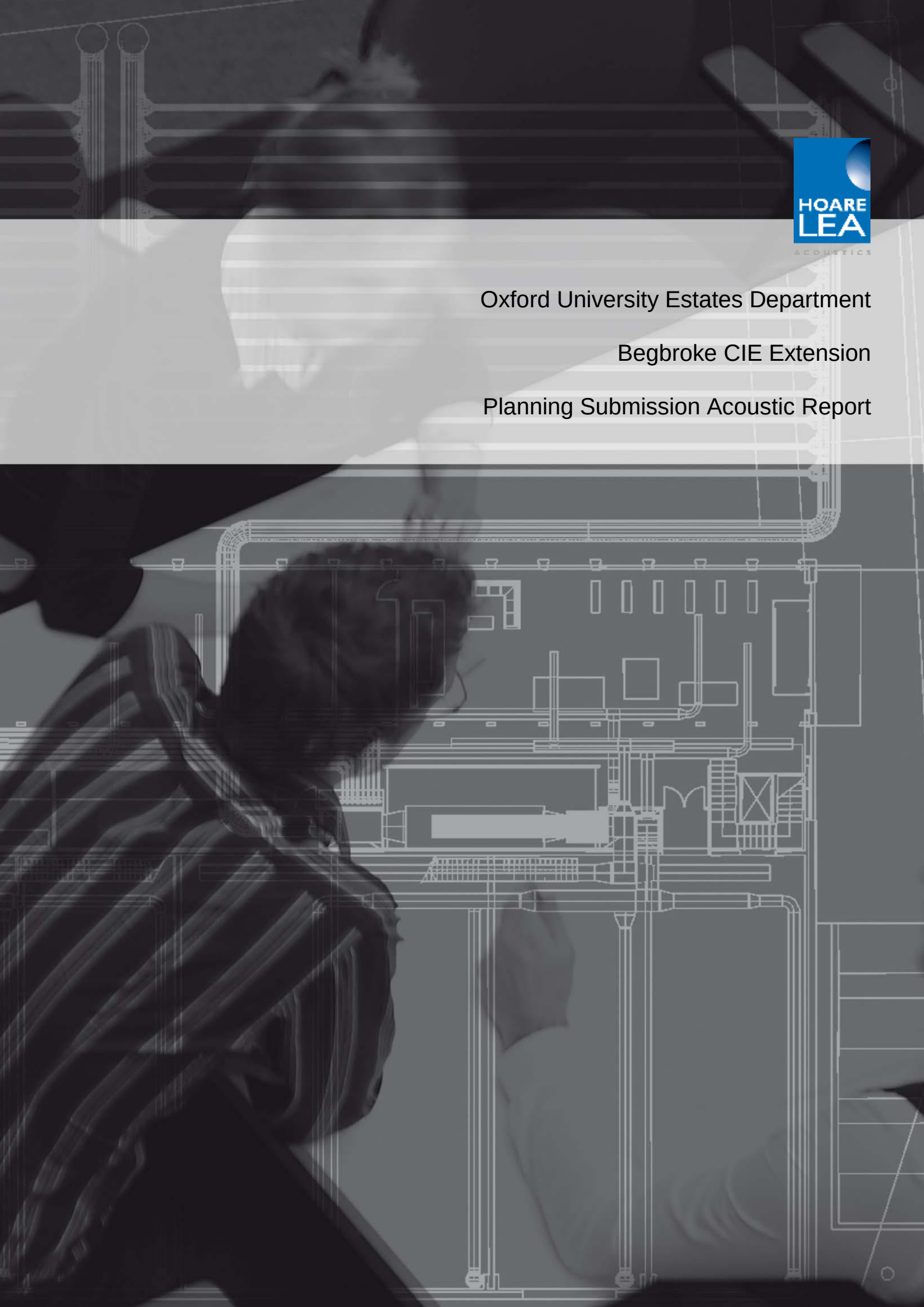

Oxford University Estates Department

Begbroke CIE Extension

Planning Submission Acoustic Report

Oxford University Estates Department

Begbroke CIE Extension

Planning Submission Acoustic Report

Tel: +44 (0) 1454 201 020
Fax: +44 (0) 1454 201 704

140 Aztec West Business Park
Almondsbury
Bristol BS32 4TX

Audit Sheet

Revision	Description	Date	Issued by	Reviewed by
0	For Review	15/05/2015	RI	GV
1	For Issue	22/05/2015	RI	GV
2	On-site noise sources included	02/06/2015	RI	GV
3	Client comments included	10/06/2015	RI	-

Contents

1.0 Introduction

Oxford University Estates Department has appointed Hoare Lea Acoustics to prepare an acoustic report in support of the planning application for the proposed extension of the Centre for Innovation and Enterprise (CIE) building at Begbroke Science Park, Begbroke, Oxfordshire. The proposal includes extending the existing building to the east to provide additional spaces for office and research uses.

