Proposed Development

Site to Rear of 106 Finchley Road NW3

Noise Assessment (DRAFT)

TECHNICAL REPORT

Proposed Development

Site to rear of 106 Finchley Road NW3

Noise Assessment (DRAFT)

Table of Contents

JOB NO: 8482		
	INITIALS:	DATE:
ORIGINATED:	SS	March 10
CHECKED:	DRAFT	-
PASSED:	DRAFT	-
DOC REF:	8482 R1D	

1 INTRODUCTION

1.1 Sound Solution Consultants Ltd. were commissioned to undertake a noise assessment of a proposed residential development on a site to rear of 106 Finchley Road NW3; to establish whether the site is suitable for a two-storey plus basement, three bedroom house.

1.2 Planning application ref. 2009/4045/P has been registered on the 23rd November 2009 with Camden London Borough Council for the *'Erection of a new 2 storey, plus basement single dwelling house to the rear of 106 Finchley Rd'*.

1.3 The objective of this study is to quantify the acoustic environment to rear of 106 Finchley Road by carrying out a noise assessment to define a Noise Exposure Category. The means used for assessing day and night-time NECs include the DEFRA revised shortened method for Calculation of Road Traffic Noise.

1.4 Guidance and recommendations are to be advised considering BS8233:1999 Sound Insulation and Noise Reduction for Buildings – Code of Practice and the World Health Organisation guidance for community noise.

2 EXISTING SITE

2.1 The site is an unused area of land accessed from Trinity Walk through a doorway leading onto a path at the rear of NatWest bank at 106 Finchley Road. The site is situated approximately half way up Trinity Walk opposite the playground of Holy Trinity Church of England Primary School.

2.2 Trinity Walk joins the busy commercial Finchley Road and relatively quiet residential area of Maresfield Gardens. The south-east boundary of the site is formed by a stepped red brick wall which runs for the length of Trinity Walk.

2.3 To the south-west is a retaining wall which follows the site boundary and beyond this lies the rear of 106 Finchley Road which is of mixed commercial and residential use. The residential accommodation is approximately 15m from the application site.

2.4 The North-West boundary is a brick wall with timber palisade fence on top. This boundary is with an external area which is part of the commercial property 108-110 Finchley Road. The North-East boundary is defined by the garden of 5 Maresfield Gardens.

2.5 The following tasks have been undertaken as part of this noise assessment:

- Survey of existing noise levels at four locations about the site. Measurement locations have been selected to represent the noisiest climate at parts of the site closest to the sources of noise. The prominent source of noise for this study for day and night time periods has been identified as road traffic noise from Finchley Road.
- Assessment of the existing noise level with regard to the residential development against the guidance provided by the national Planning Policy Guidance PPG24: Planning and Noise, BS8233: Sound Insulation and Noise Reduction for Buildings – Code of Practice and the World Health Organisation guidance for community noise .
- Consideration of appropriate noise mitigation measures required for residential development.

2.6 A glossary of acoustic terms is shown in Appendix A.

3 NOISE CRITERIA

PPG24: Planning and Noise

3.1 The most relevant criterion to assess the impact of existing noise levels on proposed residential developments is PPG 24: Planning and Noise, September 1994. This document sets out a range of 'Noise Exposure Categories' (NEC's) defined by ranges in noise level, each of which indicates advice to consider during the planning stage of noise sensitive developments.

Noise Exposure Category		Free-field noise levels corresponding to the Noise Exposure Categories for new Dwellings $L_{Aeq,T}$ dB (Traffic Noise)	
		0700-2300 hrs	2300-0700 hrs
A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level	<55	<45
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.	55-63	45-57
C	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.	63-72	57-66
D	Planning permission should normally be refused.	>72	>66

Table 1 – Extracts from PPG24: Planning and Noise Relating to Traffic Noise

3.2 The four categories relevant to road traffic noise are set out in Table 1 above, with the corresponding noise levels and advice on noise considerations.

The Department of Transportation – Calculation of Road Traffic Noise (CRTN)

3.3 The Department of Transport document "Calculation of Road Traffic Noise" (CRTN) provides a method of determining noise level from roads by calculation (prediction method) or by measurement (survey method). CRTN states that the prediction method is preferred where possible, given traffic flow and weather conditions are variable from day to day making surveyed levels often unrepresentative. The prediction method cannot always cater for some factors such as topography and so validation via the survey method is generally recommended.

3.4 The CTRN methodology was revised by The Department for Environment, Food and Rural Affairs (DEFRA) to give more accurate prediction of road traffic noise during different times of the day for different road types.

3.5 Calculation of a daytime $L_{Aeq,\ 16h}$ (07:00-23:00) and night-time $L_{Aeq,\ 8h}$ (23:00-07:00) relevant to PPG24 can be approximated from measured $L_{A10,\ 18h}$ traffic noise index values using the revised shortened CTRN methodology.

