16 Tavistock Place
London

Environmental Noise Survey and Plant Noise Assessment Report

23050/PNA1

22 April 2016

For:

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Document Control

Rev	Date	Comment	Prepared by	Authorised by
0	22/04/2016	-		
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Hann Tucker Associates

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1.0 Introduction

16 Tavistock Place is an existing building which is currently used for residential purposes and there is also a dental practice located on the ground floor of the building. It is proposed to convert the existing basement into further space for the dental practice.

As part the works, it is proposed to install new building services plant at 16 Tavistock Place, London. The plant noise emissions are subject to the requirements of the Local Authority.

Hann Tucker Associates have therefore been commissioned to propose suitable plant noise emission criteria based on the results of the survey and the requirements of the Local Authority.

This report presents the survey methodology and findings and also the plant noise assessment.

2.0 Objectives

To establish the existing noise levels by means of fully automated noise monitoring over a period of approximately 24 hours at up to 2No. secure and accessible positions.

To assess the noise emissions from the proposed plant, based upon data with which we are provided, and comment upon the acceptability.

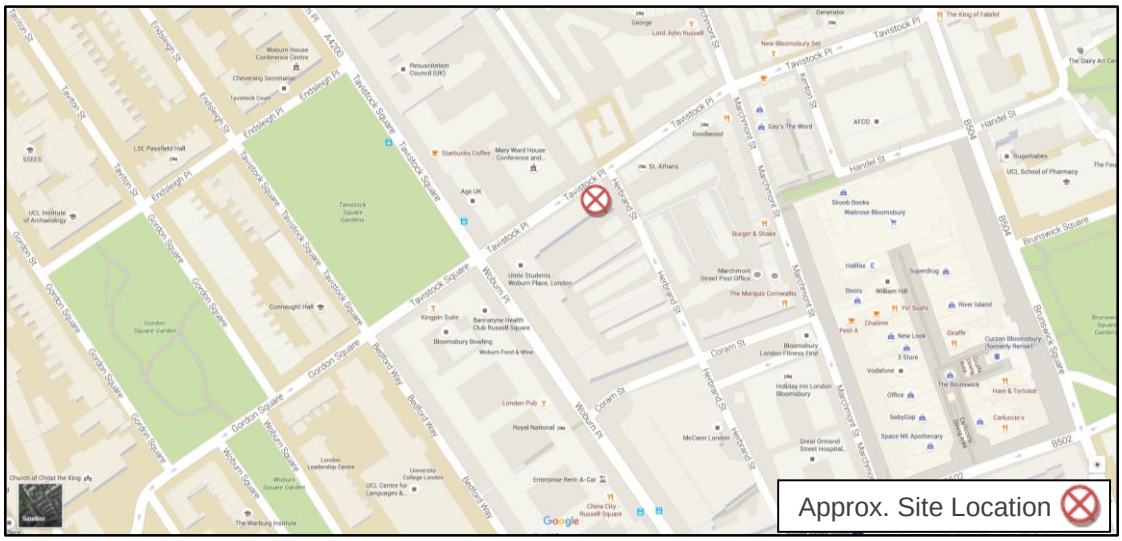
To present our results in a Report to support the planning application as far as reasonably possible.

To advise on noise control measures if required with reference to the requirements of the Local Authority.

3.0 Site Description

3.1 Location

The site is located at 16 Tavistock Place and falls within Camden Borough Council's jurisdiction. See Location Map below.



Location Map (maps.google.co.uk)

3.2 Description

16 Tavistock Place is a six storey (plus basement) building. The basement is currently disused, there is a dental practice located on the first floor and floors 1 to 5 are residential use. It is predominantly surrounded by buildings of residential use in all directions; with the exception of Bloomsbury Ambulance Station, which is located to the South of site.

The building is located on the corner of Tavistock Place and Herbrand Street (to the north and east respectively). To the west are residential buildings located on Tavistock Place and Bloomsbury Ambulance Station to the south. See Site Plan on the following page.

Location Map (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

The survey was undertaken by Paul Hill BSc (Hons) MIOA.

