11-13 Goodge Street
London

ACOUSTIC REPORT
REPORT18919/AR1

For:

Goodge Street (Tottenham Court Road) LLP
C/o Dukelease Properties
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23 Old Bond Street
London
W1S 4PZ

22 July 2013

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1.0 INTRODUCTION

A new mixed use residential and commercial development has been proposed at 11-13 Goodge Street, London. Hann Tucker Associates have therefore been commissioned to undertake a detailed environmental noise survey of the site to determine the currently prevailing airborne noise levels around site.

Neighbouring premises may be subject to noise from units of building services plant which are proposed to be located at roof level. The survey data has been used to assess the proposed plant against the requirements of the Local Authority.

The noise survey data obtained has subsequently been used to undertake a detailed acoustic analysis to determine the sound insulation requirements of the various external building fabric elements in order to control airborne traffic noise intrusion levels in line with the specified acoustic design criteria.

This report presents the survey methodology and findings.

2.0 OBJECTIVES

To establish, by means of detailed 24 hour daytime and night-time fully automated environmental noise monitoring, the existing A-weighted (dBA) L_{10}, L_{90}, L_{eq} and L_{max} environmental noise levels at selected accessible roof level positions around the site, thought to be representative of the nearest affected property.

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.

To recommend suitable plant noise emission criteria based on the results of the noise survey, and in conjunction with the Local Authority,

To assess the proposed plant and comment on its acceptability.

To propose the required internal acoustic design criteria which the levels of airborne road traffic noise intrusion should not exceed.

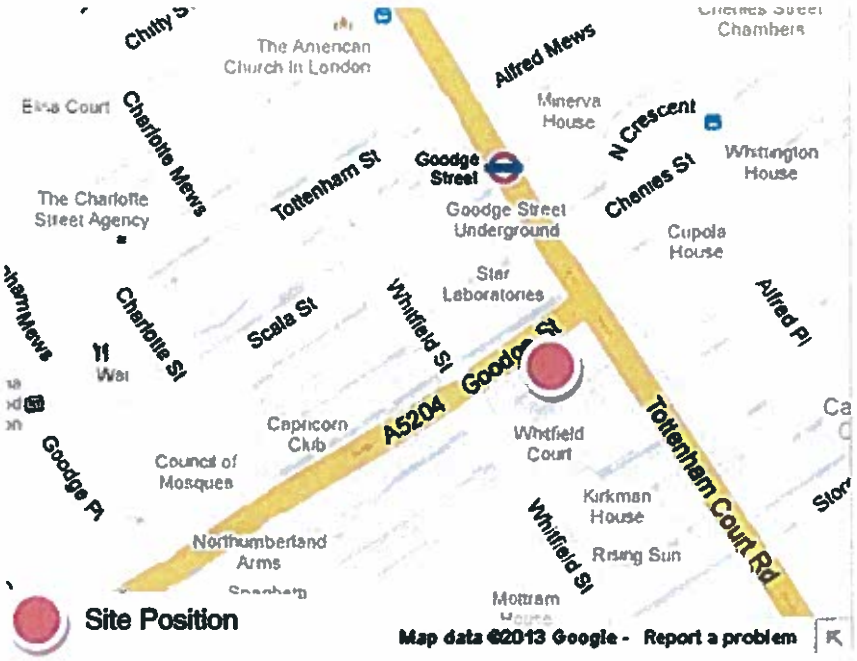
To undertake detailed acoustic analysis of the environmental noise intrusion into the building through the external building fabric.

To subsequently prepare sound reduction performance specifications for the external building fabric in order to control airborne noise intrusion in line with the proposed internal acoustic design criteria.

3.0 SITE DESCRIPTION

3.1 Location

The site is located on Goodge Street and falls within Camden Council's jurisdiction. See Location Map below.



3.2 Description

The site comprises of a four story building, with commercial space on the ground floor. The site is bound by Goodge Street to the north, and by commercial properties on all other sides. See Site Plan below.