World Health Organisation – Guidelines for Community Noise

3.6 With reference to the World Health Organisation guidelines for community noise, levels are recommended in line with those mentioned in BS8233:1999:

"The effects of noise in dwellings, typically, are sleep disturbance, annoyance and speech interference. For bedrooms the critical effect is sleep disturbance. Indoor guideline values for bedrooms are 30 dB LAeq for continuous noise.... At night-time, outside sound levels about 1 metre from facades of living spaces should not exceed 45 dB LAeq, so that people may sleep with bedroom windows open. This value was obtained by assuming that the noise reduction from outside to inside with the window open is 15 dB. To enable casual conversation indoors during daytime, the sound level of interfering noise should not exceed 35 dB LAeq."

3.7 In addition to the above:

"The capacity of a noise to induce annoyance depends upon its physical characteristics, including the sound pressure level, spectral characteristics and variations of these properties with time. During daytime, few people are highly annoyed at LAeq levels below 55 dB(A), and few are moderately annoyed at LAeq levels below 50 dB(A). Sound levels during the evening and night should be 5–10 dB lower than during the day."

BS8233:1999 Sound Insulation and Noise Reduction for Buildings – Code of Practice

3.8 The British Standard BS8233:1999 Sound Insulation and Noise Reduction for Buildings – Code of Practice recommends design criteria for internal noise levels within residential properties. This standard suggests criteria, such as reasonable resting/sleeping conditions and proposes noise limits that will normally satisfy these criteria for most people.

3.9 With respect to bedrooms, i.e. night-time, the standard provides limits for 'good' and 'reasonable' noise levels. A level of $30L_{Aeq,T}$ equates to a 'good' condition, $35L_{Aeq,T}$ equates to a 'reasonable' condition. A summary of the noise guidelines for reasonable resting/sleeping conditions in living rooms and bedrooms is shown in Table 2.

Criterion	Typical situations	Design range $L_{Aeq,T}$ dB	
		Good	Reasonable
Reasonable resting/sleeping conditions	Bedrooms	30	35
	Living rooms	30	40

Table 2 – Summary of Recommended guidance from BS 8233 Table 5.

3.10 With respect to design criteria and limits for intrusive external noise, BS8233 also states:

"As well as protection for the building, barriers or bunds should be considered to protect the gardens. In gardens and balconies etc. it is desirable that the steady noise level does not exceed $50L_{Aeq,T}$ dB and $55L_{Aeq,T}$ dB should be regarded as the upper limit."

4 NOISE SURVEY

4.1 A noise survey was undertaken over a 6h period during Monday 1st of March 2010. Three measurement locations were selected to directly assess the contribution of road traffic noise from Finchley Road, playground noise from the Holy Trinity Church of England Primary School and industrial noise from the nearby air-conditioning units.