5.1 Procedure

Fully automated environmental noise monitoring was undertaken from approximately 13:00 hours on 16 March 2016 to 13:00 hours on 17 March 2016.

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 very calm. The sky was generally patchy cloud. We understand that generally throughout the survey period the weather conditions were similar to this.

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

5.2 Measurement Positions

The noise level measurements were undertaken at 2No. positions. The measurement positions are described in the table below.

Position No	Description
1	The sound level meter was located in the undercroft of the pavement located on Tavistock Place. The microphone was located at the entrance of the undercroft just below street level.
2	The sound level meter was located to the rear of 16 Tavistock Place. The microphone was located on a drainpipe (via an extension pole) and was approximately 2.5 metres above the ground.

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

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

5.3 Instrumentation

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

Description	Manufacturer	Type	Serial Number	Calibration
Position 1 Type 1 Data Logging Sound Level Meter	Larson Davis	824	3155	LD calibration on 04/12/2014
Position 1 Type 1 ½" Condenser Microphone	Larson Davis	377B02	107427	LD calibration on 04/12/2014
Position 2 Type 1 Data Logging Sound Level Meter	Larson Davis	824	3803	LD calibration on 10/02/2015
Position 2 Type 1 ½" Condenser Microphone	Brüel and Kjær	4189	2470596	LD calibration on 10/02/2015
Type 1 Calibrator	Larson Davis	CAL200	3082	LD calibration on 09/04/2015

Each sound level meter, including the extension cables, were calibrated prior to and on completion of the survey. No significant changes were found to have occurred (no more than 0.1 dB).

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 23050/TH1 to 23050/TH2 enclosed presenting the 15 minute A-weighted (dBA) L_{90}, L_{eq} and L_{max} levels at each measurement position throughout the duration of the surveys.

6.1 L_{Aeq} Noise Levels

The daytime $L_{Aeq\ (16\text{-}hour)}$ and night-time $L_{Aeq\ (8\text{-}hour)}$ noise levels for each position are present in the table below.

Position	Daytime $L_{Aeq(16\text{-}hour)}$	Night-Time $_{(LAeq(8\text{-}hour)}$
1	56 dBA	49 dBA
2	51 dBA	43 dBA

6.2 L_{A90} Noise Levels

The following table presents the lowest measured L_{A90} background noise levels during the

survey:

Position	Lowest Measured L_{A90} Background Noise Level (dB re 2 x 10^{-5} Pa)		
	Daytime (07:00 – 23:00) Hours	Evening (19:00 – 23:00) Hours	Night-time (23:00 – 07:00) Hours
1	43 dBA	41 dBA	36 dBA
2	43 dBA	42 dBA	40 dBA

7.0 Discussion Of Noise Climate

The dominant noise sources at all positions were noted to be traffic noise from the surrounding road network.

8.0 Plant Noise Emission Criteria

16 Tavistock Place falls within the London Borough of Camden. We understand the London Borough of Camden's advice relating to noise emissions from air conditioning plant 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)".

In order to meet the above advice, noise emissions from the proposed plant should not exceed a level of 5dB below the lowest measured $L_{A90(15min)}$. Therefore, based on the results of the noise survey and the advice above, we recommend the following plant noise emission levels to be achieved with all plant running simultaneously at 1m external to the nearest noise sensitive façade.

Plant Noise Emission Criteria (dBA re:2x10^{-5}Pa)		
Daytime (07:00 – 23:00 hours)	Evening (19:00 – 23:00 hours)	Night Time (23:00 – 07:00 hours)
38 dBA	36 dBA	31 dBA
38 dBA	37 dBA	35 dBA

It should be noted that the above criteria are subject to final approval by the London Borough of Camden.

