



Noise Impact Assessment for the Oak Park Health and Wellbeing Campus

Land located at Oak Park, Havant, PO9 2EL
for:

Ashley House Plc

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For:	Ashley House Plc
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Executive Summary

Enzygo has been instructed by Ashley House Plc to prepare a noise assessment in support of a Planning Application for a new 'Health and Wellbeing Campus' development for a parcel of land off Oak Park, Havant.

Within the scope of this assessment noise levels have been quantified at 5 locations within the site in order to determine the existing ambient noise climate of the area. This has been considered and assessed against the appropriate standards and guidance in order to establish the acceptability of the site for the proposed development.

The noise surveys concluded the noise climate of the area to be dominated by infrastructure noise associated with road traffic movements within the area.

Construction related noise (and vibration) would require to be controlled within the scope of a site specific Construction Environmental Management Plan (CEMP).

Noise generated by static plant and equipment related to the development would require to be controlled by a suitably worded planning condition and considered accordingly within the detailed design phase.

With regard to site suitability for the development proposed, noise across the sites was found to predominately lie between PPG24 NEC "A" to NEC "B" during both the daytime and overnight periods, depending on the proximity to the main noise sources. However, with the implementation of the site layout provision, the areas of the site within NEC "A" increased.

Further consideration of the level of noise ingress within the sensitive portions of the proposed development indicate that, with appropriate consideration of the façade elements as detailed within this report, the internal noise climate would meet the criteria detailed within the relevant guidance documents.

It is considered that based upon the assessments undertaken within the scope of this report, the assumptions made and subject to the implementation of appropriate acoustic design considerations, there are no significant issues relating to noise impacts that should restrict the proposals from being granted full planning permission.

1 Introduction

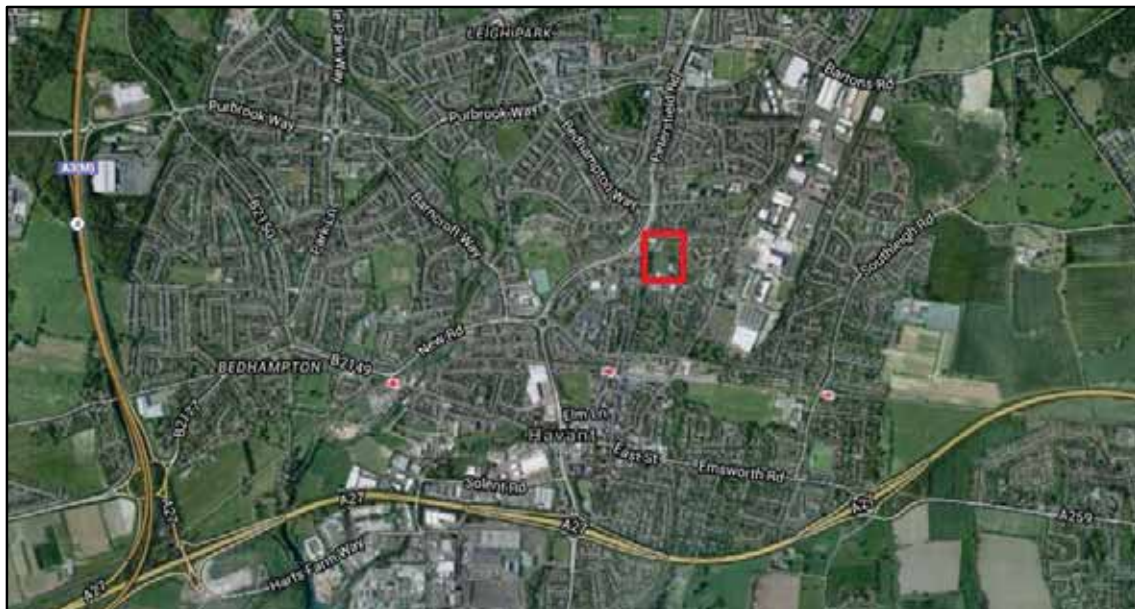
1.1 Project Introduction

- 1.1.1 Enzygo Environmental Consultants (Enzygo) have been commissioned by Ashley House Plc (AH), to provide technical support relating to noise to a planning application for a new 'Health and Wellbeing Campus' consisting of an integrated, affordable housing and a care facility at a site at Oak Park, Havant, PO9 2EL.
- 1.1.2 The purpose of this noise assessment is to confirm the suitability of the site for the proposed end use, to identify any potential noise impacts, to assess whether these would be within acceptable levels and where appropriate recommend suitable mitigation measures.
- 1.1.3 The assessment is based upon a 24hr noise measurement survey undertaken between the 3rd and 4th February 2015 at the site.
- 1.1.4 Details regarding the assessment methodology employed, together with the results of the survey undertaken, and the subsequent conclusions and recommendations drawn are presented within the following report.

1.2 Site Description

- 1.2.1 The proposed development site is in the vicinity of Petersfield Rd in Havant and is bounded by Crossland Dr to the north, Leigh Rd. to the west, Lavant Dr. to the south and Old Copse Rd. to the east. The site is centred at approximate grid ref SU 72015 07144.
- 1.2.2 The development site is indicated approximately within the red square on Figure 1-1 below.