4.2 A brief description of the measurement positions are detailed below:

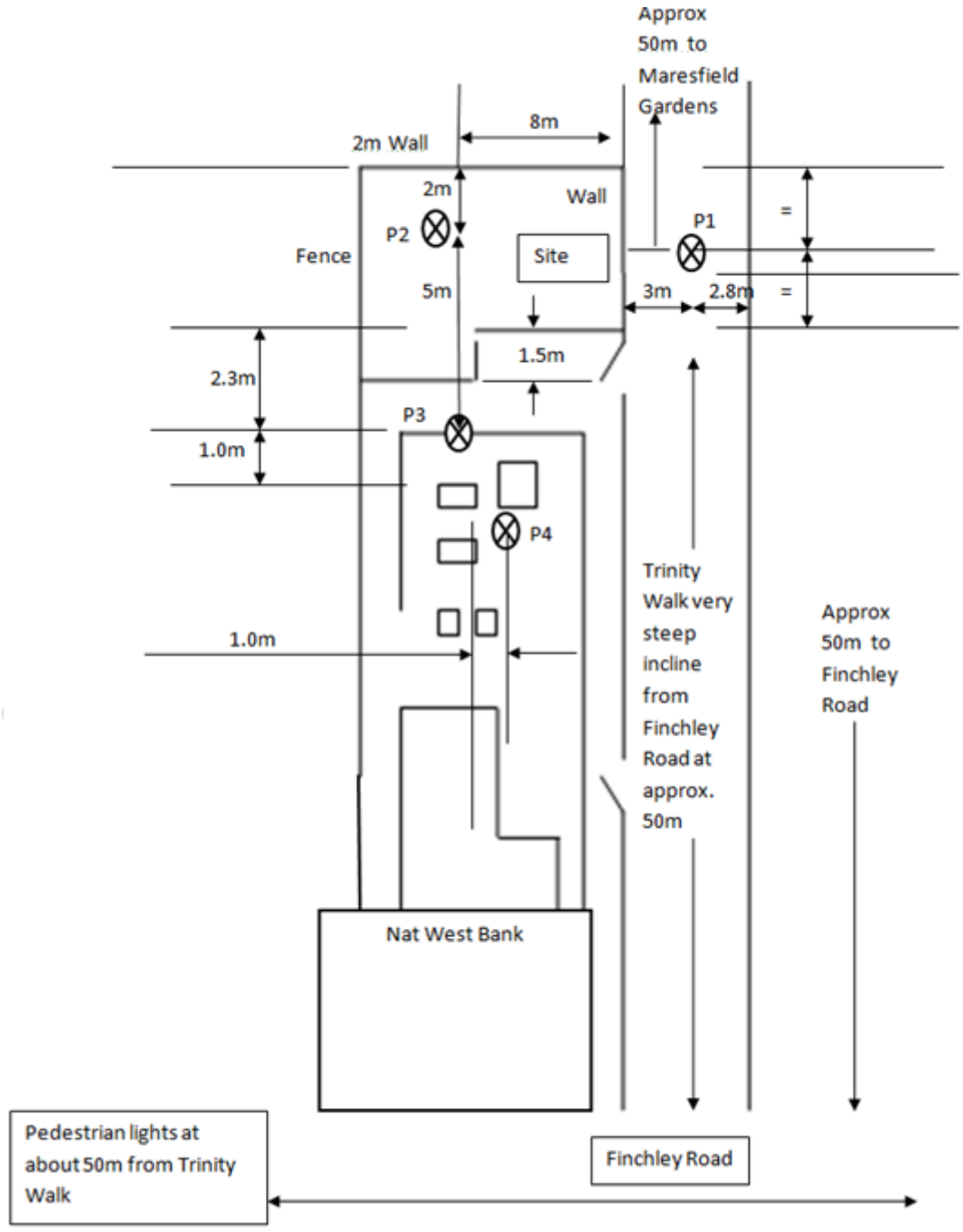


Figure 1 – Noise measurement locations.

Position 1) This measurement position was located on Trinity Walk approximately 3m from the site and school boundaries and 50m away from Finchley Road. Measurements were made at this location to directly assess the levels of $L_{A10, 1hr}$ road traffic noise for CRTN calculation and $L_{Aeq, 2h}$ playground noise from the nearby school.

Position 2) Used to assess the contribution of mechanical air-conditioning noise to the rear of the site.

Position 3) Used to assess the contribution of mechanical air-conditioning noise to the front of the site.

Position 4) Source noise level of mechanical noise.

4.3 The weather at the start of the noise survey on the 1st of March was sunny (7-10°C) with light cloud cover with a barely noticeable breeze averaging 1mph. Good measurement conditions were reported throughout the noise survey, as not have any adverse affects on the noise levels monitored.

4.4 The equipment used during the survey consisted of the following Type 1 precision noise monitoring equipment listed in Table 3. All equipment listed has traceable calibration history to relevant British Standards as performed by a UKAS accredited body.

Manufacturer	Type	Description	Serial No.	Calibration Expiry Date
Norsonic	Nor-140	SLM Analyser	1402918	09/05/2010
Norsonic	Nor-1225	Microphone	72882	09/05/2010
Norsonic	Nor-1206	Pre-amplifier	12193	09/05/2010
Norsonic	Nor-1251	Sound Level Calibrator	31233	07/05/2011

Table 3 – Noise monitoring equipment.

4.5 The instruments calibration was checked using a reference tone of 114dB at 1kHz before any measurements were taken. A validation check at the end of the survey indicated that all instruments had operated within permitted tolerances for drift and measured level.

4.6 The noise levels recorded relative to traffic noise have been summarised below in Table 4:

Measurement Period	Free field noise levels* dB $L_{A10, 1h}$
10:45:00 – 12:00:00	67.7
13:30:00 – 15:00:00	68.8
15:00:00 – 16:00:00	69.8

Table 4 – Summary of Measured Noise Levels for CRTN & PPG24 assessment.

**Noise levels are recorded as free field measurements over the measurement period shown. 1hr measurements summarised during each time period do not include playground noise and are considered representative of only road traffic noise from Finchley Road.*

4.7 The contribution of playground noise was measured at Position 1 during the break time periods of the Holy Trinity Church of England Primary School. A total period of 2h was recorded, in

addition to road traffic noise at Position 1, to estimate the likely worst case noise levels at the front facade of the development, during PPG24 daytime hours.

Noise level description	Octave Band Sound Pressure Level dB								
	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	8KHz	(A)
(1) Traffic & school $L_{eq, 2h}$	73	67	64	66	68	64	56	47	**71**

Table 5 – Worst case traffic and playground noise measured over a 2h period at Position 1.

4.8 Noise levels were measured across positions 2, 3 & 4 to establish the contribution of mechanical noise on the climate of the site:

Noise level description	Octave Band Sound Pressure Level dB								
	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	8KHz	(A)
(2) Traffic & mechanical	68	61	60	63	61	56	43	42	**65**
(3) Traffic & mechanical	70	66	65	63	59	55	54	59	**66**
(4) Mechanical source	69	66	68	66	62	58	58	61	**69**

Table 6 – Mechanical & traffic noise levels measured at Positions 2, 3 & 4.

4.9 The following subjective impressions were noted at the measurement positions with regards to the overall noise climate and contribution of mechanical noise – made up of 2 large Daikin inverter units active with 2 smaller units off:

Position 1) Inaudible mechanical noise. Location dominated by traffic noise.
Position 2) Mechanical noise at a similar level to road traffic noise.
Position 3) Mechanical noise marginally above road traffic noise.
Position 4) Mechanical noise significantly above road traffic noise.

