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KILN PLACE
NOISE AND VIBRATION IMPACT ASSESSMENT

RAMBOLL

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NOISE AND VIBRATION IMPACT ASSESSMENT

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1. INTRODUCTION

1.1.1 Ramboll UK Limited has been appointed by EC Harris and the London Borough of Camden Council (LBCC) to undertake a noise and vibration impact assessment of the proposed development at Kiln Place, Camden, London.

1.1.2 This report has been prepared by Ramboll solely for the benefit of EC Harris and LBCC. It shall not be relied upon or transferred to any third party, without the prior written authorisation of Ramboll. Any liability arising out of the use by EC Harris and LBCC, or any third party of this report for purposes not wholly connected with the above shall be the responsibility of EC Harris and LBCC, and such third party who shall indemnify Ramboll against all claims, costs, damages and losses arising out of such use.

1.1.3 Ramboll has endeavoured to assess all information provided to them during this assessment. The report summarises information from a number of external sources and cannot offer any guarantees or warranties for the completeness or accuracy of information relied upon. Information from third parties has not been verified by Ramboll unless otherwise stated in this report.

1.1.5 Refer to Appendix A for noise terminology.

1.1 Site Description

1.1.6 The site is bounded by Lamble Street to the north, Meru Close to the east, Grafton Road to the west, and a railway line to the south.

1.1.7 Residential receptors surround the site in the northern, eastern, and western directions.

1.1.8 Figure 1 overleaf shows the site location and the locations of Sites 1-5 at Kiln Place.

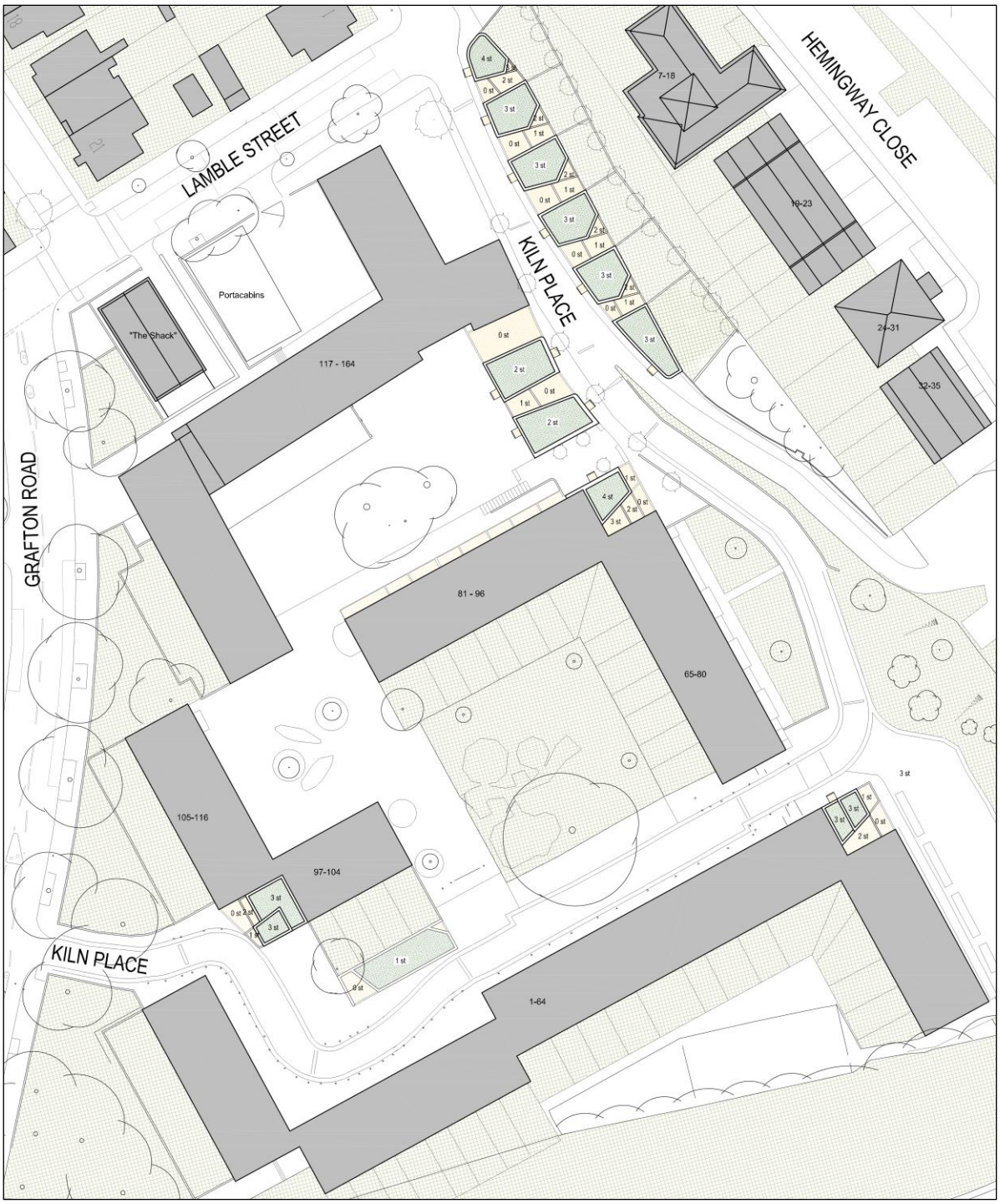

Figure 1 Kiln Place site plan

1.2 Scope of Assessment

1.2.1 The scope of the assessment undertaken within this report is as follows:

- Consultation with the Environmental Health Officer at the London Borough of Camden Council regarding the details of the methodology and scope of the assessment;
- Detailed review of relevant national and regional noise and vibration policy and legislation, in particular LBCC's Core Strategy Policy *DP28 – Noise and vibration*;
- Collection of baseline data to establish the existing background noise levels at the proposed development site. This is to include unattended noise monitoring at a location representative of

the noise climate experienced by the nearest sensitive receptors and additional attended monitoring at a number of locations around the site;

- Assessment of the site suitability for residential development in terms of noise and vibration in accordance with the guidance of LBCC's Core Strategy Policy *DP28 – Noise and vibration*;

- BS5228:2009 *Code of practice for noise and vibration control on construction and open sites (Part 1: Noise and Part 2: Vibration)* assessment of noise and vibration effects arising during the construction phase;

- A qualitative assessment of road traffic noise will be provided;

- BS4142:1997 *Method for rating industrial noise affecting mixed residential and industrial areas* assessment to establish the impact of fixed plant associated with the proposed development on the nearest noise sensitive receptors and to determine whether the predicted noise levels will give rise to complaints;

- BS8233:1999 *Sound insulation and noise reduction for buildings – Code of Practice* assessment, to include World Health Organisation (WHO) Guidelines, of the suitability of the site for residential development, including any necessary mitigation measures to reduce noise from all external sources to the 'good' standard levels for internal and external residential amenity. Recommendations for the design of building envelopes will also be made; and

- Conclusions.

