Bickerdike Allen Partners

100-102 ARLINGTON ROAD &
16-18 DELANCY STREET, LONDON NW1
NOISE ASSESSMENT REPORT

Report to

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DunnettCraven
20-23 Mandela Street
London
NW1 0DU

A6301/R01-MM/DT
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1.0 INTRODUCTION

Bickerdike Allen Partners (BAP) have been retained by 20|20 Limited [now DunnettCraven] to carry out an environmental noise assessment of the proposed mixed used development at 100-102 Arlington Road, London NW1 as part of a planning submission.

The site, currently occupied by the Crown and Goose pubic house and a snooker hall, is proposed to be redeveloped into a mixed use site.

A description of the proposed site and surrounding area is given in Section 2.0. Section 3.0 outlines relevant noise criteria to be considered. In Section 4.0 an account of survey work involving unattended environmental noise monitoring is given where measurements were made over a period of at least 24 hours. Section 5.0 describes an attended noise survey where short term measurements and observations were made around the site

Section 6.0 sets out the noise exposure levels determined around the site. Suggested sound insulation requirements for the building envelope are laid out in Section 7.0.

With regards to noise emissions from the site Sections 8.0 considers expected delivery noise levels, Section 9.0 contains an assessment of entertainment noise breakout from the proposed development and Section 10.0 sets out external plant noise requirements.

A summary of this report is provided in Section 11.0. A glossary of acoustic terminology used is included in Appendix A.

2.0 THE SITE

A general layout of the existing site, in relation to the surrounding roads can be seen in Figure 1. The existing site comprises a public house with a flat above and a snooker hall.

The site is flanked by two established busy roads, Arlington Road and Delancy Street. The traffic flow along Delancy Street was observed to be around 480 vehicles per hour along Delancy Street and around 120 vehicles per hour along Arlington Road. Around 6 % of these vehicles were heavy goods vehicles or buses.

The site is proposed to be developed into a new mixed use development comprising of a gastro pub/bar restaurant on the ground floor of the development with residential flats above. BAP have been provided with scheme drawings by the architects.

3.0 ENVIRONMENTAL NOISE CRITERIA

In assessing appropriate internal noise limits for a proposed residential development to control external environmental noise design criteria need to be considered. Consideration needs to be given to both the general ambient noise level and individual noise events. The following section presents current published environmental noise criteria relevant to the proposed development.

3.1 PPG24

In assessing the suitability of sites for noise sensitive developments such as housing or noise producing developments (such as bars and restaurants), local authorities are guided by the Department of the Environment Planning Policy Guidance, PPG 24, Planning and Noise.

PPG 24 introduced the concept of Noise Exposure Categories (NEC's) ranging from A-D to help local authorities in their consideration of applications for residential development near transport-related noise sources. Category A represents the circumstances in which noise is unlikely to be a determining factor, while Category D relates to the situation in which development should normally be refused. Categories B and C deal with situations where noise mitigation measures should be taken to make the development acceptable.

Table 1 below is an extract from PPG 24 giving the recommended noise exposure categories for new dwellings near existing noise sources.

NOISE LEVELS CORRESPONDING TO THE NOISE EXPOSURE CATEGORIES FOR NEW DWELLINGS $L_{Aeq,T}$				
	NOISE EXPOSURE CATEGORY			
NOISE SOURCE	**A**	**B**	**C**	**D**
Road traffic				
07.00 – 23.00	<55	55 –63	63 –72	>72
23.00 – 07.00	<45	45 – 57	57 – 66	>66
Rail Traffic				
07.00 – 23.00	<55	55 – 66	66 – 74	>74
23.00 – 07.00	<45	45 – 59	59 – 66	>66
Air Traffic				
07.00 – 23.00	<57	57 – 66	66 – 72	>72
23.00 – 07.00	<48	48 – 57	57 – 66	>66
Mixed Sources				
07.00 – 23.00	<55	55 – 63	63 – 72	>72
23.00 – 07.00	<45	45 – 57	57 – 66	>66

Table 1 - PPG24 NEC Categories

PPG24 also states that "*during the night time period (23.00 – 07.00) sites where individual noise events regularly exceed 82 dB L_{Amax} (S time weighting) several times in any hour should be treated as being in NEC C, regardless of the $L_{Aeq, 8h}$ (except where the $L_{Aeq, 8h}$ already puts the site in NEC D)*".

With regard to the insulation of residential buildings against external noise, such as road and rail traffic noise, PPG24 refers to the guidance provided in BS8233.

3.2 BS8233

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 criteria, relevant to this site, have been presented below in Table 2.

Criterion	Typical situations	Design range $L_{Aeq, T}$ dB	
		Good	Reasonable
Reasonable resting/sleeping conditions	Living rooms	30	40
	Bedrooms	30	35
[a] For a reasonable standard in bedrooms at night, individual noise events (measured with F time-weighting) should not normally exceed 45 dB L_{Amax}			

Table 2 - Indoor ambient noise levels in spaces when they are unoccupied

3.3 Summary of environmental noise criteria

Having considered the above criteria, BAP propose to adopt a design target of 30 dB $L_{Aeq, 8h}$ for bedrooms at night and 35 dB $L_{Aeq, 16h}$ for living rooms during the daytime. In addition, noise events within the bedrooms at night should not normally exceed 45 dB $L_{AF,max}$.