Figure 1-1: Site Location Plan



(Image Source: Imagery ©2015 Bluesky, DigitalGlobe GeoEye Getmapping plc, Infoterra Ltd & Bluesky, The Geoinformation Group, Map data ©2015 Google)

- 1.2.3 The area immediately surrounding the site is primarily residential in nature with some seemingly commercial/healthcare buildings also evident.
 - To the immediate north the site is bordered by Crossland Dr, with residential properties beyond;

- To the immediate east of the site is Old Copse Rd. with residential properties beyond. At a distance of approximately 150m to the east is the back of the Elmleigh Hospital which fronts onto New Lane. On the opposite side of New Lane is a commercial/industrial park (and some allotment provision) which is some 300m from the site;
- To the south of the site is Lavant Dr. with the NHS Oak Park Children's Services building fronting onto the development. This is surrounded by residential properties; and,
- To the west of the site is Leigh Rd. with residential properties/the Curlew Public House/The Parkway Centre (NHS Adult Mental Health Services) beyond. Petersfield Rd is approximately 100m to the west with a residential estate on the opposite side.

1.3 Existing Site Use

- 1.3.1 The existing site is currently derelict (brownfield), and has been so for a number of years. The land was allocated for residential, care home and community health use by Havant Borough Council in their Adopted Local Plan, following consultation with the local community.
- 1.3.2 The site is part of a larger 2.63 hectare site, however the south-western quadrant has been allocated for a health centre development and car parking. The remaining 1.93 hectares of the site are available for development.

1.4 Key Features of the Application

- 1.4.1 It is understood that this assessment will be submitted in support of a planning application for a new Oak Park 'Health and Wellbeing Campus' which would consist of an integrated, affordable housing and care facility for local people as they grow older and their housing and care needs change.
- 1.4.2 The site would be limited to three stories in height (maximum) and would provide;
- 51no. extra care residential units;
 - 48no. supported living accommodation units; and,
 - a nursing home with 80no. bedrooms ;
- 1.4.3 Access to the site is primarily via River Way to the east off Old Copse Rd. Further access for service and emergency vehicles will be either via the main entrance off River Way, or via a secondary entrance off Leigh Road to the west. The majority of parking will be provided to the north of the site (over the sewer), with additional parking in the southern half of the site.
- 1.4.4 The nursing home and extra care residential accommodation will be grouped around a central 'hub' which is designed for use of the whole community and will include facilities for arts and crafts, a shop, a hairdressers, a spa/ treatment room, a kitchen, staff and residents WCs, a gym, a cinema, a refuse area, and a flexible area including a lounge, dance area, day centre, dining area and IT area.
- 1.4.5 The nursing home is positioned to the North and West of the central Hub, and the Extra Care residential facility is to the South as detailed on the layout drawings accompanying the application. The supported living units are positioned to the east of the site. All living elements are grouped around two large landscaped 'courtyards', which will be accessible to residents, visitors and guests. There are also two secure garden courtyards within the Nursing Home, allowing for secure, discrete and private outdoor space for this aspect of the development.

1.5 Consultation

- 1.5.1 Within the scope of the production of this noise assessment report consultation was undertaken with Mr Laurent Lemagnen, Senior Environmental Health Officer at the LPA, Havant Council (HC). This was undertaken by telephone conversation on the 28th November 2014, subsequently confirmed in writing on the same day.
- 1.5.2 Within the initial telephone consultation a scope and methodology was proposed to HC for the assessment of noise associated with the proposed scheme, which was verbally accepted as appropriate. This was formally confirmed in writing, however, unfortunately at the time of writing no formal, written response was received from HC. As such the specifics of the agreements made, outlined within the e-mail of the 28th November 2014 will be used to inform this study.
- 1.5.3 Within the entirely separate, formal consultation exercise undertaken by the Planning Consultant to the project with the Planning Department at HC, a formal response was received from Mr Lemagnen (to Michelle Houghton at HC) dated 16th October 2014 (at 09:15am). Within this Mr Lemagnen requested that the noise study:
- In principle he did not have any objection to the scheme providing it did not negatively impact upon the locality;
 - Any noise assessment submitted would need to consider:
 - Noise from demolition/construction works;
 - Noise generated from refrigeration units and other equipment;
 - Delivery times and delivery vehicle type;
- 1.5.4 Mr Lemagnen went on to state that he would have no objection to the scheme provided that the following conditions be imposed within any granted consent. These have also been considered within the scope of the assessment presented:

Noise from Demolition/Construction

Condition 1: *No works or ancillary operations associated with the construction of the development which is audible at the site boundary or at such other place as may be agreed with the Local Planning Authority, shall take place on any Sunday or Bank Holiday, nor on any other day except between the following times*

Monday to Friday – 8:00 a.m. – 6:00 p.m.

Saturday – 8:00 a.m. – 13:00 p.m.

Unless in association with an emergency or with the prior written approval of the Local Planning Authority.

Reason: *To protect the occupants of nearby residential properties from noise disturbance.*

Noise Generated from the refrigeration units and other equipment.

Condition 3: *Any proposal relating to install noise making equipment (i.e. refrigeration units, air conditioning, extract ventilation equipment) schemes shall be agreed and approved in writing by the District Planning Authority prior to any development takes place.*

Reason: *To protect the occupants of nearby residential properties from noise, vibration and/or odour nuisance.*

BS4142 Requirement

Noise resulting from the use of any/all plant, machinery or equipment shall not exceed a level of 5dB(A) below the existing background level (or 10dB(A) below if there is a particular tonal quality) when measured according to British Standard BS4142-1997.

Reason: *in the interests of protecting the local residents from unreasonable noise levels which would be detrimental to the residential character of the area.*

Noise Generated from delivery vehicles and times of delivery.