9.0 Plant Noise Assessment

We understand that the following item of plant is to be installed at

Plant Description	Location	Qty	Plant Make	Model Number
Condensing Unit	Vault under pavement	1	Mitsubishi	MXZ-6C122VA
Sabre Fan	Vault under pavement (located in extract duct)	1	Vent-Axia	VSP50014/16

9.1 Plant Noise Emissions

We understand the manufacturer's noise data for the equipment to be as follows:

Plant Description	Sound Pressure Level (dB re $2x10^{-5}$ Pa) at 1 metre at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Condensing Unit	57	64	58	54	51	47	46	36	53

Plant Description	Sound Power Level at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Sabre Fan	66	72	70	55	59	58	51	43

9.2 Location of Plant / Description of Proposals

The condensing unit is to be located in the vault underneath the pavement at basement level. This plantroom will have a solid door separating it from the stairwell. The make-up air to the plantroom will be provided by an attenuated inlet with air flowing from street level via the external stairs. The air will be discharged from the plantroom via a duct with a sabre fan located at the plantroom end which will extract into the basement corridor under Herbrand Street and flow at a low velocity from this plenum to street level via vents in the pavement.

Before arriving at the above, we reviewed a number of alternative noise mitigation measures and found this to be the only practicable option considering;

- There is no option to relocate the plant due to site constraints and lack of outside space.

- The plant selection cannot be reselected due to airflow requirements and other non-acoustic factors.

9.3 Plant Operating Hours

We have been advised that there is potential for evening opening at the dental practice. As such, we have based our calculations on meeting daytime and evening criteria, but not night-time.

This means plant could potentially run from 07:00 to 23:00 hours.

9.4 Plant Noise Impact Assessment

The following tables present our calculations relating to the proposed plant installation.

9.4.1 Make up Air and Plant Room

The following calculation table presents the calculation for the plantroom reverberant L_p and the effect of the opening for make-up air to the plantroom on the residential noise sensitive facades at street level.

We have calculated the reverberant sound pressure level (Rev L_p) based on the ceiling being treated with 75mm mineral wool (or equivalent) as proposed in Section 9.5 of this report. We have also used the minimum required attenuator insertion loss as per our attached attenuator schedule (23050/AS) in our calculations. We have based the calculations on an attenuator of $2m^2$. In line 3 below, A = 2.

	Sound Pressure Level (dB re $2x10^{-5}$ Pa) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Plantroom Rev L_p (condenser and sabre fan)	72	77	70	63	62	59	56	47	68
Plantroom Rev L_w	79	85	78	71	70	67	64	55	-
Proportion of SWL through attenuator SWL - 10*Log(A)	76	82	75	68	67	64	61	52	-
Attenuator Insertion Loss (min)	-14	-27	-47	-50	-50	-50	-50	-50	-
Predicted Noise Level at Bottom of Stairwell (L_p)	62	56	30	21	20	17	14	5	42
Plenum Loss	-3	-3	-3	-3	-3	-3	-3	-3	-
Distance Loss	-6	-6	-6	-6	-6	-6	-6	-6	-
Façade Correction	+3	+3	+3	+3	+3	+3	+3	+3	-
Calculated Noise Level at Window	56	50	24	15	14	11	8	-	36

Utilising appropriate noise control measures (as per Section 9.5 of this report) our calculations indicate that the proposed plant should be capable of achieving the requirements of the Local Authority outlined in Section 8.0 for daytime and evening operating hours.

9.4.2 Ducted Discharge

As previously described the discharge air from the plantroom will be ducted to a plenum at the end of the basement corridor. This ductwork will require to have an attenuator installed. We suggest this is installed abutting the plantroom to minimise noise breakout through the duct walls.

Our calculations are based on the plantroom Rev L_p in the table above. We have also used the minimum required attenuator insertion loss as per our attached attenuator schedule (23050/AS) in our calculations. We have based the calculations on a duct opening in the plantroom of 0.4m^2. In line 3 below, A = 0.4m.

	Sound Pressure Level (dB re 2x10^{-5} Pa) at Octave Band Centre Frequency (Hz)								**dBA**
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Plantroom Rev L_p (condenser and sabre fan)	72	77	70	63	62	59	56	47	68
Plantroom Rev L_w	79	85	78	71	70	67	64	55	-
Proportion of SWL through attenuator SWL - 10*Log(A)	75	82	75	68	67	64	61	52	-
Sabre Fan	66	72	70	55	59	58	51	43	-
Total In-Duct L_w	**76**	**82**	**76**	**68**	**68**	**65**	**61**	**53**	**-**
Attenuator Insertion Loss (min)	8	16	28	43	47	47	39	22	-
Additional Correction Factors **	-27	-18	-17	-20	-18	-19	-19	-19	-
Façade Correction	+3	+3	+3	+3	+3	+3	+3	+3	-
Predicted Noise Level at Receiver (L_p)	44	51	34	12	7	3	7	16	36

** Additional correction factors are calculated by our in-house software, i.e. duct losses, grille effect, directivity attenuation etc.