2. RELEVANT POLICY, GUIDANCE AND LEGISLATION

2.1 The National Planning Policy Framework

2.1.1 The National Planning Policy Framework (NPPF) adopted in 2012 in England outlines the Government's planning policies and requirements for the planning system. The NPPF forms a material consideration in planning decisions and hence must be complied with for planning permission to be granted.

2.1.2 Regarding noise, the NPPF 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 noise pollution.

2.1.3 Hence the planning system should seek to:

- Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of planning 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; 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.

2.1.4 To achieve these aims the NPPF refers to the Noise Policy Statement for England 2010.

2.2 Noise Policy Statement for England 2010

2.2.1 The Noise Policy Statement for England (NPSE) sets out the long term vision of Government noise policy: 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.

2.2.2 The NPSE outlines three aims for the effective management and control of environmental, neighbour and neighbourhood noise:

- 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.

2.2.3 The guidance states that it is not possible to have a single objective noise-based measure that defines 'Significant Observed Adverse Effect Level (SOAEL)' that is applicable to all sources of noise in all situations and that not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

2.3 London Borough of Camden Council Core Strategy Policy DP28 – Noise and Vibration

2.3.1 LBCC's Core Strategy recognises the effects that noise and vibration can have on amenity and health and therefore quality of life.

2.3.2 Policy DP28 seeks to ensure that noise and vibration is controlled and managed, preventing planning permission being obtained for:

- Developments which are likely to generate noise pollution; or
- Developments which are sensitive to noise in locations with noise pollution, unless attenuation measures are provided.

2.3.3 Where developments sensitive to noise are proposed close to an existing noise source, the Council requires an acoustic report to ensure compliance with *Planning Policy Guidance (PPG) 24: Planning and noise*, although this guidance is now superseded.

2.3.4 Where developments are proposed close to an existing source of vibration, the Council sets out limits for vibration levels which refer to guidance in BS6472-1:2008 '*Guide to evaluation of human exposure to vibration in buildings – Vibration sources other than blasting'*.

2.3.5 *DP28* sets out Noise and Vibration Thresholds which include an evening period in addition to the day and night standards contained in *PPG24*, and these thresholds are presented in Tables 1 to 4 below. It is not stated within the guidance whether the guideline noise levels are free-field or façade noise levels.

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

Table 1 Noise levels on residential sites adjoining railways and roads at which planning permission will not be granted (Table A of DP28)

Noise description and location of measurement	**Period**	**Time**	**Sites adjoining railways**	**Sites adjoining roads**
Noise at 1m external to a sensitive façade	Day	0700-1900	65 dB $L_{Aeq,12h}$	62 dB $L_{Aeq,12h}$
Noise at 1m external to a sensitive façade	Evening	1900-2300	60 dB $L_{Aeq,4h}$	57 dB $L_{Aeq,4h}$
Noise at 1m external to a sensitive façade	Night	2300-0700	55 dB $L_{Aeq,8h}$	52 dB $L_{Aeq,8h}$
Individual noise events several times an hour	Night	2300-0700	>82 dB L_{Amax} (S time weighting)	>82 dB L_{Amax} (S time weighting)

Table 2 Noise levels on residential streets adjoining railways and roads at which attenuation measures will be required (Table B of DP28)

Vibration description and location of measurement	Period	Time	Vibration levels
Vibration inside critical areas such as a hospital operating theatre	Day, evening and night	0000-2400	0.1 VDV $ms^{-1.75}$
Vibration inside dwellings	Evening	0700-2300	0.2 VDV $ms^{-1.75}$
Vibration inside dwellings	Night	2300-0700	0.13 VDV $ms^{-1.75}$

Table 3 Vibration levels on residential streets adjoining railways and roads at which planning permission will not be granted (Table C of DP28)

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

Table 4 Noise levels from plant and machinery at which planning permission will not be granted (Table E of DP28)

2.4 The London Plan (2011)

2.4.1 The London Plan (Mayor of London, 2011) is the spatial development strategy for Greater London. The main purpose of the London Plan is to ensure that all of the individual plans produced by the London boroughs work together to meet the priorities that are agreed for the whole of the London region.

2.4.2 Policy 7.15 *"Reducing noise and enhancing soundscapes"* states that "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 internal layout in preference to sole reliance on sound insulation; and
- Promoting new technologies and improved practices to reduce noise at source".

2.5 The London Plan: Housing Draft Supplementary Planning Guidance (2011)

2.5.1 The London Plan: Housing Draft Supplementary Planning Guidance (Mayor of London, 2011) was published for public consultation in December 2011. This draft document sets out proposed guidance to supplement the housing policies of The London Plan (2011).

2.5.2 Section 2.3.27 of the guidance states that "in exceptional circumstances, where site constraints make it impossible to provide private open space for all dwellings, a proportion of dwellings may instead be provided with additional internal living space equivalent to the area of the private open space requirement. Enclosing balconies as glazed, ventilated winter gardens will be considered acceptable

alternative to open balconies for all flats and this solution is recommended for all dwellings exposed to NEC C or D" of PPG24.

2.5.3 Section 2.3.29 refers to policy 3.5 of The London Plan and states that the design of new housing developments is required to consider elements that enable the home to become a comfortable place of retreat. Noise is thus considered in this policy.

2.5.4 Standard 5.2.1 states that "developments should avoid single aspect dwellings that are north facing, exposed to NEC C or D, or contain three or more bedrooms".

2.5.5 Standard 5.3.1 refers to policy 7.15 of The London Plan and states that "the layout of adjacent dwellings and the location of lifts and circulation spaces should seek to limit the transmission of noise to sound sensitive rooms within dwellings". Noise from activities in the street and adjoining properties can cause stress, sleep disturbance and friction between neighbours. "All dwellings should be built with acoustic insulation and tested to current Building Regulations standards. However, acoustic insulation should not be relied upon as the only means of limiting noise and the layout and placement of rooms within the building should be considered at an early stage in the design process to limit the impact of external noise on bedrooms and living rooms. The impact of noise should also be considered in the placement of private external spaces."