4.0 UNATTENDED ENVIRONMENTAL NOISE SURVEY

4.1 Introduction

A noise survey was carried out around the existing site. The purpose of this survey was to establish existing ambient and background noise levels incident on the site. The data from this survey will assist in determining the sound insulation requirements of the building envelope and also for external plant noise assessments.

4.2 Equipment and procedure

The equipment used for this survey consisted of a Norsonic Type Nor 118 sound level analyser with a Brüel and Kjær type 4231 calibrator. The equipment was calibrated both prior to and after the survey and no significant drift was observed.

The unattended measurement position chosen can be seen in Figure 1 (Position 1). This position was a façade measurement positions, i.e. the microphone was positioned approximately 1 m away from the existing building façade. The measurements were made at first floor level.

The survey was carried out over the period between the 18th May 2004 and the 19th May 2004. The weather was clear and dry.

4.3 Results

A summary of the A-weighted measured sound levels at Position 1 can be seen in Figure 2. Detailed results obtained can be found in Appendix B. To coincide with the external noise criteria presented in PPG24 (see Section 3.1) these levels have been corrected for free field conditions by subtracting 3 dB, as is usual practice.

The ambient free field noise levels at this position are dominated by road traffic noise and are around 69 dB $L_{Aeq, 16h}$ during the daytime and around 63 dB $L_{Aeq, 8h}$ during the night time. The distribution of the night-time $L_{AFmax, 15min}$ levels can be seen in Figure 4. Typical maxima occur at around 80 dB L_{AFmax} free-field. These maximum noise events are created by road traffic on Delancy Street. Background noise levels dropped to a minimum free-field level of 43 dB $L_{A90, 15min}$ at around 0315 in the morning.

5.0 ATTENDED ENVIRONMENTAL NOISE SURVEYS

5.1 Introduction

In addition to the above, a number of attended measurements were made around the site. The purpose of these surveys was to identify the various noise sources during different periods, make observations as to existing traffic levels and activity around the site and to determine the variation in noise levels across the site.

5.2 Equipment and procedure

The equipment used for the survey consisted of a Brüel and Kjær type 2260 analyser with a Brüel and Kjær type 4231 calibrator. The equipment was calibrated both prior to and after the survey periods and no significant drift was observed.

The equipment was set to monitor three continuous five minute samples. All positions were façade measurements, i.e. around 1 m away from any reflecting surfaces, and can be seen in Figure 1 (Positions 2-3). Measurements were carried out during the daytime of May 18th 2004. The weather during the survey period was clear and dry with low levels of wind.

5.3 Results

Detailed survey result sheets can be seen in Appendix C, for the daytime survey.

<u>Delancy Street (Position 2)</u>

The ambient noise level (corrected to a free field level) at this position was similar to that measured at the façade position 1, i.e. around 70 dB $L_{Aeq, T}$. Individual noise events created by road traffic created $L_{AF, max}$ levels of around 85 dB.

Arlington Road (Position 3)

The ambient noise level at this position (corrected to a free field level) was slightly lower than that measured at the façade position 1, i.e. around 66 dB $L_{Aeq, T}$. This reduction was due to lower numbers of road traffic movements along Arlington Road. Individual noise events created by road traffic created $L_{AF, max}$ levels of around 82 dB.

6.0 NOISE EXPOSURE OF PROPOSED SITE

6.1 Road traffic noise

For future assessments of the sound insulation requirements of the building envelope an assessment has been made of the levels of noise incident on the proposed development.

Initial drawings of the proposed development indicate that the majority of the residential areas of the development will have windows that will face onto either Delancy Street or Arlington Road. These two façades will be exposed to similar levels of ambient and maximum noise.

The assumed noise levels to which these facades are exposed to are set out below in Table 3. As the surrounding roads are already well established it is not expected that these levels will increase significantly within the foreseeable future (10-15 years time).

On Delancy and Arlington Road there was not a significant variation in either measured ambient noise (L_{Aeq} values) or maximum noise events (L_{Amax} values) created by road traffic movements.

Noise Parameter	Octave band centre frequency, Hz						A
	125	250	500	1k	2k	4k	
Daytime $L_{Aeq,16h}$	73	66	63	65	60	53	69
Night time $L_{Aeq,8h}$	69	62	59	61	57	51	63
Night typical $L_{AF,max15min}$	87	79	75	75	71	66	80

Table 3 - Noise exposure of Delancy and Arlington Road façade, free field

6.2 Background noise levels

For the future design of mechanical services and plant it is common for plant noise limits to be set based on existing lowest measured background noise levels. The table below sets out the lowest measured façade background noise levels for the long term noise monitor set up at the site.

Position	Lowest measured background noise level, dB $L_{A90, 15min}$		
	Day (0700-1900)	Evening (1900-2300)	Night (2300-0700)
Delancy Street (Position 1)	54dB	54dB	43dB

Table 4 - Lowest measured background noise levels, dB free field

The above measured noise levels may be used for future plant noise assessments at the proposed development.

