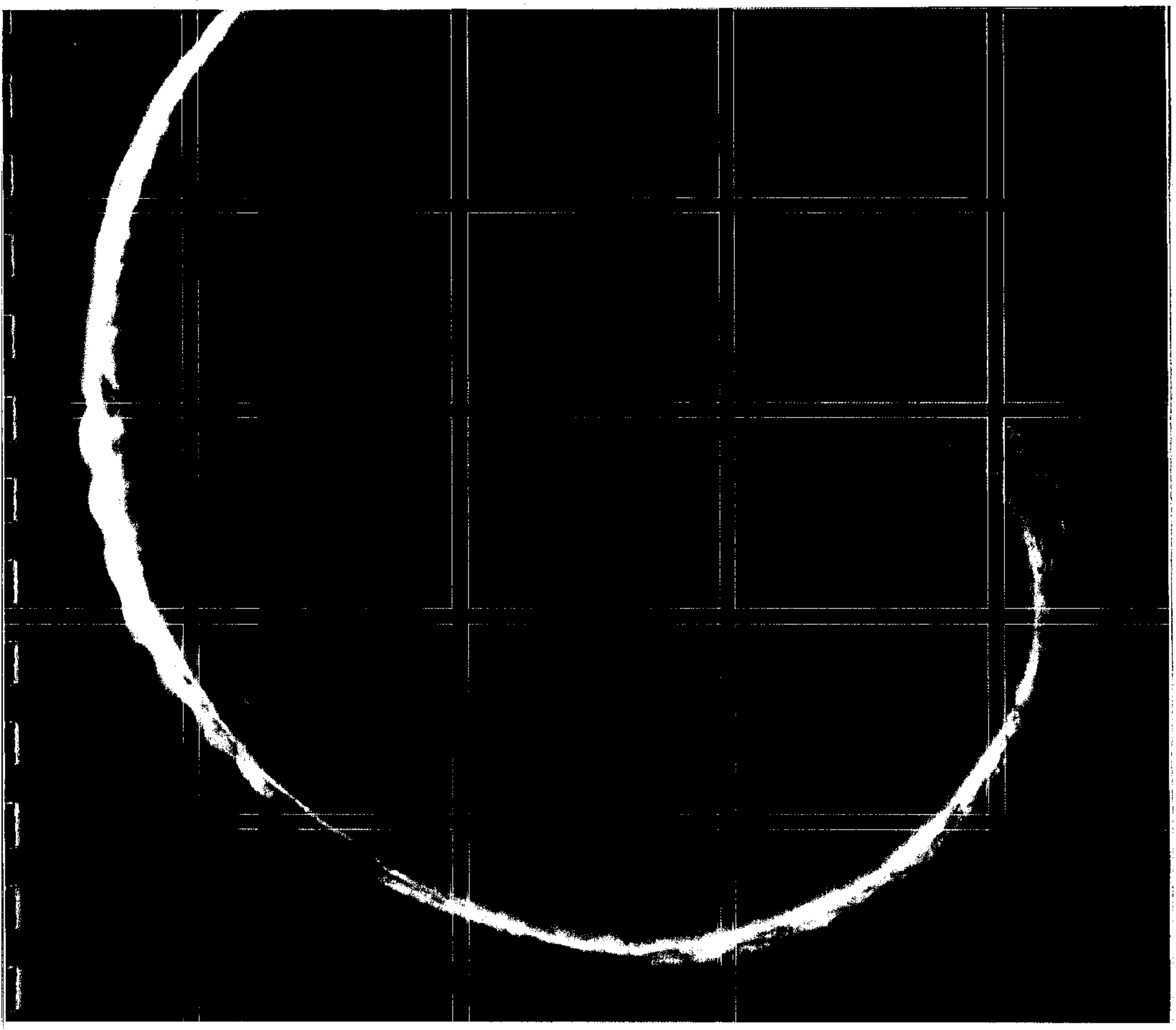

66 Hampstead Road

Air Conditioning Plant Noise Assessment

Final Report

March 2007

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66 Hampstead Road: Air Conditioning Plant Noise Assessment

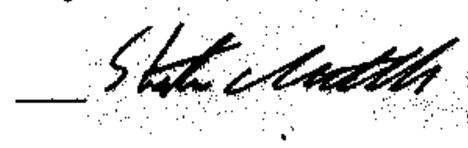
March 2007

Reference 0061126

Prepared by: Stephen Lloyd

For and on behalf of
Environmental Resources Management

Approved by: Steve Mitchell

Signed: 

Position: Technical Director

Date: 15 03 2007

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CONTENTS

1 SUMMARY

A noise study has been carried out to assist in determining the potential noise impacts of the re-positioning of a Daikin air-conditioning unit at the front of No 66 Hampstead Road, London, as a necessary requirement of a planning application for renovation of this property. A survey of baseline conditions was undertaken, and adjusted noise levels from the air-conditioning unit were predicted at the nearest noise sensitive receptor.

