Bickerdike Allen Partners

1-11 EUSTON ROAD NW1 2SA
PROPOSED RETAIL AND HOTEL DEVELOPMENT
NOISE ASSESSMENT

Report to

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A9355/AH R01
13/04/2011

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1.0 INTRODUCTION

Bickerdike Allen Partners (BAP) have been retained by Metropolis Planning and Design to advise on acoustic matters regarding a proposed retail and hotel development at 1-11 Euston Road, London, NW1 2SA.

This report sets out details of a long-term noise survey and the attended noise measurements carried out around the site. It also includes a noise assessment, with respect to London Borough of Camden's requirements on noise and relevant national guidance documents of the development.

The site is described in Section 2.0. Current environmental noise and vibration criteria relevant to the site have been presented and briefly discussed in Section 3.0. The noise survey is described in Section 4.0, and the assessment of the proposed development against these criteria is presented in Section 5.0. The report is summarised in Section 6.0.

A glossary of acoustic terminology used is presented in Appendix A.

2.0 THE SITE

A layout of the existing site can be seen in Figure 1. The site is L-shaped and is currently occupied by the Northumberland Hotel, an office building and a number of commercial properties.

The site is bordered on three sides by roads. The Euston road lies to the north, Birkenhead Road lies to the east and Crestfield Street lies to the west. King's Cross railway station lies directly across the Euston Road to the north. The site is bordered to the south by a residential property at 59 Birkenhead Street and the King's cross Methodist Church.

The land use of the surrounding area is mixed comprising commercial and residential premises with a number of small hotels.

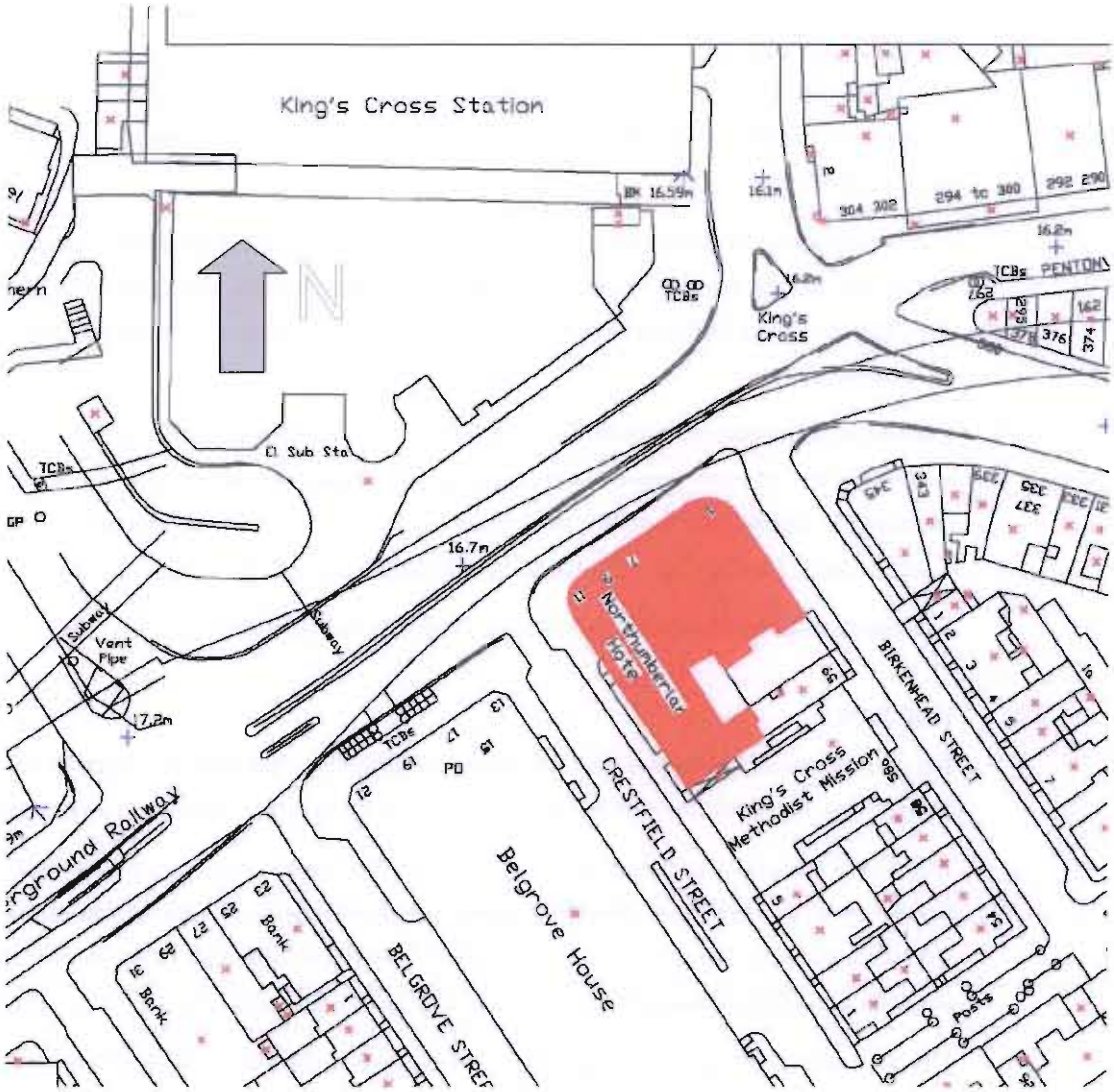

Figure 1 - General site plan

The proposed site plan of the new development is shown in Figure 2. It consists of a seven storey mixed-use (retail and hotel accommodation) block.

The hotel accommodation will be located on the first to seventh floors with access via a reception area on the ground floor level in Crestfield Street. The development also includes a retail unit on the ground floor facing the Euston Road and a restaurant/bar in the basement.

The building façade will be entirely glazed with a curtain walling system with a glass or acrylic screen in front. The screen is designed to provide an environmental buffer for noise pollution and energy loss and would be used for projections at night. This screen is not fully sealed and would include vents at the seventh floor.

Figure 2 – Scheme plan

3.0 DESIGN CRITERIA

3.1 Environmental noise

3.1.1 PPG24

In assessing the suitability of a site for a noise-sensitive development such as a hotel, which contains a mixture of accommodation with varying sensitivity to noise, Department of the Environment Planning Policy Guidance PPG 24 *Planning and Noise*, refers to specific guidance on internal noise standards. It states that general information can be found in British Standard BS8233: 1999 *Sound insulation and noise reduction for buildings – Code of practice* (see Section 3.1.2).

3.1.2 BS 8233

The British Standard BS8233: 1999 "*Sound insulation and noise reduction for buildings – Code of practice*" provides guidance on the control of external noise. The standard presents a number of

design ranges for indoor noise levels in spaces when they are unoccupied. The ranges for hotel accommodation are generally in keeping with guidance set by the World Health Organisation.

