create
CONSULTING
ENGINEERS LTD

51 CALTHORPE STREET, LONDON

Acoustic Assessment

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Acoustic Assessment

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REGISTRATION OF AMENDMENTS

Revision	Amendment Details	Prepared By	Approved By

1.0 INTRODUCTION

1.1 Create Consulting Engineers Ltd has been commissioned by Mr. Simon Firth to undertake an acoustic assessment in support of the planning application for the proposed development at 51 Calthorpe Street, London, WC1X 0HH (the Site) in the London Borough of Camden (LBC).

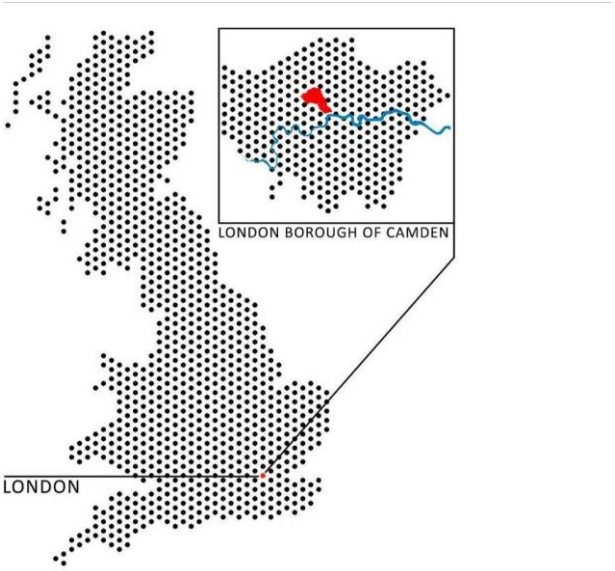
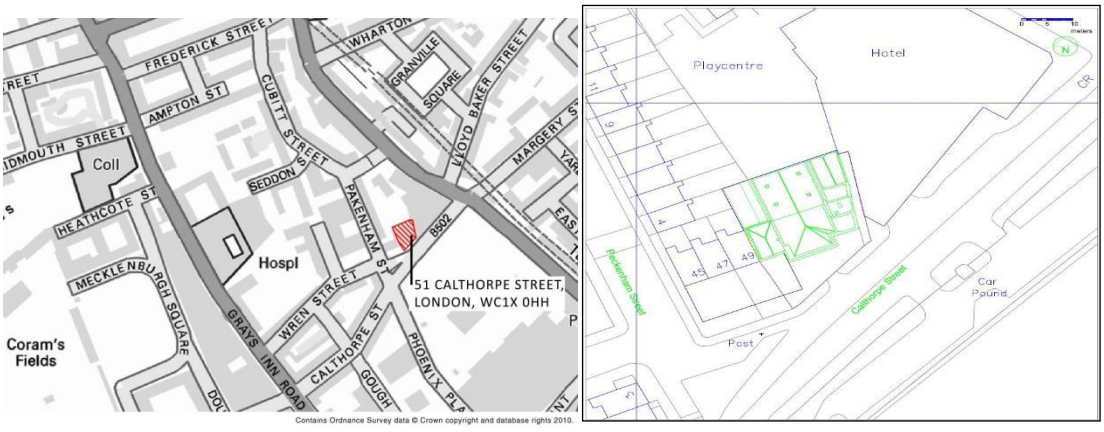


Figure 1.1 London Borough of Camden, Location Map

Current Site Use

1.2 The Site is located at 51 Calthorpe Street, London, WC1X 0HH, and comprises an existing three storey Victorian-era building that is currently used as offices and storage. The building's eastern side is located adjacent to the Holiday Inn Hotel and the western side abuts other residential buildings on Calthorpe Street. The front of the existing development faces south-east over Calthorpe Street and is opposite the Mount Pleasant Royal Mail sorting centre. The rear north-west elevation of the development faces the Cubitt Street play centre. The Site is accessed solely via Calthorpe Street.



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Figures 1.2 & 1.3: Site Location Plans

Proposed Development

1.3 The development proposals includes the partial demolition and removal of some existing structures (including the roof) with the retention of the external walls and some floors followed by the construction of 17 new flats over six storeys, including a new basement level below the footprint of the building, and the excavation of the forecourt.

Objectives

1.4 The primary objective of this assessment is to determine the site's suitability for residential use, in accordance with the requirements of Camden Council along with relevant guidance. Additionally, the need for a satisfactory internal noise environment for future occupants has been considered, having regard to appropriate guidance contained within the World Health Organisation, 2000 (WHO) '*Guidelines for Community Noise*' and BS 8233:2014: '*Guidance on sound insulation and noise reduction for buildings*'. Noise control measures required to protect internal and external amenity have been recommended.

1.5 This report considers the key environmental noise issues at the site and includes a description of certain measures that are recommended to ensure that the amenity of the occupants of building and the surrounding buildings are adequately protected. The assessment includes a description of the relevant noise national guidance documents relating to the proposed development. An assessment is made of the potential impact of noise on the new development and of any new noise likely to be introduced by the development to the surrounding areas. Where appropriate, outline guidance is given about the measures that may be taken to mitigate noise and vibration.