2.6 BS5228: 2009 'Code of practice for noise and vibration control on construction and open sites'

2.6.1 BS5228: 2009 *'Code of practice for noise and vibration control on construction and open sites'* gives recommendations for basic methods of noise and vibration control relating to construction work. It also provides guidance concerning methods of predicting and measuring noise and vibration and assessing its impact on those exposed to it. The prediction method considers the noise emission level of the plant, the separation distance between the source and the receiver and the effect of the intervening topography and structures.

2.6.2 The DoE Advisory Leaflet (AL) 72 Noise control on building sites is referenced within BS5228. It provides guidance on fixed limits for construction noise:

"Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut. Noise levels, between 07.00 add 19.00hours, outside the nearest window of the occupied room closest to the site boundary should not exceed:

- *70 decibels (dBA) in rural, suburban and urban areas away from main road traffic and industrial noise;*
- *75 decibels (dBA) in urban areas near main roads in heavy industrial areas.*

2.6.3 These limits are for daytime working outside living rooms. When working outside the normal hours say between 19.00 and 22.00 the allowable noise levels from building sites will be less: such as the reduced values given in the contract specification or as advised by the Environmental Health Officer (a reduction of 10dB(A) may often be appropriate). Noisy work likely to cause annoyance locally should not be permitted between 22.00 hours and 07.00 hours."

2.7 BS4142:1997 Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas

2.7.1 British Standard BS4142:1997 *'Method of rating industrial noise affecting mixed residential and industrial areas'* can be used to assess whether noise sources of an industrial nature are likely to give rise to complaints from people residing in nearby dwellings.

2.7.2 The standard describes a method for assessing whether the noise levels from factories, or industrial premises, or fixed installations, or sources of an industrial nature in commercial premises is likely to give rise to complaints from people residing in the affected building. The method is not suitable for

assessing the noise measured inside buildings or when the background and rating noise levels are both very low[1].

2.7.3 The procedure in BS4142:1997 for assessing the likelihood of complaint is to compare the predicted noise level from the source in question, the "specific noise level", with the background noise level. The likelihood of noise provoking complaints is assessed by subtracting the background noise level from the rating noise level. BS4142:1997 states:

"A difference of around +10dB or higher indicates that complaints are likely. A difference of around +5dB is of marginal significance. A difference of -10dB is a positive indication that complaints are unlikely."

2.7.4 The standard also notes that "The greater the difference, the greater the likelihood of complaints."

2.7.5 The following definitions apply:

i. Specific noise level $L_{Aeq,T}$: The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval;

ii. Rating level L_{Ar}: The specific noise level plus any adjustment for the characteristic features of the noise; and

iii. Background noise level L_{A90}: The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90% of a given time interval.

2.8 BS8233:1999 Sound insulation and noise reduction for buildings – Code of Practice

2.8.1 Guidance on the acceptable noise levels for living rooms and bedrooms within residential buildings is given in BS8233:1999 *'Sound insulation and noise reduction for buildings – Code of Practice'*. Advice is given on the design range of internal noise levels, depending on the use of each room and the sensitivity to noise of the operations expected to be conducted in the rooms. An extract of the design levels is reproduced in Table 5.

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

Table 5 Indoor ambient noise design levels (Table 5 of BS8233)

2.8.2 Section 7.6.1.2 of BS8233 suggests that the steady noise level within external residential amenity areas should not exceed 50 dB $L_{Aeq,T}$ and 55 dB $L_{Aeq,T}$ should be regarded as the upper limit.

2.9 World Health Organisation Community Noise Guidelines

2.9.1 The World Health Organisation (WHO) published their 'Guidelines for Community Noise' in 1999. The guidance sets out appropriate noise levels for different scenarios to ensure that communities are not subjected to unacceptable levels of noise. It should be noted that the WHO guidelines, although widely references in the UK, have no legal status.

2.9.2 The guidelines are presented in Table 6 following.

[1] For the purposes of this standard, background noise levels below about 30 dB and rating levels below about 35 dB are considered to be very low.

Specific Environment	Critical Health Effect(s)	L_{Aeq} [dB(A)]	Time Base [hours]	L_{Amax} fast [dB]
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

Table 6 Guideline values for community noise in specific environments

2.9.3 The façades of residential buildings will provide some degree of sound attenuation of outdoor noise levels, which will affect the internal noise levels experienced by occupants. This attenuation is at a minimum when windows are open in the façade of the occupied room. The WHO guidelines indicate that a façade with an open window will provide approximately 15 dB(A) attenuation. However, other sources suggest that this is an upper value and sound attenuation is generally in the range of 10 to 15 dB(A) depending upon the exact situation.

4. METHODOLOGY

4.1 Consultation with London Borough of Camden Council

4.1.1 The Environmental Health Officer (EHO) at LBCC was consulted regarding the assessment methodologies and criteria that have been used for the purpose of the assessments contained in this report. The criteria as adopted in this report are as agreed on 26 February 2014 and 28 March 2014.

4.2 Assessment of Demolition and Construction Noise and Vibration

Construction Noise

4.2.1 Proposed demolition and construction works on the Site would involve the use of a variety of working methods, and operations would vary across the Site throughout the development period. Therefore, noise levels from the works are likely to vary significantly over time as the distance from the noise sources and the type of construction activity vary relative to the sensitive receptors.

4.2.2 The exact working methodology and plant to be employed on Site for the demolition and construction work have not been established at this stage in the design. This level of detail will only be available when specialist demolition and civil engineering contractors are engaged as part of the scheme.

4.2.3 However, following best practice, an estimate of the expected noise levels over a representative period during the construction phase was undertaken using a prediction of the construction methods to be used and noise emission data for plant obtained from BS5228:2009. The assessment assumed that all plant would operate for each phase of work, at a given location within the Site.

4.2.4 Construction noise predictions were based on the methodology contained within BS5228:2009-1. This enabled predictions to be made of the noise emissions from the construction activities for given distances from the Site boundary.

4.2.5 A daytime 10 hour construction noise limit of 65dB L_{Aeq} was considered as the basis for identifying potentially significant construction impacts in accordance with the ABC method of BS5228:2009; in line with the consultation undertaken with LBCC.

4.2.6 The following development stages were considered:

- Contractor's compound;
- Demolition of existing site buildings and structures;
- Earthworks;
- Building substructure works - CFA piling;
- Building substructure works - pile caps / ground beams;
- Building superstructure works; and
- External works.