4.10 The night time operational hours of all mechanical units could not be determined by daytime noise level survey. The noise levels during the night are unknown; but may lie as high as 66dB(A) at the west boundary of the site, as measured during the daytime. *Mitigation advice is therefore recommended for all mechanical units as part of the proposed development; to significantly reduce the levels of mechanical noise on the site during the day and night time periods.*

5 TRAFFIC NOISE ASSESSMENT

5.1 Where traffic data has not been obtained for an existing road scheme, CRTN recommends that road traffic noise be estimated by a number of consecutive $L_{A10,1hr}$ measurements as part of the survey method.

5.2 CRTN advises that the $L_{A10,\ 18hr}$ is equivalent to 1dB below the arithmetic mean of the three consecutively measured $L_{A10,\ 1hr.}$ This equates to a 68dB $L_{A10,\ 18hr.}$

5.3 Similarly, the revised shortened method gives a calculative approach for non-motorway roads to estimate the traffic noise during the 16h daytime (L_{day} + $L_{evening}$) and 8h night-time (L_{night}) periods. In addition to this, CRTN states that the $L_{A10,\ 18hr}$ is generally 2dB above the $L_{Aeq,\ 16hr}$ for road traffic noise. CRTN calculations confirm a daytime (07:00 to 23:00) $L_{Aeq,\ 16hr}$ of 65dB and night-time (23:00 to 07:00) $L_{Aeq,\ 8hr}$ of 57dB.

5.4 The noise measurements have been assessed against the advice contained within Planning Policy Guidance 24. The noise exposure categories for each measurement are detailed in Table 7 below:

Period	Free-Field Noise Levels, $L_{Aeq,T}$ dB	Noise Exposure Category as defined by PPG 24
Day (07:00 – 23:00)	65	C
Night (23:00 – 07:00)	57	C

Table 7 – PPG 24 Noise Assessments

6 NOISE BREAK-IN TO CRITICAL AREAS: MITIGATION MEASURES

6.1 Owing to the fact that day time and night-time noise levels at the proposed development site fall within NEC C categories of PPG 24; mitigation measures must be incorporated into the design of the proposed properties. Suggested mitigation advice should be considered to ensure that the internal and external noise levels are within recommended criteria.

6.2 The calculation method used to meet appropriate design criteria is detailed in Section 6.7.2.1 of BS8233:1999 – Sound insulation and noise reduction for buildings – Code of practice.

6.3 $L_{Aeq,\ ff}$ noise levels are taken as the continuous equivalent free-field sound pressure level outside the room elements under consideration, for all facades of the building as summarised below:

Noise level description	Octave Band Sound Pressure Level dB								
	63Hz	**125Hz**	**250Hz**	**500Hz**	**1KHz**	**2KHz**	**4KHz**	**8KHz**	**(A)**
Av. CRTN night $L_{eq,\ ff}$ (All facades night time)	64	58	55	55	53	50	43	37	**57**
Av. CRTN daytime $L_{eq,\ ff}$ (east and rear facades)	72	66	63	63	61	57	51	44	**65**
Worst-case $L_{Aeq,\ 2h}$ day inc school playground (front facade)	*73*	*67*	*64*	*66*	*68*	*64*	*56*	*47*	***71***
Worst case mechanical noise level (west facade)	70	66	65	63	59	55	54	59	**66**

Table 8 – Summary of measured noise levels for BS8233:1999 noise break-in assessment.

6.4 The calculations take into account the average night time L_{Aeq} external noise level octave band spectra, as measured over the survey period and estimated above using CRTN methodology.

6.5 Room volumes and building specifications have been estimated from Webb Architects Ltd. architectural drawings provided as part of the planning application.

6.6 Break-in calculations have been made assuming that the envelope of the housing facades are of masonry construction, 300mm thick, with a cavity-masonry or timber framed inner, of total Sound Reduction Index 55dB Rw.

Main building: Glazing recommendation

6.7 To ensure that BS8233:1999 'good' resting conditions of 30dB $L_{Aeq, T}$ and 45dB L_{Amax} are met for all bedrooms during the night-time and 'reasonable' resting conditions of up to 40dB $L_{Aeq, T}$ for living spaces during the daytime; 8.8-12-6 double glazing IGUs recommended for all main building glazing elements where double glazing is shown, whose weighted sound reduction index is generally listed as 41 dB R_w or above and detailed below:

Building element	Sound Reduction Index, SRI dB							
	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	Rw
Pilkington 8.8/x/6 IGU	20	24	26	40	48	46	54	**41**

Table 9 –Glazing specification.

6.8 It is advised that window suppliers provide laboratory tests confirming the Sound Reduction Index Rw to BS EN ISO 140-3:1995 and BS EN ISO 717, 1997.

6.9 The double glazing specification should be used for all facades included in the building development. Pilkington Insulating glass units have been specified to compliment the Design and Access Statement Rev 2 provided by Webb Architects Ltd.

6.10 The insulation of all windows within the development can only achieve an acceptable internal noise level when closed, by attenuating airborne noise levels by 41dB Rw. W*hen open, the windows acoustic performance is estimated to be 15dB R_w (re. BS8233:1999).*

Ventilation Strategy

6.11 Calculations made to BS8233:1999 Section 6.7.2.1 in this assessment assume through-wall ventilation inlets are used to provide background ventilation for occupiable rooms; where the use of through-window trickle ventilation is to be avoided. Cooling for all occupiable rooms is to be provided using passive stack ventilation, where automatic control of room humidity may be required.