These criteria are given in Table 3.1.

Criterion	Typical Situations	Design Range $L_{Aeq,T}$ (dB)	
		Good	Reasonable
Reasonable speech or telephone communications	Department store	50	55
Reasonable resting/sleeping Conditions	Living Rooms	30	40
	Bedrooms[1]	30	35

Table 3.1 - BS 8233 recommended indoor ambient noise levels in unoccupied spaces

Note 1: For a reasonable standard in bedrooms at night, individual noise events (measured with F time-weighting) should not normally exceed 45 dB L_{Amax}.

3.2 Local authority requirements

The London Borough of Camden Development Policy DP28 on Noise (November 2010) states:

The Council will seek to ensure that noise and vibration is controlled and managed and will not grant planning permission for:

a) development likely to generate noise pollution; or

b) development sensitive to noise in locations with noise pollution, unless appropriate attenuation measures are provided.

Development that exceeds Camden's Noise and Vibration Thresholds will not be permitted.

The Council will only grant permission for plant or machinery if it can be operated without cause harm to amenity and does not exceed our noise thresholds.

The Council will seek to minimise the impact on local amenity from the demolition and construction phases of development. Where these phases are likely to cause harm, conditions and planning obligations may be used to minimise the impact.

DP28 also includes the following tables:

Table A: Noise levels in residential sites adjoining railways and roads at which planning permission will not be granted

Noise description and location of measurement	Period	Time	Site adjoining railways	Site adjoining roads
Noise at 1 metre external to a sensitive façade	Day	0700-1900	74 dB $L_{Aeq,12h}$	72 dB $L_{Aeq,12h}$
	Evening	1900-2300	74 dB $L_{Aeq,4h}$	72 dB $L_{Aeq,4h}$
	Night	2300-0700	66 dB $L_{Aeq,8h}$	66 dB $L_{Aeq,8h}$

Table B: Noise levels in residential streets adjoining railways and roads at and above which attenuation measures will be required

Noise description and location of measurement	Period	Time	Site adjoining railways	Site adjoining roads
Noise at 1 metre external to a sensitive façade	Day	0700-1900	65 dB $L_{Aeq,12h}$	62 dB $L_{Aeq,12h}$
	Evening	1900-2300	60 dB L_{Aeq4h}	57 dB $L_{Aeq,4h}$
	Night	2300-0700	55 dB $L_{Aeq,1h}$	52 dB $L_{Aeq,1h}$
Individual noise events several times an hour	Night	2300-0700	>82 dB L_{Amax} (S-time weighing)	>82 dB L_{Amax} (S-time weighing)

Table D: Noise levels from places of entertainment on adjoining residential sites at which planning permission will not be granted

Noise description and location of measurement	Period	Time	Noise level
Noise at 1 metre external to a sensitive façade	Day and evening	0700-2300	L_{Aeq} 5m shall not increase by more than 5 dB*
Noise at 1 metre external to a sensitive façade	Night	2300-0700	L_{Aeq} 5m shall not increase by more than 3 dB*
Noise inside any living room of any noise sensitive premises, with windows open or closed	Night	2300-0700	L_{Aeq} 5m (in the 63 Hz Octave band measured using the 'fast' time constant) should no no increase in dB*

* As compared to the same measure, from the same position, and over a comparable period, with no entertainment taking place.

Table E: Noise levels from plant and machinery at which planning permission will not be granted

Noise description and location of measurement	***Period***	***Time***	***Noise level***
Noise at 1 metre external to a sensitive façade	*Day, evening and night*	*0000-2400*	*5 dB(A) < L_{A90}*
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive façade		*0000-2400*	*10 dB(A) < L_{A90}*
Noise that has a distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive façade		*0000-2400*	*10 dB(A) < L_{A90}*
Noise at 1 metre external to a sensitive façade where L_{A90}>60dB		*0000-2400*	*55 dB L_{Aeq}*

BAP have sought guidance from London Borough of Camden's Environmental Health Department on the standards that should apply to this hotel development. Camden have confirmed that the development should be designed and constructed to ensure 35 dB $L_{Aeq,\ 16h}$ for environmental noise in living rooms during the day and a design limit of 30 dB $L_{Aeq,\ 8h}$ for bedrooms at night.

3.3 Summary of environmental noise criteria

BAP propose a design limit of 35 dB $L_{Aeq,\ 16h}$ for environmental noise in living rooms and living/dining rooms during the day and a design limit of 30 dB $L_{Aeq,\ 8h}$ for bedrooms at night. These are based on satisfying the local authority and ensuring the 'good' indoor ambient noise target for bedrooms and 'good' to 'reasonable' indoor ambient noise targets for living rooms from BS 8233 are achieved. Individual noise events should not normally exceed 45 dB L_{AFmax} within bedrooms at night.

Limiting plant noise levels from plant shall be as per Table E in the London Borough of Camden Development Policy DP28.

4.0 ENVIRONMENTAL NOISE SURVEY

4.1 Long-term survey

An unattended, long-term environmental noise survey was carried out from the afternoon of Thursday 24/03/2011 to the morning of Monday 28/03/2011.

A long-term noise monitor was placed at the front on the building on a first floor roof above the existing commercial properties facing Euston Road. Another long-term noise monitor was placed

on the roof at the rear of the hotel overlooking a courtyard separating the hotel from the neighbouring property at 59 Birkenhead Street.

The location of these monitors are shown in Figure 3, Figure 4 and Figure 5.

The instrumentation used at the long-term noise survey position consisted of two Norsonic 118 meters and microphones with weather protection equipment. These were checked and found to have correct calibration before and after the survey using a Brüel and Kjær type 4231 calibrator.

The weather during the long-term survey period was generally dry and still.

The noise environment was dominated by road traffic noise from the Euston Road.

