Belsize Square Synagogue

ENVIRONMENTAL NOISE SURVEY
REPORT 15693/ENS1

For:

MR Partnership
41 Foley Street
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REPORT 15693/ENS1

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1.0 INTRODUCTION

New rooftop air conditioning plant is proposed at the Synagogue in Belsize Square. Hann Tucker Associates have therefore been commissioned to undertake an environmental noise survey around the site, to propose suitable plant noise emission criteria based on the requirements of the local authority and to assess the proposed plant's noise emissions in accordance with the criteria.

This report presents the survey methodology and findings. The survey data has been used as the basis for various acoustic assessment purposes.

2.0 OBJECTIVES

To establish, by means of detailed 24 hour daytime and night time fully manned environmental noise monitoring, the existing A-weighted (dBA) L_{10}, L_{90}, L_{eq} and L_{max} environmental noise levels at selected accessible street/roof level positions around the site.

To measure L_{eq}, L_{90} and L_{max} octave band spectra noise levels for typical daytime and night time periods at each measurement position in order to obtain a more detailed description of the noise climate.

Based on the results of the noise survey, and in conjunction with the Local Authority, to recommend suitable plant noise emission criteria.

To assess the proposed plant for compliance with the criteria recommended.

If necessary, to advise on noise control measures to satisfy the requirements of the local authority.

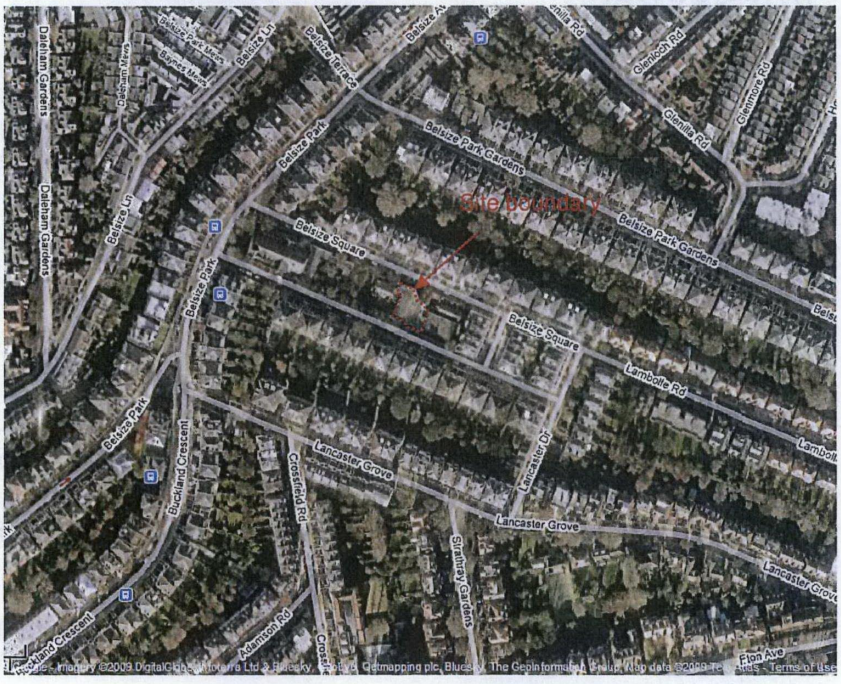
These objectives are as set out in Parts 1.0 and 2.0 of our letter dated 22 May 2009.

3.0 SITE DESCRIPTION

3.1 Location

The site is located in Belsize Square and falls within the administrative boundary of Cambden Borough Council. See Location Map below.

Location Map (maps.google.co.uk)



3.2 Description

The site is bounded to the North-East and South-West by Belsize Square, to the North-West by a house and to the South-East by a scout hut and hall.

Residential properties lie on the opposite sides of Belsize Square.

The dominant noise sources were judged to be road traffic and activities in and around the synagogue.

Site Plan (maps.google.co.uk)

4.0 ACOUSTIC TERMINOLOGY

For an explanation of the acoustic terminology used in this report please refer to Appendix A enclosed.

5.0 METHODOLOGY

5.1 Procedure

Fully automated environmental noise monitoring was undertaken from approximately 10:20 hours on Tuesday 16 June 2009 to 14:30 hours on Wednesday 17 June 2009.