4.2.7 As noted during the consultations with LBCC, noisy construction work would only be undertaken within daytime hours, between 08.00 and 18.00, Monday to Friday and 08.00 and 13.00 on Saturdays. No work should be undertaken on Sundays or Bank Holidays. If work is required to extend into other periods beyond the core daytime hours, reduced threshold noise levels would apply and separate authorisation would be secured with LBCC.

Construction Vibration

4.2.8 Certain construction activities can produce a significant amount of ground-borne vibration, which has the potential to cause concern at nearby sensitive receptors. There is no accepted method for predicting the vibration at a sensitive receptor due to the ground-borne vibration from construction plant. However, it is possible to provide an estimate based on historical measurements provided within BS5228 and therefore provide some guidance on the likely levels that might be generated during the construction period.

4.2.9 BS5228 suggests that for the majority of people, vibration levels between 0.14 and 0.3 mms^{-1} PPV are just perceptible. Table 7 details the distances at which certain activities give rise to a just perceptible level of vibration. These figures are based on historical field measurements to inform BS5228. The distances provided in Table 7 have been used to assess if vibration from construction activities would result in an impact on surrounding properties.

Construction activity	Distance from activity (m)
Heavy vehicles (e.g. dump trucks)	5-10
Excavation	10-15
Hydraulic breaker	15-20
Driven piling	50-100

Table 7 Distances at which vibration may just be perceptible

4.3 Noise Surveys

4.3.1 Noise surveys were undertaken to establish the existing noise climate around the Kiln Place site against which the assessment of construction and operational noise effects has been determined.

4.3.2 Unattended monitoring was carried out from Wednesday 12 March 2014 to Saturday 15 March 2014 at one location that is noted as monitoring position LT1 on Figure 2.

4.3.3 Short-term attended noise monitoring was undertaken on Thursday 20 March 2014 at four locations as indicated on Figure 2 as ST1-ST4. Measurements were 15 minutes in duration at each location.

Figure 2 Noise monitoring locations

4.3.4 The surveys were carried out using Type 1 Sound Level Meters (SLM). The following equipment was used on site:

i. 2 No. 01dB DUO Sound Level Meters, Type 1, serial numbers 10515 and 10511;
ii. 1 No. 01 dB Outdoor Microphone Kit;
iii. 2 No. 01 dB Acoustic Calibrators, serial numbers 35183003 and 50441973;
iv. 2 No. Heavy duty tripods;

v. 1 No. Outdoor weather protection kit (peli case) containing batteries.

4.3.5 Measurements were taken under free field conditions i.e. >3.5m away from reflecting surfaces unless otherwise stated. All unattended and attended measurements were undertaken at a height of 1.5m above local ground level.

4.3.6 Each SLM had been calibrated to traceable standards within the preceding two years and the calibrator within the previous 12 months; calibration certificates are available upon request.

4.3.7 Each SLM was field calibrated once it was set up in the measurement position and on completion of the survey. No significant drift in the calibration was recorded at any time during the survey.

4.3.8 At each measurement location, a comprehensive suite of noise level metrics were recorded. The following noise level indices are relevant to this assessment:

i. $L_{Aeq,T}$ The A-weighted equivalent continuous noise level over the measurement period;
ii. L_{A90} The A-weighted noise level exceeded for 90% of the measurement period. This parameter is often used to describe background noise; and
iii. L_{AFmax} The maximum A-weighted noise level during the period.

4.3.9 Other metrics were measured and are available for further analysis if required.

4.3.10 The weather conditions during the surveys were dry, with wind speeds mostly below 5m/s in variable direction. Periods of wind speeds in excess of 5m/s were experienced on Friday 14 March 2014 and Saturday 15 March 2014.

4.4 Vibration Survey

4.4.1 Vibration measurements were undertaken to establish the existing vibration levels on the Kiln Place site due to passing trains on railways surrounding the Eastern and Southern site boundaries.

4.4.2 Attended monitoring was carried out on Thursday 20 March 2014 at one location that is noted as monitoring position VM1 on Figure 2.

4.4.3 The following equipment was used on site:

i. 1 No. Svantek SVAN958 Vibration Real Time Analyser, serial number 15812;
ii. 3 No. Piezotronics PCB 393B31 accelerometers, serial numbers 27605, 27623 and 27624;
iii. 1 No. Ground spike; and
iv. 1 No. Magnetic mounting block.

4.4.4 Each of the accelerometers were mounted to the magnetic block, which was attached to the ground spike, which was placed into soft ground.

4.4.5 The real time analyser and accelerometers had been calibrated within the preceding 12 months; calibration certificates are available on request.

4.4.6 Each accelerometer was field calibrated upon setup of the equipment in the measurement position via setting the accelerometer sensitivity on the real time analyser.

4.4.7 The Vibration Dose Value (VDV) was measured during each measurement.

4.4.8 Measurements were averaged over 15 minute intervals and were undertaken over a 1 hour period.

4.4.9 In accordance with the methodology of BS6472-2008:1, the estimated vibration dose value (eVDV) shall be calculated to provide the 16 hour daytime eVDV, for repeated exposures over one day.

4.5 Operational Noise Assessment - Site Suitability for Residential Development

4.5.1 The assessment of the Site's suitability for residential use, in terms of both noise and vibration, will be determined by using the guidelines contained within Camden Policy DP28: Noise and Vibration, and the NPPF as agreed with the LBCC.

4.6 Operational Noise Assessment - Road Traffic Noise

4.6.1 A qualitative assessment of road traffic noise will be provided as traffic data is not available to produce a quantitative assessment in accordance with the methodology of CRTN, as traffic flows around the site are not deemed to be significant.

4.7 Operational Noise Assessment – Plant Noise Assessment

4.7.1 The type, quantity and location of fixed mechanical and electrical (M&E) plant associated with the Proposed Development has not been finalised at this stage in the design and hence it is not possible to fully quantify the building services plant noise impact at the nearest noise sensitive receptors.

4.7.2 The noise levels from M&E plant should be considered once details of the plant are known and it is therefore suggested that noise emissions from plant associated with the Proposed Development is controlled via a suitably worded planning condition.

4.7.3 However, in accordance with the methodology contained within BS4142:1997, rating noise levels ($L_{A,r}$ dB) at the surrounding noise sensitive premises have been provided based upon the lowest measured daytime and night-time noise levels from the baseline survey, and the assessment criteria stipulated by the LBCC.

4.8 Operational Noise Assessment – Internal and External Amenity

4.8.1 Based upon the external building façade noise levels, recommendations will be made for appropriate glazing build-ups in order to achieve the 'good ' criteria of BS8233:1999 and the WHO Guidelines for Community Noise.