Figure 3 – Unattended environmental noise survey location facing Euston Road

Figure 4 – Unattended environmental noise survey location at rear of hotel

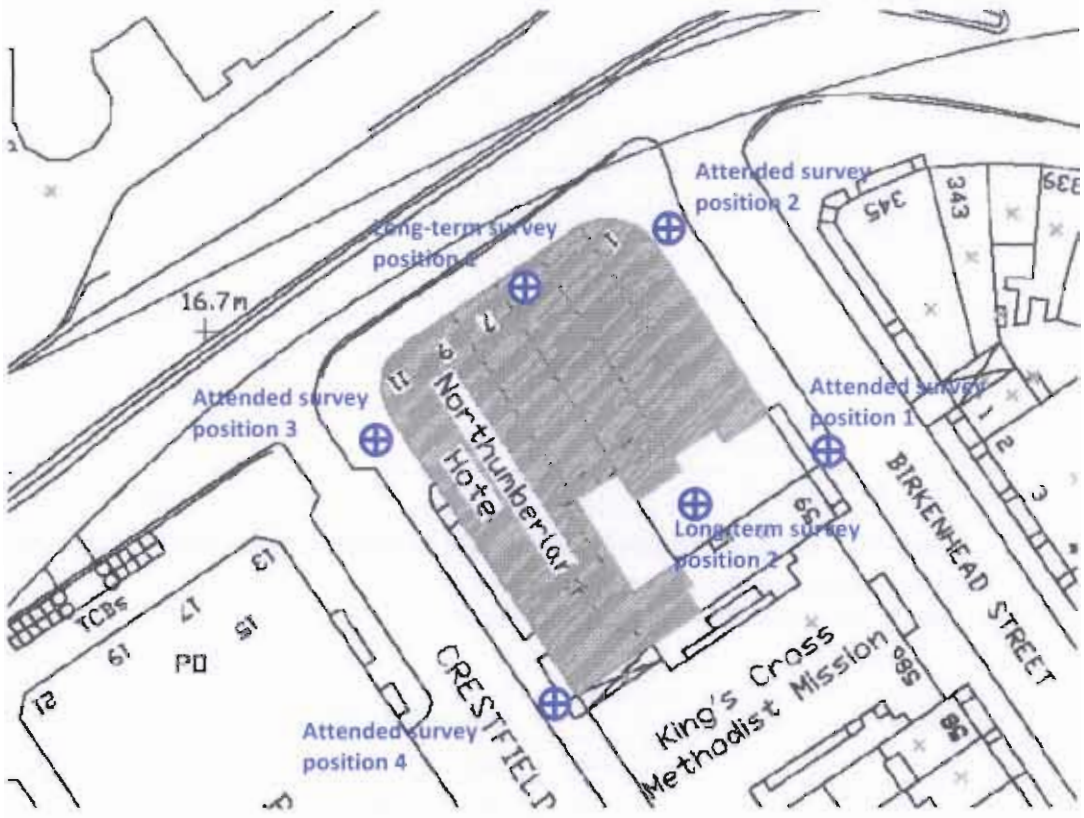

Figure 5 – Survey measurement positions

Detailed graphical results of the long-term noise surveys are given in Appendix B.

A summary of long-term noise levels in terms of $L_{Aeq,T}$ for the daytime (0700-1900), evening (1900-2300) and night (2300-0700) periods is given in Table 4.1 for the Euston Road location (long-term survey position 1) and Table 4.2 for the rear of the hotel location (long-term survey position 2).

Date	Period	Octave Band Centre Frequency, Hz						L_{Aeq}
		125	250	500	1k	2k	4k	
Thurs 24th	Day(1)	74	70	68	71	70	66	76
	Eve.	72	68	67	73	70	61	76
	Night	70	67	66	69	67	58	72
Fri 25th	Day	73	70	68	71	68	62	74
	Eve.	72	68	66	70	69	63	74
	Night	70	67	66	69	66	60	72
Sat 26th	Day	72	69	67	69	67	60	73
	Eve.	72	67	68	70	68	59	74
	Night	70	67	67	70	67	59	73
Sun 27th	Day	71	67	66	69	66	58	72
	Eve.	71	67	67	70	67	59	73
	Night	69	66	65	68	65	58	72
Mon 28th	Day(2)	74	70	68	70	69	62	74

Table 4.1 - Long-term noise survey results summary – Euston Road, $L_{Aeq,T}$ dB

Note 1: Survey period from 1200 hours to 1900 hours.
Note 2: Survey period from 0700 hours to 1200 hours.

Date	Period	Octave Band Centre Frequency, Hz						L_{Aeq}
		125	250	500	1k	2k	4k	
Thurs 24th	Day(1)	62	61	55	55	52	44	60
	Eve.	62	61	56	58	53	43	61
	Night	58	56	52	53	50	39	57
Fri 25th	Day	62	60	55	54	51	42	59
	Eve.	61	60	54	55	52	44	59
	Night	58	56	51	53	49	41	56
Sat 26th	Day	62	60	56	55	51	42	59
	Eve.	61	61	55	55	51	41	59
	Night	57	55	52	54	51	41	57
Sun 27th	Day	60	59	54	54	50	40	58
	Eve.	61	60	54	55	51	41	59
	Night	57	55	51	52	48	39	56
Mon 28th	Day(2)	61	58	55	53	50	41	58

Table 4.2 - Long-term noise survey results summary – Rear of hotel, $L_{Aeq,T}$ dB

Note 1: Survey period from 1200 hours to 1900 hours.
Note 2: Survey period from 0700 hours to 1200 hours.

The long-term noise levels in terms of $L_{Aeq,T}$ for the daytime (0700-2300) and night (2300-0700) periods is given in Table 4.3.

Location	Description	Octave Band Centre Frequency, Hz						L_{Aeq}
		125	250	500	1k	2k	4k	
Euston Road[1]	Daytime, 07:00 – 23:00	73	69	67	70	69	62	74
	Night time, 23:00 – 07:00	70	67	67	70	67	59	73
Rear of Hotel[2]	Daytime, 07:00 – 23:00	62	60	55	54	51	42	59
	Night time, 23:00 – 07:00	57	55	52	54	51	41	57

Table 4.3 – Day and night noise levels – $L_{Aeq,T}$ dB

Note 1: Daytime level is Friday. Night-time level is Saturday/Sunday.
Note 2: Daytime level is Friday. Night-time level is Thursday/Friday.

Figures 6 and 7 show the frequency of maximum night-time noise events recorded over the long-term survey period for the Euston Road and rear of hotel positions respectively. Each event is the maximum sound level, L_{AFmax}, recorded in a 5 minute period.