Due to the nature of the survey, i.e. unmanned, it is not possible to accurately comment on the weather conditions throughout the entire survey period. However at the beginning and end of the survey period the wind conditions were calm and the sky was generally patchy cloud. We understand that generally throughout the survey period the weather conditions were similar to these and are considered suitable for obtaining representative measurement results.

Measurements were taken continuously of the A-weighted (dBA) L_{10}, L_{90}, L_{eq} and L_{max} sound pressure levels over 15 minute periods.

5.2 Measurement Positions

The noise level measurements were undertaken at 2no. positions around the development site. The measurement positions are described in the table below.

Position No	Description
1	The sound level meter was situated on the first floor roof in approximately the middle of the building's footprint. The microphone was secured to a pole in a free field position at a height of approximately 10 metres above street level, approximately 3 metres North of the proposed plant location.
2	The sound level meter was situated on the ground floor roof to the West of the hall. The microphone was secured to a pole in a free field position approximately 7 metres above street level.

The positions were selected in order to assess the lowest noise levels at the development site for subsequent use in setting plant noise emission criteria and are shown on the plan below.

Plan Showing Unmanned Measurement Positions (maps.google.co.uk)

5.3 Instrumentation

The instrumentation used during the survey is presented in the Table below:

Description	Manufacturer	Type	Serial Number	Latest Verification
Position 1 Type 1 Data Logging Sound Level Meter	Larson Davis	824	3841	LD calibration on 19/03/2010
Position 1 Type 1 ½" Condenser Microphone	Larson Davis	377B02	108290	LD calibration on 19/03/2010
Position 2 Type 1 Data Logging Sound Level Meter	Larson Davis	824	3838	LD calibration on 19/03/2010
Position 2 Type 1 ½" Condenser Microphone	Larson Davis	377B02	108306	LD calibration on 19/03/2010
Type 1 Calibrator	Larson Davis	CAL200	3082	LD calibration on 31/10/2008

Each sound level meter, including the extension cable, was calibrated prior to and on completion of the surveys. No significant changes were found to have occurred.

Each sound level meter was located in an environmental case with the microphone connected to the sound level meter via an extension cable. Each microphone was fitted with a Larson Davis windshield.

6.0 RESULTS

The results have been plotted on Time History Graphs 15693/TH1 to 15693/TH4 enclosed presenting the 15 minute A-weighted (dBA) L_{10}, L_{90}, L_{eq} and L_{max} levels at each measurement position throughout the duration of the survey.

The lowest measured L_{90} noise levels are presented in the following table.

	Lowest Measured L_{90} Noise Levels	
Position	**Daytime (07:00 – 23:00)**	**Night-time (23:00 – 07:00)**
1	38	35
2	39	36

7.0 DISCUSSION OF NOISE CLIMATE

Due to the nature of the survey, i.e. unmanned, it is not possible to accurately describe the dominant noise sources, or specific noise events throughout the entire survey period. However, at the beginning and end of the survey period the dominant noise sources were noted to be road traffic and activity in and around the synagogue.

8.0 PLANT NOISE EMISSION CRITERIA

Belsize Square Synagogue lies within the administrative boundary of the London Borough of Camden. We understand Camden's noise standards relating to new plant installations to be as follows:

> "**1a.** **(CG08)**
>
> 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).
>
> And,
>
> **1b.** **(CG09)**
>
> For each of the octave band of centre frequencies 63Hz-8KHz inclusive, noise levels from all plant/equipment (measured in L_{Aeq}) when in operation shall at all times add not more than 1 decibel to the existing background noise level L_{A90}, expressed in dB(A), in the same octave band as measured 1 metre external to sensitive facades."

Based on the requirements quoted above, and the results of the environmental noise survey, we recommend the following plant noise emission criteria to be achieved at all nearby noise-sensitive properties.

Plant Noise Emission Levels	
Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
33	30

9.0 PLANT NOISE ASSESSMENT

9.1 Proposed Plant

We understand that 3no. Daikin RXYQ18P external condensers are proposed to be installed at ground level in the yard to the East of the Synagogue building.

We understand that 1no. Vecon A48D condensing unit and 1no. VES air handling unit are proposed to be installed on the second floor roof above the Rabbi's office.

We understand that the Vecon condensing unit is to be installed with the manufacturer's Low Noise Kit and that the VES air handling unit will be installed with a forward-curved fan and housed within the manufacturer's double skin case entitled "50mm standard case".. We have assumed grille sizes for the air handling unit of 500x500mm, and that they would be positioned at right angles to the residential properties on each side of Belsize Square. If this should not be the case, we should be informed immediately in order to amend our calculations.