Condition 4: *Deliveries shall only be taken and/or dispatched from the site between the hours of ... - pm Monday to Friday and am - pm Saturdays and not at all on Sundays and recognised public Holidays.*

Reason: *in the interest of the amenities of occupiers of nearby residential properties.*

1.6 Noise Assessment Methodology

1.6.1 In order to consider and assess the suitability of the site for residential development a number of elements of work have been completed. These are as detailed below:

- Formal consultation with the Local Planning Authority to discuss and agree an appropriate scope and methodology for the study;
- Completion of a noise survey to quantify the existing baseline and ambient noise climate of the site over a full 24hr period;
- Assessment and consideration of the suitability of the site for the proposed end use;
- Where necessary, consideration of suitable acoustic mitigation measures and strategies that could be employed within the design of the site to control noise.

2 Noise Units

2.1 Noise

- 2.1.1 Before presenting the results of the noise assessment, it is considered useful to provide some background information on noise, the units of measurement and perception of changing levels by people.
- 2.1.2 Noise is defined as unwanted sound. The range of audible sound is taken to be from 0 dB to 140 dB. Examples of typical noise levels relating to everyday occurrences are presented within Table 2-1 below:

Table 2-1: Typical Noise Levels

Source	Sound Pressure Level in dB(A)	Subjective Level
Traffic at kerb edge	70 – 85	Loud
Raised voice at 1 metre	80	Loud
Normal voice at 1 metre	60	Moderate
Residential area at night	40	Quiet

- 2.1.3 The frequency response of the human ear to noise is usually taken to be about 18Hz (number of oscillations per second) to 18,000Hz. However, the human ear does not respond equally to different frequencies at the same level, it is more sensitive in the mid-frequency range than the lower and higher frequencies and, because of this, when undertaking the measurement of noise the low and high frequency components of any given sound are reduced in importance by applying a filtering (weighting) circuit to the noise measuring instrument. The weighting which is widely accepted to correlate best with the subjective nature of human response to noise and is most widely used to quantify this is the A-weighted filter set. This is an internationally accepted standard for noise measurements.
- 2.1.4 For variable noise sources within an area an increase of 3 dB(A) would be considered to be the minimum perceptible to the human ear under normal conditions. It is generally accepted that an increase/decrease of 10 dB(A) corresponds to a doubling or halving in perceived loudness. The 'loudness' of a noise is a purely subjective parameter, dependant not only upon the sound pressure of the event but also on the dynamics of the listener's ear, the time of the day and the general mood of the person.
- 2.1.5 With regard to environmental noise levels (in the open air), these are rarely steady, but rise and fall according to the activities being undertaken within the surrounding area at any given time. In an attempt to produce a figure that relates this variable nature of noise to human subjective response, a number of statistical noise metrics have been developed. These include:

2.2 L_{Aeq} Noise Level

- 2.2.1 This is the 'equivalent continuous A-weighted sound pressure level, in decibels', and is defined in British Standard BS7445 as the 'value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval, T, has the same mean square sound pressure as a sound under consideration whose level varies with time'.
- 2.2.2 It is the unit most suitable for the description of general environmental noise.

2.3 L_{A90} Noise Level

- 2.3.1 The L_{A90} is the noise level that is exceeded for 90% of the measurement period and gives an indication of the noise level during the quieter periods.
- 2.3.2 It is often referred to as the 'background' noise level.

2.4 L_{Amax} Noise Levels

- 2.4.1 The L_{Amax} is the maximum value of the A-weighted sound pressure level measured during the survey period. L_{Amax} can be quantified in two ways, $L_{Amax F}$. or Fast time response averaged over a 0.125 second time period or $L_{Amax S}$. or Slow time response averaged over a 1 second time period.
- 2.4.2 This typically relates to impulsive noises such as infrequent vehicle movements, emergency services sirens, shouting, bangs and impact noises etc.

3 Standards and Guidance

3.1 Introduction

3.1.1 Within the following section of the report, detail will be presented relating to the guidance documents and assessment methodologies appropriate for noise associated with the consideration of the following:

- Construction noise;
- Operational noise assessment (static plant); and,
- Residential suitability with regard to noise.

3.2 National Planning Policy Framework (NPPF, March 2012)

3.2.1 The National Planning Policy Framework determines the government's planning policy for England. The NPPF states that, with respect to noise, 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 a new development, including through the use of conditions;
- Recognise that development will often create some noise and existing business 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; 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.

3.2.2 The guidance contained within the NPPF further determines that consideration should be given to the Noise Policy Statement for England (DEFRA, March 2010).

3.3 Noise Policy Statement for England (NPSE, March 2010)

3.3.1 The Noise Policy Statement for England attends to three types of noise;

- "Environmental noise" which includes noise from transportation sources;
- "Neighbour noise" which includes noise from inside and outside people's homes; and
- "Neighbourhood noise", which includes noise arising from within the community such as industrial and entertainment premises, trade and business premises, construction sites and noise in the street.

3.3.2 In line with the aims determined in the NPPF, the NPSE determines three aims;

1. Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development;

2. Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development; and,
3. Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

3.3.3 The guidance detailed within the NPSE relates a number of key phrases with regards to adverse effects which can be applied to noise impacts as used by the World Health Organisation.

NOEL – No Observed Effect Level

The level below which no health effect or detrimental impact on the quality of life is observed.

LOAEL – Lowest Observed Adverse Effect Level

The level at which adverse effects on health and quality of life can be detected

SOAEL – Significant Observed Adverse Effect Level

The level, above which significant adverse effects on health and quality of life occur.