Predicted noise levels from the relocated unit have been assessed according to guidelines set by the London Borough of Camden, and according to UK standards. Recommendations have been made to minimise background noise 'creep', and to avoid any adverse affects at nearby properties.

2 *BASELINE*

The closest noise sensitive receptor was identified as a residential premises located on the first floor of 66 Hampstead Road, having a window facing the roof area where the unit will be located. Measurement of baseline noise levels at 66 Hampstead Road was carried out on Tuesday the 13th of February 2007. Measurements were made using a Brüel and Kjaer 2260 Investigator sound level meter logging continuously over a 9 hour period, during the hours over which the air-conditioning unit is expected to operate 0900 - 1900. The baseline levels are reported below.

The noise meter was located at the front facade of 66 Hampstead Road, as can be seen in *Figure A1*, and calibrated before and after the measurement period. The equipment used is calibrated to national standards in a laboratory each year. Weather conditions during the survey were generally fine and dry.

Noise levels in the area are predominantly influenced by heavy road traffic travelling on Hampstead Road. The lowest $L_{A90,\,15\,min}$ (the measure of background noise) recorded during the expected operating hours was 60 dB(A), measured between the hours of 1430 and 1445. Similarly, the lowest $L_{Aeq,\,15\,min}$ (equivalent noise level for the period) value recorded was 70 dB(A), indicating a noise environment influenced to a substantial extent by peak noise events.
Recorded maximum (L_{ASmax}) noise levels for the period ranged between 78 – 104 dB.

Details of this survey are included in *Annex A*.

3 *AIR-CONDITIONING UNIT NOISE LEVELS*

The air-conditioning unit is a Daikin model MY90CJ7V1. This unit, with approximate dimensions 1.06m x 0.32m x 0.9m (width x depth x height), is expected to be relocated on the roof of the proposed ground floor extension. It is assumed that the unit will be positioned at the point on the roof furthest from the window of the nearest sensitive property on the first floor of 66 Hampstead Road, approximately 3m away, with the left side of the unit facing the window. Operational noise levels from the unit were measured on Monday the 26th of February 2007. Details of the measured levels are shown in *Table A2* of *Annex A*.

Octave band data for the noise emission levels of the unit are shown below in *Table 3.1,* together with predicted levels at the nearest noise sensitive receptor.

Table 3.1 ***Octave Band Sound Pressure Levels (A-weighted)***

Freq. (Hz)	63	125	250	500	1k	2k	4k	8k	Total
A/C Unit Emission Level (SPL dB) – Left Side	53	56	58	64	63	62	53	51	69
Predicted Free-field Noise Level 1m in front of Window of Nearest Noise Sensitive Receptor (dB)	47	50	52	58	57	56	47	45	63
Lowest Background (Free-field $L_{A90,15\ min}$) Noise Level	40	41	47	52	56	54	44	-	60

Assuming a worst case situation, neglecting any screening, and with no additional mitigation, the free-field noise level from the air-conditioning unit at the closest window of 66 Hampstead Road was predicted to be 63 dB(A).

The predicted noise level from the proposed air-conditioning plant is 3 dB above the measured background noise level. Camden Council's Noise Standards (1a) require that noise at sensitive façades shall be at least 5 dB less that existing background levels, or 10 dB where it is anticipated that the plant/equipment will have a noise that has a distinguishable, discrete continuous note. Following the plant noise survey, it is not anticipated that the noise will have such a tone (at an intrusive frequency), and as such the threshold of 5 dB below background levels is deemed to apply.

Also, the Noise Standards state (1b) that for octave band frequencies, noise levels from the plant/equipment shall not add more than 1 dB to the existing background noise level. As can be seen in *Table 3.1,* predicted levels are in all frequencies higher than the lowest background levels, and will subsequently add more than 1 dB(A) to those octave bands.

For evaluation of the effect of plant noise on residential premises, British Standard 4142 [1] provides useful guidelines, and is required to be considered in the assessment by Camden Council. In summary, BS 4142 assesses the likelihood of complaints about plant noise based upon a comparison between the plant's noise rating level and the background (L_{A90}) level.