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

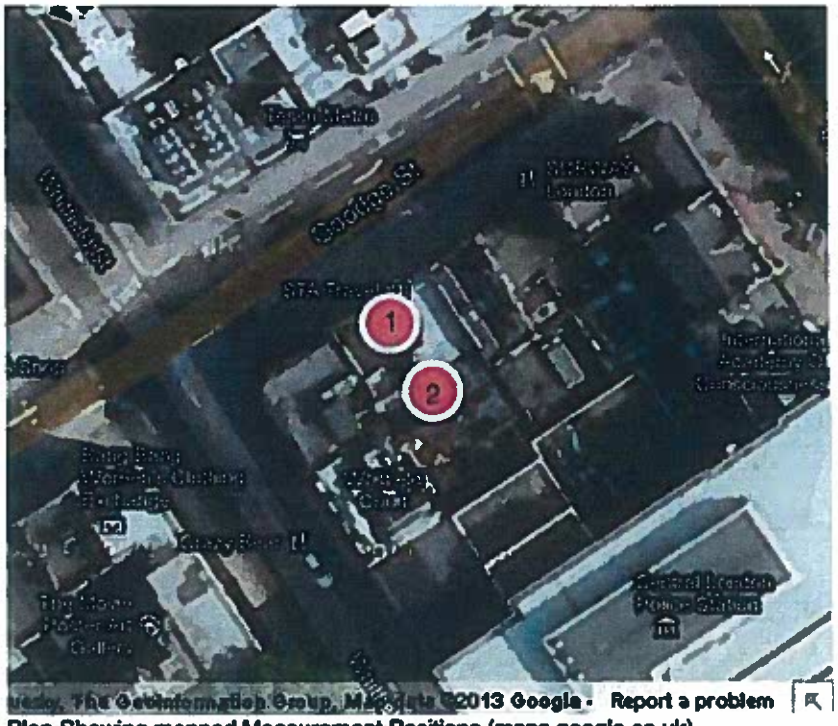
Fully unmanned environmental noise monitoring was undertaken from approximately 15:00 hours on Monday 04 February 2013 to 15:00 hours on Tuesday 05 February 2013.

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 throughout the survey period the weather conditions were generally similar to this.

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 2 positions at the site. Position 1 was positioned out of a second floor window to the front of the property, Position 2 was positioned out of a second floor window to the rear. The measurement positions are shown on the plan below.



Plan Showing manned 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	3803	LD calibration on 28/08/2012
Position 1 Type 1 ½" Condenser Microphone	Larson Davis	377B02	107427	LD calibration on 28/08/2012
Position 2 Type 1 Data Logging Sound Level Meter	Larson Davis	824	3802	LD calibration on 28/08/2012
Position 2 Type 1 ½" Condenser Microphone	PCB	377B02	107040	LD calibration on 28/08/2012
Type 1 Calibrator	Larson Davis	CAL200	3082	LD calibration on 02/03/2012

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

6.0 RESULTS

The results have been plotted on Time History Graphs 18919/TH1 to 18919/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 following table presents the typical worst case incident noise levels for each façade (with suitable corrections made for façade reflections).

Position/Façade		Sound Pressure Level (dB) @ Octave Band Centre Frequency (Hz)								dBA
		63	125	250	500	1k	2k	4k	8k	
Position 1 Front	Daytime L_{Aeq}	73	67	62	61	64	64	51	42	68
	Night-Time L_{Aeq}	68	61	57	57	57	55	47	40	61
	L_{Amax}	85	82	81	85	86	84	86	84	93
Position 2 Rear	Daytime L_{Aeq}	64	64	58	53	51	45	38	28	56
	Night-Time L_{Aeq}	59	57	54	51	50	45	41	35	54
	L_{Amax}	87	85	77	76	75	69	60	50	79

7.0 DISCUSSION OF NOISE CLIMATE

During the duration of the survey period the main source of noise was deemed to be road traffic from Tottenham Court Road and Goodge Street.

8.0 PLANT NOISE EMISSION CRITERIA

We understand that the requirements of Camden Council are as follows:

"Noise levels at a point 1 metre external to sensitive facades shall be at least 5dBA less than the existing background measurement (L_{A90}), expressed in dBA 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 10dBA below the L_{A90}, expressed in dBA."

As the proposed plant has been judged to contain no tonal element and on the basis of the above and the survey results we thus propose the following plant noise emission limits to be achieved at 1m from the façades of the nearest neighbouring buildings:

	Plant Noise Emission Criteria (dB re $2x10^{-5}$ Pa)	
	Daytime (07:00 – 23:00 hours)	Night-time (23:00 – 07:00 hours)
Position 1	44	43
Position 2	47	46

It should be noted that the above plant noise emission limits are subject to approval from Camden Council.