Manufacturer's data for the proposed plant units is as follows.

	Sound Power Levels (dB re: 10^{-12}) at Octave Band Centre Frequencies (Hz)							
	63	125	250	500	1000	2000	4000	8000
Daikin RXYQ18P	-	88	83	82	77	73	67	66
Vecon A48D with Low Noise Kit	68	62	63	70	67	69	65	55
VES Air Handling Unit (in-duct levels)	88	87	84	72	71	69	75	71

9.2 Impact Assessment

The nearest residential window to the two proposed plant locations lies to the North of the Synagogue, approximately 26 metres from the ground floor plant location and 29 metres from the second floor roof position.

Based on the above information, our assessment of the proposed plant is summarised as follows.

	Sound Levels (dB) at Octave Band Centre Frequencies (Hz)							
	125	250	500	1000	2000	4000	8000	dBA
Daikin RXYQ18P (SWL)	88	83	82	77	73	67	66	
Correction for 3no. units	5	5	5	5	5	5	5	
Divergence correction (29m) & conversion to sound pressure	-36	-36	-36	-36	-36	-36	-36	
Resultant SPL at residential window	56	51	50	45	41	35	34	51
Vecon A48D with Low Noise Kit (SWL)	62	63	70	67	69	65	55	
Divergence correction (29m)	-39	-39	-39	-39	-39	-39	-39	
Resultant SPL at residential window	23	24	32	29	30	26	16	35

VES Air Handling Unit (in-duct SWL)	87	84	72	71	69	75	71	
Calculated sound power level at grille	86	85	75	74	72	78	74	
Directivity correction	0	0	0	-4	-7	-7	-7	
Divergence correction	-34	-34	-34	-34	-34	-34	-34	
Resultant total SPL at residential window	52	51	41	36	31	37	33	46
Total SPL at residential window	57	54	51	46	42	39	37	52

The above calculations demonstrate that noise emissions from the currently proposed plant scheme would exceed the recommended plant noise emission criteria. Therefore, in order to meet the local authority's requirements, noise control measures would be necessary.

9.3 Noise Control Measures

In order to satisfy the plant noise emission criteria set out in Section 8.0, we recommend that the following noise control measures are adopted.

Our calculations indicate if the following measures are implemented, that plant noise emission levels at the nearest residential property would be 30dB and would therefore meet both day and night time criteria.

9.3.1 Ground Floor Condensers

We would recommend that the 3no. Daikin condensers proposed for installation at ground floor level are installed within acoustic enclosures capable of the following transmission losses.

	Minimum Required Octave Band Sound Reduction Levels, dB							
	63	**125**	**250**	**500**	**1K**	**2K**	**4K**	**8K**
Acoustic Enclosure	12	13	20	29	36	37	39	39

Please find enclosed our list of suitable suppliers of acoustic enclosures.

9.3.2 Second Floor Roof Level DX Condenser

We would recommend that the DX condenser proposed for installation on the second floor roof is screened from the residential properties by an acoustic screen. Please find our specification attached.

9.3.3 Air Handling Unit

We would recommend that supply and exhaust ducts are fitted with attenuators capable of achieving the following insertion losses. We would typically expect these to be met by a 1500mm attenuator with 35% free area. However, it is imperative that the prospective supplier can demonstrate compliance with the following insertion losses.

	Minimum Required Octave Band Insertion Losses, dB							
	63	125	250	500	1K	2K	4K	8K
AHU Attenuators	6	13	23	37	43	44	35	20

Please find enclosed our list of suitable suppliers of attenuators.

It is essential that all silencers are manufactured in accordance with our "General Specification for Acoustic and Vibration Isolation Materials and Products" which is enclosed with this Report. This should ensure that silencers are both mechanically and aerodynamically suitable.

10.0 CONCLUSIONS

A detailed 24 hour daytime and night time fully automated environmental noise survey has been undertaken in order to establish the currently prevailing roof level environmental noise climate around the site.

Plant noise emission criteria have been recommended based on the results of the noise survey and in conjunction with the Local Authority.

The proposed plant units have been assessed for compliance with the proposed criteria and shown to exceed the plant noise emission limits recommended.