The noise rating level is the predicted plant noise level at the assessment location, corrected by 5 dB if the noise contains a distinguishable, discrete, continuous note or distinct impulses. The A-weighted plant noise level was not considered to contain these elements, and as such the rating level was determined to be 63 dB(A) at the nearest noise sensitive property (*Table 3.1*). The lowest background noise level at this location was measured to be 61 dB $L_{A90,\ 1\ hour}$.

The rating level is 2 dB above the background level, and as such BS 4142 suggests that the noise from the air-conditioning unit is of marginal significance in terms of the likelihood of generating complaints.

(1) BS 4142:1997, Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas, BSi, 1997

Due to the exceedence of threshold criteria (1a and 1b) in Camden's Noise Standards, it is recommended that design measures are undertaken to reduce noise levels from the air conditioning unit at the first floor window of 66 Hampstead Road. Such measures may include selection of a quieter air-conditioning unit, incorporation of a purpose built attenuation screen, or addition of an acoustic enclosure.

A purpose built absorptive screen, installed between the air-conditioning unit and the windows of the first floor of 66 Hampstead Road, is considered by ERM to be the most practical method for reducing the plant noise in this situation. The suggested configuration for this screen is shown in Figure A3, although the final dimensions of this screen will depend upon detailed design. It will be necessary for such a screen to significantly intersect the line of sight between the window and the air-conditioning unit.

With inclusion of a suitably designed acoustic screen in renovation designs for 66 Hampstead Road, it is anticipated that plant noise levels at the nearest receptor can be attenuated to the following levels:

Table 5.1 ***Attenuated Octave Band Sound Pressure Levels (A-weighted)***

Freq. (Hz)	63	125	250	500	1k	2k	4k	8k
Predicted Free-field Noise Level at Window of Nearest Noise Sensitive Receptor	39	41	42	46	43	40	29	25

This would reduce the overall plant noise level to below 53 dB(A), at least 7 dB below the existing background level. Similarly, this would also reduce all octave band levels to below the corresponding measured levels. Although these levels would not strictly follow the London Borough of Camden's guidance in all octaves, it is ERM's recommendation that this would ensure acceptable levels are achieved.

Annex A

Baseline, Plant Noise Survey Details and Glossary

Table A1 ***Measured Baseline Noise Levels – Free-field***

Date	Measurement Start Time	$L_{Aeq,\ 15\ min}$	L_{ASmax}	$L_{A90,\ 15\ min}$
13.02.07	1000	69.8	81.2	62.4
	1015	70.3	79.7	62.0
	1030	70.7	83.6	62.0
	1045	70.7	83.0	62.0
	1100	75.5	99.2	62.8
	1115	73.9	94.4	63.2
	1130	75.3	96.6	63.4
	1145	70.2	80.8	61.4
	1200	70.9	83.4	62.8
	1215	70.9	86.6	62.1
	1230	70.3	82.1	62.0
	1245	70.4	83.3	62.1
	1300	69.7	81.9	62.0
	1315	70.7	82.4	61.5
	1330	71.0	84.2	62.6
	1345	70.1	86.0	61.2
	1400	72.8	93.9	61.8
	1415	70.4	86.6	61.4
	1430	70.9	88.9	60.0
	1445	70.1	84.8	61.3
	1500	70.3	81.5	63.0
	1515	70.7	86.3	62.5
	1530	70.0	80.0	62.7
	1545	70.1	82.2	62.6
	1600	73.3	90.6	60.5
	1615	70.0	83.3	62.5
	1630	78.2	103.6	62.1
	1645	69.5	82.7	60.5
	1700	69.7	78.3	61.2
	1715	74.6	96.2	60.9
	1730	70.6	87.9	63.2
	1745	73.5	95.9	61.1
	1800	70.3	87.1	61.9
	1815	70.0	85.2	61.9
	1830	71.3	88.5	62.9

Table A2 ***Measured Plant Noise Spectra (SPL) at Surface of AC Unit (A-weighted)***

Freq. (Hz)	63	125	250	500	1k	2k	4k	8k	Total
Left Side	52.5	55.9	58.4	64.3	63.1	61.5	53.2	50.5	**68.9**
Front	56.1	58.1	60.9	66.3	65.0	62.4	55.5	46.8	**70.7**
Right Side	44.6	57.3	60.1	60.1	63.2	61.1	52.8	53.4	**68.1**

Figure A1 ***Baseline Noise Measurement Location and Nearest Residential Receptor Window***