6.12 Through wall ventilation should be rated as 45dB $D_{ne, w}$ or above to achieve BS8233:1999 'good' standards of internal noise levels. A typical product to achieve this acoustic performance would be the Passivent Fresh 90dB (or equivalent), whose element normalised level difference is detailed below:

Building element	Element Normalised level difference, D_{ne} dB							
	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	Dne,w
Wall ventilation	43	45	30	40	42	46	58	**45**

Table 10 – Ventilation specification.

6.13 Cooling for all occupiable rooms is to be provided using passive stack ventilation, where automatic control of room humidity may be required.

6.14 Ventilation test data to BS EN ISO 140-10:1991 is shown in Appendix C.

Sound insulation from roofing

6.15 Sound insulation of the main building roof structure has been reviewed assuming the following constructions; whose sound insulation performances are rated using guidance in BS8233:1999:

Position 5) A typical load-bearing flat construction with timber trusses with PVC membrane and lead; encompassing at least 100mm of thermal insulating material above a 25mm plasterboard ceiling. *Such a construction is estimated to achieve at least 48dB R_w.*

6.16 The above-listed roof structure provides sufficient attenuation of external noise for a 'good' standard for indoor noise levels during the day and night for all rooms with a roof. Estimates have been made using calculations to Section 6.7.2.1 of BS8233:1999; assuming any roof penetrations or ceiling lights do not compromise the acoustic integrity of the ceiling or roofing.

Reduction of existing mechanical noise by means of enclosure

6.17 As part of the development scheme it is recommended that the mechanical units are enclosed on the roof of the lower commercial part of 106 Finchley Road.

Figure 2 – Mechanical units recommended to be enclosed.

6.18 The use of an acoustic screen is not recommended where sight lines may remain from development to unit the estimated performance may only be 5dB(A).

6.19 The use of a simple, sight built, ventilated acoustic enclosure is recommended to achieve a nominal 20-25dB(A) noise level reduction at the boundary of the site. Environ Technologies Ltd. provides standard-sized noise reducing enclosures that are designed specifically for this type of application; and should be included as part of the mitigation for the site.

7 CONCLUSIONS

7.1 An assessment of the noise climate has been carried out about a proposed development to rear of 106 Finchley Road, to ensure suitable building element design in the construction of a new 2-storey plus basement, single dwelling house.

7.2 Day and night-time noise levels at the proposed development fall within NEC C categories of PPG 24; where mitigation measures must be incorporated into the design of the proposed properties. Day and night time road traffic noise levels have been estimated using the DEFRA shortened methodology for Calculation of Road Traffic Noise; with other prominent sources of noise from the nearby playground and mechanical plant being measured directly.

7.3 The methodology and assessment criteria used are contained in the planning guidance PPG 24: Planning and noise. The internal design criteria used for assessment is detailed in of BS8233:1999 – Sound insulation and noise reduction for buildings – Code of practice.

7.4 A noise break-in assessment has been carried out based on the proposed layout and building elements of the scheme, provided by Webb Architects Ltd. as part of the planning submission. The calculation method used to meet appropriate internal design criteria is detailed in Section 6.7.2.1 of BS8233:1999.

7.5 The main building glazing and ventilation inlet specifications have been verified to ensure that BS8233:1999 internal design criteria are achieved. It is also recommended that the noise from mechanical plant be reduced by means of acoustic enclosure.

7.6 This report demonstrates that with the inclusion of noise mitigation provisions specified; external noise levels should not be a prohibitive issue in attaining planning approval of the proposed scheme to rear of 106 Finchley Road, NW3.

Appendix A: Glossary of Acoustic Terms

A1.1 Noise is defined as unwanted sound. The range of audible sound is from 0dB to 140dB, which is taken to be the threshold of pain. The sound pressure detected by the human ear covers an extremely wide range. The decibel (dB) is used to condense this range into a manageable scale by taking the logarithm of the ratio of the sound pressure and a reference sound pressure.

A1.2 The unit of frequency is Hz. 1 Hz is one pressure fluctuation in one second. The frequency response of the ear is usually taken to be about 16Hz (number of oscillations per second) to 18,000Hz. The ear does not respond equally to different frequencies at the same level. It is more sensitive in the mid-frequency range than at the lower and higher frequencies, and because of this, the low and high frequency component of a sound are reduced in importance by applying a weighting (filtering) circuit to the noise measuring instrument. The weighting which is most used and which correlates best with the subjective response to noise is the dB(A) weighting. This electronic filter matches the variation in the frequency sensitivity of the meter to that of the human ear. This is an internationally accepted standard for noise measurements.

A1.3 The ear can just distinguish a difference in loudness between two noise sources when there is a 3dB(A) difference between them. Also when two sound sources of the same noise level are combined the resultant level is 3dB(A) higher than the single source. When two sounds differ by 10dB(A) one is said to be twice as loud as the other.