4.8.2 The noise levels as measured during the baseline noise survey will be assessed against the BS8233:1999 guidance for noise levels in external amenity spaces, including balconies.

5. NOISE SURVEY RESULTS

5.1 LT1 – Centre of Kiln Place site next to Meru Close

5.1.1 A summary of the noise levels as measured at 1.5m above local ground level in the centre of the Kiln Place site during the survey is presented following in Table 8.

Date	Time Period	Average $L_{Aeq,T}$ dB	Maximum $L_{AF(Max)}$ dB	Average $L_{A90,T}$ dB	Lowest $L_{A90,15min}$ dB (time occurring)
Wednesday 12/03/2014	Daytime* (14.45-19.00)	54.7	91.5	43.7	42.2 (17.15-17.30)
	Evening (19.00-23.00)	49.1	66.5	39.8	38.4 (22.45-23.00)
	Night-time (23.00-07.00)	47.6	68.7	38.0	34.5 (01.30-01.45)
Thursday 13/03/2014	Daytime (07.00-19.00)	51.8	80.1	43.3	40.8 (14.00-14.15)
	Evening (19.00-23.00)	49.0	71.5	39.7	37.6 (22.00-22.15)
	Night-time (23.00-07.00)	48.5	78.1	39.7	36.5 (23.45-00.00)
Friday 14/03/2014	Daytime (07.00-19.00)	56.1	85.4	45.8	41.9 (18.30-18.45)
	Evening (19.00-23.00)	49.7	75.6	42.2	40.2 (22.00-22.15)
	Night-time (23.00-07.00)	50.1	70.7	39.7	35.6 (03.30-03.45)
Saturday 15/03/2014	Daytime** (07.00-13.45)	50.5	76.7	44.2	41.3 (07.15-07.30)

* Readings taken from 14.45 to 19.00 only, not full daytime measurements
** Readings taken from 07.00 to 13.45 only, not full daytime measurements

Table 8 Noise Levels at Monitoring Position LT1

5.2 ST1 – Junction of Oak Village and Lamble Street

5.2.1 A summary of the noise levels as measured at noise monitoring location ST1 is provided following in Table 9.

Time of measurement	Average $L_{Aeq,T}$ dB	Maximum $L_{AF(Max)}$ dB	Average $L_{A90,T}$ dB
11.47-12.02	55.6	71.7	48.9

Table 9 Noise Levels at Monitoring Position ST1

5.2.2 The dominant noise sources at this location included road traffic, passing trains, train horns and nearby scaffolding work at Kiln Place. Other noise sources included pedestrian conversation and distant construction noise.

5.3 ST2 – Centre of Kiln Place site

5.3.1 A summary of the noise levels as measured at noise monitoring location ST2 is provided following in Table 10.

Time of measurement	Average $L_{Aeq,T}$ dB	Maximum $L_{AF(Max)}$ dB	Average $L_{A90,T}$ dB
12.05-12.20	53.5	70.4	47.3

Table 10 Noise Levels at Monitoring Position ST2

5.3.2 The dominant noise sources at this location included road traffic, passing trains, plant extract noise at the nearest residential receptors, train horns and nearby scaffolding work at Kiln Place. Other noise sources included pedestrian conversation, distant construction noise, distant dog barking and distant sirens.

5.4 ST3 – South East of Kiln Place site

5.4.1 A summary of the noise levels as measured at noise monitoring location ST3 is provided following in Table 11.

Time of measurement	Average $L_{Aeq,T}$ dB	Maximum $L_{AF(Max)}$ dB	Average $L_{A90,T}$ dB
12.24-12.39	53.7	67.3	47.5

Table 11 Noise Levels at Monitoring Position ST3

5.4.2 The dominant noise sources at this location included road traffic, passing trains, train horns and nearby scaffolding work at Kiln Place. Other noise sources included overhead aircraft, pedestrian conversation, distant construction noise, rustling leaves and birdsong.

5.5 ST4 – South West of Kiln Place site next to Grafton Road

5.5.1 A summary of the noise levels as measured at noise monitoring location ST4 is provided following in Table 12.

Time of measurement	Average $L_{Aeq,T}$ dB	Maximum $L_{AF(Max)}$ dB	Average $L_{A90,T}$ dB
12.45-13.00	59.3	72.1	49.0

Table 12 Noise Levels at Monitoring Position ST4

5.5.2 The dominant noise sources at this location included on-site and off-site construction noise, road traffic and passing trains. Other noise sources included pedestrian conversation, music in nearby flats and faint wind chimes.

6. DISCUSSION

6.1 Assessment of Demolition and Construction Noise and Vibration

Construction Noise

6.1.1 At this stage in the design, it is understood that the proposed development buildings will comprise the following construction methods:

- Substructure – Continuous flight auger piling solution.
- Superstructure - of existing site buildings and structures; and
- Earthworks.

6.1.2 The construction activities which are associated with this development and have the potential to cause noise impacts are listed below:

- Contractor's compound
- Demolition of existing site buildings and structures;
- Earthworks;
- Building substructure works - CFA piling;
- Building substructure works - pile caps / ground beams; and
- Building superstructure works.

6.2 On-site Construction Activities

6.2.1 Exact details of the construction methods and plant to be employed on site have not been finalised. However, in accordance with industry best practice, an estimate of the expected noise levels over a representative period has been prepared to provide initial guidance on the magnitude of the noise impact on the surrounding noise sensitive receptors. The assessment assumes that all plant would operate for each phase of work, at the closest point to each sensitive receptor without any mitigation measures in place.

6.2.2 Table 13 presents typical items of plant likely to be used during the various phases of demolition and construction works at the site. It should be noted that the types of plant and estimated time periods that they will be operational during the construction activities has been based on experience of similar developments.

Activity	Plant	Est.% on time	Noise level at 10m (dB)*	Noise level per Activity at 10m (L_{Aeq} dB)
Contractor's compound	Generator	100	66	**72**
	Telescopic handler	10	69	
	Lorry pulling up	25	64	
Demolition	Lifting platform	30	62	**76**
	Tracked excavator	75	75	
	Wheeled mobile crane	50	67	
	Lorry pulling up	30	65	
Earthworks	Dozer	50	74	**76**
	Tracked excavator	80	72	
	Lorry pulling up	30	65	
Substructure works (CFA piling)	CFA piling - Crawler mounted rig	80	79	**80**
	Tracked excavator	30	69	

Activity	Plant	Est.% on time	Noise level at 10m (dB)*	Noise level per Activity at 10m (L_{Aeq} dB)
	(inserting cage)			
	Concrete pump	30	73	
	Lorry pulling up	30	65	
Substructure works (pile caps / ground beams)	Tracked excavator	50	70	**77**
	Lorry pulling up	20	63	
	Concrete mixer truck + pump	20	71	
	Poker vibrator	20	71	
	Compressor	50	69	
Superstructure works	Wheeled mobile crane	10	60	**72**
	Lifting platform	20	60	
	Telescopic handler	10	69	
	Compressor for power tools	25	68	
	Lorry pulling up	10	60	

** Noise level accounts for number of plant operating and estimated percentage on-time*

Table 13 Predicted Construction Activities

6.2.3 It should be noted that the plant and possible operations to be used during the construction phase have been estimated using data from similar developments. This enables an indication to be provided of the worst case noise level that would affect the surrounding noise sensitive receptors during the construction period. The assessment assumes that all the plant would be operational at the closest point to each sensitive receptor without any mitigation measures in place.