Noise surveys have been conducted at the proposed development site to characterise the prevailing noise climate.

National and Local Planning Policy have been reviewed in respect of noise and a report prepared to address these issues.

There is mention of vibration in the Local Authority guidance. A subjective assessment of the site did not identify any cause for concern regarding vibration and so this has not been assessed any further at this stage.

2.0 Policy

2.1 National Planning Policy

2.1.1 National Planning Policy Framework

The NPPF sets out the Government's planning policies for England and how these are expected to be applied.

Section 11 para 123 of NPPF states:

'Planning policies and decisions should aim 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 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 upon them because of changes in nearby land uses since they were established;*
- *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*;'

Reference is made to the DEFRA Noise Policy Statement for England 2010 (NPSE). This latter document is intended to apply to all forms of noise other than that which occurs in the workplace and includes environmental noise and neighbourhood noise in all forms.

NPSE advises that the impact of noise should be assessed on the basis of adverse and significant adverse effect but does not provide any specific guidance on assessment methods or limit sound levels. Moreover, the document advises that it is not possible to have *'a single objective noise-based measure…that is applicable to all sources of noise in all situations'*. It further advises that the sound level at which an adverse effect occurs is '*likely to be different for different noise sources, for different receptors and at different times'*.

2.1.2 Planning Practice Guidance 2013

The Planning Practice Guidance (PPG), published on line by the Department for Communities & Local Government, provides greater details in relation to the relevance of noise to planning following the introduction of the NPPF and NPSE.

It states under the heading *'How to Determine the Noise Impact'* that the following should be considered by local authorities:

- *'whether or not a 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.'*

The overall effect of both construction and when a development is complete should be considered.

In line with NPSE this includes identifying where noise exposure is above or below the significant observed adverse effect level and the lowest observed adverse effect level for a given situation. The observed effects are defined in the table below which is detailed in the section headed *'How to Recognise when Noise could be a concern?'*

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows for some of the time because of the noise. Potential for non-awakening sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. having to keep windows closed most of the time, avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

Table 1: PPG Noise Exposure Hierarchy

It is important to note that no specific noise parameters are defined in the text or target noise levels provided.

Under the heading *'What factors influence whether noise could be a Concern?'* the subjective nature of noise is discussed. It is stated that there is no simple relationship between noise levels and the impact on those affected. This depends on how various factors combine in particular situations, these include:

- *'The source and absolute level of the noise together with the time of day it occurs. Some types and level of noise will cause a greater adverse effect at night than if they occurred during the day*

– this is because people tend to be more sensitive to noise at night as they are trying to sleep. The adverse effect can also be greater simply because there is less background noise at night;

- *For non-continuous sources of noise, the number of noise events, and the frequency and pattern of occurrence of the noise;*
- *The spectral content of the noise (i.e. whether or not the noise contained particular high or low frequency content) and the general character of the noise (i.e. whether or not the noise contains particular tonal characteristics or other particular features). The local topology and topography should also be taken into account along with the existing and, where appropriate, the planned character of the area.'*
- *'Consideration should also be given to whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time. In both cases a suitable alternative means of ventilation can be found in the Building Regulations;*
- *In cases where existing noise sensitive locations already experience high noise levels, a development that is expected to cause even a small increase in noise may result in a significant adverse effect occurring even though little to no change in behaviour would be likely to occur.*
- *If external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended.'*

2.2 Local Planning Policy

Cherwell District Council (CDC) is the Local Authority for this development

2.2.1 Cherwell Local Plan

CDC's *Cherwell Local Plan* was published in 1996 and contains the Local Authority's policies for developments in the area. The policies relating to noise that are relevant to this development are reproduced below.

> *"ENV1 DEVELOPMENT WHICH IS LIKELY TO CAUSE MATERIALLY DETRIMENTAL LEVELS OF NOISE, VIBRATION, SMELL, SMOKE, FUMES OR OTHER TYPE OF ENVIRONMENTAL POLLUTION WILL NOT NORMALLY BE PERMITTED.*
>
> *10.4 The Council will seek to ensure that the amenities of the environment, and in particular the amenities of residential properties, are not unduly affected by development proposals which may cause environmental pollution, including that caused by traffic generation. In addition to the above policy, policies AG3 and AG4 of chapter 8 relate specifically to intensive livestock and poultry units and associated problems of smell and waste disposal.*
>
> *10.5 Where a source of pollution is already established and cannot be abated, the Council will seek to limit its effect by ensuring that development within the affected area maintains a suitable distance from the pollution source."*

CDC's *Cherwell Local Plan* does not provide guidance on appropriate internal noise levels for offices and does not provide noise limits for fixed items of plant.