A1.4 A few examples of noise of various levels are given below:

Sound Level, dB(A)	Environmental Condition
0 – 10	Threshold of hearing
10 - 20	Broadcasting Studio
20 – 30	Bedroom at night
30 – 40	Library
40 – 50	Living room urban area
50 – 60	Typical Business Offices
60 – 70	Conversation Speech
70 – 80	Average traffic on street corner
80 – 90	Inside a factory
100 – 110	Burgalar alarm (1m away)
110 – 120	Loud car horn (1m away)
120 – 130	Pneumatic drill (1m away)
130 - 140	Threshold of pain

Table A1 – Example noise levels.

A1.5 The subjective response to a noise is dependent not only upon the sound pressure level and its frequency, but also its intermittency. Various statistical indices have been developed to

try and correlate annoyances with the noise level and its fluctuations in a changing noise environment. The indices and parameters used in this report are defined below:

A1.6 L_{Aeq}: Equivalent Continuous Sound Pressure Level The A-weighted sound pressure level of a steady sound that has, over a given period, the same energy as the fluctuating sound under investigation. It is in effect the energy average level over the specified measurement period (T) and is the most widely used indicator for environmental noise.

A1.7 L_{AN}: the A-weighted sound level exceeded for N% of the measurement period. In BS7445 the L_{A90} is used to define the background noise level, i.e. the noise that would remain once all local noise sources were removed. The L_{A10} gives an indication of the upper limit of fluctuating noise and is used in the assessment of road traffic noise.

A1.8 L_{AMAX}: The maximum 'A' weighted noise level recorded during the measurement period.

Appendix B: Measurement Positions

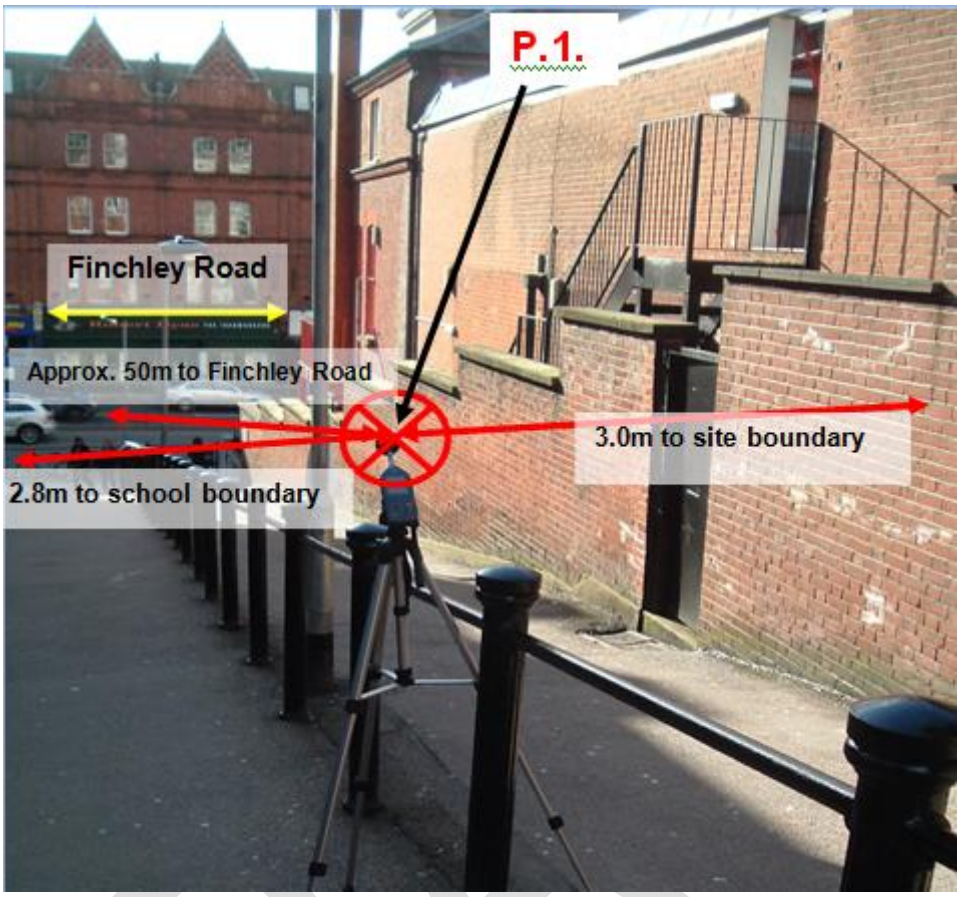


Figure B1 – Microphone Position 1 @ 1.45m above ground.