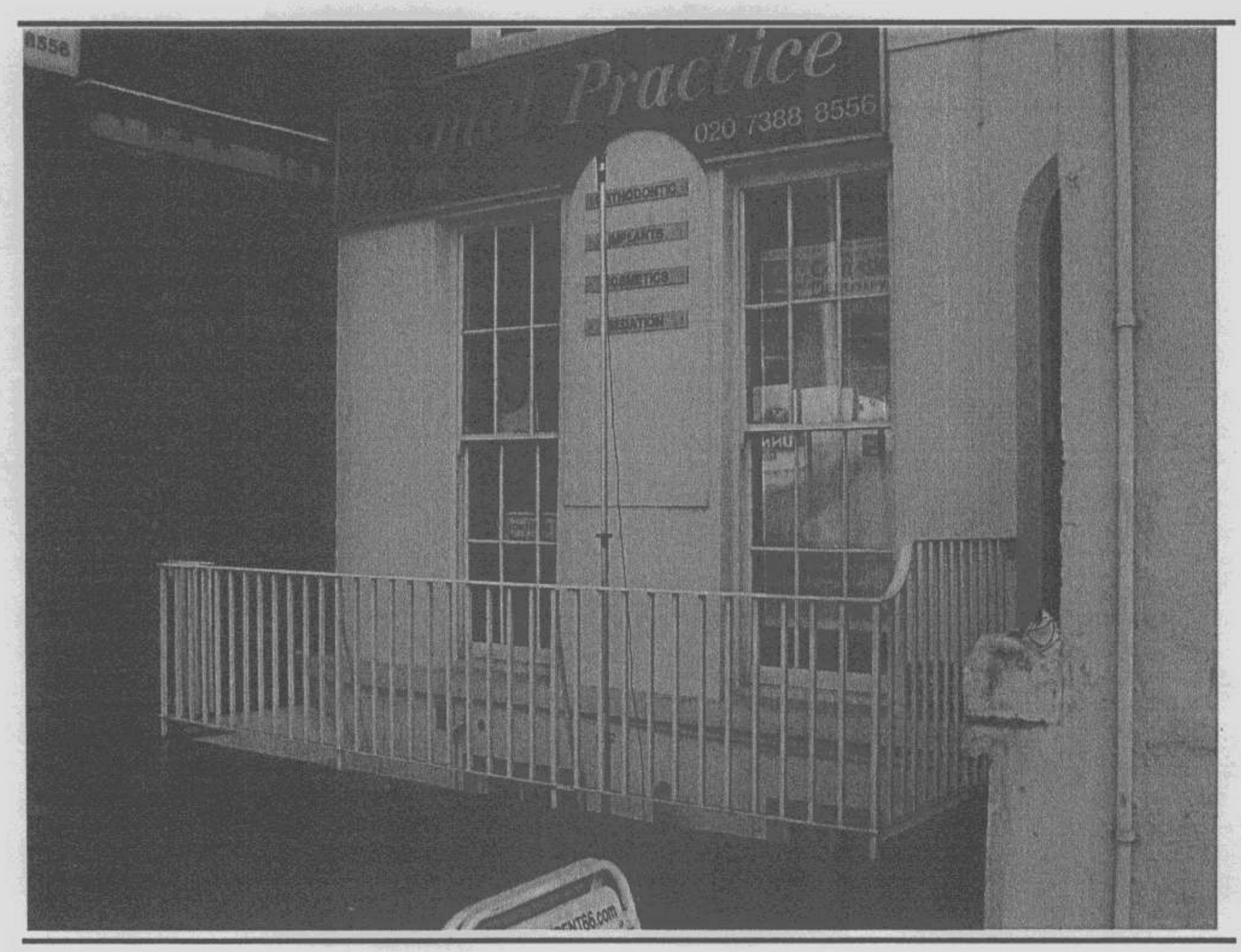
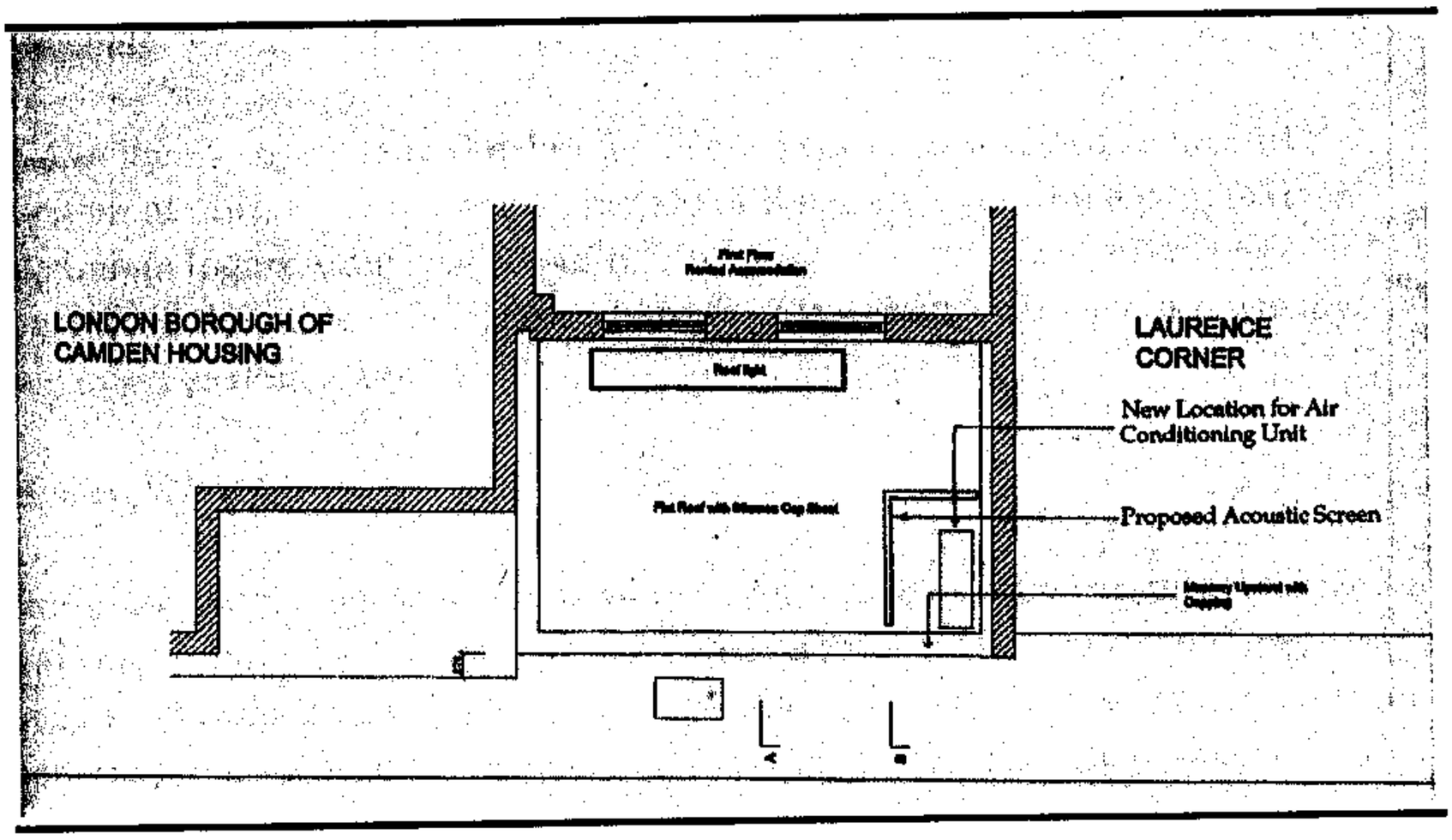