- 3.3.4 The guidance indicates that it is not possible to have a single objective noise based measure that defines SOAEL and as such, the SOAEL is likely to be different for different noise sources and receptors. The document indicates that further research is required to establish what may constitute a significant adverse impact on health and quality of life from noise.
- 3.3.5 While the NPSE determines the NOEL, LOAEL and SOAEL descriptions, the document indicates that, unlike other environmental disciplines, there are currently no European or national noise limits which have to be met although the NPSE states that “there can be specific local limits for specific developments” allowing for negotiation.

3.4 Planning Practice Guidance - Noise

- 3.4.1 The Planning Practice Guidance for noise (updated December 2014) broadly considers the same issues as demonstrated within both the NPPF and the NPSE with regards to noise within the planning realm.
- 3.4.2 The information detailed within the planning practice guidance indicates that noise should be considered when:
- New developments may create additional noise; and/ or,
 - New developments would be sensitive to the prevailing acoustic environment.
- 3.4.3 The guidance indicates that Local Planning Authorities should take account of the acoustic environment and in doing so consider:
- 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.
- 3.4.4 The impact of noise is rated within the policy document in terms of the relative ‘*Observed Effect Level*’ defined in line with the criteria summarised within paragraph 3.3.3 above. Based upon this the Planning Practice Guidance provides the following matrix of likely average response:

Table 3-1: Planning Practice Guidance – Noise, Exposure Hierarchy

Perception	Example 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; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported 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 avoiding certain activities during periods of intrusion: where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. 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 character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/ or an ability 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

3.5 Planning Policy Guidance Note 24: Planning and Noise (1994)

- 3.5.1 The NPPF has superseded the guidance contained within the Planning Policy Guidance Note 24: Planning and Noise 1994 (PPG24). However, a review of the framework provided in the NPPF and of the policy determined in the NPSE does not put forward a replacement assessment methodology. As such, given the limitations of the NPPF and the agreements made with the Environmental Health Department at the LPA, the methodology determined by PPG24 will still be applied to this assessment of residential suitability where appropriate.

3.5.2 In general, the guidance contained within PPG24 considers the following:

- Outlines the considerations relating to noise, to be borne in mind when determining planning applications for both developments which will generate noise and those that will be noise sensitive;
- Introduces the Noise Exposure Category (NEC) method of determination for residential developments;
- Advises on the use of conditions to minimise noise impact.

3.5.3 The document PPG24 states the following, with respect to assessing the impact of noise on proposed residential developments;

“When assessing a proposal for residential development near a source of noise, local planning authorities should determine into which of the four noise exposure categories (NECs) the proposed site falls, taking into account both the day and night-time noise levels and the main noise sources of the area”.

3.5.4 The Noise Exposure Categories (NEC) are subsequently defined as follows:

Table 3-2: PPG24 Noise Exposure Category (NEC) Definitions

Noise Exposure Category	Definition
A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the higher end of the category should not be regarded as a desirable level.
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.
C	Planning permission should not normally be granted. Where it is considered that permission should be given for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
D	Planning permission should normally be refused

3.5.5 The L_{Aeq} noise levels corresponding to the above noise exposure categories are as detailed within the table below:

Table 3-3: PPG24 Noise Level Bands

Noise Levels Corresponding to the Noise Exposure Categories for New Dwellings $L_{Aeq,T}$ dB, PPG24				
Noise Source	Noise Exposure Category			
	A	B	C	D
Road Traffic 07:00 – 23:00	< 55	55 – 63	63 – 72	>72
23:00 – 07:00	< 45	45 – 57	57 – 66	>66
Rail Traffic 07:00 – 23:00	< 55	55 – 66	66 – 74	>74
23:00 – 07:00	< 45	45 – 59	59 – 66	>66
Air Traffic 07:00 – 23:00	< 57	57 – 66	66 – 72	>72
23:00 – 07:00	< 48	48 – 57	57 – 66	>66
Mixed Sources 07:00 – 23:00	< 55	55 – 63	63 – 72	>72
23:00 – 07:00	< 45	45 – 57	57 – 66	>66

- 3.5.6 As defined within Table 3 2 above, PPG24 defines appropriate bandings for the NEC categories for both the daytime and night-time periods. Daytime is subsequently defined within the document as being between the hours of 07:00 and 23:00 with night-time being defined as the period 23:00 to 07:00.
- 3.5.7 Local planning authorities have the power under PPG24 to increase NEC limits by up to 3dB(A) above the recommended levels where for example there is a clear need for the development.
- 3.5.8 With regard to night-time noise levels where individual noise events regularly exceed 82dB L_{Amax} several times in any one hour, the site should be considered to be within NEC “C” regardless of the $L_{Aeq,8h}$ except when the site is already within NEC “D”.
- 3.5.9 Furthermore, with regards to industrial developments, PPG24 notes within paragraph 19 of annex 3 that when considering internal noise levels the guidance found in BS8233 is appropriate for reference.

3.6 British Standard 8233:2014 – ‘Guidance on Sound Insulation and Noise Reduction for buildings’

- 3.6.1 When internal noise levels are required to be considered suitable guidance can be found within BS8233 2014.
- 3.6.2 This Standard provides guidance values within Section 7.7 relating to a range of design criteria levels for certain building types. Section 7.7.1 covers “Dwelling Houses, flats and rooms in residential use (when unoccupied)” and the appropriate values are presented within Table 3-4 below.