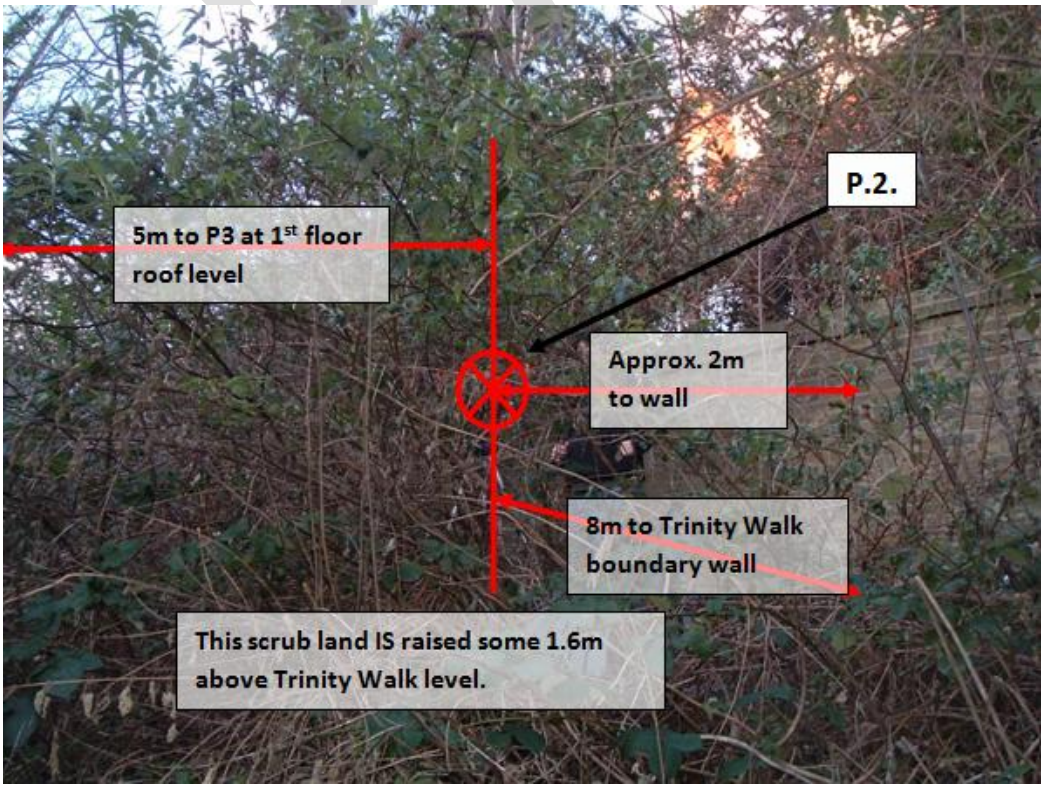


Figure B2 –Microphone Position 2 @ 1.4m off scrubland.

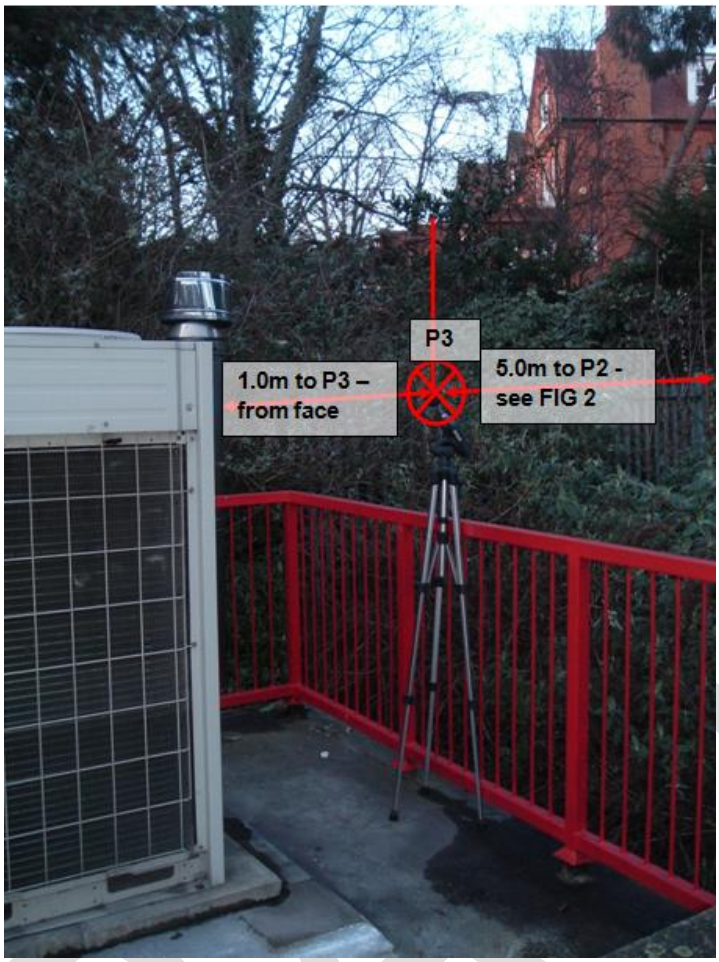


Figure B3 – Microphone position 3 @ 1.45m above roof level.

Figure B4 – Microphone Position 4 @1.45m above roof level.