6.2.4 Table 14 shows the noise levels (dB) at various distances from the activities presented in Table 13 by estimating the noise reduction with distance from the source, assuming 6dB reduction per doubling of distance. A +3dB building façade correction factor has been applied in accordance with BS5228.

Construction Activity	Distance to Receptor (m)				
	10	**20**	**30**	**40**	**50**
Contractor's compound	75	69	65	63	61
Demolition	79	73	69	67	65
Earthworks	79	73	69	67	65
Substructure works - CFA piling	83	77	74	71	69
Substructure works - pile caps / ground beams	80	74	70	68	66
Superstructure works	75	69	66	63	61

Table 14 Site Activities during Construction and Corresponding Noise Levels at Various Distances

6.2.5 Table 14 identifies the distances from the construction activities where the 65dB $L_{Aeq,T}$ threshold criteria will be exceeded. It can be seen that the noise levels are expected to be highest during the CFA piling works, where the threshold criteria is expected to be exceeded at distances of up to 80m from the work activities.

6.2.6 Due to the proximity of the surrounding residential properties at Kiln Place, Oak Village, Meru Close, Hemmingway Close, and Grafton Road, there is potential for the construction works to result in adverse impacts if the key noise producing activities are not adequately mitigated.

6.2.7 Based on the factors outlined above, mitigation measures will be required to control noise arising from the proposed construction works. Mitigation measures are discussed in Section 7 of the report.

Construction Vibration

6.2.8 With reference to Table 7, there is potential for certain construction activities to give rise to a perceptible level of vibration at the nearest noise sensitive receptors at Kiln Place, Oak Village, Meru Close, Hemmingway Close, and Grafton Road.

6.2.9 For the majority of on-site construction activities, the effects of vibration are only likely to be apparent when the works are being undertaken at the closest point to the receptor. However, the exception to this is the proposed CFA piling which may give rise to a perceptible level of vibration during operation.

6.2.10 Construction activities that have the potential to result in vibration impacts will need to be effectively managed so that where practicable, they are undertaken away from sensitive receptors. Where the works cannot be sited in less sensitive locations, the use of alternative techniques and/or plant shall be considered.

6.2.1 It should be noted that the vibration criteria used for the assessment is based on the likelihood of perceptibility, rather than causing damage to property.

6.2.2 Vibration mitigation measures are discussed in Section 7.

6.3 Operational Noise and Vibration Assessment - Site Suitability for Residential Development

Noise

6.3.1 From the unattended noise survey results as presented in Table 8, the average daytime, evening and night-time noise levels in terms of L_{Aeq} are presented following in Table 15.

Daytime average $L_{Aeq12hr}$ dB	Evening average L_{Aeq4hr} dB	Night-time average L_{Aeq8hr} dB
54	49	49

Table 15 Daytime, evening and night-time average noise levels at Kiln Place

6.3.2 The noise levels in Table 8 have been assessed against the criteria in DP28 for sites adjoining railways and roads.

6.3.3 It can be seen that the noise levels in Table 8 do not exceed the noise levels on residential streets adjoining railways and roads at and above which attenuation measures will be required.

6.3.4 The threshold for individual noise events of >82 dB L_{Amax} (slow weighting) during night-time periods was not exceeded at any point throughout the duration of the baseline noise survey.

Vibration

6.3.5 From the attended vibration survey results, the root mean square (r.m.s) acceleration values in terms of m/s^2 for the 15 vibration measurements were averaged to provide an average r.m.s acceleration over a representative 1 hour period.

6.3.6 To calculate a 16 hour daytime eVDV, for comparison with the guidance of *DP28*, the average r.m.s acceleration was used in calculation method B.2 of BS6472:2008-1

6.3.7 The worst case 16 hour daytime eVDV across each of the measurement axes has been calculated to be 0.11 $m/s^{-1.75}$. This does not exceed the vibration levels criteria for inside dwellings (daytime and night-time periods) for residential sites adjoining railways and roads at which planning permission will not be granted, and therefore on-site vibration levels are not deemed significant. Furthermore the site currently comprises residential development and so vibration should not significantly affect future development.

6.4 Operational Noise Assessment - Road Traffic Noise

6.4.1 The Kiln Place site is accessed via Oak Village and Lamble Street to the North, and Grafton Road to the West. On-site vehicle movements are only required for access to properties at Kiln Place and Meru Close, and whilst on site, vehicular flows are travelling at low speeds. Given this, and that the site already comprises residential use, no significant increase in road traffic noise is expected.

6.4.2 Traffic flows at the access via Grafton Road are also travelling at low speeds due to traffic calming restrictions and it was noted during the baseline noise surveys that traffic flows on this road were limited. Given this, and that the site already comprises residential use, no significant increase in road traffic noise is expected.

6.5 Operational Noise Assessment – Plant Noise Assessment

6.5.1 BS4142:1997 considers the background noise to be measured using the L_{A90} metric. Based on the survey results undertaken at measurement position LT1 which was sited in the locality of the nearest residential receptors the relevant background noise levels are as follows:

- Lowest $L_{A90,15min}$ background noise level during the daytime period = 41 dB
- Lowest average $L_{A90,15min}$ background noise level during the daytime period = 44 dB
- Lowest $L_{A90,15min}$ background noise level during the night-time period = 35 dB
- Lowest average $L_{A90,15min}$ background noise level during the night-time period = 39 dB

6.5.2 The levels presented are deemed to be representative of the noise levels experienced at the nearest sensitive receptors. The duration of the background noise level is not defined in the standard but a representative period should be chosen based on the site conditions.