Utilising appropriate noise control measures (as per Section 9.5 of this report) our calculations indicate that the proposed plant should be capable of achieving the requirements of the Local Authority outlined in Section 8.0 for daytime and evening operating hours.

9.5 Mitigation Measures

In order to bring the proposed installations into compliance with the proposed criterion, we have recommended the following mitigation measures:

- Line the plantroom soffit with at least 75mm mineral wool (or equivalent). This is to

lower the reverberant noise level inside the plantroom.

- Attenuator for air intake to the plantroom (see attached attenuator schedule).
- Plantroom doorset to meet R_w 38 dB.
- Attenuator for discharge to atmosphere (see attached attenuator schedule).

The above measures have been taken into account when presenting our calculations.

10.0 Conclusions

A detailed daytime and night-time fully automated environmental noise survey has been undertaken in order to establish the currently prevailing 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.

An assessment has been carried out to determine the plant noise emissions at the nearest noise sensitive windows via the make-up air route to the plantroom and also the ducted discharge air.

The assessment indicates that the proposed plant should be capable of achieving requirements of the Local Authority at the nearest noise sensitive residential window, so long as the advice and noise control measures contained in this document are followed.

Appendix A

The acoustic terms used in this report are defined as follows:

dB — Decibel - Used as a measurement of sound level. Decibels are not an absolute unit of measurement but an expression of ratio between two quantities expressed in logarithmic form. The relationships between Decibel levels do not work in the same way that non-logarithmic (linear) numbers work (e.g. 30dB + 30dB = 33dB, not 60dB).

dBA — The human ear is more susceptible to mid-frequency noise than the high and low frequencies. The 'A'-weighting scale approximates this response and allows sound levels to be expressed as an overall single figure value in dBA. The $_A$ subscript is applied to an acoustical parameter to indicate the stated noise level is A-weighted

It should be noted that levels in dBA do not have a linear relationship to each other; for similar noises, a change in noise level of 10dBA represents a doubling or halving of subjective loudness. A change of 3dBA is just perceptible.

$L_{90,T}$ — L_{90} is the noise level exceeded for 90% of the period *T* (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.

$L_{eq,T}$ — $L_{eq,T}$ is the equivalent continuous sound pressure level. It is an average of the total sound energy measured over a specified time period, *T*.

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.

L_p — Sound Pressure Level (SPL) is the sound pressure relative to a standard reference pressure of 2×10^{-5} Pa. This level varies for a given source according to a number of factors (including but not limited to: distance from the source; positioning; screening and meteorological effects).

L_w — Sound Power Level (SWL) is the total amount of sound energy inherent in a particular sound source, independent of its environment. It is a logarithmic measure of the sound power in comparison to a specified reference level (usually 10^{-12} W).

Attenuator Schedule
23150/AS

Hann Tucker Associates
Consultants in Acoustics Noise & Vibration
Woking: 01483 770 595
Manchester: 0161 832 7041

16 Tavistock Place

Revision: 0	Date: 22/04/2016	Prepared by: Paul Hill				Comments:									
			Dimensions (mm)			Vol	Max PD	Minimum Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
Attenuator Ref.	Description	No. Off	W	H	L	m^3/s	Pa	63	125	250	500	1k	2k	4k	8k
1	Make up air	1	1000	2000	tbc			14	27	47	50	50	50	50	50
2	Ducted Discharge	1	tbc	tbc	1800			8	16	28	43	47	47	39	22