7.0 ENVIRONMENTAL NOISE ASSESSMENT

7.1 PPG24 noise exposure category

It can be seen from Sections 3 and 4 that the site is currently exposed to a free-field noise level of 69 dB $L_{Aeq, 16h}$ during the daytime and 63 dB $L_{Aeq, 8h}$ during the night. This places the site at the upper end of noise exposure category (NEC) C.

PPG24 recommends for this NEC that "*Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.*"

These levels of traffic noise are not uncommon within the London Borough of Camden. An assessment has been made by BAP to demonstrate that British Standard recommended internal noise limits can be met with suitable attention made to the acoustic performance of the building envelope.

In order to ensure an adequate level of protection against external noise, an assessment has been made of the sound insulation requirements of the building envelope. This is reported in the following sections.

7.2 General assumptions

The following assumptions have been used in this assessment,

- Assumed external noise data is presented in section 6.0.
- Predictions use the method set out in BS EN 12354-3:2000.
- Sound insulation data is based on both BAP generic data and specific manufacturer's data.
- For this assessment BAP have adopted the following British Standard recommended internal noise targets i.e.;

  Residential living rooms and dining rooms - Not greater than 35 dB(A) L_{eq} during the daytime (0700-2300)

  Residential, bedrooms at night (2300-0700) 30 dB L_{Aeq} & for individual peak noise events (vehicle passbys) 45 dB L_{AFmax}.
- Assumed generic bedroom 30 m^3 volume with a window area of approximately 1.6 m^2.
- Assumed generic living/dining room 75 m^3 volume with a window area of approximately 3 m^2.
- Assumed external wall construction cavity masonry wall (mass 400 kg/m^2).

7.3 Sound insulation requirements of building envelope

In order for the proposed residential building to provide a commensurate level of protection against external noise the following advice is provided. The following recommendations are provided to demonstrate that recommended internal noise targets will not be exceeded if attention is given to the acoustic specification of the building envelope.

7.3.1 Bedrooms

The building façade for bedrooms will need to be constructed so as to provide sound attenuation against external noise, of around 40 dB with windows shut and background ventilation provided. This section sets out recommended building envelope constructions that have been predicted to meet this requirement.

Due to the levels of road traffic noise, background ventilation will not be possible with the use of trickle, or slot, window ventilators. It is recommended that sound attenuating in-wall ventilators should be installed within the bedrooms. These should comply with the acoustic requirements of the Noise Insulation Regulations 1996. Details of manufacturer's of these proprietary ventilators are included in Appendix D.

In order to meet the recommended noise limits within the living rooms the glass chosen will need to have a minimum acoustic performance of 35 dB R_w and 29 dB R_W+C_{tr}. For guidance, data from the manufacturers indicates that Saint Gobain acoustic "Stadip" laminated 6.4(lam)/12/6 mm glass or Pilkington acoustic laminate 6/12/7(lam) mm glass meets the above requirement. Alternatively a thicker non-laminated glass type could be used such as a 10/12/6 mm.

7.3.2 Living Rooms

The building façade for any living rooms will need to be constructed so as to provide sound attenuation against external noise, of around 35 dB, with windows shut. This section sets out recommended building envelope constructions that have been predicted to meet this requirement.

In order to meet the recommended noise limits within the living rooms the glass chosen will need to have a minimum acoustic performance of 35 dB R_w and 29 dB R_W+C_{tr}. For guidance, data from the manufacturers indicates that Saint Gobain acoustic "Stadip" laminated 6.4(lam)/12/6 mm glass or Pilkington acoustic laminate 6/12/7(lam) mm glass meets the above requirement. Alternatively a thicker non-laminated glass type could be used such as a 10/12/6 mm.

Ventilators – Predictions have shown that an 'acoustic' standard trickle ventilator is required. This should have a minimum laboratory tested performance of 35 dB $D_{ne,w}$ when open.

7.3.3 Roof

To limit levels of noise entering the top floor flats via the roof, it is recommended that the ceiling of the top floor flats should comprise of 2 no. layers of 12.5 mm plasterboard with at least a 100 mm layer of sound absorbing material (mineral wool) in the cavity above.

8.0 DELIVERY NOISE

The ground floor of the proposed mixed use development is proposed to be used for a gastro pub/bar restaurant. BAP have undertaken an assessment of likely levels of noise created by commercial deliveries and to assess if these levels will have a significant impact on the surrounding area. It is envisaged that deliveries will be taken on the Arlington Road entrance of the site during the daytime period, 0700 – 2300 hours.

It is important to note however that there is an existing public house on the site for which deliveries must be made. The proposed development does not therefore introduce a new noise source but merely retains the status quo with regards to delivery noise.

8.1 Criteria

There is no official guidance on the specific criteria that should be applied to delivery noise impact assessment. Some of those currently in existence are discussed below.

8.1.1 PPG 24

The Department of the Environment published the Government's policies on Planning and Noise; document PPG 24, September 1994. This planning guidance does not contain advice on the impact of service yard noise specifically. It does however clarify in the Glossary of the guidance that a change of 3 dB(A) is the minimum perceptible under normal conditions.

Also the assessment has noted the Government's advice that whilst accepting development will generate noise the essence is to ensure that it does not cause an "unacceptable" degree of disturbance.

8.1.2 BS 4142

A method for assessing the effect of industrial noise is given in BS 4142 "*Method for rating industrial noise affecting mixed residential and industrial areas*". The standard describes methods for assessing noise from "factories, or industrial premises, or fixed installations, or sources of an industrial nature in commercial premises".