9.0 PLANT NOISE ASSESSMENT

We understand that the following items of plant are to be installed on the roof of the site.

Plant Description	Location	Qty	Plant Make	Model Number	Dimensions (WxHxL)
New Residential	Roof Plant Area	4	Mitsubishi	PUHZ-RP71VHA	0.94 x 0.95 x 0.33
Existing STA Travel	Roof Plant Area	2	Daikin	5MXS90E3V3B	0.77 x 0.90 x 0.32
Existing Subway 1	Roof Plant Area	1	Daikin	RZQG140	0.94 x 1.43 x 0.32
Existing Subway 2	Roof Plant Area	1	Mitsubishi	SCM60ZJ-S	0.64 x 0.92 x 0.29

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 at 1m
	63	125	250	500	1k	2k	4k	8k	
New Residential	56.5	55.0	49.5	44.0	42.5	38.5	32.0	28.0	48.0
Existing STA Travel	60.5	59.0	53.5	48.0	46.5	42.2	36.0	32.0	52.0
Existing Subway 1	61.5	60.0	54.5	49.0	47.5	43.2	37.0	33.0	53.0
Existing Subway 2	60.5	59.0	53.5	48.0	46.5	42.2	36.0	32.0	52.0

No octave band data was available for any of the existing units. Therefore we have used typical spectral data for these items taken from another manufacturer.

9.2 Location of Plant

We understand that all the units will be located in a plant area at roof level. The plant area will be surrounded by a solid barrier, which we understand will be tall enough to provide at least line-of-sight screening to nearby premises.

The closest noise sensitive premises to the plant area are located to the southwest, at 26-28 Whitfield Street at a distance of approximately 6m. However, some of the plant serves the commercial areas of 11-13 Goodge Street at ground floor level. This plant must also be assessed for its impact on the proposed new residential premises, the closest windows of which are to the north at approximately 5m

9.3 Plant Noise Impact Assessment

Our assessment indicates that to meet the requirements of the Local Authority the screen surrounding the plant area must be at least 250mm taller than the tallest item of plant within it. The screen must be constructed and installed as per our Acoustic Specification for Acoustic Screen enclosed. A summary of our plant noise calculations is enclosed.

10.0 ACOUSTIC DESIGN CRITERIA

There are no criteria in the current Building Regulations concerning external noise intrusion. We also understand the Planning Authority have not imposed any noise criteria for external noise intrusion. Therefore, there are no statutory requirements for controlling external noise intrusion on this project.

Various reference documents including BS 8233: 1999 edition and WHO Community Noise Guidelines present acoustic criteria for residential premises, as outlined below.

BS 8233: 1999 "Sound insulation and noise reduction for buildings"

British Standard 8233: 1999 "Sound insulation and noise reduction for buildings" recommends design criteria for internal ambient noise levels for dwellings providing a reasonable or good level of protection from external noise. It states that reasonable resting and sleeping conditions in living rooms and bedrooms can be achieved by the following target $L_{Aeq,T}$ internal noise levels:

Room Type	Design Range $L_{Aeq,T}$	
	Good	Reasonable
Living Rooms	30 dB	40 dB
Bedrooms	30 dB	35 dB

The Standard also states *"For a reasonable standard in bedrooms at night, individual noise events (measure with F time-weighting) should not normally exceed 45dB L_{Amax}".*

World Health Organisation (WHO)

The World Health Organisation document on "Guidelines for Community Noise" states the following guideline values for community noise in specific environments.

Specific Environment	Critical Health Effect(s)	L_{Aeq}	$L_{Amax,fast}$
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35dB	-
Inside Bedrooms	Sleep disturbance, night-time	30dB	45dB

The document also states *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dBA L_{Amax} more than 10-15 times per night, (Vallet & Vernet 1991)."*

The above levels are however the subject of much controversy, as indicated by one of the feature articles in the January/February 2003 edition of the Institute of Acoustics' publication.

In our opinion the above criteria for bedrooms should thus be regarded as preferred, rather than mandatory maxima to be achieved in all cases.

Summary

On the basis of the above we propose the following internal acoustic design criteria which the levels of road traffic/train/aircraft/other nose intrusion should not exceed.