2.2.2 Local Authority Consultation

As part of the preparation for the assessments in this report, Cherwell District Council were contacted by phone to establish if they have any requirements regarding appropriate internal noise levels for offices and noise from fixed items of plant associated with the development. A response was not received by Hoare Lea Acoustics and so guidance has been taken from the relevant British Standards.

2.3 British Standard 8233

British Standard 8233:2014 Guidance on sound insulation and noise reduction for buildings (BS 8233) came into effect in February 2014 and supersedes all previous editions of the standard. The standard provides information on the design of buildings such that the internal acoustic environment is appropriate to the building's function. This includes control of externally generated noise, noise from plant and services within the building, and room acoustics for non-critical situations.

The standard gives typical noise levels that should be expected in non-domestic buildings. The values given for *Study and work requiring concentration* can be considered appropriate for offices and have been applied to various office sizes as shown below. For further guidance the standard directs the reader to the British Council for Offices publication.

BS 8233 Location	Interpretation appropriate for offices	Design Range, $L_{Aeq,T}$, dB
Library, gallery, museum	Open plan office (more than 5 people)	40 – 50
Staff/meeting room, training room	Multi-person office (3 to 5 people)	35 – 45
Executive office	Single/Double office (1 or 2 people)	35 – 40

Table 2: Interpretation of BS 8233:2014 typical non-domestic noise levels for office uses

2.4 British Standard 4142

British Standard 4142:2014 Methods for rating and assessing industrial and commercial sound (BS 4142) is applicable to the determination of the following levels at outdoor locations:

a) rating levels for sources of sound of an industrial and/or commercial nature; and
b) ambient, background and residual sound levels,

for the purposes of:

1) investigating complaints;
2) assessing sound from proposed, new, modified or additional source(s) of sound of an industrial and/or commercial nature; and
3) assessing sound at proposed new dwellings or premises used for residential purposes.

Weather conditions should be monitored and recorded. Caution is advised of rain influence and measurements in wind speeds greater than 5 m/s.

The specific sound (i.e. that generated by the source or sources of interest) should be measured or determined using a 1 hour period during the daytime (07:00 hours to 23:00 hours) and a 15 minute period at night (23:00 hours to 07:00 hours).

The monitoring duration should reflect the range of background sound levels for the period being assessed. In practice, there is no "single" background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment should be representative of the period being assessed. Measure the background sound level at times when the specific sound source(s) is intended to be operated.

Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, a character correction is added to the specific sound level to obtain the rating level. Three methods are described in BS 4142:2014[(3)] for this purpose:

a) subjective method;
b) objective method for tonality;
c) reference method.

NOTE 1 Sound with prominent impulses has been shown to be more annoying than continuous types of sound (without impulses or tones) with the same equivalent sound pressure level.

NOTE 2 The rating level is equal to the specific sound level if there are no such features present or expected to be present.

A sliding scale between 0 dB(A) and 6 dB(A) additional correction is commonly applied to continuous sound and 0 dB(A) to 9 dB(A) for impulsive sound depending on perceptibility at the sensitive receptor locations.

Consider the level of uncertainty in the data and associated calculations. Where the level of uncertainty could affect the conclusion, take reasonably practicable steps to reduce the level of uncertainty. Report the level and potential effects of uncertainty.

Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level, and consider the following.

a) Typically, the greater this difference, the greater the magnitude of the impact.
b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration.

2.5 Guide to Specification 2014

The British Council for Offices publication *Guide to specification 2014* (BCO Guide) is a best practice guide that provides recommendations for various aspects to be considered for modern office buildings. The chapter on acoustics gives guidance on controlling noise levels inside an office building by considering externally generated noise, internally generated noise from the building services plant and occupational sources such as office equipment.

It states that noise intrusion from external sources should not exceed the following noise ratings and maximum noise levels (for naturally ventilated spaces the values may be relaxed):

- Open plan offices: NR40 ($L_{eq,T}$) and L_{AFmax} 55 dB
- Speculative offices: NR38 ($L_{eq,T}$) and L_{AFmax} 55 dB
- Cellular offices and meeting rooms: NR35 ($L_{eq,T}$) and L_{AFmax} 50 dB

3.0 Site description

The proposed development site is directly adjacent to the east of the existing CIE building at Begbroke Science Park, Begbroke, Oxfordshire. The proposal includes extending the existing building to the east to provide additional spaces for office and research uses.

The site is in a predominately rural location. Adjacent to the east, south and west of the proposed extension are the other buildings that make up Begbroke Science Park. Agricultural land surrounds the Science Park with residential dwellings beyond. There is a railway line approximately 600 metres to the east with Kidlington beyond. Residential dwellings along Sandy Lane are approximately 375 metres to the south. The A44 Woodstock Road (a busy dual carriageway) is approximately 700 metres to the west. Residential dwellings along Fernhill Road are approximately 390 metres to the north separating the site from London Oxford (Kidlington) Airport approximately 1.5 km away.

