be checked by the Structural Engineer.

3.2 Type B Bases (Steel Plant Bases)

Steel plant bases shall comprise an all-welded steel framework of sufficient rigidity to provide adequate support for the equipment, and fitted with isolator height saving brackets. The frame depth shall be approximately 1/10 of the longest dimension of the equipment with a minimum of 150 mm. This form of base may be used as a composite A.V. rail system.

3.3 Type C Bases (Concrete Inertia Base: for use with steel springs)

These shall consist of an all-welded steel pouring frame-work with height saving brackets, and a frame depth of approximately 1/12 of the longest dimension of the equipment, with a minimum of 100 mm. The bottom of the pouring frame should be blanked off, and concrete (2300 kg/m³) poured in over steel reinforcing rods positioned 35 mm above the bottom. The inertia base should be sufficiently large to provide support for all parts of the equipment, including any components which over-hang the equipment base, such as suction and discharge elbows on centrifugal pumps.