Room Type	Period	Criterion
Living Areas	Daytime (07:00-23:00 hours)	40dB $L_{Aeq,16hr}$
Bedrooms	Night Time (23:00-07:00 hours)	35dB $L_{Aeq,8hr}$

The above levels correspond to "reasonable" as defined in BS 8233. If these criteria are adopted as minimum standards for worst affected dwellings, the typical levels in typical flats will approach, and in many cases exceed, "good" as defined in BS 8233.

Note: If the worst case was designed to "good" this would lead to "over design" for other dwellings – which could be undesirable for various reasons (including cost and acoustic privacy between dwellings).

In addition it is proposed that L_{Amax} noise levels in bedrooms should not regularly exceed approximately 45dBA more than several times per hour between 23:00 and 07:00 hours.

11.0 ARCHITECTURAL ASSUMPTIONS

11.1 Room Finishes

In our calculations we have assumed bedrooms and living areas will have typical furnishings including beds, sofas, chairs etc.

11.2 Drawings

Our calculations have been based on the following drawings from Rolfe Judd.

4988/T(20)

12.0 SPECIFICATION FOR CLADDING

The composite acoustic performance required of any portion of the building envelope will depend on its location relative to the principal noise sources around the site and the nature of the spaces behind it (noise criteria, size, room finishes etc).

The levels of noise incident upon each façade of the building are different. Consequently, each façade therefore has its own unique sound insulation requirement. In our experience, however, it is not appropriate to prepare numerous performance specifications. In this instance, for the sake of simplicity, we have prepared a specification with 4 performance levels, which corresponds to appropriate notional glazing configurations.

The enclosed Acoustic Specification for Cladding to Residential Facades details our recommended minimum octave band sound reduction indices. In all cases, it is essential that the system is tested in accordance with BS EN ISO 10140-2:2010 and that the quoted minimum sound reduction specifications are met by the system as a whole, including frames, trickle ventilators etc as appropriate - not just the glass.

Where structural glass or non-vision spandrel panels are proposed, they should provide sound reduction performance at least equal to that required of the cladding in order to maintain the acoustic integrity of the building envelope.

In order to comply with Building Regulations (Part F), it is necessary to provide background ventilation to habitable rooms (living rooms and bedrooms). This property will be mechanically ventilated.

13.0 CONSTRUCTION GUIDANCE FOR GLAZING AND VENTILATORS

It is essential that prospective glazing system suppliers can demonstrate compliance with the acoustic performance detailed in our specification rather than simply offering a generic glazing configuration. However, we would suggest that the following configurations could typically be expected to provide the required levels of noise insulation.

Type	Façade	Example Glazing Configuration	Type of Trickle Vent
A	Front Living Room	10/16/6 Double Glazing	Hit and Miss Trickle Vent
B	Front Bedroom	10/16/6 Double Glazing	Passive attenuated in wall Vent
C	Rear Living Room	4/16/4 Double Glazing	Hit and Miss Trickle Vent
D	Rear Bedroom	4/16/4 Double Glazing	Hit and Miss Trickle Vent

In order to avoid weakness at junctions between cladding and party walls/floors we recommend:

- All party walls abut 2No. separate mullions
- All party floors abut 2No. separate transoms

14.0 CONCLUSIONS

A detailed 24 hour environmental noise survey has been undertaken in order to establish the currently prevailing environmental noise climate around the site.

Suitable environmental noise intrusion criteria have been proposed specified on the basis of BS 8233: 1999 and in accordance with the relevant planning condition.

Detailed acoustic analysis has been undertaken to assess the sound insulation requirements of the external cladding and ventilators.

This has enabled a sound reduction performance specification for the cladding and ventilators to be prepared, along with advice to be given on types of constructions we would typically expect to provide the required acoustic performance.

We would stress however, that the proposed cladding (including frames) must comply with the enclosed performance specifications.

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 window.

The assessment indicates that the proposed plant should be capable of achieving the requirements of the Local Authority at the nearest noise sensitive window, provided the screen surrounding the plant area is constructed and installed in accordance with the enclosed specification.

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HANN TUCKER ASSOCIATES

Appendix A

The acoustic terms used in this report are explained below:

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.

dBA : 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 dBA level.

Because of being a logarithmic scale noise 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_{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 : 18919

12 February 2013

11-13 GOODGE STREET
LONDON

ACOUSTIC SPECIFICATION
FOR GLAZING TO RESIDENTIAL FACADES

SOUND REDUCTION PERFORMANCE

The complete glazing system shall achieve the following minimum sound reduction indices when tested in accordance with BS EN 10140-2:2010.