Table 3-4: BS8233 Guidance Values

Activity	Location	Design Range dB $L_{Aeq,T}$	
		07:00 – 23:00	23:00 – 07:00
Resting	Living room	35 dB $L_{Aeq, 16hr}$	-
Dining	Dining room/area	40 dB $L_{Aeq, 16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16hr}$	30 dB $L_{Aeq, 8hr}$

- 3.6.3 Note 7 to the above table within BS8233 details that “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”.
- 3.6.4 With regard to external noise levels the Standard states that “For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments”. However, the Standard recognises that these levels are not achievable in all situations and further states that “In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited”.
- 3.6.5 The internal values detailed within the scope of BS8233: 2014 generally accord well with the recommendations of the WHO guidance.

3.7 The World Health Organisation Guidelines for Community Noise (1999)

- 3.7.1 The World Health Organisation’s (WHO) ‘Guidelines for Community Noise’ report for external environmental noise levels states that;

“4.2.7 Annoyance responses

During the daytime, few people are seriously annoyed by activities with L_{Aeq} levels below 55dB; or moderately annoyed with L_{Aeq} levels below 50dB. Sound pressure levels during the evening and night should be 5-10dB lower than during the day....”

- 3.7.2 For night-time noise sources the WHO guidelines recommend a night-time (23:00 – 07:00) 8hour noise level of 30dB L_{Aeq} inside bedrooms (for reasonably steady noise source) to avoid sleep disturbance. However, this has been somewhat superseded by the more recent Night Noise Guidelines for Europe (2009) as detailed in Section 3.8.
- 3.7.3 For internal noise levels during the daytime and evening period it is suggested that a noise level of 35dB $L_{Aeq, 16hr}$ (07:00 – 23:00hrs) be achieved to avoid speech intelligibility and moderate annoyance.

3.8 World Health Organisation: Night Noise Guidelines for Europe (2009)

- 3.8.1 The ‘Night Noise Guidelines for Europe’ were published by the WHO in 2009 and works in association with the 2000 Guidelines for Community Noise.
- 3.8.2 The guidance also states that;

“Considering the scientific evidence on the thresholds of night noise exposure indicated by $L_{night, outside}$ as defined in the Environmental Noise Directive (2002/49/EC), an $L_{night, outside}$ of 40dB should be the target of the night noise guidelines (NNG) to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly.”

- 3.8.3 The document accords well with the ‘Good’ internal design criteria as defined within BS8233 when windows are open for ventilation.

3.9 Department of Health - Health Technical Memorandum (HTM) 08-01: Acoustics

- 3.9.1 With regard to noise levels within hospitals and health facility developments the guidance of the Department of Health Specialist Services Health Technical Memorandum (HTM) 08-01: Acoustics dated March 2013 should be referenced.

- 3.9.2 This document provides details of appropriate internal noise criteria and performances that should be taken into account within the design stage of any health care development. However, the guidance is more specifically for conventional hospital type facilities citing limits for words and clinical areas. Therefore, the guidance of HTM 08-01 has not been referenced further within this study.

3.10 BS5228: 2009 - ‘Code of practice for noise and vibration control on construction and open sites’

- 3.10.1 BS5228 ‘Code of practice for noise and vibration control on construction and open sites’ 2009 is the current UK guidance cornerstone for the consideration of potential impacts associated with noise (and vibration) from construction sites. Part 1 of BS5228 (+A1:2014), Code of practice for basic information and procedures for noise control, gives recommendations for basic methods of noise control where work activities/operations generate significant noise. The document includes sections on legislative background, community relations, training, occupational noise effects, neighbourhood nuisance, project supervision and control of noise.
- 3.10.2 Annexes to Part 1 include information on EC and UK legislation, noise sources, remedies and their effectiveness (mitigation options), sound level data for onsite equipment and site activities (source terms that are used for modelling), a methodology for estimating noise from sites (calculation procedures which form the basis of the modelling packages) and guidance relating to noise monitoring.
- 3.10.3 It is noted that the guidance of BS5228 Part 1 provides example noise effect significance criteria within Annexe E, and concludes that significant effects will be dependent on the absolute levels of ambient and construction noise, as well as the magnitude, duration, time of occurrence and frequency of the noise change. BS 5228 contains two example methodologies that could be employed in order to determine the significance of construction noise levels. These methods are as defined and discussed in detail below:

Example Method 1 – The ABC Method. *The ABC method is based upon threshold noise levels defined by both time and existing ambient noise levels. The method requires the ambient pre construction noise level to be determined and rounded to the nearest 5dB. This ambient noise level is then required to be compared to the total noise level (containing noise associated with the construction operations). If the total noise level exceeds the appropriate category value then a significant effect is deemed to have occurred.*

The threshold/category values and definitions are contained within Table E.1 of annex E of BS5228 and reiterated within Table 3-2 below:

Table 3-5: BS5228 Example Method 1 – ABC Method

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A ^{A)}	Category B ^{B)}	Category C ^{C)}
Night-time (23:00 – 07:00)	45	50	55
Evening and Weekends ^{D)}	55	60	65
Daytime (07:00 -19:00) and Saturdays (07:00 – 13:00)	65	70	75
NOTE 1 A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level. NOTE 2 If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3 dB due to construction activity. NOTE 3 Applied to residential receptors only. ^{A)} Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values ^{B)} Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values ^{C)} Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values ^{D)} 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.			