Noise control measures have therefore been proposed for each item of plant, which should allow the plant to meet the criteria for both day and night time operation.

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Appendix A

The acoustic terms used in this report are as follows:

dB : Decibel - Used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level.

dB(A) : The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level.

Because of being a logarithmic scale noise levels in dB(A) do not have a linear relationship to each other. For similar noises, a change in noise level of 10dB(A) represents a doubling or halving of subjective loudness. A change of 3dB(A) is just perceptible.

L_{10} & L_{90}: If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The Ln indices are used for this purpose, and the term refers to the level exceeded for n% of the time, hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the average minimum level and is often used to describe the background noise.

It is common practice to use the L_{10} index to describe traffic noise, as being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic noise.

L_{eq} : The concept of L_{eq} (equivalent continuous sound level) has up to recently been primarily used in assessing noise in industry but seems now to be finding use in defining many other types of noise, such as aircraft noise, environmental noise and construction noise.

L_{eq} is defined as a notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 1 hour).

The use of digital technology in sound level meters now makes the measurement of L_{eq} very straightforward.

L_{max} : L_{max} is the maximum sound pressure level recorded over the period stated. L_{max} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L_{eq} noise level.

HT: 15693

26/06/2009

BELSIZE SQUARE SYNAGOGUE

ACOUSTIC SPECIFICATION FOR

ACOUSTIC SCREENING

Acoustic screening shall extend:

- continuously around the second floor roof condenser,
- from the roof up to a height of 500 mm above the highest part of the condenser unit.

Performance

The acoustic screen shall provide in its as-installed condition the following minimum combined sound reduction indices (SRIs)/transmission losses when tested in accordance with BS EN ISO 140-3: 1995:

Minimum Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
20	21	27	37	44	46	51	49

The internal surface of the acoustic screen shall provide in its as-installed condition the following minimum absorption coefficients:

Minimum Absorption Coefficients (∝) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
-	0.85	0.95	0.95	0.95	0.95	0.9	0.8

Construction

The acoustic panels shall comprise 100mm thick mineral wool retained between galvanised mild steel sheet – perforated on the plant side with a free area of at least 25%. The outer panels shall be constructed from galvanised sheet steel having a minimum thickness of 1.2mm (16 swg) and fixed at 300mm (max) centres. The inner panels shall be constructed from perforated galvanized sheet steel (not "expanet" or similar derivative) having a minimum thickness of 0.8mm (20 swg) and fixed at 300mm (max) centres.

The inert, rot and vermin proof, non-hygroscopic and non-combustible mineral wool or glass fibre acoustic medium shall be packed to a density of not less than 45kg/m^3. This shall be faced with a glass fibre cloth, or other approved infill protection membrane. Panels shall be constructed and assembled so that no egress of the acoustic medium will occur under the operating conditions.

The complete structure shall be inert, rot and vermin proof, and wind resistant to standards agreed with the Client.

The acoustic media shall not comprise materials which are generally composed of mineral fibres, either man made or naturally occurring, which have a diameter of 3 microns or less and a length of 200 microns or less or which contain any fibres not sealed or otherwise stabilised to ensure fibre migration is prevented.

Doors, access panels and service penetrations shall be treated so as to maintain the acoustic performance of the assembled screen.

All junctions between the acoustic screen and adjacent structures shall be made good and sealed with a heavy grout and/or dense non-hardening mastic.

The exact design and technical specification for the screen will be agreed with and approved by Hann Tucker Associates.

SUITABLE SUPPLIERS

of

ACOUSTIC ENCLOSURES

Name & Address	Telephone Number	Contact
Industrial Acoustic Company IAC House Moorside Road Winchester Hampshire SO23 7US	01962 87300	Scott Simmons - Enclosure Ventilation
Allaway Acoustics Ltd 1 Queens Road Hertford SG14 1EN	01992 550825	Jim Grieves Roger Wade
Acoustic Engineering Services Ltd 78 High Road Byfleet Surrey KT14 7QW	01932 352733	Barry Austin Mark Stagg

SUITABLE SUPPLIERS

OF

ACOUSTIC ENCLOSURES FOR SMALL AIR CONDITIONING UNITS

Name & Address	Telephone Number	Contact
Environ Technologies Ltd Regus House 1010 Cambourne Business Park Cambourne Cambridge CB3 6DP	0870 383 3344	Steve Cox
Acoustic Engineering Services Ltd 78 High Road Byfleet Surrey KT14 7QW	01932 352733	Barry Austin Mark Stagg