The acoustic environment at the site is predominately made up of activities local and inherent to the Science Park. Sources include noise from fixed items of plant (particularly the roof mounted items associated with the nearby Hirsch Building and IAT Building) and vehicles using the service roads and carpark. Intermittent noise sources include light aircraft and helicopters movements associated with the nearby airport and rail movements on the nearby railway line. Road traffic noise from the A44 was minimal.

Figure 1 shows an aerial view of the site with the noise sources and receptors discussed highlighted.

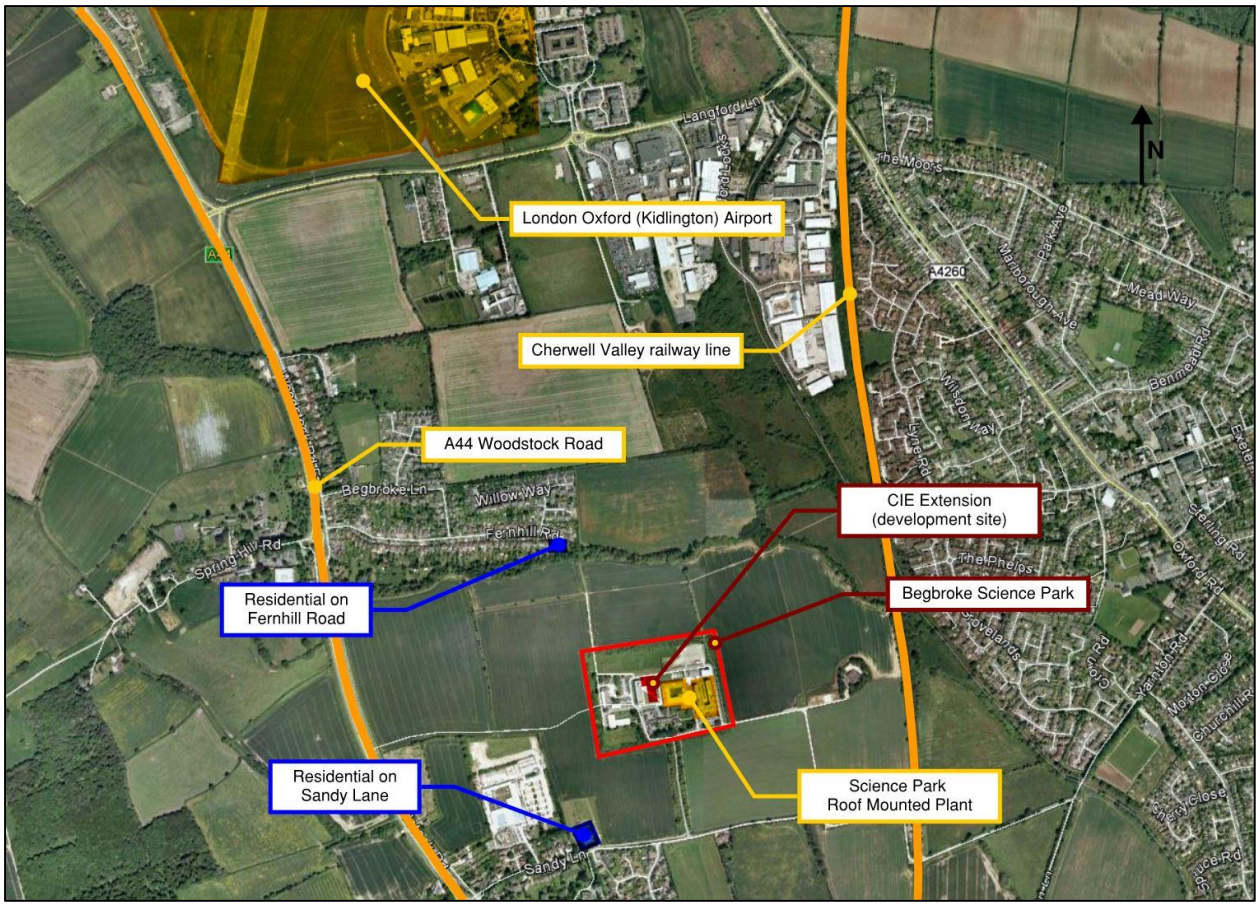

Figure 1: Site location (red), local noise sources (orange) and closest receptors (blue).

4.0 Noise Survey Methodology

4.1 Unattended Survey

An unattended acoustic survey was undertaken between Friday 1st May 2015 and Wednesday 6th May 2015 to establish the prevailing noise climate at the site. The surveys were conducted at a single location on the northern façade of the existing CIE building: a location representative of the proposed façade of the extension.