1.6 To assist the reader, a glossary of acoustic terminology is included in Appendix A.

2.0 LEGISLATION, POLICY AND GUIDANCE

Introduction

2.1 This section presents the planning policy context of the proposed development with regard to noise quality.

National Planning Policy

National Planning Policy Framework (2012)

2.2 The National Planning Policy Framework (NPPF)[1] replaces existing Planning Policy Statements (PPS) and Planning Policy Guidance (PPG), including the Department of the Environment's Planning Policy Guidance Note 24: 'Planning and Noise' (PPG24), which was published in 1994. The main reference to noise within the NPPF is at Paragraph 123:

2.3 *'Para.123. Planning policies and decisions should aim to:*

- *avoid noise from giving rise to significant adverse impacts[27] on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts[27] on health and quality of life arising from noise from new development, including through the use of conditions;*
- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established;[28] and*
- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.'*

2.4 The reference numbers 27 and 28 point respectively to the National Policy Statement for England (NPSE) Explanatory Note, and the provisions of the Environmental Protection Act 1990 and other relevant law.

2.5 Policy 11 Conserving and Enhancing the Natural Environment also states that '*the planning system should contribute to and enhance the natural and local environment by:*

...preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution...'

[1] Department for Communities and Local Government (2012). National Planning Policy Framework. HMSO, London.

National Planning Policy Guidance (2014)

2.6 On 6th March 2014, the Department for Communities and Local Government (DCLG) launched the National Planning Practice Guidance (NPPG)[2] web-based resource to supersede previous planning guidance documents and clarify certain aspects of the NPPF.

2.7 The NPPG provides guidance on the assessment of noise, the factors to be considered when new developments may create additional noise and when developments will be sensitive to the prevailing acoustic environment.

2.8 The acoustic environment should be taken into account in the planning of new development and decision making should take the following into consideration:

- *'whether or not significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*
- *whether or not a good standard of amenity can be achieved.'*

2.9 The overall effect of the noise exposure needs to be assessed by reference to the levels documented in the NPSE.

The Noise Policy Statement for England (2010)

2.10 The Noise Policy Statement for England (NPSE)[3] was published in March 2010 and is the overarching statement of noise policy for England. It applies to all forms of noise other than occupational noise and sets out the long term vision of Government noise policy, which is to:

'Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.'

2.11 The vision is supported by the following aims, which are reflected in the aims for planning policies and decisions in Paragraph 123 of the NPPF:

'Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life.'*

[2] Department for Communities and Local Government (2014). National Planning Policy Guidance. HMSO, http://planningguidance.planningportal.gov.uk/

[3] Department for Environment, Food and Rural Affairs (DEFRA) (2010). Noise Policy Statement for England. HMSO, London.

2.12 The Explanatory Note to the NPSE introduces three concepts for the assessment of the potential effects of noise:

- *'NOEL – No Observed Effect Level: This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.*
- *LOAEL – Lowest Observed Adverse Effect Level: This is the level above which adverse effects on health and quality of life can be detected.*
- *SOAEL – Significant Observed Adverse Effect Level: This is the level above which significant adverse effects on health and quality of life occur.'*

2.13 The three levels are not defined numerically in the NPSE, and for the SOAEL the NPSE makes it clear that the noise level is likely to vary depending upon the noise source, the receptor and the time of day/day of the week, etc. The need for more research to investigate what may represent a SOAEL for noise is acknowledged and the NPSE asserts that not stating specific SOAEL levels, thereby providing flexibility until there is further evidence and guidance.

Regional Planning Policy

<u>The London Plan (2011)</u>

2.14 The London Plan[4] and Revised Early Minor Alterations[5] Policy 7.15 provide guidance for noise pollution within the Greater London area in the context of development and planning.

2.15 Policy 7.15 Reducing Noise and Enhancing Soundscapes: *'Development proposals should seek to reduce noise by:*

- *minimising the existing and potential adverse impacts of noise on, from, within, or in the vicinity of, development proposals;*
- *separating new noise sensitive development from major noise sources wherever practicable through the use of distance, screening, or interval layout in preference to sole reliance on sound insulation; and*
- *promoting new technologies and improving practices to reduce noise at source.'*

[4] Greater London Authority (2011). The London Plan: Spatial Development Strategy for Greater London. GLA, London.

[5] Greater London Authority (2013). Revised Early Minor Alterations Consistent with the NPPF. GLA, London.

The Mayor's Ambient Noise Strategy (2004)

2.16 The Mayor's Ambient Noise Strategy[6] was published to complement the existing Borough work on neighbour noise, construction sites and other local nuisances. It is intended that the document be used in partnership with the London boroughs, the Environmental Agency and others in developing fresh approaches to integrated noise management.

2.17 Policy 77: *'The Mayor will urge the Government, as part of developing National Ambient Noise Strategy, to support:*

- *Review of international good practice in sound-conscious urban design, including costs, effectiveness, administration and policy mechanisms;*
- *Preparation of technical guidance giving practical tools for people to get involved with planning and urban design, neighbourhood regeneration and management, with particular reference to higher density mixed use development where noise nuisance can otherwise be a risk; and*
- *In particular, review of the framework governing design, installation and maintenance of ventilation, cooling and air handling equipment, including practical measures to address creeping ambient.'*

Local Planning Policy and Guidance

Camden Core Strategy Local Development Framework (2010)

2.18 The Development Framework[7] for the London Borough of Camden (LBC) guides the development of the Borough over 15 years (2010-2025).