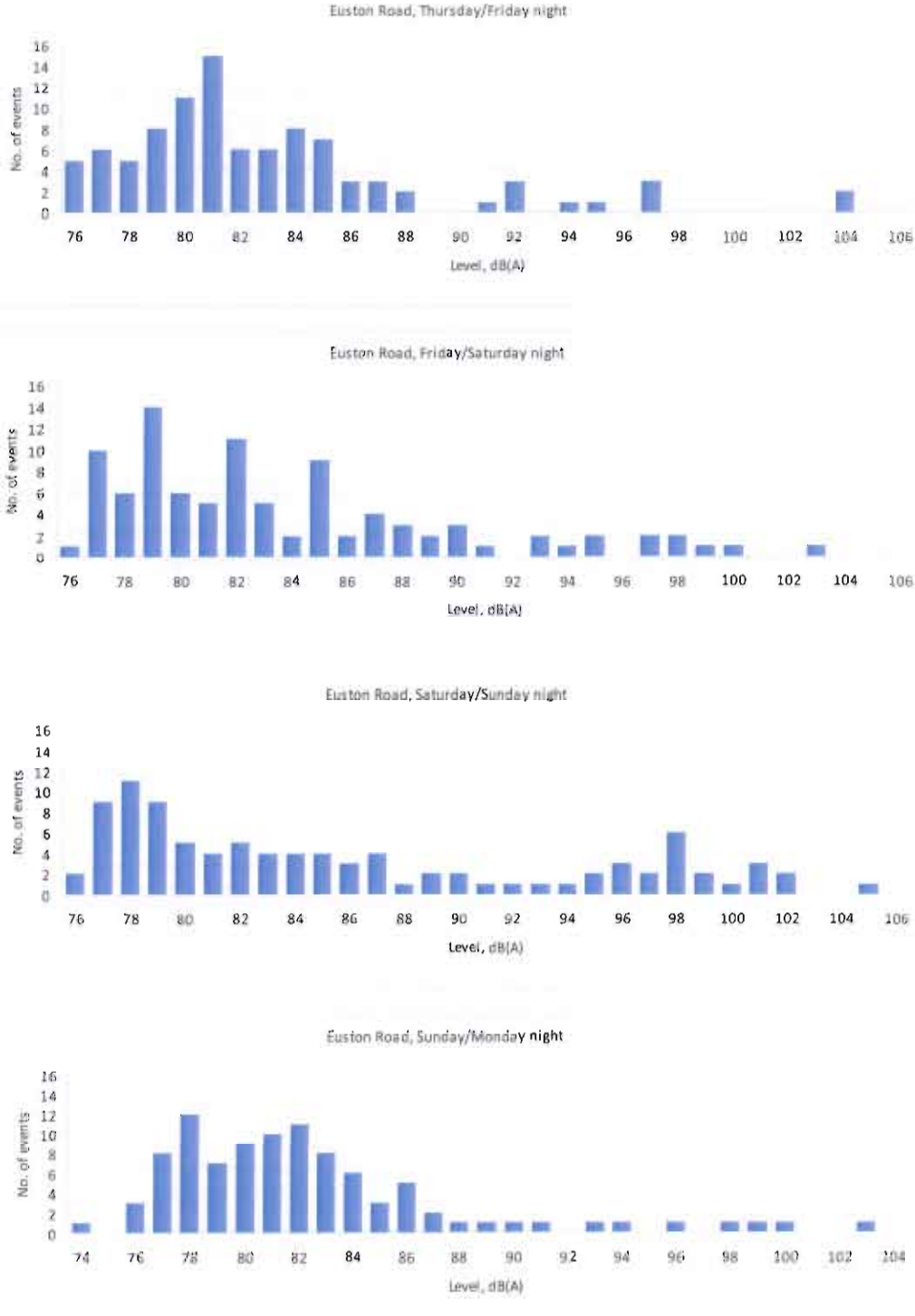

Figure 6 – Maximum night-time noise levels, Euston Road $L_{AFmax,5\ min}$, dB

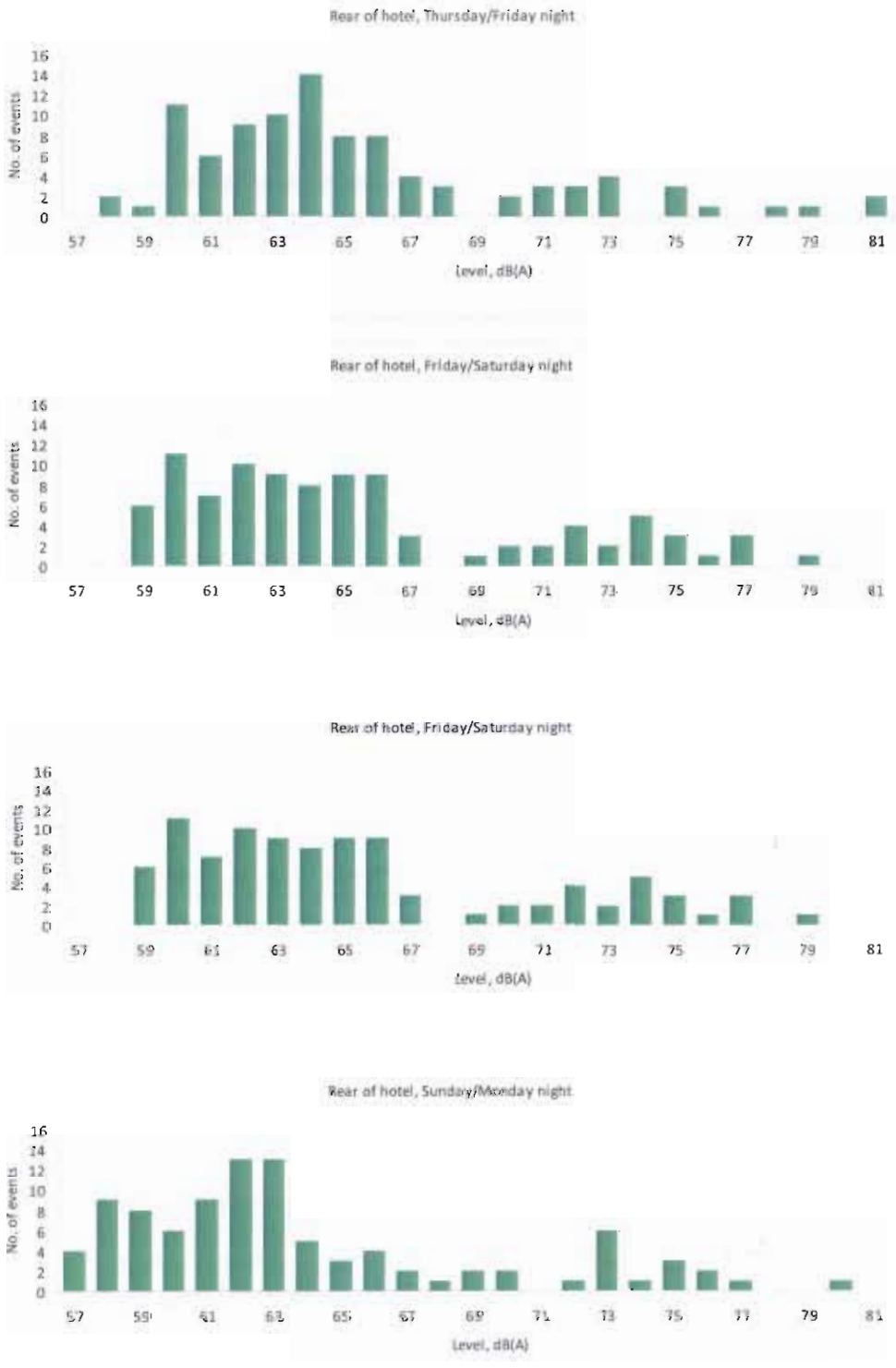

Figure 7 – Maximum night-time noise levels, rear of hotel, $L_{AFmax,5\ min}$, dB

From Figure 6 it can be seen that most maximum noise events at the Euston Road position are below 91 dB L_{AFmax}. Those few events that occur above this level are likely to be attributable to the use of vehicle horns and emergency vehicle sirens.