Figure A2 ***Air Conditioning Plant to be Relocated***

Figure A3 ***Proposed First Floor Plan Showing New Location of Air-conditioning Unit***



Decibels

Noise levels are measured using the decibel scale. This is not an additive system of units (as for example, metres or kilograms are) but a proportional system (a logarithmic progression). A change of 10 dB corresponds to a perceived doubling in loudness; changes of less than 3 dB are not normally regarded as noticeable.

A-weighting

Environmental noise measurements and levels are usually expressed using a variation of the decibel scale, which gives less weight to low frequencies and very high frequencies. This system was derived to correspond to the reduced sensitivity of the hearing mechanism to these frequencies when noise levels are low (ie relatively quite). It is now used regardless of the intensity of the noise.

$L_{Aeq,T}$ -Equivalent Continuous Sound Level

The L_{Aeq} level gives a single figure to describe a sound that varies over a given time period, T. It is the A-weighted steady sound level that would result in the same sound energy at the receiver as occurred in practice with the varying level. It is derived from the logarithmic summation of the sound signal and so unlike a conventional (linear) average it gives additional weighting to higher levels.

Background Noise Level - L_{A90}

Background noise level is a measure of the low level of noise that occurs between the higher levels from particular events, for example passing vehicles. This may be abbreviated to BNL and the symbol is L_{A90}. It is the value exceeded for 90% of the time period being considered. Note that it is higher than the minimum noise level but may be regarded as the typical noise level during 'quiet periods'.

Maximum Noise Levels

The L_{Amax} is the highest value of the sound level over the specified period. It is sometimes referred to as 'peak' noise level. However, the term 'peak' has a special meaning in acoustics and the expression 'maximum' is preferable to avoid confusion.

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