BS5228 Example Method 2 – 5 dB(A) Change. *The 5 dB(A) change method is based upon the premise that a significant effect is deemed to occur if the total noise (pre-construction ambient plus construction noise) exceeds the pre-construction ambient noise by 5dB or more.*

The criterion is subject to lower cut-off values of 65dB, 55dB and 45dB $L_{Aeq, 1hr}$, period from construction noise alone, for the daytime, evening and night-time periods respectively. The criteria further requires that for a significant effect to occur the total noise level must exceed the pre-construction ambient noise for a duration of one month or more, unless works of a shorter duration are likely to result in significant impacts

- 3.10.4 Part 2 of BS5228 gives recommendations for basic methods of vibration control. The Standard also describes the legislative background to vibration control and offers advice regarding the establishment of effective liaison between developers, site operators and local authorities, and contains guidance on measuring and assessing the effects of ground borne vibration.
- 3.10.5 With regard to the assessment of significance of vibration BS5228 refers to BS6472. However, BS5228 also presents the following guidance on construction vibration levels and effects referenced to purely PPV criteria for ease of policing on site:

Table 3-6: BS5228 Ground Borne Vibration PPV criteria Values

BS5228 Guidance on effects of vibration levels	
Vibration Level	Effect
0.14 mm/s	Vibration might just be perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

- 3.10.6 With regard to structural response to vibration BS5228 specifically refers to the damage threshold criteria presented in BS 7385 *Evaluation and measurement for Vibration in Buildings Part 1:1990* and Part 2:1992. The guidance limits proposed within this BS are contained within Table 3-7 below as thresholds at which vibration from construction activities may result in structural damage as measured in Peak Particle Velocity (PPV). BS7385 states that “*Peak Particle Velocity (PPV) has been found to be the best single descriptor of vibration induced damage*” and recommends the simultaneous measurement of the three orthogonal components of particle velocity (Longitudinal, Vertical and Transverse) be undertaken. The figures stated below relate to this maximum value.

Table 3-7: Significance criteria of structural damage from construction vibration

Building/Location	Threshold Criterion mm/s
Industrial/Heavy Commercial Building	50 mm/s at 4Hz and above
Residential/Light Commercial Building	15 mm/s at 4Hz, 20 mm/s at 15Hz 50 mm/s at 40Hz and above

4 Noise Monitoring Survey

4.1.1 This section of the report describes the specifics of the noise survey undertaken within the scope of this study.

4.2 Survey Details

4.2.1 In order to determine the existing noise climate of the area a noise monitoring survey was undertaken at five (5no) locations within the site boundary. The survey was undertaken between the 3rd and 4th February 2015.

4.2.2 The noise monitoring was undertaken at the following locations at the site.

Table 4-1: Noise Monitoring Locations

Location	Grid Ref
M01	SU 7197 0721
M02	SU 7208 0721
M03	SU 7204 0707
M04	SU 7198 0713
M05	SU 7203 0712

4.2.3 The noise monitoring locations are presented graphically within Figure 4 1 below.

Figure 4-1: Noise Monitoring Location plan



(Image Source: Imagery ©2015 Bluesky, DigitalGlobe GeoEye Getmapping plc. Infoterra Ltd & Bluesky, The Geoinformation Group, Map data ©2015 Google)

4.2.4 The noise monitoring survey was undertaken on a rotational basis for a full 24 hour period as detailed in Table 4-2 below. The monitoring was broadly undertaken on the following basis:

- between 30/60 minutes at each location during the daytime hours (07:00 to 23:00); and
- Up to 60 minutes at each location during the overnight hours (23:00 to 07:00).

Table 4-2: Noise Monitoring Durations

Location	Period	Duration (hh:mm:ss)	Times
M01	Daytime	16:00:00	13:51 to 23:00 on 3 rd Feb 2015 07:00 to 13:51 on 4 th Feb 2015
	Overnight	08:00:00	23:00 to 07:00 on 3 rd /4 th Feb 2015
M02	Daytime	04:45:00	15:15 to 16:00 on 3 rd Feb 2015 17:10 to 17:40 on 3 rd Feb 2015 18:50 to 19:20 on 3 rd Feb 2015 20:30 to 21:00 on 3 rd Feb 2015 22:32 to 23:02 on 3 rd Feb 2015 07:43 to 08:13 on 4 th Feb 2015 09:24 to 09:54 on 4 th Feb 2015 11:03 to 11:33 on 4 th Feb 2015 12:43 to 13:13 on 4 th Feb 2015
	Overnight	02:00:00	01:15 to 02:15 on 4 th Feb 2015 04:31 to 05:31 on 4 th Feb 2015
M03	Daytime	16:00:00	13:39 to 23:00 on 3 rd Feb 2015 07:00 to 13:39 on 4 th Feb 2015
	Overnight	08:00:00	23:00 to 07:00 on 3 rd /4 th Feb 2015
M04	Daytime	04:30:00	14:10 to 14:40 on 3 rd Feb 2015 16:02 to 16:32 on 3 rd Feb 2015 17:43 to 18:13 on 3 rd Feb 2015 19:23 to 19:53 on 3 rd Feb 2015 21:02 to 21:32 on 3 rd Feb 2015 08:17 to 08:47 on 4 th Feb 2015 09:58 to 10:28 on 4 th Feb 2015 11:36 to 12:06 on 4 th Feb 2015 13:20 to 13:50 on 4 th Feb 2015
	Overnight	03:00:00	23:09 to 00:09 on 3 rd /4 th Feb 2015 02:21 to 03:21 on 4 th Feb 2015 05:37 to 06:37 on 4 th Feb 2015
M05	Daytime	04:30:00	14:43 to 15:13 on 3 rd Feb 2015 16:35 to 17:05 on 3 rd Feb 2015 18:16 to 18:46 on 3 rd Feb 2015 19:56 to 20:26 on 3 rd Feb 2015 21:35 to 22:20 on 3 rd Feb 2015 06:55 to 07:40 on 4 th Feb 2015 10:31 to 11:01 on 4 th Feb 2015 12:10 to 12:40 on 4 th Feb 2015
	Overnight	02:15:00	00:11 to 02:11 on 4 th Feb 2015 03:28 to 04:28 on 4 th Feb 2015 06:40 to 06:55 on 4 th Feb 2015