The survey was conducted to establish the noise levels resulting from rail noise and aircraft noise affecting the development and to establish the background noise levels in the area.

The survey was conducted at ground floor level at a height of 1.4 metres and can be assumed to be under façade conditions as the microphone was positioned within 1 metre of the existing elevation. The survey location is shown below on the proposed site plan.

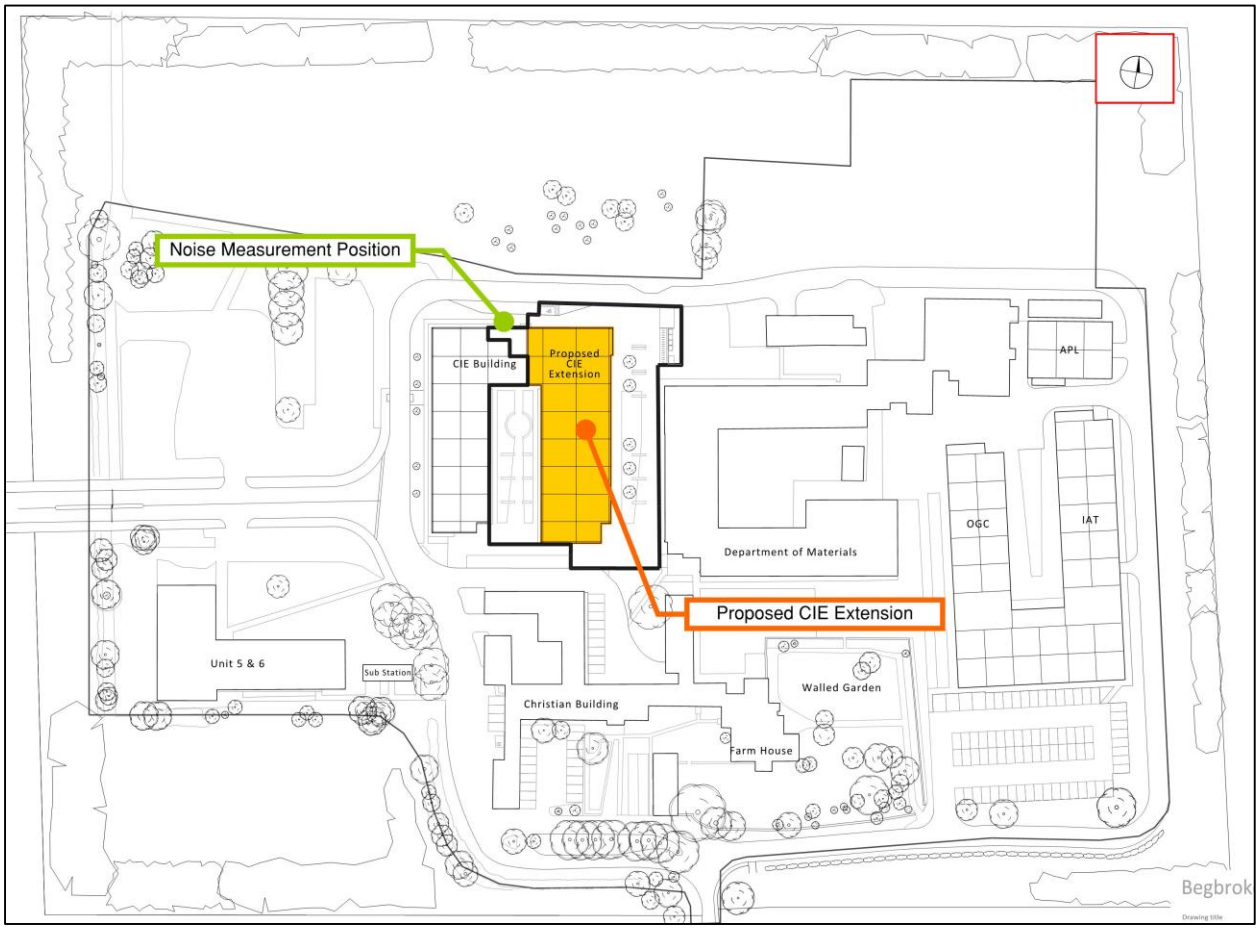

Figure 2: Proposed Site Plan (SRA Architects Drawing 3141-050-E) showing noise measurement position with development highlighted.

Throughout the survey period, the measurements recorded at the unattended position consisted of continuous 15 minute samples of the following A-weighted broadband fast-time weighted noise metrics: ambient noise levels ($L_{Aeq,15min}$), maximum noise levels ($L_{AFmax,15min}$) and background noise levels ($L_{A90,15min}$).