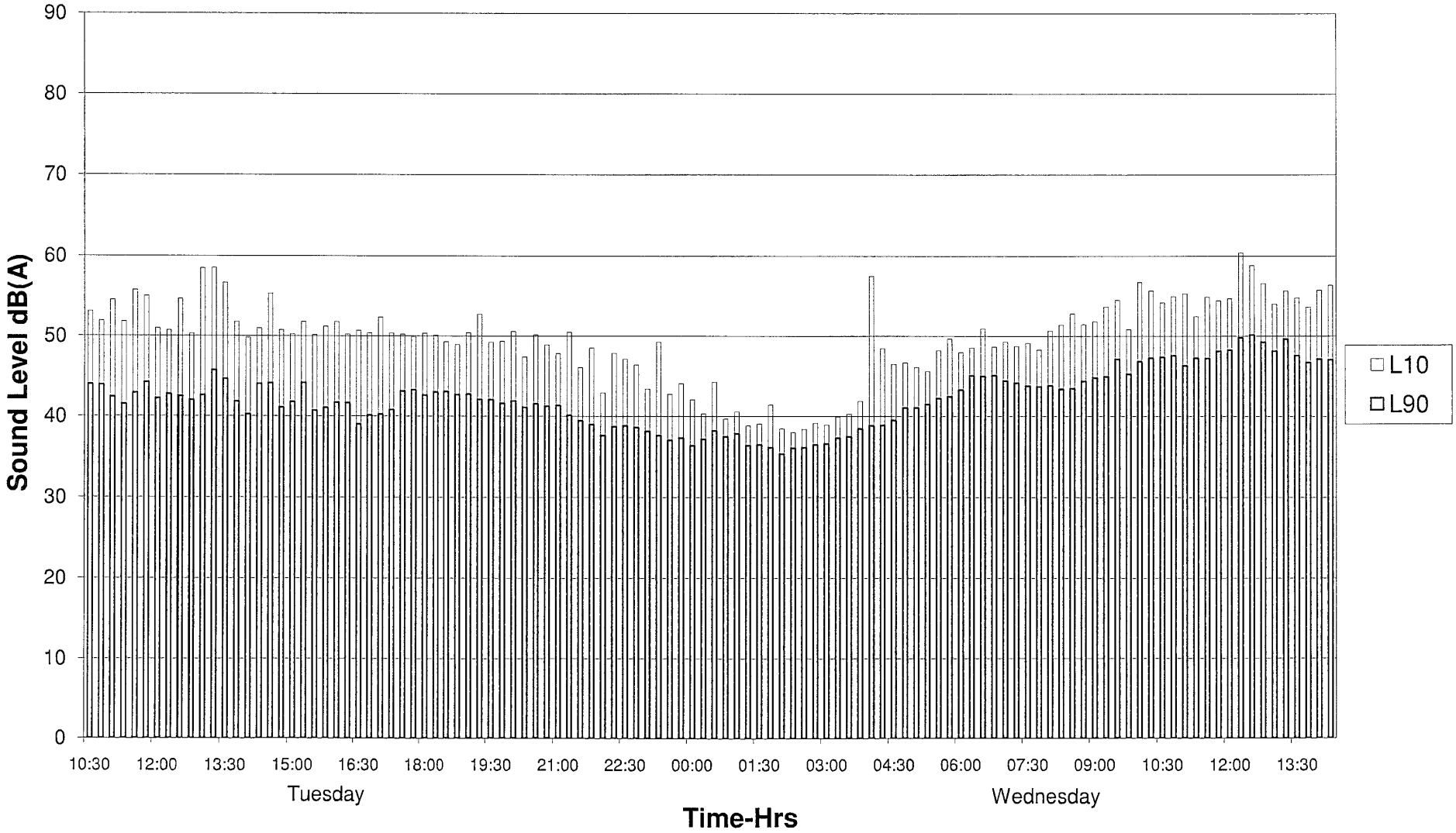
SUITABLE SUPPLIERS

OF

ATTENUATORS (H & V)