2.19 Development Policy 28 (DP28) – Noise and vibration: *'The Council will see to ensure that noise and vibration is controlled and managed and will not grant planning permission for:*

- *development likely to generate noise pollution; or*
- *development sensitive to noise in locations with pollution, unless appropriate attenuation measures are provided.*

[6] Greater London Authority (2004). Sounder City: The Mayor's Ambient Noise Strategy. GLA, London.

[7] London Borough of Camden (2010). Camden Core Strategy Local Development Framework (2010), London.

3.0 ASSESSMENT METHODOLOGY AND CRITERIA

3.1 This section outlines the assessment methodology and the significance criteria that have been used to assess the significance of risk associated with the proposed development.

Data Sources

3.2 The key data sources reviewed as part of this study are listed in Table 3.1 below.

Data Source	Reference
British Standards Institute (BSI)	BSI (2014). BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites: Noise
	BSI (2014). BS 4142:2014 Method for rating and assessing industrial and commercial sound
	BSI (2014). BS 8233:2014 Guidance on sound insulation and noise reduction for buildings
	BSI (2000). BS 12354-3:2000 Estimation of acoustic performance in buildings from the performance of elements. Airborne sound insulation against outdoor sound.
World Health Organisation (WHO)	WHO (2000). Guidelines for Community Noise
Department for Environment, Food and Rural Affairs (Defra)	Defra (2010). Noise Policy Statement for England
Department for Transport (DFT)	DFT (1988). Calculation of Road Traffic Noise

Table 3.1: Key Information Sources

3.3 This assessment considers the existing acoustic environment and the likely significant effects on existing and proposed human receptors within the site and surrounding area in terms of:

- noise impacts expected during demolition and construction;
- existing baseline conditions and potential noise sources that may impact the proposed development;
- noise from changes in road traffic attributed to the proposed development; and
- noise from building services plant associated with the operation of the proposed development.

Technical Guidance

Demolition and Construction

3.4 Guidance relating to the prediction and assessment of demolition and construction phase noise effects has been taken from BS 5228-1: 2009+A1:2014 'Code of practice for noise and

vibration control on construction and open sites' Part 1: 'Noise'[8] which provides recommendations for basic methods of noise control relating to construction and open sites where work activities/operations generate significant noise levels.

3.5 Amongst other things, the annexes to BS 5228 provide information on the following:

- relevant legislation (annex A);
- typical noise sources and advice on mitigating them (annex B);
- sound level data for use in the prediction methods described in the Standard (annexes C and D);
- assessing the significance of noise effects (annex E);
- estimating noise levels (annex F); and
- implementing noise monitoring (annex G).

Road Traffic

3.6 The following documents are relevant with respect to predicting and assessing traffic noise affecting existing receptors and future receptors within the proposed development.

3.7 The Calculation of Road Traffic Noise (CRTN)[9] describes procedures for predicting and measuring noise from road traffic in terms of the L_{A10} – the level exceeded for 10% of the time – and is suitable for environmental assessments of schemes where road traffic noise may have an effect.

3.8 Design Manual for Roads and Bridges, Volume 11 'Environmental Assessment', Section 3 'Environmental Assessment Techniques', Part 7 'Noise and Vibration' Revision 1, November 2011[10].

Fixed Building Services Plan

3.9 BS 4142:2014 'Method for rating and assessing industrial and commercial sound'[11] describes methods for determining and assessing sound levels from factories, industrial premises, fixed installations or sources of an industrial nature in commercial premises, with a view to determining the likelihood of complaints. The document is appropriate to the measurement of the existing acoustic environment and the acoustic assessment of activities of an industrial nature emanating from new or proposed commercial premises/uses.

[8] British Standards Institute. (2014). BS 5228-1:2009+A1:2014: Code of practice for noise and vibration control on construction and open sites. Part 1: Noise. BSI, London.
[9] Department of Transport (1988). Calculation of Road Traffic Noise. HMSO, London.
[10] Department for Transport (2011). Design Manual for Roads and Bridges Volume 11: Environmental Assessment Section 3: Environmental Techniques Part 7 HD 213/11 – Revision 1 Noise and Vibration. HMSO, London.
[11] British Standards Institute. (2014). BS 4142:2014 Method for rating and assessing industrial and commercial sound, BSI, London.

Site Suitability

3.10 In addition to the qualitative recommended noise level guidance from the NPSE, quantitative noise level guidance can be taken from a number of documents, including BS 8233:2014 and the WHO Guidelines for Community Noise.

Internal Noise Levels

3.11 BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings'[12] provides criteria for the assessment of noise affecting various uses including residential dwellings.

3.12 WHO 'Guidelines for Community Noise' provide criteria for the assessment of internal and external noise levels affecting various uses including residential dwellings.

3.13 The Guidelines on Community Noise have been developed by the WHO in order to:

'…consolidate actual scientific knowledge on the health impacts of community noise and to provide guidance to environmental health authorities...'

3.14 The WHO 'Guidelines for Community Noise states that:

'...there is no distinction between sound and noise. Sound is a sensory perception and the complex pattern of sound waves is labelled noise. Noise is thus defined as unwanted sound.'

3.15 The current BS 8233:2014 standard has revised the residential 'good' and 'reasonable' noise level criteria that were set out in BS 8233:1999, and replaces them with a recommendation of a single standard shown in Table 3.2.