Appendix C: Building Element Data

Pilkington **Optiphon**™

	dB sound reduction index by octave band – Hz						$R_w(C;C_{tr})$	R_w	R_w+C	R_w+C_{tr}
	125	250	500	1000	2000	4000				
Configuration single glazing										
6.8 mm Pilkington **Optiphon**™	21	26	31	35	37	38	35(-1;-3)	35	34	32
8.8 mm Pilkington **Optiphon**™	24	28	34	38	37	43	37(-1;-4)	37	36	33
10.8 mm Pilkington **Optiphon**™	28	31	36	38	39	47	38(-1;-2)	38	37	36
12.8 mm Pilkington **Optiphon**™	30	32	37	39	41	51	39(-0;-2)	39	39	37
16.8 mm Pilkington **Optiphon**™	29	34	37	39	46	55	40(-0;-2)	40	40	38
Configuration Insulating Glass Unit (IGU), thickness in mm										
6 / 6 to 20 mm / 6.8 Pilkington **Optiphon**™	23	24	34	42	43	52	38(-2;-5)	38	36	33
6 / 6 to 20 mm / 8.8 Pilkington **Optiphon**™	24	26	40	48	46	54	41(-3;-7)	41	38	34
6 / 6 to 20 mm / 10.8 Pilkington **Optiphon**™	23	28	41	47	45	55	42(-3;-7)	42	39	35
6 / 6 to 20 mm / 12.8 Pilkington **Optiphon**™	20	29	43	47	46	49	42(-3;-8)	42	39	34
8.8 Pilkington **Optiphon**™ / 6 to 20 mm / 12.8 Pilkington **Optiphon**™	26	36	46	50	52	63	47(-2;-7)	47	45	40
16.8 Pilkington **Optiphon**™ / 6 to 20 mm / 16.8 Pilkington **Optiphon**™	29	40	45	47	54	68	48(-2;-6)	48	46	42

The above IGUs with Pilkington **K Glass**™ on one pane and a 16 mm 90 % Argon-filled cavity achieve a U value of 1.5 W/m² K
Further information on solar and thermal performance is available on the Pilkington website using the Spectrum program: www.pilkington.com/spectrum
Impact classification EN12600 Class 1(B)1 for all above Pilkington **Optiphon**™ products
$R_w(C;C_{tr})$ are in accordance with EN717-1

Figure C1 – Pilkington glazing IGUs summary to BS EN ISO 717-1:1997.

08-JUL-1998 11:52 FRESH AB SWEDEN 46 470 67819 SID 04/04

RAPPORT Bilaga 1

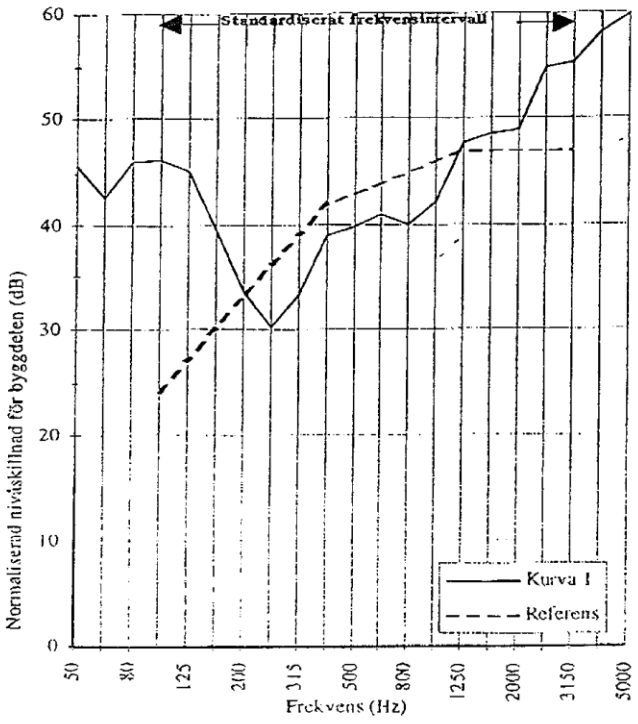
Fysik och Elteknik 1997-04-11 97F33107

Geir Andresen

Bestämning av luftljudsisolering i laboratorium enligt SS EN ISO 140-10

Uppdragsgivare: Fresh Ventilation AB Mätdatum:97-04-08
Provobjekt: F 90 + "gammalt" dB rör + galler. Genomföring var utdragen genom hål i vägg. Längd 300 mm.
Mätvillkor: Mätyta 10 m². Mottagarrummsvolym 129 m³
Provvägg: 300 mm gipsvägg med skild regelstomme.3 x 13 mm gips + 215 mm mineralull + 3 x 13 mm gips.

Resultat: Normaliserad nivåskillnad för byggdelen, beräknad på 10 m².



Frekvens (Hz)	Kurva 1 (dB)
50	≥45.7
63	≥42.6
80	≥46
100	≥46.2
125	45.1
160	39.5
200	33.5
250	30.2
315	33.2
400	39
500	39.7
630	40.9
800	40
1000	42.1
1250	47.7
1600	48.6
2000	48.9
2500	54.8
3150	55.3
4000	58.2
5000	59.8

D n.c.w	43
D n.c.w. 8	43
(C; Ctr)	(-1;-3)
(C; Ctr)	(0;-3)
50 5000	
Sum. avv.	29.9
Max. avv.	5.8
Frekvens	43.4

SP - Sveriges Provnings - och Forskningsinstitut
Akustik

Christian Simmons
Tekniskt ansvarig

Geir Andresen
Teknisk handläggare

Figure C2 – Ventilation test data sheet to ISO 140:10:1991.

Appendix D: Scheme Design

Figure D1 – Front elevation view from Trinity Walk.

Figure D2 – West elevation view from rear of 106 Finchley Road.

Figure D3 – Rear view of proposed scheme.