Type	Façade	Minimum Sound Reduction Index (dB) @ Octave Band Centre Frequency (Hz)				
		125	250	500	1k	2k
A	Front Living Room	26	27	34	40	38
B	Front Bedroom	26	27	34	40	38
C	Rear Living Room	24	20	25	34	37
D	Rear Bedroom	24	20	25	34	37

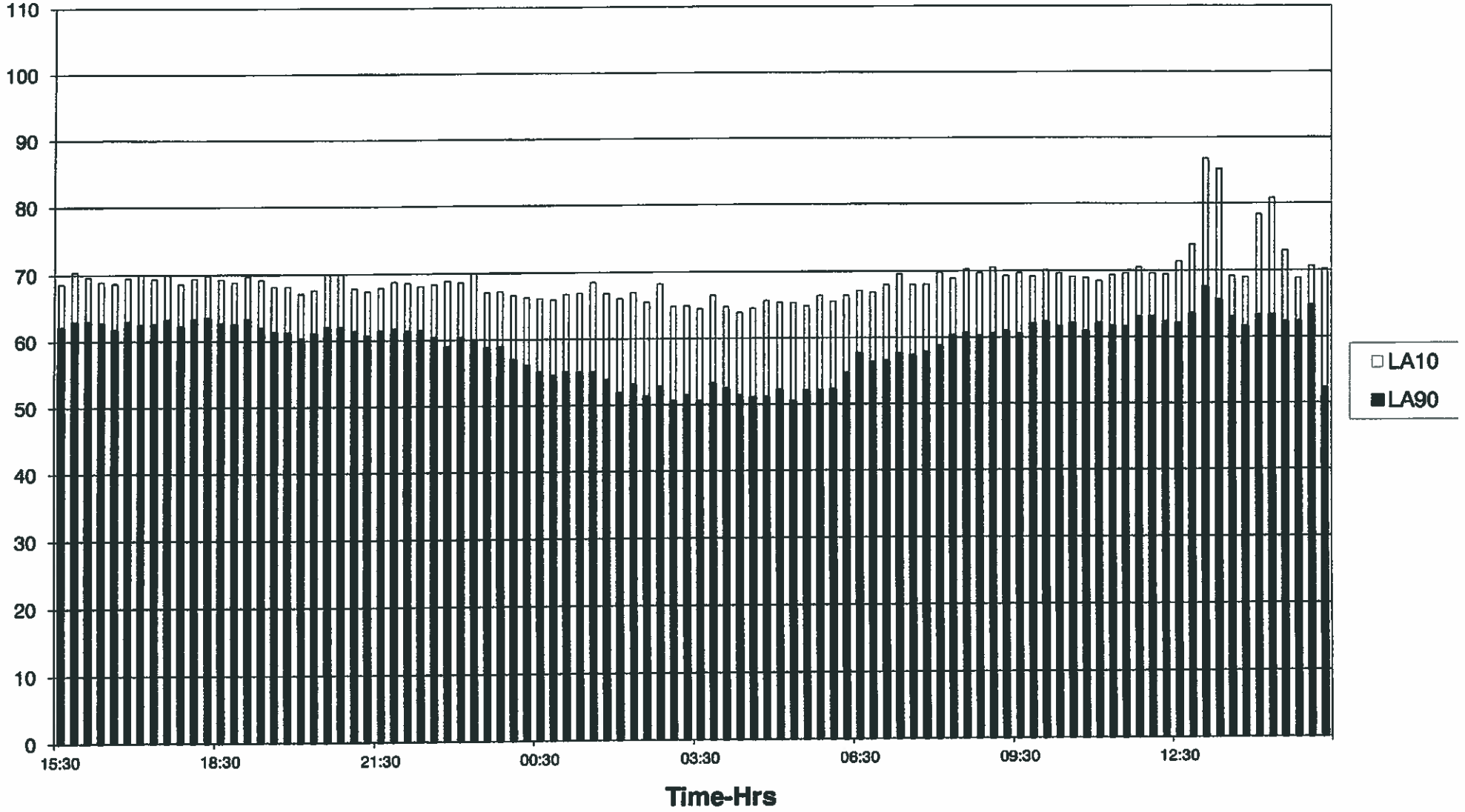
TEST DATA

Fully detailed test reports from independent acoustic test authorities shall be supplied. All test reports shall be in English or, a full English translation.