Activity	Location	Daytime 07:00 to 23:00	Night time 23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq,16h}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq,16h}$	-
Sleeping	Bedroom	35 dB $L_{Aeq,16h}$	30 dB $L_{Aeq,8h}$
Note – Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.			

Table 3.2: BS 8233:2014 Indoor ambient noise levels for dwellings

[12] British Standard Institute (2014). BS 8233:2014 Sound Insulation and Noise Reduction for Buildings. BSI, London.

3.16 The WHO Guidelines for Community Noise state the following guideline values for community noise in specific environments, see Table 3.3.

Specific Environment	Critical Health Effects	Criterion
Dwelling, indoors	Speech intelligibility and moderate annoyance	35 dB L_{Aeq}
Inside Bedrooms	Sleep disturbance, night-time	30 dB L_{Aeq}
Outdoor living area	Serious Annoyance, daytime and evening	55 dB L_{Aeq}
	Moderate annoyance, daytime and evening	50 dB L_{Aeq}

Table 3.3: WHO Guideline Values for Community Noise

3.17 The document also states:

'For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night, (Vallet & Varnet 1991[13]).'

Proposed Residential Criteria

3.18 On the basis of the above we would propose the following internal noise levels be adopted as a minimum design target for the proposed residential dwellings.

Scenario	Criterion
Daytime 07:00-23:00 Desirable average noise limits within living spaces	35 dB $L_{Aeq, 16hr}$
Night time 23:00-07:00 Desirable average noise limits within bedrooms	30 dB $L_{Aeq, 8hr}$
Note - The design targets relate to internal noise levels. With respect to outdoor living areas, a target of 55 dB $L_{Aeq,T}$ should avoid serious annoyance during the day and evening.	

Table 3.4: Proposed indoor criteria

[13] Vallet, M and Vernet, I (1991). Night aircraft noise index and sleep research results. In Lawrence, A (ed.), Inter-Noise 91. The Cost of Noise, Vol. 1, pp. 207-210. Noise Control Foundation, Poughkeepsie, NY, USA.

4.0 EXISTING ACOUSTIC ENVIRONMENT

Procedure

4.1 Unattended measurements of the existing acoustic environment were undertaken from Tuesday 1st November 2012 until Friday 2nd November 2012 over a 24-hour period. The monitor was installed on the rear first floor roof of the existing building, designated as Position 1. See Figure 4.1.

4.2 The measurement location, although influenced primarily by road traffic noise was partially screened by the existing building and the neighbouring Holiday Inn hotel. Due to the screening at Position 1 additional attended measurements were undertaken at the front of the building, designated as Position 2; from 10:00 to 13:00 on Friday 2nd November 2012

4.3 Figure 4.1 presents the acoustic measurement positions.

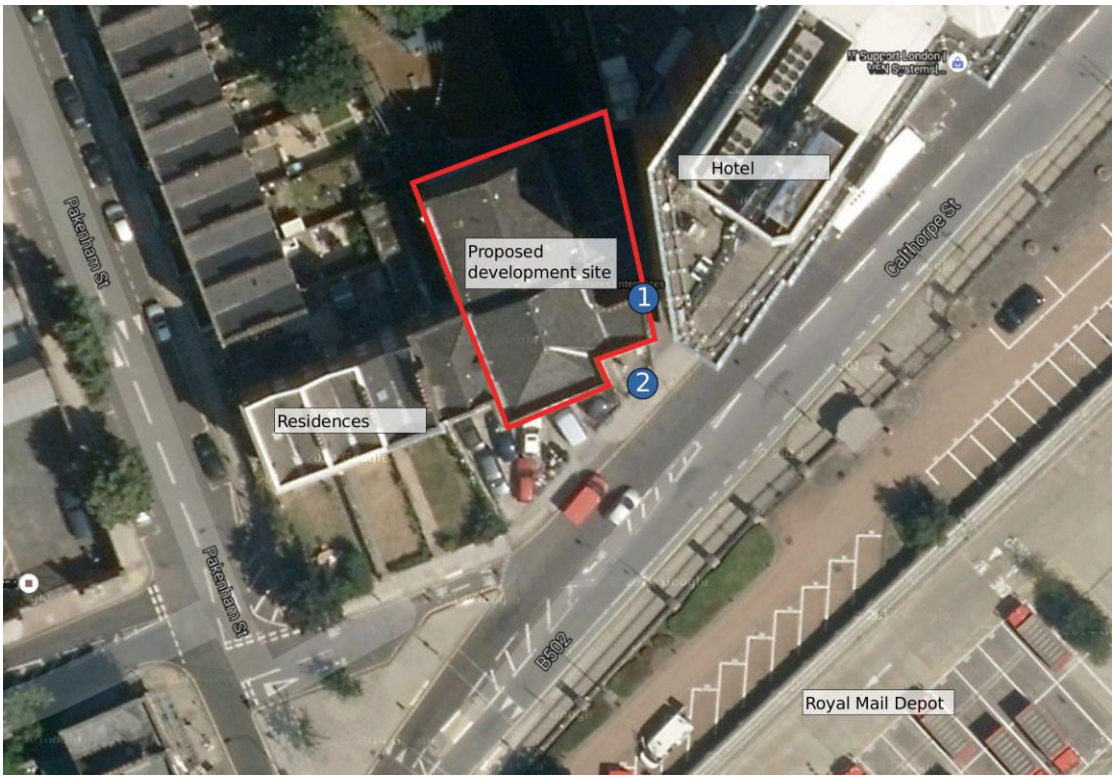

Figure 4.1: Acoustic measurement positions

4.4 Weather conditions for the survey periods, whilst not actively measured for during the survey period, were mild and dry with predominantly light winds estimated to have not exceeded 5 m/s.