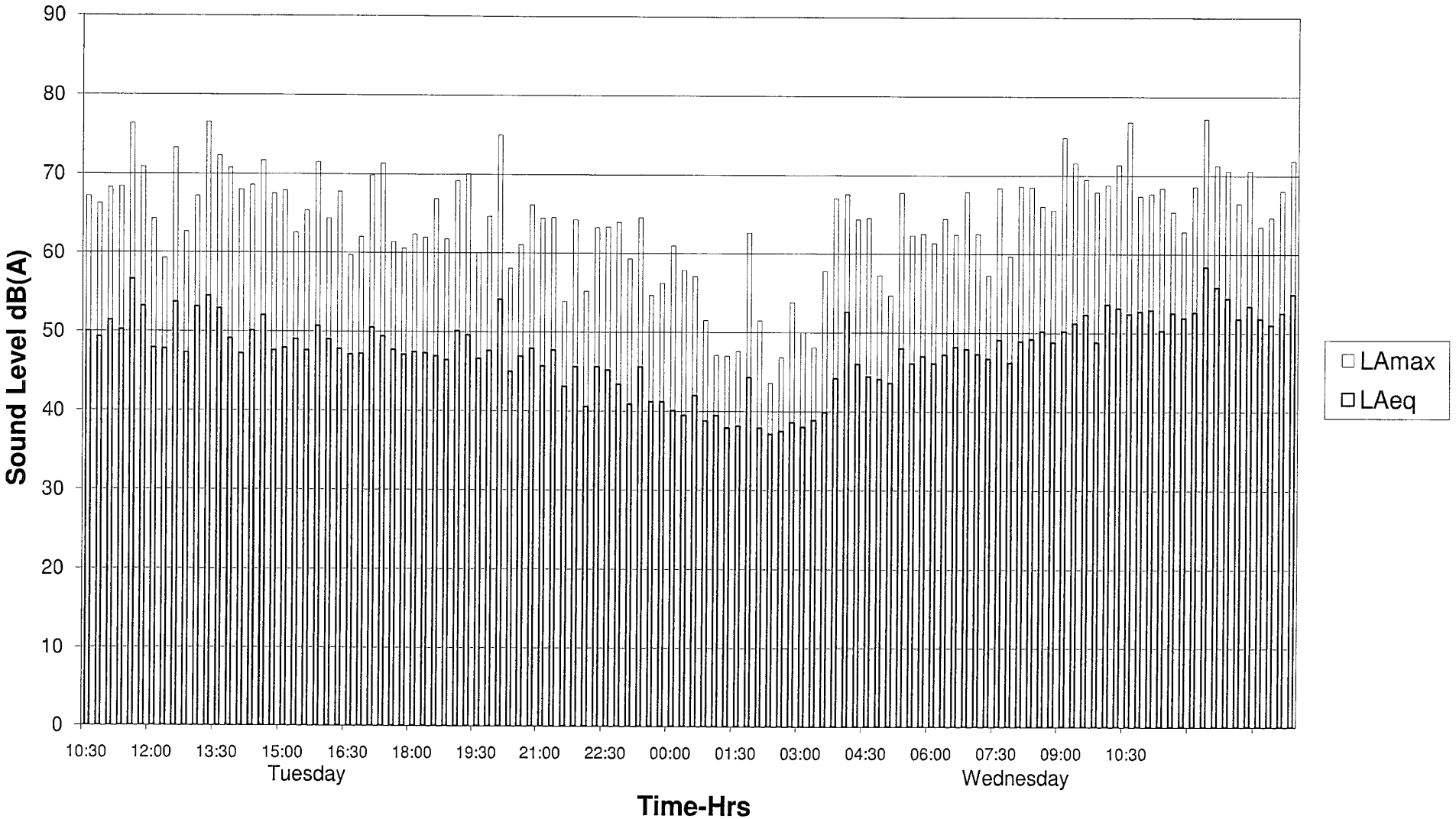
Name & Address	Telephone Number	Contact
Industrial Acoustics Co. Ltd IAC House Moorside Road Winchester Hampshire SO23 7US	01962 873000	Andy Heatherington
Allaway Acoustics Ltd 1 Queens Road Hertford SG14 1EN	01992 550825	Jim Grieves Roger Wade

Belsize Square Synaoguge
Position 1
L_{A10} and L_{A90} Noise Levels
Tuesday 16/06/2009 - Wednesday 17/06/2009