4.3 Weather

Tuesday 3rd February 2015

- 4.3.1 The weather during the Tuesday daytime period was noted to be cold, with an ambient air temperature of around 2°C. Wind speeds were noted to be light (measures at 2-3m/s) with no discernible directional component. Ground conditions were noted as dry, with no precipitation falling. Cloud cover was estimated at around 20%.
- 4.3.2 The weather leading in to the overnight period was considered to be similar to the preceding daytime, dry with light/ no wind and temperatures averaging around 3°C.

Wednesday 4th February 2015

- 4.3.3 The weather during the early part of the 12th February was noted to be cold with the ambient air temperature of less than 2°C. Wind speeds were again noted to be low (measured to be below 3m/s) with no real discernible directional component. Ground conditions were again noted as dry, with no precipitation falling. Cloud cover was estimated at around 80%

4.4 Monitoring Equipment

- 4.4.1 The monitoring was undertaken in line with the guidance set out within BS7445: 1991, with the sound level meters programmed to monitor over 60 minute intervals during the daytime and 15 minutes intervals during the overnight. The equipment used was set to record the following statistical parameters:

L_{eq} in dB

L_{10} in dB

L_{90} in dB

L_{max} in dB

- 4.4.2 The following noise monitoring equipment was used in order to undertake the survey work in the vicinity of the site.

Table 4-3: Noise Monitoring Equipment

Equipment	Manufacturer	Type	Serial Number	Calibration due date
Sound Level Meter	01dB	Black Solo	65396	20/12/15
			65445	28/03/16
			65446	28/03/16
Calibrator	Cirrus	CR:515	59522	29/12/15

- 4.4.3 The following set-up parameters were used on the sound level meters during all of the noise measurements undertaken:

Time Weighting: Fast

Frequency Weighting: "A"

- 4.4.4 The sound level meters used within this assessment were locally calibrated using an electronic calibrator prior to commencement and upon completion of the survey, no significant drift in calibration was observed as detailed below:

Table 4-4: Local Survey Calibration Record

Sound Level Meter	Overall Survey	
	Start	End
Solo 1 - 65396	94.0	94.0
Solo 2 - 65446	94.0	94.0
Solo 3 - 65445	93.8	93.8

4.4.5 The instrumentation calibration documentation for the equipment used is provided in Appendix A.

5 Noise Survey Results

5.1.1 This Section of the report summarises the results of the noise monitoring survey undertaken within the scope of this assessment. The full monitoring dataset is presented in Appendix B of this report.

5.2 Noise Monitoring Survey Results

5.2.1 Presented within Table 5-1 below is a summary of the daytime and overnight noise levels monitored at the locations detailed within Section 4.

- The daytime data is presented as the average during the overall daytime period of 07:00 to 23:00.
- The overnight data is presented as the average during the overall overnight period of 23:00 to 07:00.

Table 5-1: Noise Monitoring Data

Location	Period	Duration (hh:mm:ss)	L _{Aeq}	L _{Amax}	L _{A90}	L _{A10}
Location M01	Daytime	16:00:00	59.8	83.9	52.9	62.1
	Overnight	08:00:00	52.4	72.3	32.7	56.9
Location M02	Daytime	04:45:00	57.3	86.3	48.6	59.4
	Overnight	02:00:00	47.8	75.2	33.9	48.6
Location M03	Daytime	16:00:00	53.8	74.1	49.1	55.9
	Overnight	08:00:00	46.8	61.8	34.9	50.9
Location M04	Daytime	04:30:00	56.5	70.6	52.5	58.2
	Overnight	03:00:00	52.5	87.5 ^{*(1)} (65.0)	40.3	50.8
Location M05	Daytime	04:30:00	55.5	86.0 ^{*(1)} (78.2)	50.5	56.9
	Overnight	02:15:00	51.9	67.8	40.3	50.8

Notes to Table 5-1

^{*(1)} The L_{max} events identified are associated with entries in the field notes identifying that the microphone has fallen over on uneven ground. The value presented in (x) relates to a representative L_{max} for the area with this erroneous result screened out.

5.3 Subjective Field Notes

5.3.1 The noise monitoring survey was attended throughout by competently trained and experienced field technicians in order to subjectively quantify the existing noise climate of the area.

5.3.2 The notes made during the noise monitoring survey are summarised below;

The noise climate during the daytime period was considered to be governed primarily by road traffic noise from the surrounding road network, predominantly from Petersfield Road and Crossland Drive. This was coupled with some noted natural noises such as birdsong.

During the overnight the noise climate was noted to remain similar with a predominance of road traffic noise.

6 Construction Noise

6.1 Introduction

- 6.1.1 Specific details relating to the construction phase of the development are not available at the time of assessment, and as such detailed predictive consideration of construction related noise is not possible. Therefore, a qualitative assessment of potential impacts of construction noise and associated mitigation strategies has been undertaken within the scope of this study.
- 6.1.2 The construction operations required for the development of the facility may require the following potential operations to be undertaken. These operations have the potential to cause short term disturbance to the amenity of nearby sensitive receptors.
- *Site establishment activities (including ground works)* – this is typically the activity which employs the greatest amount of large earth moving equipment;
 - *Building construction* – typically undertaken with less large scale equipment than the ground works phases; and,
 - *Construction traffic* – the road traffic movements associated with the construction operations have the potential to generate short term increases in traffic movements on the surrounding highways depending upon flow numbers.