From Figure 7 it can be seen that most maximum noise events at the Euston Road position are below 70 dB L_{AFmax}. The relevant facades will be designed to protect against these level of road traffic noise ensuring most events do not exceed a noise level of 45 dB L_{AFmax} inside hotel bedrooms at night.

Table 4.4 gives the noise spectra for a typical L_{AFmax} 91 dB event at the Euston Road position and a typical L_{AFmax} 70 dB event at the rear of the hotel position.

Location	Octave Band Centre Frequency, Hz						dB(A)
	125	250	500	1k	2k	4k	
Euston Road	83	83	82	87	83	77	91
Rear of Hotel	70	65	65	64	63	57	70

Table 4.4 - Typical maximum noise events - L_{max}, dB

The minimum background noise levels recorded during the survey period are given in Table 4.5.

Location	Date and Time	$L_{A90,15\ min}$, dB
Euston Road	28/03/11 0145 hours	56
Rear of Hotel	28/03/11 0145 hours	47

Table 4.5 - Minimum background noise levels, $L_{A90,15\ min}$, dB

4.1.1 Attended measurements

On afternoon of Thursday 24/03/2011 attended measurements were taken around the site at positions representative of the eastern and western façades of the proposed hotel. These locations are described in Table 4.6 and shown in Figure 5.

Position	Description
Position 1	Pavement, boundary between 61 and 59 Birkenhead Street
Position 2	Pavement, Birkenhead Street
Position 3	Pavement, Crestfield Street, boundary between hotel and rear of 59 Birkenhead Street
Position 4	Pavement, Crestfield Street, Entrance to hotel

Table 4.6 - Attended noise and vibration measurement locations

Noise measurements were conducted for durations of 5 minutes simultaneously with the measurements taken by the long-term monitor facing Euston Road.

The microphone was located approximately 1.2 m above the ground in all four positions.

Noise measurements were made using a Brüel and Kjær Type 2260 Sound Level Meter, calibrated with Brüel and Kjær type 4231 calibrator. The meter was checked and found to have correct calibration before and after each set of measurements with no significant drift observed.

The weather during the attended survey period was dry with no significant wind.

The attended noise survey measurement results (in terms of $L_{Aeq,5\,min}$) are given in Table 4.7.

Location	Octave Band Centre Frequency, Hz						dB(A)
	125	250	500	1k	2k	4k	
Position 1	68	63	62	61	58	53	65
	69	63	60	58	58	56	65
Position 2	69	66	63	67	65	55	70
	73	68	66	64	61	58	69
Position 3	69	61	60	67	64	62	70
	70	64	60	57	55	52	64
Position 4	70	64	61	59	57	55	65
	70	65	62	60	58	55	66

Table 4.7 – Attended noise measurement results – $L_{Aeq,5min}$, dB

5.0 ENVIRONMENTAL NOISE ASSESSMENT

5.1 External noise levels

The external noise levels used in this noise assessment have been derived from the environmental noise surveys described in Section 4.0. These are specified in the relvant sections below.

5.2 Sound insulation of building envelope

5.2.1 Assumptions

The proposed building will be exposed to noise from road traffic during the day and night. In order to ensure that the noise levels experienced in hotel accommodation meet the local authority requirements, the façade glazing elements of the building envelope have been assessed.

The assessment assumptions are set out below together with the calculated minimum sound insulation requirements. Example glazing specifications are given where relevant to indicate what glazing would achieve the performance requirements.

The area of glazing and method of ventilation in any particular room, along with the room size and room acoustic conditions, affects the degree of reduction in noise transmission from outside to inside. BAP have carried out an assessment using some generic assumptions. These may require reviewing during detailed design development.

The following assumptions have been used for the assessment of the sound insulation requirements of the building envelope:

- Predictions made using the general method set out in BS EN 12354-3:2000
- Sound insulation data based on both BAP library data and specific manufacturers' data. It has been assumed that the on-site performance will be comparable with manufacturer's claimed performance
- The predictions assume good quality workmanship, for example that windows, doors and opening lights are well sealed. Poor workmanship or low quality seals may result in predicted internal noise levels being exceeded
- Roof is pre-cast concrete planks
- The rooms are mechanically ventilated
- The area of glazing in any particular room, along with the room size and room acoustic conditions, affects the degree of reduction in noise transmission from outside to inside. Due to the large number of room layouts, calculations are based on a generic room. Details of these are given in Table 5.1.

Dimension	Residential room
Volume (m^3)	60
Glazing area (m^2)	10
External solid wall area (m^2)	N/A
No. ventilators	N/A

Table 5.1 - Generic Room Dimensions

The proposed façade construction is a curtain walling system (SSG curtain wall system 2 x 6 mm laminated with 24 mm cavity) with a screen. The screen, which includes vents at the seventh floor, will be either glass or acrylic. For the purposes of this assessment the effect of the screen

has not being taken into account. Although the screen will provide some protection against road traffic noise, there are a number of openings in the screen to allow ventilation that result in a negligible sound insulation performance.

For this assessment the following criteria have been used:

- Daytime ambient noise levels in the rooms not to exceed 35 dB $L_{Aeq,16h}$ during the day
- Ambient noise levels in the rooms at night not to exceed 30 dB $L_{Aeq,8h}$ and for individual noise maxima (vehicle passbys) not to normally exceed 45 dB $L_{AF,max}$.

The sound insulation requirements of the glazing are applicable to the window system as a whole, including frames, mullions and panels. They are based on BS EN ISO 140-3: 1995 "*Laboratory measurement of airborne sound insulation of building elements and rated in accordance with BS EN ISO 717-1:1997 Acoustics – Rating of sound insulation in buildings and of building elements Part 1. Airborne sound insulation*".

5.2.2 External noise levels used for design

The façade facing onto Crestfield Street is partially shielded from road traffic noise from the Euston Road. The attended measurements in this location (see Section 4.1.1) can be used to derive design noise spectra to determine the performance requirements of the glazing on this façade.

The façade facing onto Birkenhead Street is not shielded to any significant degree from road traffic noise from the Euston Road.

The external noise levels to be used for design are given in Table 5.2.

Location	Parameter	Octave Band Centre Frequency, Hz						L_A
		125	250	500	1k	2k	4k	
Euston Road Birkenhead Street	$L_{eq,16h}$ Daytime	73	69	67	70	69	62	74
	$L_{eq,8}$ Night time	70	67	67	70	67	59	73
	L_{Fmax}	83	83	82	87	83	77	91
Rear of Hotel	$L_{eq,16h}$ Daytime	62	60	55	54	51	42	59
	$L_{eq,8}$ Night time	57	55	52	54	51	41	57
	L_{Fmax}	70	65	65	64	63	57	69
Crestfield Street	$L_{eq,16h}$ Daytime	62	58	56	59	58	51	63
	$L_{eq,8}$ Night time	59	56	56	59	56	48	62
	L_{Fmax}	72	72	71	76	72	66	79

Table 5.2 – Façade design external levels dB

The locations of the façades considered for design purposes are given in Figure 8.