4.5 Measurements were undertaken continuously of the A-weighted (dBA) L_{eq}, L_{max}, L_{10} and L_{90} sound pressure levels for consecutive 15-minute sampling periods for the duration of the noise survey.

Equipment

4.6 Table 4.1 contains details of the equipment used during the acoustic surveys.

Position	Description	Mode/serial no.	Calibration date	Calibration certificate
1	Class 1 Sound level meter	Svantek 949 / 12262	07/04/2011	13680
	Condenser microphone	Svantek SV22 / 4012444		
	Preamplifier	Svantek SV12L / 13163		
	Calibrator	Svantek SV 40A / 10847	07/04/2011	13679
2	Class 1 Sound level meter	Svantek 945A / 6436	29/06/2011	13728
	Condenser microphone	GRAS 40AE / 86699		
	Preamplifier	Svantek SV11 / 5861		
	Calibrator	CEL 284/2 3/01920312	02/11/2012	14118

Table 4.1: Equipment

Results

4.7 The results of the unattended and attended monitoring at Positions 1 and 2 are presented in Table 4.2. Graphical results of unattended monitoring are included in Appendix B

Position	Time Period	Ambient sound level	Typical maximum sound level	Typical background sound level
1	Daytime 07:00 – 23:00	55 dB $L_{Aeq,16h}$	67 dB L_{Amax}	50 dB L_{A90}
	23:00 – 07:00	50 dB $L_{Aeq,8h}$	64 dB L_{Amax}	45 dB L_{A90}
2	10:00 – 13:00	65 dB $L_{Aeq,3h}$	85 dB L_{Amax}	54 dB L_{A90}
Note - Position 2 was too close from Calthorpe street (less that 3.5 m), this results in non-linear L_{Amax} values. They have been considered non-representative.				

Table 4.2: Sound monitoring results

4.8 Overall, the difference between Position 1 and 2 has been calculated to be 10 dB, therefore the night time sound levels at Position 2 have been extrapolated in order to represent the levels without screening. Table 4.3 presents the day and night time extrapolated sound levels at Position 2.

Position	Period	Ambient sound level	Typical maximum sound level
2	Daytime	65 dB $L_{Aeq,16h}$	77 dB L_{Amax}
	Night time	60 dB $L_{Aeq,8h}$	74 dB L_{Amax}

Table 4.3: Extrapolated sound levels at Position 2

4.9 To assist with façade design and glazing specification for the proposed building, sample frequency data, in single-octave bands, measured at Position 2 are provided in Table 4.4.

Frequency [Hz]	$L_{eq,15min}$ [dB] Position 2
63	72
125	63
250	60
500	60
1000	60
2000	57
4000	50
8000	43

Table 4.4: Sample frequency data at Position 2

5.0 POTENTIAL NOISE IMPACTS

Construction

Site Activities

5.1 As well as considering the effect of the existing noise on the future occupants of the proposed development, consideration must also be given to the effects of construction noise upon existing sensitive receptors located in close proximity to the site.

5.2 The development site is located close to a number of properties of differing uses that potentially may experience adverse effects due to the construction and demolition noise associated with the proposed development.

5.3 All of the above have the potential to be affected by construction and demolition noise, these include:

- Increased noise levels on-site due to construction activities, plant and road haulage vehicles;
- Increased noise levels caused by any ground treatment or remediation; and
- Increased noise levels off-site due to road haulage vehicles.

5.4 The specific duration, location and magnitude of potentially significant effects cannot be fully assessed at this stage. However, where occupied dwellings are in excess of 50-60 metres from the construction works, adverse noise effects are unlikely to be significant.

5.5 A further assessment of specific construction impacts is dependent upon a number of detailed building design details which are not available at this stage. Therefore, the impact of construction activities should be controlled by the use of a detailed Construction Method Statement (CMS) which should include the use of noise 'Action Levels', to be set at the site boundary to ensure that residents and workers are not disturbed by site activities.

Construction Traffic

5.6 Throughout the demolition and construction phases a number of HGV's will access the site for delivery and removal purposes. The construction management plan produced for the site has estimated that the number of HGV's visiting the site will be no more than 5 per day.

5.7 The movement of vehicles during construction should be managed by the use of a detailed Construction Method Statement (CMS) in order to reduce as much as possible construction traffic noise disturbance to the local community.

Operation

5.8 During operation, noise nuisance typically can arise from both vehicles using the development and point sources such as heating/cooling systems or other proposed on-site plant.

Site Activities

5.9 The design criteria should be in accordance with BS 4142:2014 in that sound level from building services should not exceed background sound level. This will ensure that no significant effects are likely from on-site stationary noise sources.

Operational Traffic

5.10 The development is proposed to be car free. Therefore, it has not been considered necessary to quantify traffic noise impacts as a result of the operation of the proposed development.