Test data should include the $^1/_3$ octave band results from 100Hz to 3150Hz inclusive, together with the corresponding octave band results from 125Hz to 4000Hz inclusive.

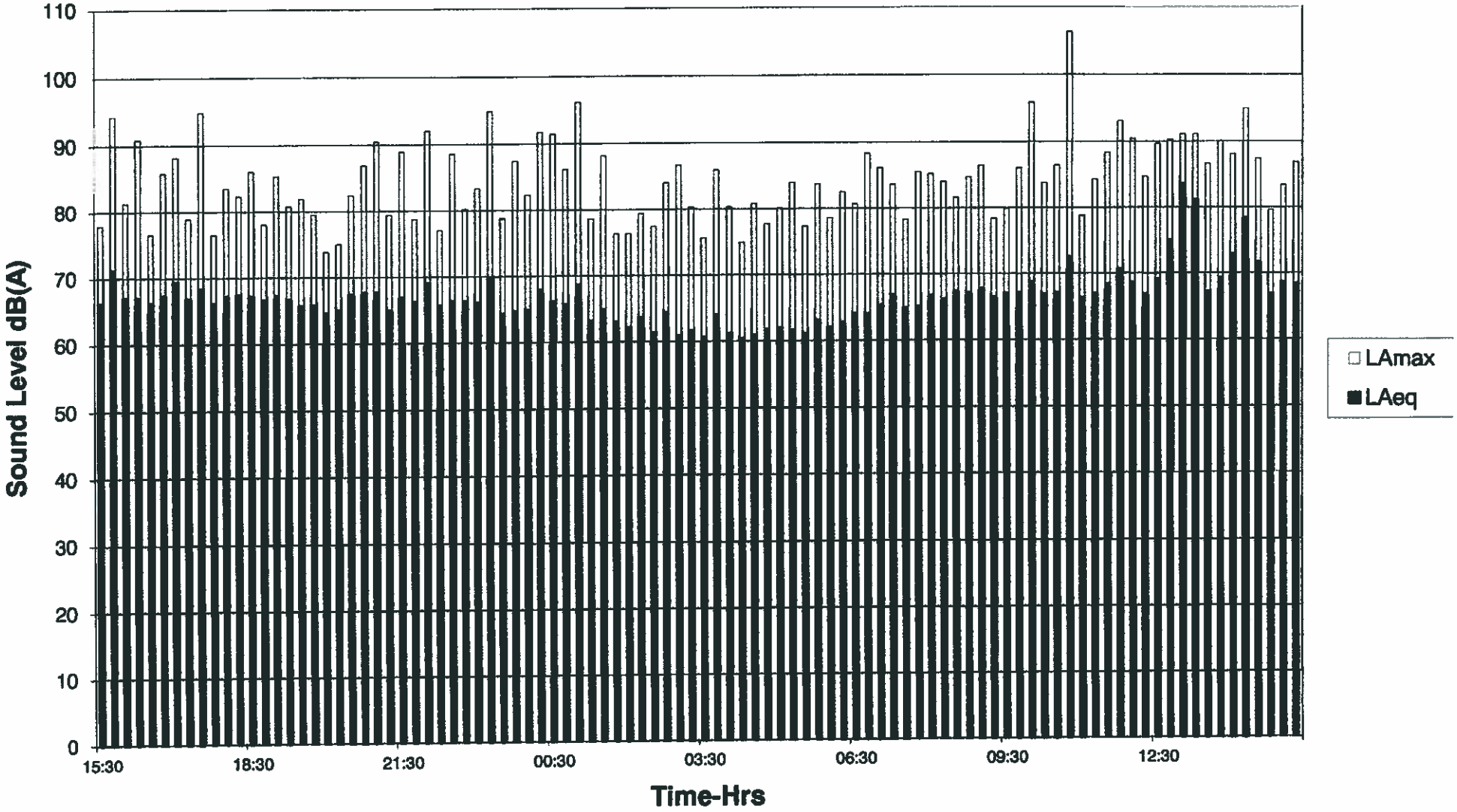
The test report shall be provided for test samples which are representation of the complete system for the relevant facades - including frames, joints, seals, spandrel panels and opening lights and trickle vents (as appropriate). The samples proposed should be approved by Hann Tucker Associates.