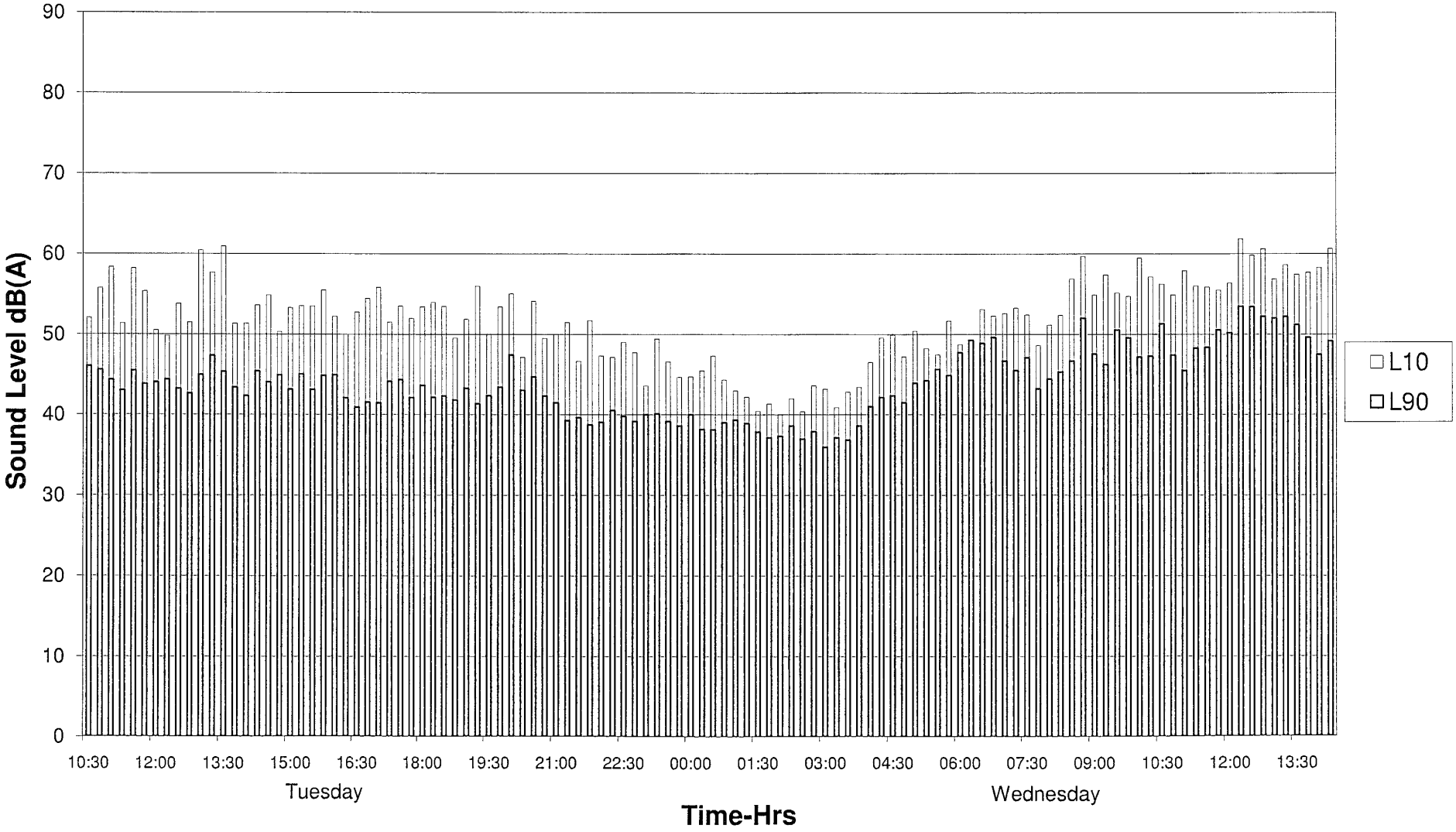


Time History Graph 15693/TH1

Belsize Square Synagogue
Position 1
L_{Aeq} and L_{Amax} Noise Levels
Tuesday 16/06/2009 - Wednesday 16/06/2009



Belsize Square Synaoguge
Position 2
L_{A10} and L_{A90} Noise Levels
Tuesday 16/06/2009 - Wednesday 17/06/2009



Time History Graph 15693/TH3

Belsize Square Synagogue
Position 2
L_{Aeq} and L_{Amax} Noise Levels
Tuesday 16/06/2009 - Wednesday 16/06/2009