6.0 CONTROL OF NOISE INTRUSION

General

6.1 The development will be subject to noise from road traffic from Calthorpe Street. This section of the report considers the noise levels expected to affect the noise sensitive areas of the development as a result of the external acoustic environment and provides advice on the sound insulation performance requirements for the building façades.

External noise exposure

6.2 Taking into account the acoustic environment in the area, the façades categorised in Figure 6.1 would be exposed to external sound levels derived from the measurements described in Section 4.

6.3 The façades marked up in red are mainly affected by traffic noise from Calthorpe Street, while the yellow façades are affected by distant traffic noise from Pakenham Street as well as Calthorpe Street.

Figure 6.1: Façades categorisation layout

6.4 An assessment has been made to determine the level of sound insulation required to the key façade elements of the building to protect the amenity of the occupants from the effects of external noise intrusion.

6.5 In addition to the ambient noise levels, it is also important to consider isolated loud events occurring regularly during the night time period.

6.6 The level of noise intrusion will depend on the acoustic performance of all the elements of the façade, but is generally determined by the components of least airborne sound resistance, which are usually the ventilation devices and glazing.

6.7 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. This assessment has been carried out using some generic assumptions. These may require reviewing during detail design development.

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

- Predictions have been made using the general method set out in BS EN 12354-3:2000;
- 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;
- External walls are of a brick/block cavity construction with a sound insulation value of at least 52 dB R_w and 48 dB R_w+C_{tr};
- The roof has a sound insulation value of at least 52 dB R_w and 47 dB R_w+C_{tr};
- The ventilation strategy is for natural ventilation with one trickle ventilator in each habitable room. The number of background or trickle ventilators has a substantial influence on the sound insulation of the building envelope. Current guidance on complying with the Building Regulations Approved Document F offers many options to provide adequate ventilation. Some of these are preferable with regard to noise break-in, such as whole house ventilation with heat recovery as no trickle vents are required. Other options require anywhere between 1 and 6 vents per room. This report assumes 1 ventilator per room.
- 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.

6.9 The façade elements have been designed assuming closed windows with natural ventilation provided by vents to the habitable rooms.

6.10 The sound insulation requirements of the glazing are applicable to the window system as a whole, including frames, mullions and panels. The sound insulation measurements for glazing and unit ventilators are based on BS EN ISO 10140-1:2010+A2:2014 ‘Acoustics – Laboratory measurement of sound insulation of building elements. Part 1: Application rules

for specific products'[14] and rated in accordance with BS EN ISO 717-1:2013 'Acoustics – Rating of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation (ISO 717-1:2013)'[15].

6.11 Table 6.1 presents the predicted internal sound levels that are expected within the proposed development when 4/(6-16)/4 Insulating Glass Units (IGU) and Trickle ventilator with an indirect air path are used.

6.12 The façade sound levels are derived from the measurements described in Section 4; the levels for the yellow façade are based on the measurement on the 1st position, and the levels for the façade are based on the measurement on the 2nd position with a distance attenuation factor.

Location / Façade	Period	Façade sound level	Design criteria	Internal sound level	Proposed criteria met?
Bedroom on façade yellow	Daytime	55 dB $L_{Aeq,16h}$	35 dB $L_{Aeq,16h}$	25dB $L_{Aeq,16h}$	Yes
	Night time	50 dB $L_{Aeq,8h}$	30 dB $L_{Aeq,8h}$	21 dB $L_{Aeq,8h}$	Yes
		64 dB L_{Amax}	45 dB L_{Amax}	35 dB L_{Amax}	Yes
Bedroom on façade red	Daytime	58 dB $L_{Aeq,16h}$	35 dB $L_{Aeq,16h}$	29dB $L_{Aeq,16h}$	Yes
	Night time	53 dB $L_{Aeq,8h}$	30 dB $L_{Aeq,8h}$	24 dB $L_{Aeq,8h}$	Yes
		68 dB L_{Amax}	45 dB L_{Amax}	39 dB L_{Amax}	Yes
Living room on façade red	Daytime	58 dB $L_{Aeq,16h}$	40 dB $L_{Aeq,16h}$	26dB $L_{Aeq,16h}$	Yes

Table 6.1: Predicted internal sound levels

6.13 The performance values given in Table 6.1 should be treated as indicative and taken as a demonstration that acceptable internal noise levels can be achieved in practice with appropriate specification of façade components.

6.14 The above predicted internal sound levels are based on information provided at the time of writing. The final acoustic specification for the façades and the ventilation strategy might vary slightly in line with development at the detailed design stage.

6.15 It is thus demonstrated that the predicted internal sound levels shown in Table 6.1 all fall within the proposed residential criteria set out in Table 3.4. Therefore, it can be concluded that a good average internal sound environment as per BS 8233 is achievable when appropriate glazing and typical building materials/techniques are incorporated into the proposed development.

[14] British Standard Institute (2014). BS EN ISO 10140-1:2010+A2:2014 Acoustics – Laboratory measurement of sound insulation of building elements. Part 1: Application rules for specific products

[15] British Standard Institute (2013). BS EN ISO 717-1:2013 Acoustics -- Rating of sound insulation in buildings and of building elements. Part 1: Airborne sound insulation (ISO 717-1:2013)

Amenity Areas

6.16 For the façade closest to Calthorpe Street (red) there will be a need to ensure that amenity areas such as gardens are protected to reduce the ambient noise conditions to an acceptable level. Calculations indicate that with the provision of standard and well installed solid fencing along the perimeter of gardens facing the street, the noise level in the gardens can be reduced to below a level of 55 dB(A), the limit suggested in Section3.