It is questionable whether service activity noise should be assessed using this standard that was devised to rate noise of an industrial nature, and really intended for assessment of noise from fixed plant.

8.1.3 Existing noise climate

It is not uncommon to assess delivery noise by direct comparison of the expected delivery noise levels with the existing noise climate around the site in question. Delancy Street is of mixed use with an element of residential buildings whereas Arlington Road is predominately residential.

The existing ambient noise levels around the site are generally around 65 – 70 dB(A) L_{eq} free field with regular peak noise events caused by buses and HGVs on Delancy Street ranging from 78 -90dB(A) L_{Amax}.

It must be noted that there is an existing public house on the site, the Crown & Goose, this takes deliveries throughout the week on the Arlington Road façade. It is therefore not proposed to introduce a new noise source, but to continue similar delivery arrangements as the current situation. BAP have not been retained to assess existing delivery noise levels.

8.2 Assessment

BAP have undertaken many delivery noise assessments for various commercial clients. The results of these can be seen below in Table 6. These have been used to predict likely levels of noise that will occur during a typical delivery.

Delivery activity	Range of noise at 30 m	Typical noise level at 30m	Predicted noise level @ 7 m free-field (Arlington Road residential buildings facing site)
Lorry Manoeuvring	46-70	59	72
Lorry Idling	50-56	54	67
Reversing beeper	49-73	65	78
Lorry rear doors opening	39-54	46	59
Scissor Lift	39-44	42	55
Lift flap lowering hurriedly	55-67	61	74
Lift flap lowering - carefully	46-49	48	61
Moving roll cages in street	40-60	55	68
Existing noise levels in Arlington Road	Average noise level of (68-70 dB $L_{Aeq,\ 15min}$). Peak noise events from road traffic (78-89 dB $L_{AFmax,5min}$)		

Table 5- Predicted noise levels due to typical delivery activities

It can be seen from the above table that typical delivery noise events will be at a similar level, to the existing ambient noise level. These typical delivery noise levels are significantly less than typical maximum levels caused by traffic in Delancy Street and Arlington Road.

It is therefore concluded that maintaining the delivery arrangements at this site will not have a significant impact on the nearby residential properties. The proposed dwellings will already be protected against external noise due to the existing levels of road traffic noise.

9.0 ENTERTAINMENT NOISE

In assessing the suitability of the site for a noise generating development BAP have considered the likely levels of noise 'breakout' from the proposed gastro pub/bar restaurant to both the existing residential properties close to the site and the proposed residential flats above the premise.

It is important to note again that, as with the delivery noise, it is not intended to introduce a new noise source into the area. It is instead proposed to maintain the commercial use of this site at ground floor level.

9.1 London Borough of Camden noise standards for licensing applications

The local authority's standard noise criteria are as follows;

"*The noise climate of the surrounding area shall be protected such that the A-weighted equivalent continuous noise level (L_{Aeq}) emanating from the application site, as measured 1 m from any façade of any noise sensitive premises over any 5 minute period with entertainment taking place shall not increase by more than 5 dB as compared with the same measure, from the same position, and over a comparable period with no entertainment taking place. And*

The unweighted equivalent noise level (L_{eq}) in the 63 Hz Octave band, measured using the "fast" time constant, inside any "living room" of any noise sensitive premises, with the windows open or closed, over any 5 minute period with entertainment taking place, should show no increase as compared to the same measure, from the same location(s), and over a comparable period, with no entertainment taking place."

9.2 Assessment of noise breakout to neighbouring properties

An assessment has been made to the breakout of noise from the ground floor gastro pub/bar restaurant to the nearby residential properties approximately 7 m away.

BAP have carried out numerous assessments of noise breakout from entertainment venues for both licensing and planning purposes. Some typical noise measurements carried out within various premises are presented below in Table 6.

Description	Octave band centre frequency, Hz							
	63	125	250	500	1k	2k	4k	A
Night club music system	104	106	99	97	95	89	89	100
Busy pub with music system	90	89	86	83	84	84	80	89
Bar with background music	74	81	75	76	74	75	77	82
Busy restaurant with background music	76	74	72	75	75	67	61	78
Bar with DJ	82	85	79	83	81	78	74	86

Table 6- Typical entertainment noise spectra, $L_{eq,T}$

As a worst-case assessment BAP have assumed a typical internal noise level of a "busy pub with music system". In practice internal noise levels are likely to be lower.

In order to carry out an assessment in accordance with the local authority guidelines, the background noise level outside the nearest noise sensitive properties needs to be established. This has been taken from the lowest measured noise level between the evening/night time period of 2300-0000. This was measured at 2345 hours and the spectrum can be seen in Table 7. This time period was chosen as a period when noise from the existing public house will not have contributed to this noise level. The time period was 15 minutes rather than the required 5 minutes required by Camden, although it is not expected that this will have significantly affected the measured ambient noise level.

Based on information on the proposed bar area set out in drawings provided by 20|20 architects, predictions have been made of entertainment noise breakout to the nearby residential properties (approximately 7 m from the bar façade). The results of these predictions can be seen below in Table 7.