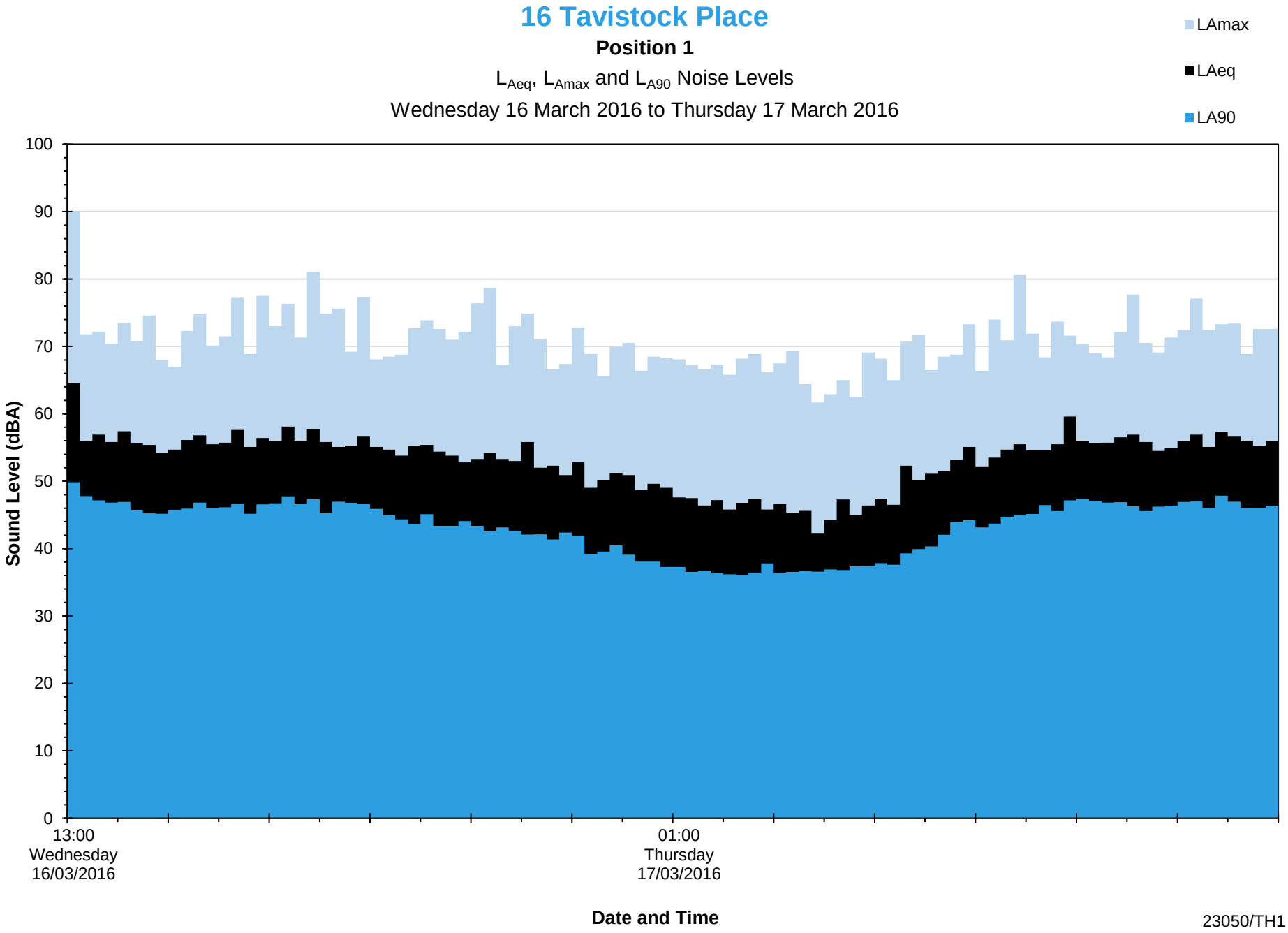
All attenuators must comply with Hann Tucker Associates General Specification for Acoustic and Vibration Isolation Materials and Products (copy available upon request if not supplied)