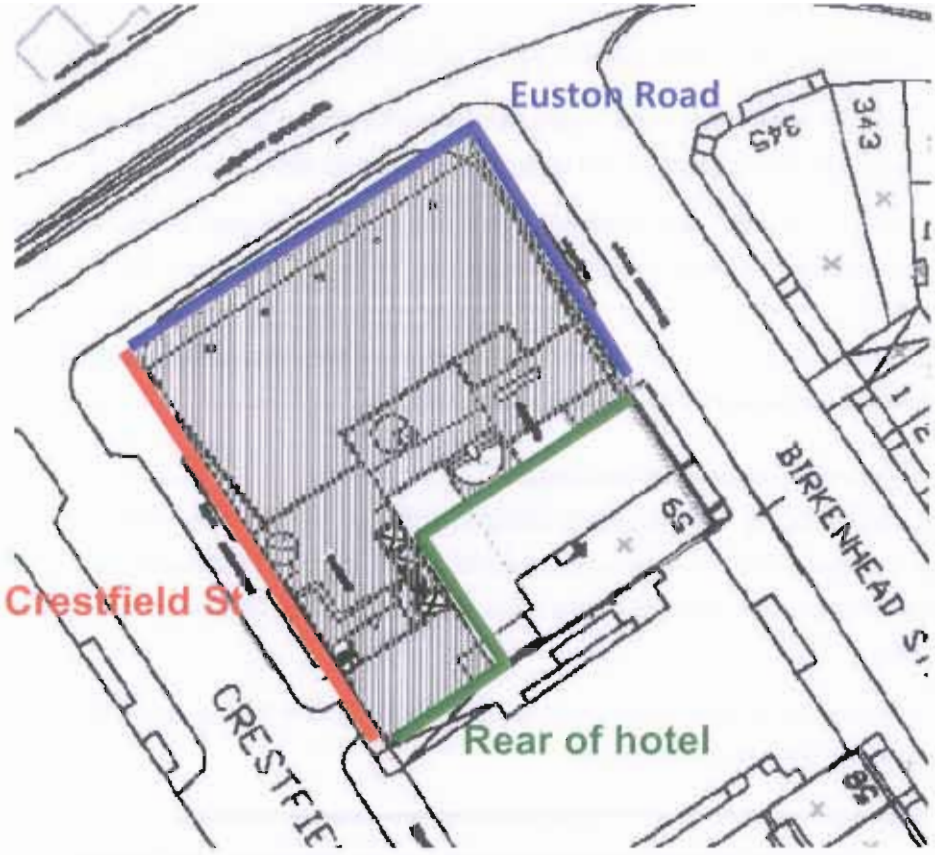

Figure 8 – Façades considered for sound insulation of building envelope

5.2.3 Performance requirements

Details of the recommended performance requirements of the windows and ventilators are given in Table 5.3.

Location	Glazing
Euston Road	Glazing with a minimum tested acoustic performance of 48 dB R_w and 41 dB $R_w + C_{tr}$ such as Pilkington Optilam 16.8(lam)/16/16.8(lam) double glazing.
Rear of Hotel	Glazing with a minimum tested acoustic performance of 31 dB R_w and 27 dB $R_w + C_{tr}$ such as 4/12/4 mm double glazing.
Crestfield Street	Glazing with a minimum tested acoustic performance of 37 dB R_w and 33 dB $R_w + C_{tr}$ such as 10/12/6 mm double glazing.

Table 5.3 - Façade performance requirements

5.3 Noise emissions

5.3.1 Plant

At present there are no details of the type and location of plant for the hotel or retail units. If it is assumed that the any plant will be located on the roof of the building, then the nearest noise sensitive windows are to the rear of the hotel at No. 59 Birkenhead Street.

From the results obtained during the survey at the rear of the hotel, any noise emissions ($L_{Aeq,15min}$) from external plant should not exceed 5 dB below the minimum external background level of 47 dB(A) at the nearest noise sensitive windows to satisfy the requirements of Table E in DP28.

If the emitted noise from plant contains tones, or is intermittent sufficient to attract attention, then it should not exceed 10 dB below the minimum external background level of 47 dB(A) at the nearest noise sensitive windows.

5.3.2 Service yard

During the daytime a small service yard will be used by small vehicles to make deliveries to the hotel. The entrance to the yard will be in Crestfield Street and will be isolated from the street by an electric roller shutter or similar.

The roof of the service yard will be formed by the soffit of the first floor of the hotel. Since windows at the rear of the properties at 59 and 61 Birkenhead Street are shielded from overlooking the service yard by enclosure of the yard, and provided delivery hours are limited to the daytime period, then use of the service yard is not anticipated to be a problem, particularly with respect to the relatively high ambient noise levels in the area.

5.3.3 Restaurant/bar

A restaurant and bar will be located in the basement of the hotel with entrances in Birkenhead Street and Crestfield Street.

Noise breakout from the restaurant/bar will be controlled providing the doors from the streets are lobbied. Suitable supervision of patrons will be required, however, to ensure that the noise of people entering or leaving the restaurant/bar do not disturb neighbouring residents.

The roof light above the stairwell that provides internal access to the restaurant/bar from the hotel will require adequate sound insulation performance to ensure that the residents of the properties at 59 and 61 Birkenhead Street that may overlook this stairwell are not disturbed by noise break-out from the restaurant/bar. The rooflight may have to be double glazed and, if noise levels in the restaurant/bar are likely to be high, or it will operate early in the morning, it may require secondary glazing.

5.3.4 Retail

As the noise environment at the front of the hotel is dominated by relatively high levels of road traffic noise, disturbance to neighbouring properties due to noise generated by activates in the retail units on the ground floor is less likely. Noise from plant is covered in Section 5.3.1.

6.0 SUMMARY AND CONCLUSIONS

Bickerdike Allen Partners have undertaken a noise survey and assessment of a site proposed for a mixed-use (hotel and retail) development at 1-11 Euston Road, London, NW1 2SA.

Noise mitigation measures are described that should be adopted in the hotel accommodation of the proposed development to ensure that internal noise levels are within limits set out in London Borough of Camden's Planning Guidance on noise and relevant national guidance documents.

Advice is also given on the control of noise emissions from plant, use of the service yard, the restaurant/bar and the retail unit, to ensure local authority requirements are met.

Anthony Hayes

for Bickerdike Allen Partners

Peter Henson

Partner

APPENDIX A
GLOSSARY OF ACOUSTIC TERMINOLOGY

The Decibel, dB

The unit used to describe the magnitude of sound is the decibel (dB) and the quantity measured is the sound pressure level. The decibel scale is logarithmic and it ascribes equal values to proportional changes in sound pressure, which is a characteristic of the ear. Use of a logarithmic scale has the added advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers. The threshold of hearing occurs at approximately 0 dB (which corresponds to a reference sound pressure of 2 x 10-5 pascals) and the threshold of pain is around 120 dB.