Description	Octave band centre frequency, Hz							
	63	125	250	500	1k	2k	4k	A
External ambient noise level (façade)	78	72	64	61	62	57	51	66
Entertainment noise (façade)	67	57	57	50	46	46	42	54
Total noise level Entertainment plus ambient (façade)	78	72	65	61	62	57	52	66
Increase	0	0	+1	0	0	0	+1	0

Table 7 – Entertainment noise breakout calculation, noise levels dB re $2x10^{-5}$ Pa

It can be seen that, as a worst case, the entertainment noise will not increase the existing ambient noise level outside neighbouring properties. This is clearly well below Camden's suggested 5 dB(A) maximum increase.

With regards to Camden's internal noise limit an assessment of noise levels inside neighbouring properties is outside BAP's brief. However the above worst case assessment indicates no increase in noise level outside neighbouring windows in the 63 Hz octave band. Again, this indicates that the internal noise levels will be within Camden's licensing noise guidelines.

9.3 Assessment of noise transmission to flats above

An appropriate design criterion to protect the first floor residential areas from the ingress of noise from the ground floor bar restaurant will depend on the prevailing background noise levels in the residential spaces. The background noise level within the proposed flats above is not known. An assumed background noise level of around 25 dB has been taken. This is based on the quietest time of the night and our experience of similar developments.

BAP recommend controlling noise ingress to at least 5 – 10dB below the first floor background level. This would require limiting noise from the ground floor to around 15-20dB L_{Aeq} inside the bedrooms.

Based on past noise surveys carried out by BAP in restaurants and bars, a worst-case level in a busy bar/pub with background music is likely to be around 89dB $L_{Aeq,}$ see Section 9.2.

BAP have been informed that the separating floor is likely to be a concrete slab construction. It is expected that a 200mm thick cast in-situ reinforced first floor slab with a floating screed layer would provide around 50dB attenuation between the ground and first floor rooms. This alone, will not meet the recommended minimum performance if the assumed noise level occurs in practice. Therefore, the addition of a suspended ceiling will be required. An example specification of such a ceiling is presented below, together with measures for controlling flanking transmission. The actual construction will depend on the actual proposed activity noise level and detailed design development.

BAP suggest a ceiling comprising two layers of 15 mm plasterboard (minimum surface mass of 13 kg/m^2) or two layers of 12.5 mm plasterboard with a skim plaster coat, suspended below the floor slab on metal hangers (such as the British Gypsum MF system). The cavity between the underside of the slab and the top surface of the plasterboard ceiling should be at least 240 mm. The ceiling may have recessed fittings as long as this does not give rise to any holes through the ceiling lining. Essential penetrations (for example, for sprinkler heads) should be carefully sealed with British Gypsum acoustic sealant. Similarly, any penetrations through the floor slab should be carefully sealed by packing mineral fibre around the perimeter, applying a flexible sealant to the top and bottom surfaces. Pipework, such as soil stacks, should be enclosed above and below floor level with two layers of 12.5 mm plasterboard with mineral fibre in the cavity.

An independent wall lining should be fitted to ground floor masonry walls in order to prevent flanking sound transmission via these to the rooms above. This should consist of two layers of 12 mm plasterboard fixed to an independent metal or timber studwork frame, which is not fixed back to the wall. The gap between the surface of the wall and the internal face of the plasterboard should be not less than 100 mm, and 50 mm mineral fibre should be fixed in the cavity. Junctions between the walls and the ceiling must be well sealed with flexible sealant.

10.0 PLANT NOISE

10.1 Camden Criteria

"*The rating noise level of the noise emitted from the proposed development, determined by the procedure at BS 4142: 1997, should be at least 5 dB(A) below the background* L_{A90} *(1 hour) noise level, measured or calculated at 1 m from the nearest façade of the nearest affected premises.*"

10.2 Assessment

Based on the noise survey carried out, BAP recommend that plant noise should not exceed the following façade levels as set out in Table 8. These limits are to be assessed outside the nearest residential properties, i.e. the residential properties opposite the site on Delancy Street and Arlington Road.

Maximum plant noise level, dB $L_{Aeq, 15min}$		
Day (0700-1900)	**Evening (1900-2300)**	**Night (2300-0700)**
52	52	41

Table 8 – Maximum plant noise façade levels (dB re $2x10^{-5}$ Pa)

Items of external plant should ideally be positioned away from and screened from the windows of neighbouring residential properties. It is unlikely that noise from plant will cause a significant problem but some form of noise control (screens, silencers) are likely to be required to meet Camden Council's plant noise criterion.

11.0 SUMMARY

Bickerdike Allen Partners have carried out an environmental noise assessment at the site at 100-102 Arlington Road, NW1. This site is proposed to be developed into a mixed use building with a bar restaurant on the ground floor and residential flats above.

The site is exposed to a moderate level of road traffic noise from Delancy Street and Arlington Road. Provided that attention is made to the acoustic specification of the building envelope, recommended maximum internal noise limits will not be exceeded. It is therefore concluded that the site is suitable for residential development.

Part of the site is currently already occupied by a public house, The Crown & Goose. The proposed bar restaurant on the ground floor is therefore unlikely to result in any significant change in the noise climate due to either noise from within the bar or noise from deliveries to the bar. However, to check that noise levels from the bar restaurant will not have a significant impact on the neighbouring area an assessment has been of both delivery noise and entertainment noise breakout from the premises.