7.0 MITIGATION MEASURES

Construction

7.1 Potentially significant impacts during the construction phase will be associated with noise generating activities adjacent to potentially sensitive receptors. By employing appropriate site management practices, the potential for adverse noise impacts from construction vehicles and plant during the works will be minimised.

7.2 Although only temporary, the impacts of noise from demolition and construction can cause severe nuisance to neighbouring properties.

7.3 The proposed development has been estimated to be completed in 18 months from the onset of demolition work. Throughout much of this period there is the potential of nuisance from elevated noise levels upon the surrounding area.

7.4 It is stated within the construction management plan that work will only be carried out during the following times:

- Monday to Friday 08:00 till 17:00; and
- Saturday 09:00 till 13:00.

7.5 No work will take place on Sundays or Bank Holidays.

7.6 Prior to any construction activity on site, a detailed CMS should be drawn up setting out appropriate site management practices to be adhered to.

7.7 The CMS should be completed in accordance with BS 5228 Part 1: Noise and Part 2: Vibration in order to ensure the management and control of any potential noise or vibration upon the surrounding areas, as a result of construction activities.

7.8 The CMS should cover the following matters:

- A programme of work indicating the level of noise and vibration and the location of each activity, ensuring 'Best Practical Means' are used;
- Methods and materials that should be used to ensure that the generation of noise is minimised;
- Information on the type of plant to be used and the proposed noise control methods;
- The use of prefabricated materials wherever possible;
- A recommendation that noise generating activities should be located away from sensitive receptors; and
- Good housekeeping and management, i.e.:

- Review of plant and activities to ensure noise minimisation measures are in place and operating;
- Public relations, e.g. provision of telephone numbers for complaints, pre-warning of noisy activities, sensitive working hours;
- Controlling of site traffic and setting up of access routes away from sensitive receptors; and
- Provision of noise monitoring during activities likely to affect local sensitive receptors.

7.9 The main contractor should be responsible for the execution of the CMS and should ensure that the appropriate personnel understand their responsibilities in terms of the minimisation of noise and the reporting of incidents and the taking of appropriate remedial steps. It should also be responsible for identifying and organising appropriate training.

7.10 Mitigation measures will include the following where possible:

- Regular monitoring where the potential for significant noise is identified;
- Working hours of the site to be agreed with the London Borough of Camden;
- Where possible, 'silenced' plant and equipment to be used;
- Where vehicles are standing for a significant period of time, engines to be switched off;
- Screening around parts of the site where activities are likely to generate noise;
- Location of noise generating plant to be at a low level where practical and as distant as possible from sensitive receptors;
- Acoustic enclosures to be fitted where possible to suppress noisy equipment;
- Plant to operate at low speeds where possible, and to incorporate automatic low speed idling;
- All plant to be properly maintained (greased, blown silencers replaced, saws kept sharpened, teeth set and blades flat, worn bearings replaced, etc);
- Consideration to be given to temporary screening or enclosures for static noisy plant to reduce noise emissions and plant should be certified to meet any relevant EC Directive Standards; and
- All contractors to be made familiar with the guidance in BS:5228 (Parts 1 and 2) which should form a pre-requisite of their appointment; and
- Early and good public relations with the adjacent tenants and occupants of buildings will also reduce the likelihood of complaints.

7.11 Ultimately, if plant that generates high levels of noise has to be used in close proximity to sensitive receptors, the exposure to these activities may need to be limited either in terms of a cap on the total number of operational hours each day or by restricting the activities to certain times of the day. The CMS should be prepared so as to accommodate such an eventuality.

7.12 Once the exact methods and plant to be employed are confirmed, the need for further mitigation measures can be determined and specified within the CMS.

Operation

Development Traffic

7.13 The proposed development has been designed to be car free. Therefore, it is not anticipated that any mitigation measures would be required in relation to proposed development traffic.

Maintaining Suitable Internal Noise Levels

7.14 The assessment detailed in Section 6, demonstrates that acceptable internal sound levels as per BS 8233 is achievable when appropriate glazing and typical building materials/techniques are incorporated into the proposed development.

8.0 CONCLUSION

8.1 Create Consulting Engineers Ltd has undertaken an assessment of the noise issues in support of the planning application for the proposed development at 51 Calthorpe Street, London.

8.2 This report records the design parameters and measures required to protect the amenity of the future occupants of the development, and those of the surrounding buildings, from the effects of noise. It sets out the acoustic strategy required such that the scheme design will result in compliance with national guidelines and local policies.

8.3 Noise intrusion to the development will be controlled to acceptable levels by ensuring the facade and internal building elements satisfy the specified minimum sound insulation performance requirements set out in this report. Indicative performance values have been pointed as a demonstration that acceptable internal noise levels can be achieved in practice with appropriate specification of façade components.

8.4 To minimise risk of noise nuisance to the surrounding community during the operation of the development, an assessment has been undertaken and noise emission limits derived to ensure compliance with recommended external noise criteria.

8.5 On the basis of the noise assessment and proposed acoustic strategy for the scheme, it is concluded that noise issues can be adequately addressed in the scheme design and should therefore not impede any decision to grant permission for the development of this project.