The sound energy radiated by a source can also be expressed in decibels. The sound power is a measure of the total sound energy radiated by a source per second, in watts. The sound power level, Lw is expressed in decibels, referenced to 10-12 watts.

Frequency, Hz

Frequency is analogous to musical pitch. It depends upon the rate of vibration of the air molecules that transmit the sound and is measure as the number of cycles per second or Hertz (Hz). The human ear is sensitive to sound in the range 20 Hz to 20,000 Hz (20 kHz). For acoustic engineering purposes, the frequency range is normally divided up into discrete bands. The most commonly used bands are octave bands, in which the upper limiting frequency for any band is twice the lower limiting frequency, and one-third octave bands, in which each octave band is divided into three. The bands are described by their centre frequency value and the ranges which are typically used for building acoustics purposes are 63 Hz to 4 kHz (octave bands) and 100 Hz to 3150 Hz (one-third octave bands).

Noise Rating

The Noise Rating (NR) system is a set of octave band sound pressure level curves used for specifying limiting values for building services noise. The Noise Criteria (NC) and Preferred Noise Criteria (PNC) systems are similar.

A-weighting

The sensitivity of the ear is frequency dependent. Sound level meters are fitted with a weighting network which approximates to this response and allows sound levels to be expressed as an overall single figure value, in dB(A).

Environmental Noise Descriptors

Where noise levels vary with time, it is necessary to express the results of a measurement over a period of time in statistical terms. Some commonly used descriptors follow.

Statistical Term	Description
$L_{Aeq, T}$	The most widely applicable unit is the equivalent continuous A-weighted sound pressure level (LAeq, T). It is an energy average and is defined as the level of a notional sound which (over a defined period of time, T) would deliver the same A-weighted sound energy as the actual fluctuating sound.
L_{AE}	Where the overall noise level over a given period is made up of individual noise events, the LAeq, T can be predicted by measuring the noise of the individual noise events using the sound exposure level, LAE (or SEL or LAX). It is defined as the level that, if maintained constant for a period of one second, would deliver the same A-weighted sound energy as the actual noise event.
L_{A01}	The level exceeded for 1% of the time is sometimes used to represent typical noise maxima.
L_{A10}	The level exceeded for 10% of the time is often used to describe road traffic noise.
L_{A90}	The level exceeded for 90% of the time is normally used to describe background noise.

Sound Transmission in the Open Air

Most sources of sound can be characterised as a single point in space. The sound energy radiated is proportional to the surface area of a sphere centred on the point. The area of a sphere is proportional to the square of the radius, so the sound energy is inversely proportional to the square of the radius. This is the inverse square law. In decibel terms, every time the distance from a point source is doubled, the sound pressure level is reduced by 6 dB.

Road traffic noise is a notable exception to this rule, as it approximates to a line source, which is represented by the line of the road. The sound energy radiated is inversely proportional to the area of a cylinder centred on the line. In decibel terms, every time the distance from a line source is doubled, the sound pressure level is reduced by 3 dB.

Factors Affecting Sound Transmission in the Open Air

Reflection

When sound waves encounter a hard surface, such as concrete, brickwork, glass, timber or plasterboard, it is reflected from it. As a result, the sound pressure level measured immediately in front of a building façade is approximately 3 dB higher than it would be in the absence of the façade.

Screening and Diffraction

If a solid screen is introduced between a source and receiver, interrupting the sound path, a reduction in sound level is experienced. This reduction is limited, however, by diffraction of the sound energy at the edges of the screen. Screens can provide valuable noise attenuation, however. For example, a timber boarded fence built next to a motorway can reduce noise levels on the land beyond, typically by around 10 dB(A). The best results are obtained when a screen is situated close to the source or close to the receiver.

Meteorological Effects

Temperature and wind gradients affect noise transmission, especially over large distances. The wind effects range from increasing the level by typically 2 dB downwind, to reducing it by typically 10 dB upwind – or even more in extreme conditions. Temperature and wind gradients are variable and difficult to predict.