Anticipated noise levels due to deliveries have been presented and were found to be of a similar level to the existing levels of road traffic noise in the area and therefore will not have a significant impact.

An assessment has been made of entertainment noise breakout from the proposed premises. This indicates that recommended local authority licensing noise limits are unlikely to be exceeded.

Methods have been presented for the protection of future residents on the first floor from noise within the bar restaurant below. Provided that attention is paid to the acoustic specification of the separating floor and flanking elements, the recommended noise limits will not be exceeded.

Recommended maximum plant noise limits have been presented. External building services plant will need to be designed to meet these local authority requirements.

David Trew	**Michael Morrow**	**Peter Henson**
For Bickerdike Allen Partners	**Acoustician**	**Partner**

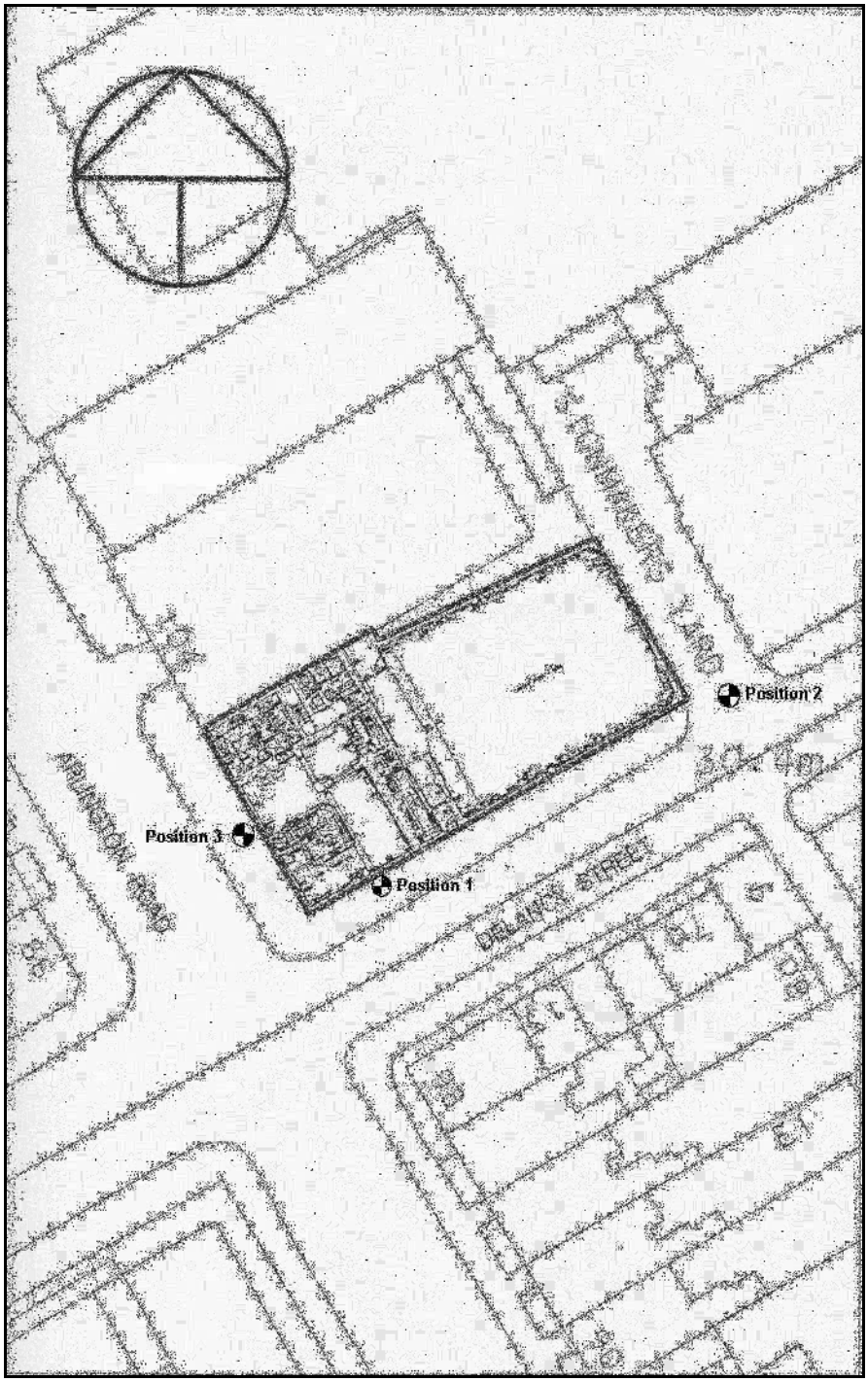

Figure 1 - Existing site plan and noise survey positions

(not to scale)