Construction works (including a mini excavator with breaker attachment) underway outside the Christian Building meant that noise measurements could not be made close to the locations of the eastern, southern and western elevations of the development building without the results being unduly affected. The measurement position was a compromise: the location was close to the refuse store and the rear exit to the existing building. For this reason maximum noise levels recorded may be excessive. A factor in deciding on the chosen measurement position was it provided a means of securing the equipment.

During the survey period the weather was suitable for noise measurements to be undertaken being generally fine and dry with light winds.

The equipment used during the surveys is shown in Appendix A. The equipment was calibrated prior to and at the conclusion of each set of measurements with no significant drift observed.

4.2 Attended Surveys

In addition to the unattended measurements, attended measurements were made at ground level adjacent to the logging sound level meter.

The attended measurements were made on Friday 1st May 2015 The attended measurements were all made at a height of 1.4 metres above the ground and can be considered to be under façade conditions as the microphone was positioned within 1 metre of the existing elevation.

The attended measurements recorded 15 minute duration samples of ambient, background and maximum noise levels synchronised with the logging sound level meter and a selection of events including aircraft, rail movements and vehicles on the service road.

The attended measurements were A-weighted and made in broadband, octave band and third octave band resolution.

The weather was suitable for noise measurements to be undertaken being generally fine and dry with the maximum wind speed measured as 4.5 m/s.

The equipment used during the survey is shown in Appendix A. The equipment was calibrated prior to and at the conclusion of each set of measurements with no significant drift observed.

5.0 Noise Survey Results

5.1 Unattended Survey

Table 3 shows the façade noise levels measured by the unattended logging sound level meter during the daytime (07:00 hours to 23:00 hours). Night-time noise levels are given in Table 4. Appendix B provides the measured noise level time history at this location.

Date	Duration, T	$L_{Aeq,T}$, dB	Minimum $L_{A90,15\ min}$, dB
Friday 1st May 2015	9 hour 15 min	52	36
Saturday 2nd May 2015	16 hour	46	35
Sunday 3rd May 2015	16 hour	48	34
Monday 4th May 2015	16 hour	46	35
Tuesday 5th May 2015	16 hour	58	38
Wednesday 6th May 2015	6 hour 45 min	58	45

Table 3: Unattended measured daytime façade noise levels.

Date	Duration, T	$L_{Aeq,T}$, dB	Minimum $L_{A90,15\ min}$, dB
Friday 1st May 2015	8 hour	45	32
Saturday 2nd May 2015	8 hour	39	31
Sunday 3rd May 2015	8 hour	41	32
Monday 4th May 2015	8 hour	42	33
Tuesday 5th May 2015	8 hour	43	33

Table 4: Unattended measured night-time façade noise levels.

Table 2 shows that the measured daytime ambient noise ranged from 46 dB to 58 dB $L_{Aeq,T}$. The minimum measured background noise levels during the day was measured as 34 dB $L_{A90,15\ min}$.

Table 3 shows that the night-time ambient noise levels ranged from 39 dB to 45 dB $L_{Aeq,T}$. Background noise levels during the night were measured as low as 31 dB $L_{A90,15\ min}$.

The ambient noise level measured during working hours (taken as 08:30 to 18:30 Monday to Friday) is 56 dB $L_{Aeq,T}$.

The maximum noise levels are shown in Appendix B but have not been included in the tables above as they are considered excessive due to the close proximity of the measurement location to the refuse store and access door. The maximum events from the attended survey are more reliable and so will be used in any assessments. Night-time noise levels are not relevant for this development.

5.2 Attended Surveys

The maximum difference between the broadband synchronised measurements was 0.7 dB(A). Table 5 shows the octave band ambient noise level spectra. Table 6 shows the octave band resolution maximum noise level spectra.

Start Time	$L_{eq,15min}$, dB								
	A-weighted Broadband	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
14:45	52	35	41	46	46	46	39	34	23
15:00	49	32	40	44	45	42	34	24	16

Table 5: Synchronised octave band ambient noise level spectra.

Start Time	$L_{max(fast),15min}$, dB								
	A-weighted Broadband	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
14:45	70	35	54	69	57	60	52	35	23
15:00	70	31	60	67	65	56	45	29	14

Table 6: Synchronised octave band maximum noise level spectra.

Table 7 shows the maximum noise level spectra for the event measurements.

Event	Duration, T	$L_{max(fast),T}$, dB								
		A-weighted Broadband	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Car on access rd.	5 s	54	51	57	62	44	43	33	32	16
Car on access rd.	5 s	54	51	57	62	44	43	33	32	16
Car on access rd.	15 s	62	61	52	53	56	58	56	49	40
Helicopter	17 s	60	58	65	68	50	41	38	32	21
Light Aircraft	10 s	55	56	57	63	46	40	34	32	18
Light Aircraft	6 s	54	57	53	59	52	44	42	36	30
Light Aircraft	6 s	57	60	62	52	51	51	50	46	39
Light Aircraft	14 s	76	71	65	73	77	68	55	46	43
Light Aircraft	16 s	81	71	73	83	83	70	64	44	30
Train	14 s	66	63	64	68	64	60	57	54	49

Table 7: Event maximum noise level spectra.