9.0 DISCLAIMER

9.1 Create Consulting Engineers Ltd disclaims any responsibility to the Client and others in respect of any matters outside the scope of this report.

9.2 The copyright of this report is vested in Create Consulting Engineers Ltd and Parritt Leng Ltd. The Client, or his appointed representatives, may copy the report for purposes in connection with the development described herein. It shall not be copied by any other party or used for any other purposes without the written consent of Create Consulting Engineers Ltd and Parritt Leng Ltd.

9.3 Create Consulting Engineers Ltd accepts no responsibility whatsoever to other parties to whom this report, or any part thereof, is made known. Any such other parties rely upon the report at their own risk.

APPENDICES

APPENDIX A

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_{A90} The level exceeded for 90% of the time is normally used to describe background noise.

L_{A10} The level exceeded for 10% of the time is normally used to describe road traffic noise.

L_{Amax} The maximum A-weighted sound pressure level, normally associated with a time weighting, F (fast), or S (slow).

Factors Affecting Sound Transmission in the Open Air

over a period of time in statistical terms. Some commonly used descriptors follow.

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, 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.

Sound Transmission in Rooms

Sound energy is reflected from the room surfaces and this gives rise to reverberation. At short distances from a sound source, the sound level will fall off at a rate of 6 dB per doubling of distance, as it would in the open air – this is known as the direct field. Beyond a certain distance, the effect of reverberation takes over and the level ceases to fall off significantly with distance from the source. This is known as the reverberant field. For receiver positions in this part of the room, sound levels can be reduced by applying sound absorbing finishes to the surfaces of the room. A 3 dB reduction can normally be obtained by doubling the absorption present, which corresponds to halving the reverberation time.

Reverberation Time

Sound wavefronts are repeatedly reflected from room surfaces and, as a result of absorption, gradually grow weaker and weaker. The reverberation time (RT) of a space is a measure of the rate at which the sound dies away. It is defined as the time taken for the reverberant sound energy to decay to one millionth of its original intensity (corresponding to a 60 dB reduction). The reverberation time is proportional to the volume of the room and inversely proportional to the quantity of absorption present.

Building Regulations

The Building Regulations of 1965 were the first to cover the sound insulation of separating walls and floors. They required the provision of `adequate sound insulation' in new dwellings and offered several deemed-to-satisfy constructions. In 1972, the Regulations were revised and, in addition to deemed-to-satisfy constructions, they introduced deemed-to-satisfy numerical performance requirements for airborne and impact sound. Minor revisions were made in the 1976 Regulations.

In 1985 a major revision was made to the Regulations. Approved Document E gave more detailed constructional specifications for separating walls and separating floors and new numerical performance standards were given -- though the requirements were commensurate with the former deemed-to-satisfy provisions. These Regulations were the first to govern building in Inner London. Prior to this the London Building Act of 1939 was in force, but, as this did not include provisions for sound insulation, reference was usually made to the Building Regulations.

In 1991 the Building Regulations were further revised to include constructional provisions and numerical performance standards for conversion properties. Some of the new-build constructional provisions were altered at this time.

In 2003 further amendments were made to Part E. This includes the introduction of new requirements for the sound insulation of partitions within dwellings, for the control of reverberation in the common parts of residential buildings and for the control of acoustic conditions in schools. The requirements for separating walls and separating floors are proposed to apply to both dwellings and rooms for residential purposes, which include hotels, hostels, care homes and student accommodation.

For domestic separating walls, separating floors and stairs, the normal way of satisfying the requirement is to meet given numerical standards, which are to be demonstrated by precompletion testing.

Airborne Sound Insulation

Voices, hi-fi systems, television and radio sound and musical instruments are all sources of airborne sound. They excite the air around them and the vibration in the air is transmitted to surrounding surfaces, such as walls, ceilings and floors. This sets these constructions into vibration and this vibration is radiated in neighbouring rooms as sound. Energy is lost in the transmission path and this is referred to as transmission loss or, more generally, sound insulation. The most simple measure of sound insulation is the sound level difference, *D*, which is the arithmetic difference between the sound level, in dB, in the source room and the sound level in the receiving room.

Other measures of sound insulation include the sound reduction index, *R*, which is a measure of the acoustical performance of a partition, obtained in a laboratory, and the standardised level difference, D_{nT}, which is used mainly in the sound insulation of domestic separating walls and separating floors. The relevant test procedures are laid down in BS EN ISO 140-4. A single figure 'weighted' result can be obtained from one-third octave band test results by using a curve-fitting procedure laid down in BS EN ISO 717. The subscript 'w' is added to the relevant descriptor (eg $D_{nT,w}$).

The sound reduction index, *R*, is used in the specification of components, such as partitions, doors and windows. It is important to bear in mind that the performance of components in the field is usually lower than can be obtained in a laboratory. The transmission of sound via other components common to both rooms ('flanking transmission') can reduce the apparent sound reduction index (*R*') significantly.

White and Pink Noise

Noise sources, which provide a continuous spectrum over a wide frequency range, are normally used for test purposes. White noise contains constant energy per unit of frequency. Pink noise contains constant energy per octave or one-third octave band.

APPENDIX B

B. GRAPHICAL RESULTS OF UNATTENDED MONITORING