APPENDIX B
ENVIRONMENTAL NOISE SURVEY RESULTS

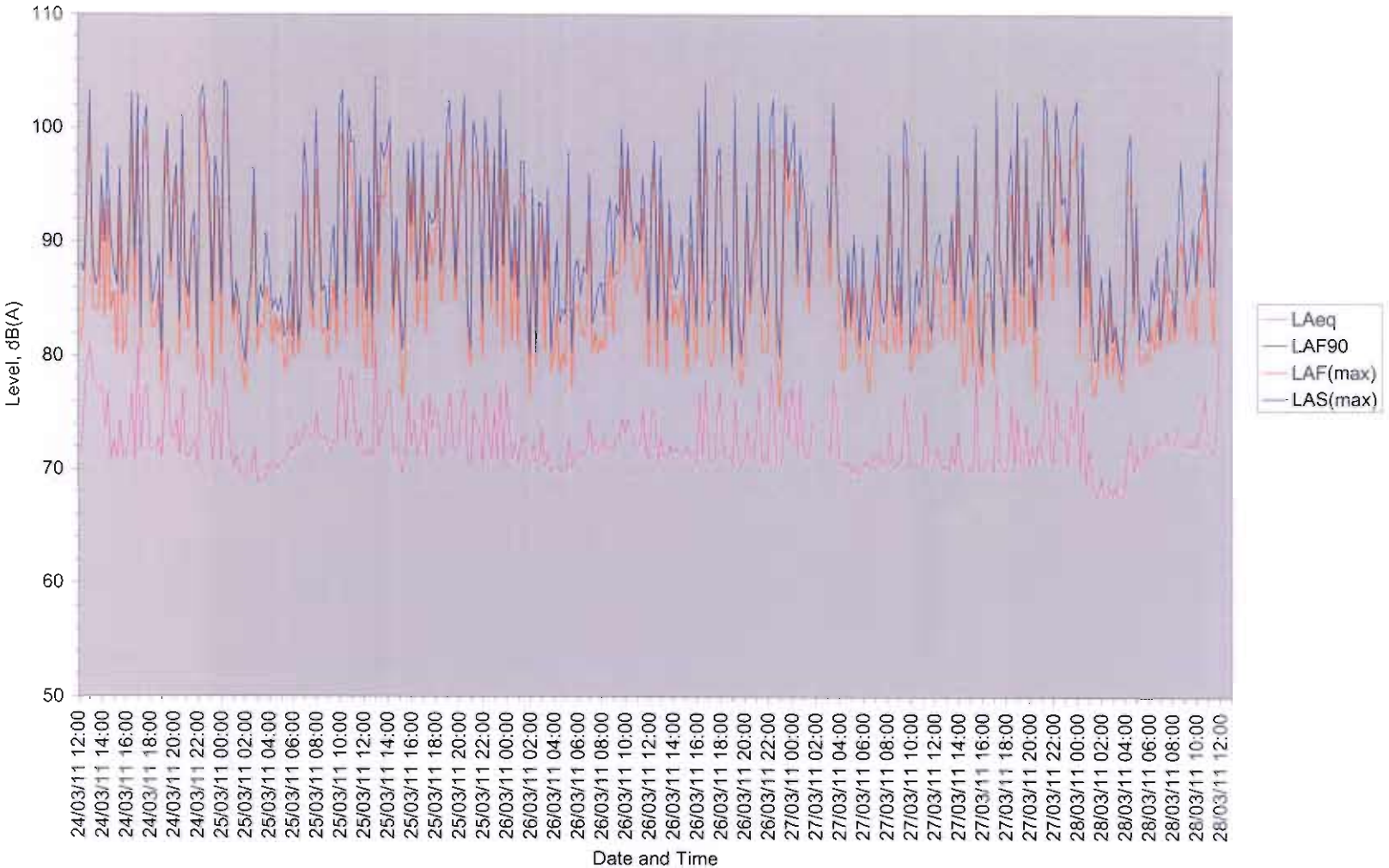

Figure 9 - Long Term Noise Survey Results – Euston Road location

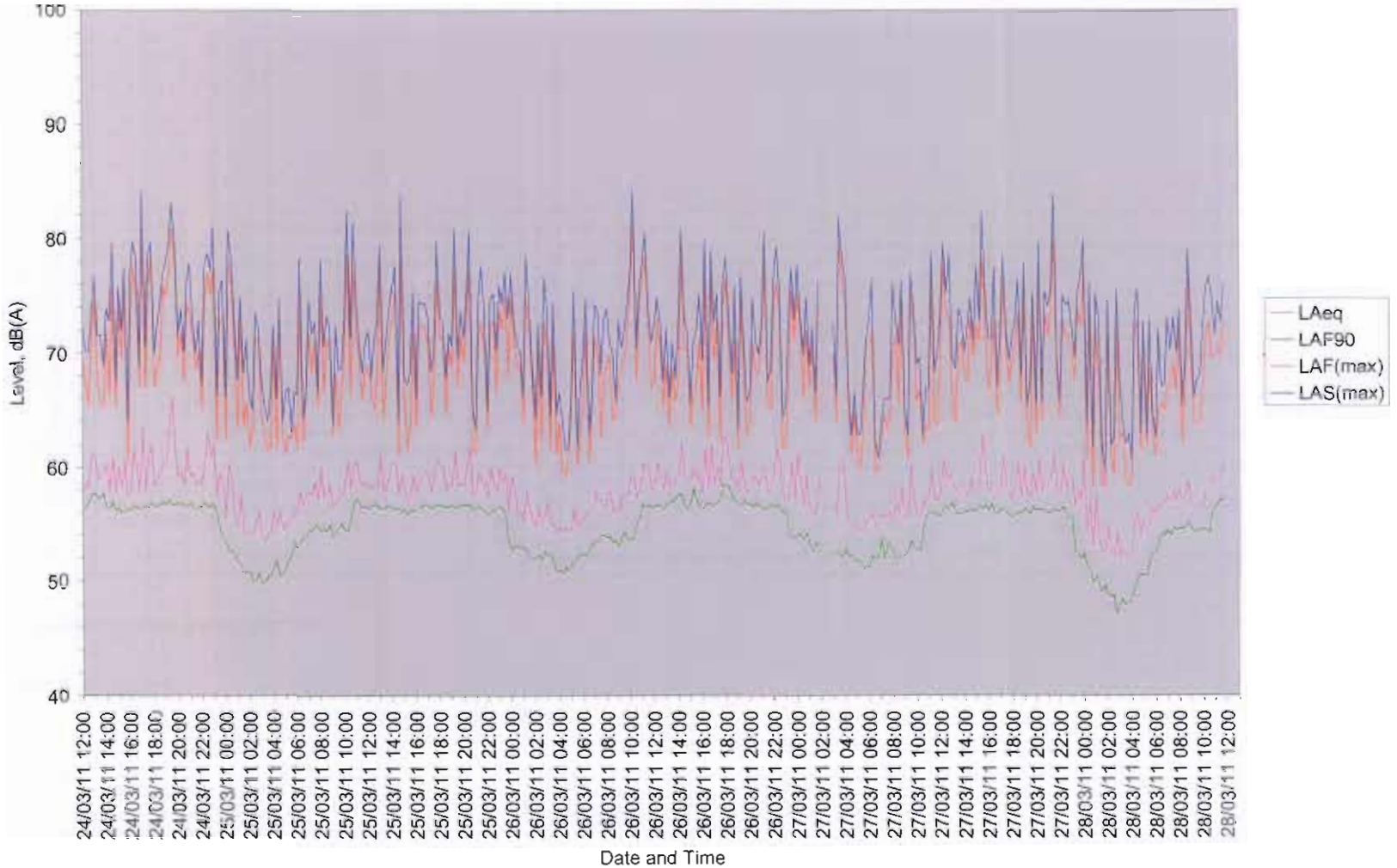

Figure 10 - Long Term Noise Survey Results – Rear of hotel location

PROPOSED HOTEL DEVELOPMENT, 1-11 EUSTON ROAD NW1
ENVIRONMENTAL NOISE SURVEY REPORT SHEET

DAYTIME NOISE SURVEY: Thursday, 24/03/2011
All measurements dB ref $2x10^{-5}$ Pa

Position: Various
Time: See below
Note: Noise sources – rad traffic
Weather conditions: Clear, no significant winds, no rain, dry roads

Parameter - Sound Level, dB, L_{eq}

Date	Time	Location	Octave Band Centre Frequency (Hz)						L_{Aeq}	Dur.	Comments
	hh;mm:ss		125	250	500	1k	2k	4k		mm:ss	
24/03/2011	12:20:03	Position 1, Birkenhead Street	68	63	62	61	58	53	65	05:00	-
24/03/2011	12:25:32	Position 2, Birkenhead Street	69	66	63	67	65	55	71	05:00	-
24/03/2011	12:35:23	Position 2, Birkenhead Street	73	68	66	64	61	58	69	05:00	-
24/03/2011	12:40:37	Position 1, Birkenhead Street	69	63	60	58	58	56	65	05:00	-
24/03/2011	12:50:04	Position 3, Crestfield Street	69	61	60	67	64	62	70	05:00	-
24/03/2011	12:55:27	Position 4, Crestfield Street	70	64	61	59	57	55	65	05:00	-
24/03/2011	13:00:32	Position 4, Crestfield Street	70	65	62	60	58	55	66	05:00	-
24/03/2011	13:10:02	Position 3, Crestfield Street	70	64	60	57	55	52	64	05:00	-