From Tables 6 and 7 it can be said that the maximum façade noise levels are in the region of c. 68 dB $L_{FAmax,T}$.

6.0 Noise Assessments

6.1 Indoor Noise Levels

Internal noise levels have been predicted based on the measured noise levels and the Architect's current elevations and plans. A traditional masonry construction with standard double glazed units suitable for thermal insulation have been assumed. Open window ventilation (100 mm opening) has been included.

The predicted internal noise levels from noise break in are:

Ambient noise	c. 41 dB(A) and NR 36 ($L_{eq,T}$)
Typical maximum	c. 55 dB $L_{AFmax,T}$

The above calculated noise levels are in line with the guideline values given in BS 8233 and the BCO Guide. The advice at this stage is that a traditional façade construction with natural ventilation will provide adequate sound insulation for a speculative office environment at this location.

A more thorough analysis of the façade construction and ventilation strategy will be undertaken during the detailed design stage.

6.2 Noise from Fixed Items of Plant

The guidance given in BS 42142 has been followed in order to establish noise limits for the fixed items of plant associated with the development. The noise limits will ensure that the noise from the development will have a low impact on the nearby receptors.

The method prescribed in BS 4142 is to establish the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. If the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.

Due to the rural context of the area, the background noise levels measured can be considered representative of those at the nearest receptors on Fernhill Road and Sandy Lane.

In line with the guidance given in BS 4142: 2014, in order *"to quantify what is typical during particular time periods"*, a statistical analysis of the measured $L_{A90,15min}$ data is presented below. Figure 3 shows the daytime data and Figure 4 shows the night-time data.