16 Tavistock Place

Position 1

L_{Aeq}, L_{Amax} and L_{A90} Noise Levels

Wednesday 16 March 2016 to Thursday 17 March 2016



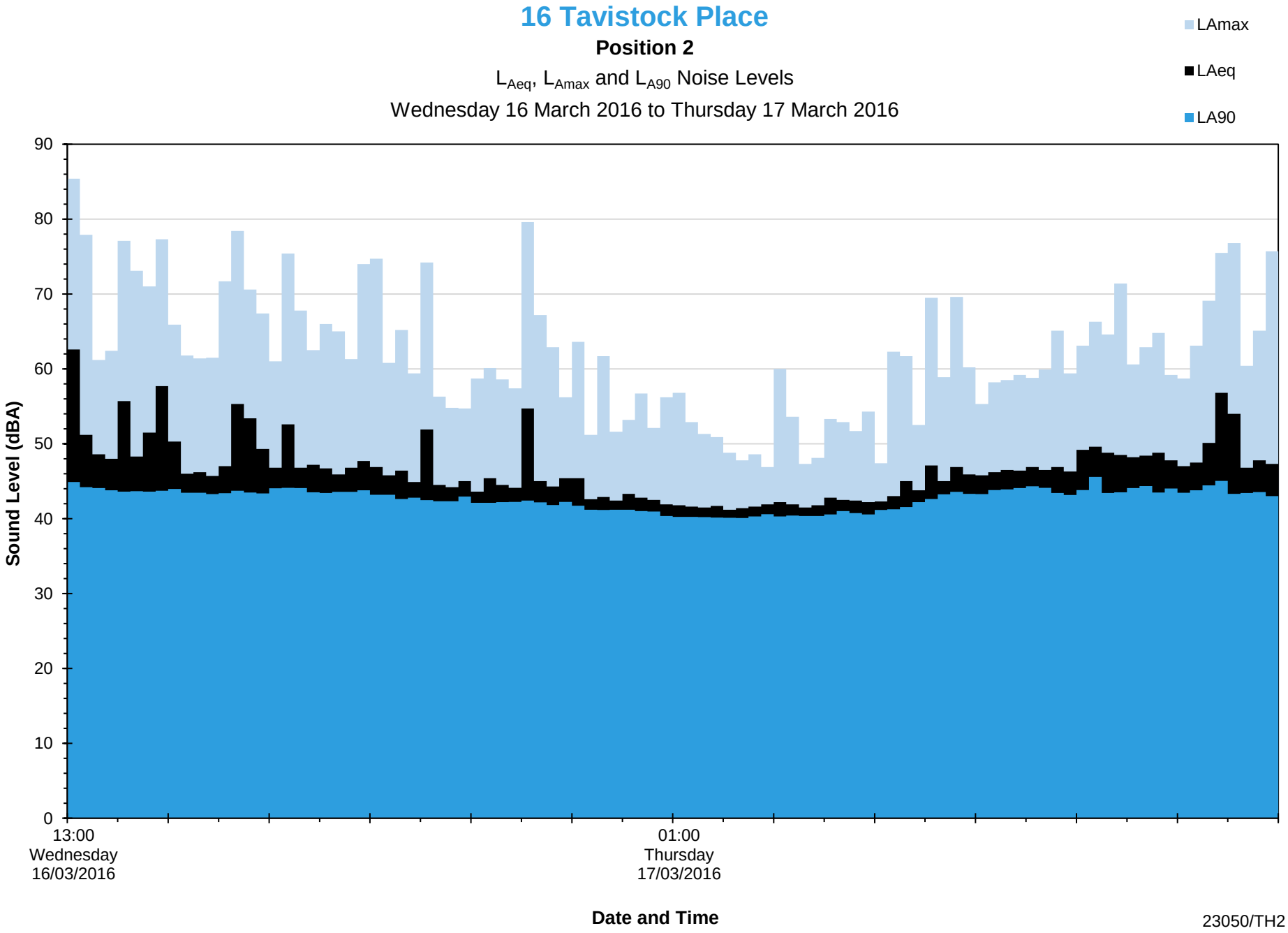
23050/TH1

16 Tavistock Place

Position 2

L_{Aeq}, L_{Amax} and L_{A90} Noise Levels

Wednesday 16 March 2016 to Thursday 17 March 2016



23050/TH2