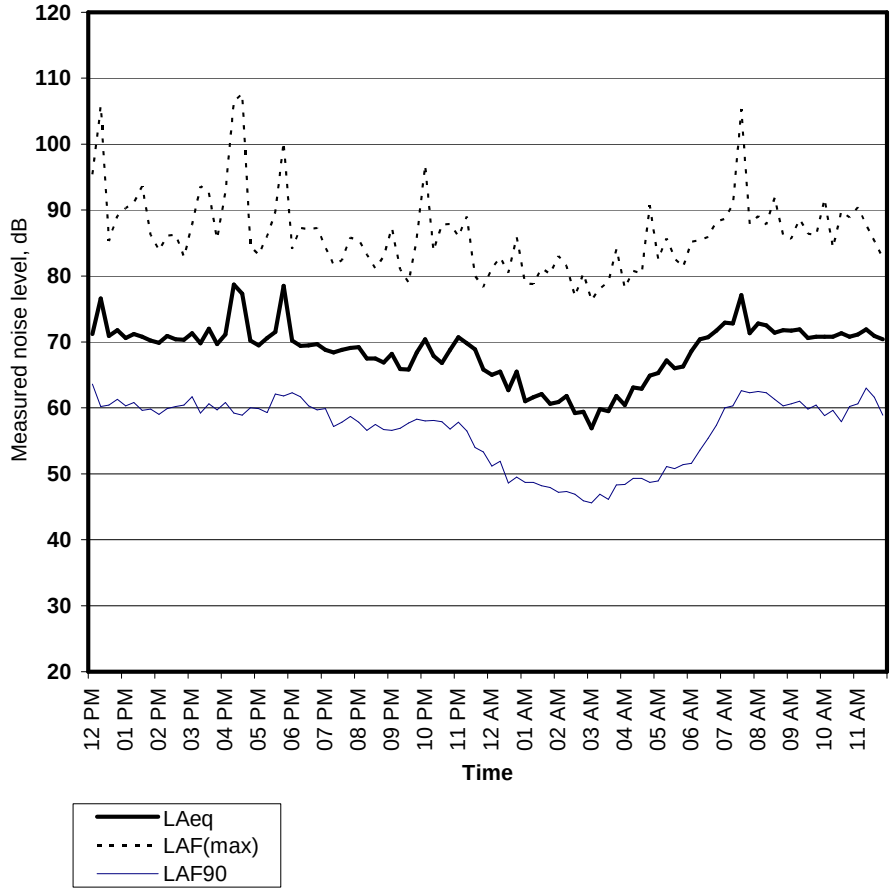

Figure 2 - Long term survey results, Position 1

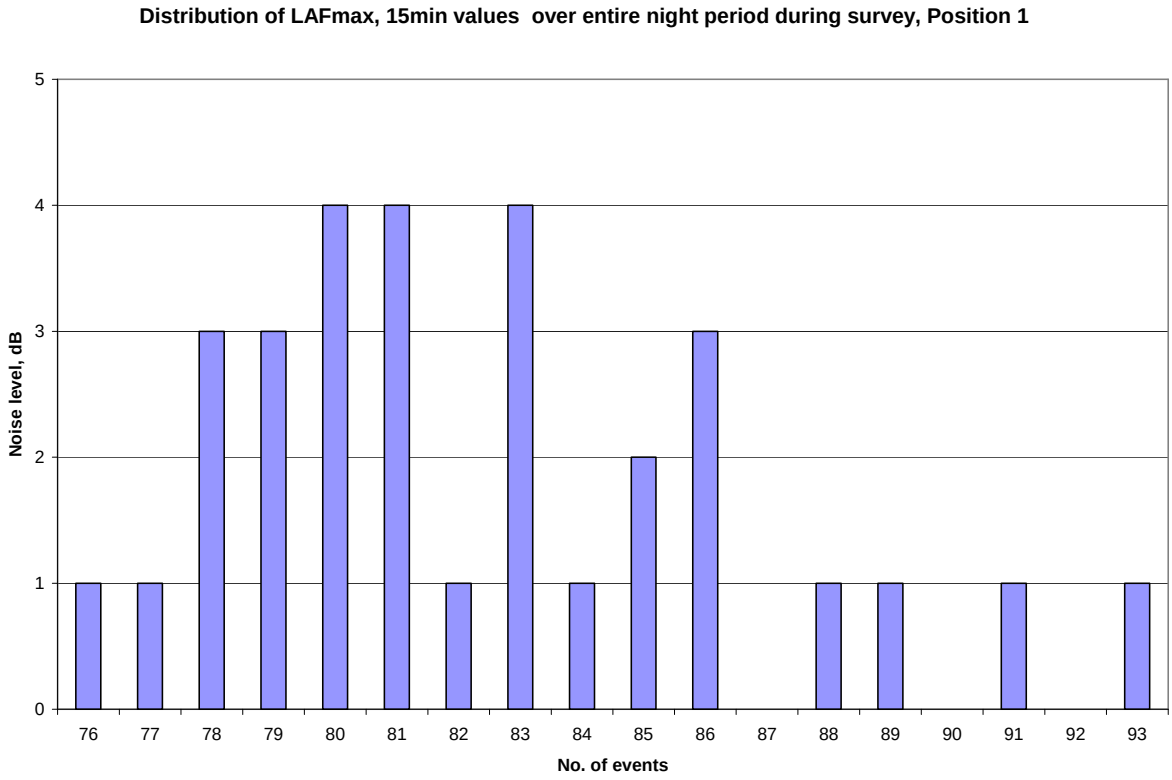

Figure 3 - Distribution of LAF,max levels, Position 1

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 2×10^{-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, L_w 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).