6.5.3 Based upon the lowest background noise levels ($L_{A90,15min}$) measured during the baseline noise survey at LT1, the rating level (L_{Ar} dB) as per BS4142:1997 can be calculated as shown in Table 16. The rating noise levels are designed to -5 dB (A) below the background noise level, in accordance with the consultation undertaken with LBCC.

Daytime rating level $L_{Ar,\ 1hour}$ dBA	Night-time rating level $L_{Ar,5mins}$ dBA
36-39	30-34

Table 16 Daytime and night-time rating levels at the nearest sensitive receptors

6.5.4 Section 1 of BS4142:1997 states that background noise levels below about 30 dB and rating levels below about 35 dB(A) are considered to be very low.

6.5.5 Provided that the noise emissions from all of the M&E plant are within the calculated rating noise level above for the appropriate period then noise emissions from plant can be deemed to be adequately controlled.

6.5.6 A +5dB(A) acoustic feature correction must be applied to the rating level if one or more of the following features occur, or are expected to be present for new or modified noise sources:

- The noise contains a distinguishable, discrete, continuous note (whine, hiss, screech, hum, etc.);
- The noise contains distinct impulses (bangs, clicks, clatters, or thumps); and/or
- The noise is irregular enough to attract attention.

6.5.7 If the acoustic feature correction is applied, the rating noise levels presented must be reduced by 5 dB(A).

6.5.8 The operational hours of the plant to be installed is not known at the time of writing. Therefore daytime and night-time criteria have been defined. If the night-time criterion is satisfied, the daytime criterion will be met.

6.6 Operational Noise Assessment – Internal Noise Levels

6.6.1 In terms of absolute noise levels, BS8233:1999 specifies that (L_{Aeq}) noise levels should be between 30-40 dB(A) for good to reasonable resting/sleeping conditions within living rooms and 30-35 dB(A) for bedrooms. In accordance with BS8233:1999 and the WHO Guidelines for Community Noise, a level of 45 dB L_{AFmax} in bedrooms should not be exceeded.

6.6.2 These are internal noise levels and therefore with 10-15 dB(A) of attenuation that would be provided with an 'open window' arrangement, this gives an external façade design level between 45-55 dB $L_{Aeq,16hr}$ for living rooms and 45-50 dB $L_{Aeq,16hr}$ for bedrooms.

6.6.3 It can be seen that from Table 8 that the daytime façade noise levels are expected to be greater than 50 dB L_{Aeq} and therefore a natural ventilation strategy based purely on opening windows would not be sufficient to control internal ambient noise levels to achieve the 'good' criterion of BS8233:1999.

6.7 Operational Noise Assessment – Noise Levels in Outdoor Amenity Spaces

6.7.1 BS8233:1999 and the WHO Guidelines recommend an upper ambient noise level of 55 dB L_{Aeq} in outdoor amenity spaces. The results of the noise survey as shown in Table 8 indicate that there will be periods when this criterion will be exceeded; although the background noise levels are mostly below the criterion. However this is deemed typical of outdoor amenity spaces in London.

7. MITIGATION

7.1 Demolition and Construction Noise

7.1.1 As noted previously, in the absence of mitigation, adverse noise effects are likely to arise during the demolition and construction phase of the Proposed Development. At this stage, the detailed methodology for the works has not been defined and consequently specific mitigation measures cannot be given. However, standard best practice controls and measures would be adopted on-site to ensure that noise management forms an integral part of the contractors' scope of works.

7.1.2 A Construction Environment Management Plan (CEMP) will be prepared which will define mitigation measures to be adopted to minimise noise and vibration emissions at surrounding sensitive receptors. This will incorporate specific measures within all phases of the works where noise and vibration may give rise to disturbance. It is expected that the CEMP will be secured by means of an appropriately worded planning condition.

7.1.3 Best practicable means (BPM) as defined by the Control of Pollution Act 1974, will be implemented as part of the working methodology. This will serve to minimise the noise and vibration effects at receptors in the vicinity of the construction works. The reduction in noise levels provided through the implementation of BPM varies depending on the nature of the works; however, values in excess of 10 dB can be expected through a combination of appropriate measures.

7.1.4 Typical BPM measures which could be implemented are listed below:

- Restrict working hours;
- Plan working hours to take account of the effects of noise and vibration upon persons in areas surrounding site operations and upon persons working on-site;
- Where reasonably practicable, adopt quiet working methods, using plant with lower noise emissions;
- Where reasonably practicable, adopt working methods that minimise vibration generation;
- Locate plant away from noise and vibration sensitive receptors, where feasible;
- Use silenced and well-maintained plant conforming with the relevant EU directives relating to noise and vibration;
- Avoid unnecessary revving of engines and switch off equipment when not required;
- Keep internal haul routes well maintained;
- Use rubber linings for chutes and dumpers to reduce impact noise;
- Minimise drop height of materials;
- Start-up plant and vehicles sequentially rather than all together;
- Carry out regular inspections of noise mitigation measures to ensure integrity is maintained at all times;
- Provide briefings for all site-based personnel so that noise and vibration issues are understood and mitigation measures are adhered to;
- Manage plant movement to take account of surrounding noise sensitive receptors, as far as is reasonably practicable; and
- Carry out compliance monitoring of on-site levels to ensure that the agreed noise and vibration limits are being adhered to.

7.1.5 Hoarding 2.4 m high would be erected around the working areas, which will serve to provide acoustic screening to the nearby noise sensitive receptors.

7.1.6 The further use of temporary acoustic screens and/or enclosures may need to be adopted for all static items of plant which generate noise levels that have the potential to cause disturbance. Any specific construction activities requiring acoustic screening will be defined as part of the CEMP process, which may include demolition activities and elements of the earthworks/external works.

7.1.7 Community liaison and communication regarding construction works should be undertaken throughout the construction phase to provide information to people residing in properties located in the vicinity of the construction works, to reduce the likelihood of adverse effects on the local community which could result in potential noise complaints. The level of engagement required would vary during the

construction period, depending upon the expected effects experienced by individual receptors due to the construction works.

7.1.8 Details relating to liaison with the local community will be managed by the Contractor. It is envisaged that community liaison will provide local residents with the following information in relation to the construction works:

- The nature of the works being undertaken;
- The expected duration of the works;
- The contractor's working hours;
- Mitigation measures that have been adopted to minimise noise and vibration, as detailed in the CEMP;
- Contact details in the event of a noise disturbance; and
- If work is required to extend into periods beyond the agreed hours, separate authorisation should be secured with LBCC via the CEMP.

Considerate Constructors Scheme

7.1.9 It is intended that the development will be registered with the Considerate Constructors Scheme. The Scheme strives to minimise any negative impact that construction activities may have on neighbourhoods, while leaving behind long-lasting benefits that enhance communities.