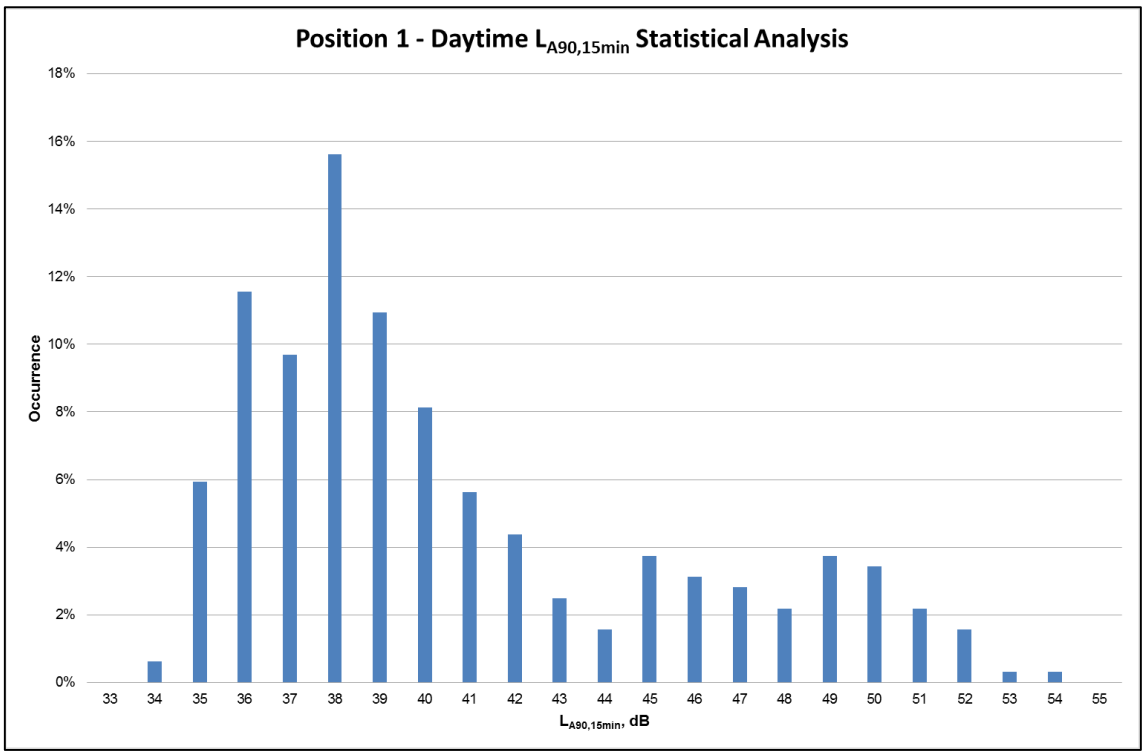

Figure 3: Statistical analysis of measured daytime $L_{A90,15min}$

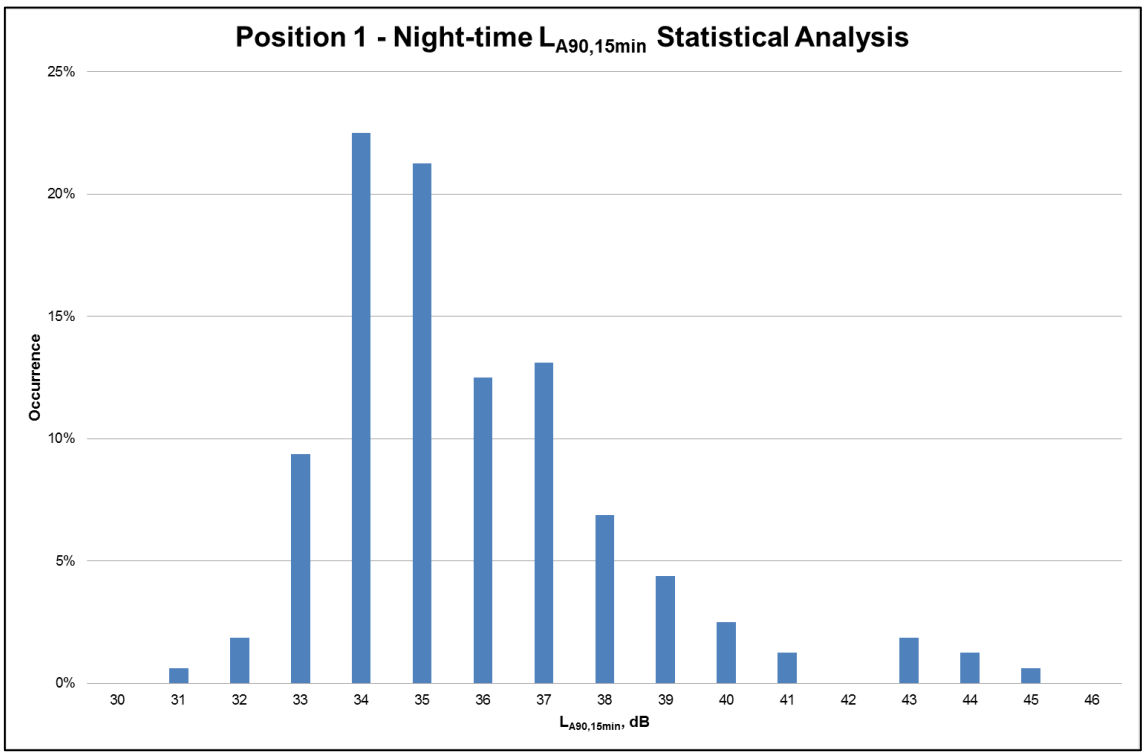

Figure 4: Statistical analysis of measured night-time $L_{A90,15min}$

Based on the analysis shown above and the time history given in Appendix B, the typical background sound levels can be interpreted as:

Daytime (07:00 to 23:00)	33 dB $L_{A90,T}$
Night-time (23:00 to 07:00)	32 dB $L_{A90,T}$

Given the above analysis and to ensure that the noise associated with the development has a low impact on the receptors to account for potential undesirable acoustic characteristics in the sound, the following specific noise level limits are proposed at the receptors:

Daytime (07:00 to 23:00)	27 dB $L_{Aeq,1\ hour}$
Night-time (23:00 to 07:00)	26 dB $L_{Aeq,15\ min}$

The above noise limits apply for all items of plant (landlord and tenant) running simultaneously.

7.0 Summary

The current Planning Policy has been reviewed and an assessment of the noise associated with the proposed development has been undertaken.

Noise surveys have been conducted to characterise the prevailing noise climate.

The assessment has indicated that a traditional façade construction and a natural ventilation strategy will provide adequate internal ambient and maximum noise levels for offices at this location.

Plant noise limits at the closest receptors have been proposed in the form of specific noise level limits. Given the context of the area, these are to ensure that noise associated with the development will have a low impact.

Appendix A: Noise Monitoring Equipment

Sound Level Meter – Unattended Measurements

Rion NL-31 Sound Level Meter (Serial Number 00431027)
Rion NH-21 Pre-Amplifier (Serial Number 07194)
Rion UC-53A Microphone (Serial Number 320327)

Sound Level Meter and Real Time Analyser – Attended Measurements

Rion NA-28 Sound Level Meter (Serial Number 01260203)
Rion NH-23 Pre-Amplifier (Serial Number 60106)
Rion UC-59 Microphone (Serial Number 00286)

Sound Calibrator

Rion NC-74 Sound Calibrator (Serial Number 34304644)

Anemometer

Skywatch Xplorer 1

Appendix B: Unattended Noise Logger Time History Graph