11-13 Goodge Street
Position 1
L_{A10} and L_{A90} Noise Levels
Monday 04/02/2013 - Tuesday 05/02/2013



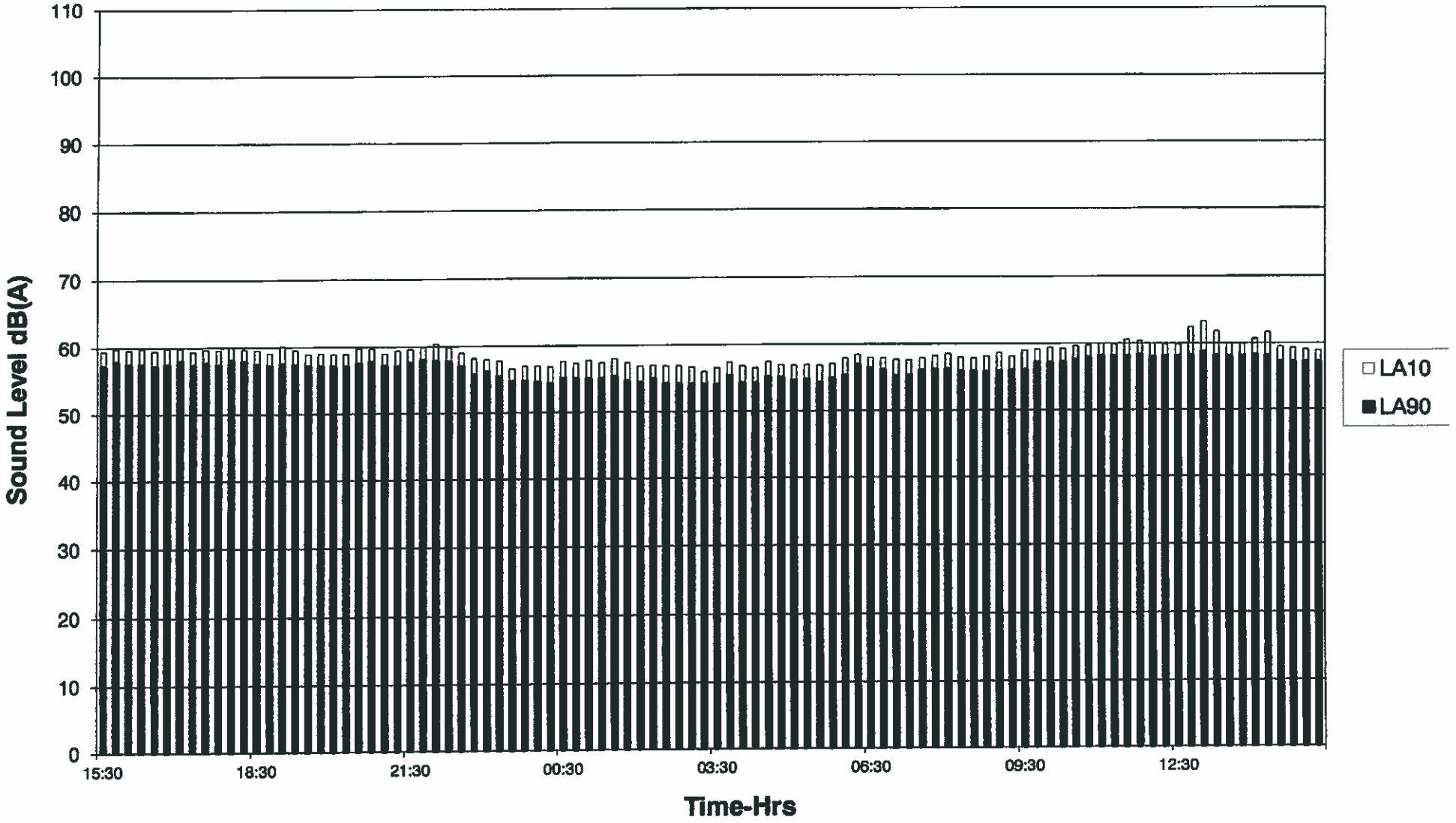
Time History Graph 18919/TH1

11-13 Goodge Street
Position 1
L_{Aeq} and L_{Amax} Noise Levels
Monday 04/02/2013 - Tuesday 05/02/2013