7.2 Operational Noise Assessment - Site Suitability for Residential Development

7.2.1 The mitigation measures required in order to achieve internal ambient noise level criteria are discussed in Section 7.5.

7.2.2 The existing buildings at Meru Close and Hemmingway Close are expected to provide screening to the developments at Sites 1-4 from the railway line at the east of the site. Therefore further design considerations are not expected to be required in order to achieve internal ambient noise level criteria, e.g. placing the least sensitive rooms at the worst affected façades, such as toilets and bathrooms, and placing living rooms and bedrooms on shielded façades, in order to minimise the likelihood of daytime and sleep disturbance to future occupants.

7.2.3 The proposed development at Site 5 may be subject to increased noise levels due to greater exposure to the road network, i.e. Grafton Road, and the railway to the south of the site. Careful consideration should be given to the internal layout of these properties in order to minimise the impacts to future occupants of these units.

7.2.4 Mitigation measures are not deemed to be required to attenuate vibration levels on site.

7.3 Operational Noise Assessment - Road Traffic Noise

7.3.1 As no perceptible increase in road traffic noise is expected to occur as the site currently comprises residential development, no mitigation measures are proposed.

7.4 Operational Noise Assessment – Plant Noise Assessment

7.4.1 The following mitigation measures should be taken into account by the design team at the detailed design stage:

- Where possible, placing fixed plant installations internally;
- Selection of low noise emission plant;
- Use of enclosures, acoustic louvres and acoustic barriers;
- Selection of appropriately sized attenuators; and
- Operating plant installations at reduced duty during night-time periods.

7.4.2 It is recommended that the noise levels from fixed plant installations should be considered once details of the building services plant are known and it is therefore suggested that noise emissions from plant associated with the Proposed Development are controlled via a suitably worded planning condition.

7.5 Operational Noise Assessment – Internal Noise Levels

7.5.1 A combination of standard double glazing and acoustic ventilators are expected to be sufficient to control internal ambient noise levels to within the BS8233:1999 'good' criterion.

7.5.2 Glazing should meet a minimum specification of R_W 30 dB so as not to compromise the sound insulation performance of the façade. This could typically be achieved with a specification of 6mm glass, 12mm air gap, and 6mm glass, however the sound insulation performance of the glazing must be confirmed by the manufacturer. This assumes the building fabric provides a sound insulation performance in excess of R_W 40 dB.

7.5.3 Acoustic ventilators of minimum performance 30 dB $D_{n,e,w}$ should be sought so as not to compromise the sound insulation performance of the façade.

7.5.4 The recommended sound insulation performance is expected to meet the WHO Guidelines criterion 45 dB L_{AFmax} inside bedrooms based upon the 10^{th} highest L_{AFmax} value measured during the survey period of 68 dB L_{AFmax}. This approach recognises that the suggested 45 dB(A) limit should not be exceeded more than 10-15 times in the night.

7.5.5 The required sound insulation performance is not deemed to be onerous.

7.6 Operational Noise Assessment – Noise Levels in Outdoor Amenity Spaces

7.6.1 No mitigation measures are proposed in order to reduce noise levels in outdoor amenity spaces. Although at periods the criterion for outdoor amenity spaces will be exceeded, this is deemed typical of a London location.

8. CONCLUSIONS

8.1.1 Ramboll UK Limited has been appointed by EC Harris and the London Borough of Camden Council (LBCC) to undertake a noise and vibration impact assessment of the proposed development at Kiln Place, Camden, London.

8.1.2 A detailed review of relevant national, regional and local policy has been undertaken.

8.1.3 The EHO at LBCC was consulted regarding the assessment methodologies and criteria as adopted for the assessments contained in this report.

8.1.4 Unattended monitoring was undertaken at 1 location between Wednesday 12 March 2014 and Saturday 15 March 2014 to assess the current noise climate at the Lloyd House building. Attended monitoring was undertaken at 4 locations on Thursday 20 March 2014. Attended vibration monitoring was undertaken over a 1 hour period on Thursday 20 March 2014 to establish the current vibration levels on site due to railways lines at the site boundary.

8.1.5 A construction noise and vibration assessment has been undertaken based upon likely construction activities to occur at the proposed development site. Likely construction noise levels are predicted to be more than 10 dB(A) greater than background noise levels at the proposed development site. There is potential for significant impacts at the nearest sensitive receptors if key noise producing activities are not adequately mitigated.

8.1.6 Due to the proximity of the sensitive receptors in the vicinity of the application site boundary, it is likely that some vibration will be perceptible in the properties during construction activities.

8.1.7 The site suitability for residential development in terms of noise and vibration have been determined in accordance with LBCC policy; DP28. The assessment found that noise levels at the site do not exceed the criteria for attenuation measures to be required, and that the estimated Vibration Dose Value (eVDV) as experienced by on-site residential receptors does not exceed guideline criteria.

8.1.8 A qualitative assessment of road traffic noise levels has been provided. The change in vehicular movements due to the proposed development is not expected to give rise to a significant change in noise levels at the façade of the nearest sensitive receptors.

8.1.9 The type, quantity and location of mechanical and electrical plant associated with the proposed development have not been defined at this stage in the design and hence it is not possible to fully quantify the noise impact at the nearest noise sensitive receptors. Therefore daytime and night-time rating noise levels have been recommended to be considered during the detailed design stage in order to achieve the LBCC criterion of -5dB below the background noise level. It is therefore suggested that noise emissions from plant associated with the proposed refurbishment is controlled via a suitably worded planning condition.

8.1.10 Suitable façade sound insulation performances have been provided in order to achieve the 'good' criterion of BS8233:1999 and WHO Guidelines.

8.1.11 It is likely that there will be periods in which the upper ambient noise level of 55 dB L_{Aeq} in outdoor amenity spaces will be exceeded; although the background noise levels as measured during the surveys are mostly below the criterion. However this is deemed typical of outdoor amenity spaces in London.

8.1.12 Mitigation measures for the construction and operational phases have been identified. With the application of appropriate mitigation measures, it is considered that all significant noise and vibration issues associated with the construction and operational phases of the proposed development can be controlled and minimised to acceptable levels.

APPENDIX 1
ACOUSTIC TERMINOLOGY

Term	Definition
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20μPa ($20x10^{-6}$ Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by 20 log10 (s_1/s_2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the time period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$ or Background Noise Level	A noise level index defined as the noise level exceeded for 90% of the time over the time period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5 metres
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS5969.