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.

$L_{Aeq, T}$ The most widely applicable unit is the equivalent continuous A-weighted sound pressure level ($L_{Aeq, T}$). 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 $L_{Aeq,\ T}$ can be predicted by measuring the noise of the individual noise events using the sound exposure level, L_{AE} (or SEL or L_{AX}). 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_{A1} 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

UNATTENDED SURVEY, DETAILED RESULTS

(Sound levels given in dB re $2x10^{-5}$ Nm^{-2})

APPENDIX C

ATTENDED SURVEY, DETAILED RESULTS

ARLINGTON ROAD, LONDON NW1
ENVIRONMENTAL NOISE SURVEY REPORT SHEET

Position 2 – Measurement 1

DAYTIME NOISE SURVEY: May 18, 2004
All measurements dB ref $2x10^{-5}$ Pa
Note: Noise source – road traffic noise
Weather conditions: Clear & sunny, no rain, light winds.
Free field / façade: Façade, Ground floor level

Start Time hh:mm	$L_{AF,max}$ dB	L_{A10} dB	L_{A90} dB	L_{Aeq} dB	Comments
12:25	94		65	76	$L_{AF,max}$ Car horn
12:30	86		60	72	$L_{AF,max}$ Bus
12:35	86		62	71	$L_{AF,max}$ Ambulance

N.B. All measurements are 5 minute samples

AVERAGE LEVEL = 73 dB $L_{Aeq, 15min}$

Spectral data

Octave Band Centre Frequency, Hz	63	125	250	500	1k	2k	4k
$L_{Aeq, 15min}$	82	75	70	69	68	66	65

Photo 1 – Microphone position facing east along Delancy Street

Photo 2 – Microphone position facing west along Delancy Street

ARLINGTON ROAD, LONDON NW1
ENVIRONMENTAL NOISE SURVEY REPORT SHEET

Position 2 – Measurement 2

DAYTIME NOISE SURVEY: May 18, 2004
All measurements dB ref $2x10^{-5}$ Pa
Note: Noise source – road traffic noise
Weather conditions: Clear & sunny, no rain, light winds.
Free field / façade: Façade, Ground floor level

Start Time hh:mm	$L_{AF,max}$ dB	L_{A10} dB	L_{A90} dB	L_{Aeq} dB	Comments
13:00	89		64	74	$L_{AF,max}$ HGV
13:05	84		60	71	$L_{AF,max}$ HGV
13:10	87		61	71	$L_{AF,max}$ Bus

N.B. All measurements are 5 minute samples

AVERAGE LEVEL = 73 dB $L_{Aeq, 15min}$

Spectral data

Octave Band Centre Frequency, Hz	63	125	250	500	1k	2k	4k
$L_{Aeq, 15min}$	80	76	70	69	68	65	60

Photo 1 – Microphone position facing east along Delancy Street

Photo 2 – Microphone position facing west along Delancy Street

ARLINGTON ROAD, LONDON NW1
ENVIRONMENTAL NOISE SURVEY REPORT SHEET

Position 3 – Measurement 1

DAYTIME NOISE SURVEY: May 18, 2004
All measurements dB ref $2x10^{-5}$ Pa
Note: Noise source – road traffic noise
Weather conditions: Clear & sunny, no rain, light winds.
Free field / façade: Façade, Ground floor level

Start Time hh:mm	$L_{AF,max}$ dB	L_{A10} dB	L_{A90} dB	L_{Aeq} dB	Comments
12:40	86		59	69	$L_{AF,max}$ Sports car
12:45	88		58	69	$L_{AF,max}$ HGV
12:50	78		58	68	$L_{AF,max}$ Car brake squeal

N.B. All measurements are 5 minute samples

AVERAGE LEVEL = 68 dB $L_{Aeq, 15min}$

Spectral data

Octave Band Centre Frequency, Hz	63	125	250	500	1k	2k	4k
$L_{Aeq, 15min}$	75	72	67	65	64	61	56

Photo 1 – Microphone position facing south along Arlington Road

Photo 2 – Microphone position facing north along Arlington Road

ARLINGTON ROAD, LONDON NW1
ENVIRONMENTAL NOISE SURVEY REPORT SHEET

Position 3 – Measurement 2

DAYTIME NOISE SURVEY: May 18, 2004
All measurements dB ref $2x10^{-5}$ Pa
Note: Noise source – road traffic noise
Weather conditions: Clear & sunny, no rain, light winds.
Free field / façade: Façade, Ground floor level

Start Time hh:mm	$L_{AF,max}$ dB	L_{A10} dB	L_{A90} dB	L_{Aeq} dB	Comments
13:20	85		58	69	$L_{AF,max}$ HGV
13:25	81		55	70	$L_{AF,max}$ HGV
13:30	89		59	71	$L_{AF,max}$ Ambulance

N.B. All measurements are 5 minute samples

AVERAGE LEVEL = 70 dB $L_{Aeq, 15min}$

Spectral data

Octave Band Centre Frequency, Hz	63	125	250	500	1k	2k	4k
$L_{Aeq, 15min}$	77	72	67	65	66	63	56

Photo 1 – Microphone position facing south along Arlington Road

Photo 2 – Microphone position facing north along Arlington Road