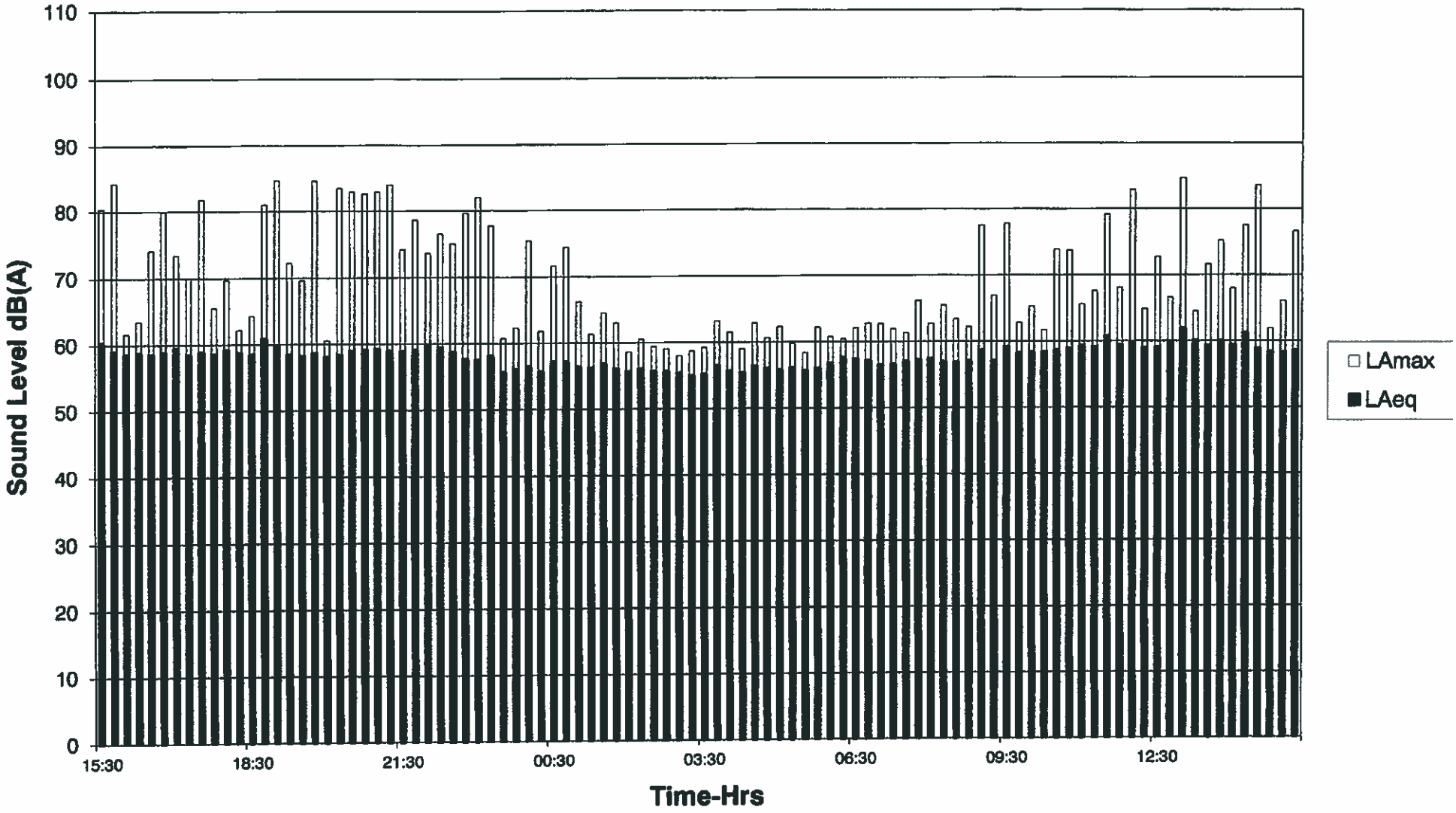
Time History Graph 18919/TH2

11-13 Goodge Street
Position 2
L_{A10} and L_{A90} Noise Levels
Monday 04/02/2013 - Tuesday 05/02/2013



Time History Graph 18919/TH3

11-13 Goodge Street
Position 2
L_{Aeq} and L_{Amax} Noise Levels
Monday 04/02/2013 - Tuesday 05/02/2013



Time History Graph 18919/TH4