6.2 Construction Vibration

- 6.2.1 Typical construction activities associated with a scheme such as this would not generate significant levels of ground borne vibration that could be discernible outside of the site boundary. However, certain operations such as piling or ground stabilisation do have the potential to generate ground borne vibration and under certain conditions this could be discernible outside of the site boundary.
- 6.2.2 As a result of the level of information available at the time of writing this report, it is not known whether piling or ground stabilisation would be a requirement and therefore the risk of ground borne vibration impacts cannot be concluded. As such, construction work generated vibration control should form part of the Construction Environmental Management Plan (CEMP) once the requirement for piling has been concluded. The CEMP would require to consider generation and control, and reference should be made to the guidance of BS5228: Pt2 and associated documents.

6.3 Construction Noise

- 6.3.1 As a result of the ambiguities associated with the prediction of noise from construction activities and the lack of specific information available at this stage of the planning process, a qualitative assessment of construction noise in line with the requirements of BS5228 has been undertaken, discussing potential noise limits and control measures that could be implemented at the closest residential properties.
- 6.3.2 As previously stated, there is a potential that temporary increases in traffic noise may result from the construction of the facility due to changes in traffic flow on the surrounding highways, directly attributable to delivery/export of materials and construction staff movements. At the present time the specifics of the construction methodology has not been concluded and as such details of the expected construction traffic flows associated with the site is still not concluded. Therefore this aspect of the development should be further considered within the scope of the CEMP for

the site once a contractor is on board and a detailed construction programme concluded to ensure impacts do not arise at any point of the development.

- 6.3.3 With regard to on site construction operations associated with the facility, again exact details regarding techniques and types of plant likely to be used are not currently available. Nevertheless, with regard to on site construction operations it is possible to present potential worst-case noise levels from a selection of key construction plant which may be used within a development of this type. The noise generated by this plant has been calculated at differing offset distances from the equipment which may reflect noise levels at local receptors.
- 6.3.4 The noise levels calculated at distance from each item of plant do not take into account any attenuation due to screening and have been based upon hard reflective ground between the source and receiver. The figures presented are also based upon a 100% on-time which is unlikely to occur in practice.

Table 6-1: Propagation of Noise from Typical Construction Plant

Plant	Sound Pressure Level in dB(A) at 10m	Sound pressure level (dB L _{Aeq})						
		20m	50m	100m	200m	300m	600m	1km
Vibratory Sheet Piling rig	88	82	74	68	62	58	52	48
44tn Tracked 360° Excavator	85	79	71	65	59	55	49	45
14tn Tracked 360° Excavator	83	77	69	63	57	53	47	43
Telescopic Handlers	71	65	57	51	45	41	35	31
Vibratory Roller	79	73	65	59	53	49	43	39
Water Pump	62	56	48	42	36	32	26	22
Concrete Pump	78	72	64	58	52	48	42	38
Generators	57	51	43	37	31	27	21	17
Cement Mixers	75	69	61	55	49	45	39	35
Crane	78	72	64	58	52	48	42	38
Road lorry (Drive by)	80*	74*	66*	60*	54*	50*	44*	40*

*Drive by maximum sound pressure level, LpA (max), at speed in km/h as shown

- 6.3.5 It is considered that the potentially worst affected receptors for construction noise would be those directly surrounding the site and identified within Section 1.2.
- Residential dwellings to the north of **Crossland Dr.**, approx. 40m from the northern site boundary;
 - Residential dwellings off **Gaulter Close**, approx. 60m from the eastern site boundary;
 - Health care facility (NHS Oak Park Children's Services) off **Lavant Dr.**, approx. 60m from the southern site boundary; and,
 - Residential dwellings off **Havant Farm Close**, approx. 40m from the eastern site boundary.
- 6.3.6 Existing baseline noise at the closest elevations of these receptors would not be dissimilar to those levels monitored around the site presented within Section 5.0. As such the noise levels quantified at the site have been used within the following table in the qualification of appropriate construction noise limits as defined within BS5228. The ambient noise levels used to inform this assessment is an average L_{Aeq} value derived from all of the surveys undertaken at each location, presented within Table 5-1. The limits are constrained to the daytime period as construction works at the site would be limited to this period.

- 6.3.7 A breach of these limits during the construction phase would be considered to be a significant impact and measures would need to be put in place within the CEMP to ensure that these levels are met:

Table 6-1: Construction Noise Limits

Assessment Location	Average measured Daytime L_{Aeq} dB*	ABC Method rounded up to nearest 5dB	BS5228 Noise Limit Guidance (07:00 – 19:00)	
			"ABC" Method	"+5dB(A)" Method
Receptors to the north off Crossland Dr. (northern receptors) (Measurement positions M01 and M02)	M01 - 60.2	60	65	65
	M02 - 58.0	60	65	65
Receptors to the east off Gaulter Close (Measurement positions M02, M03 and M05)	M02 - 58.0	60	65	65
	M03 - 54.4	55	65	65
	M05 - 56.2	55	65	65
Receptors to the south off Lavant Dr. (Measurement position M03)	M03 - 54.4	55	65	65
Receptors to the west off Havant Farm Close (Measurement positions M01 and M04)	M01 - 60.2	60	65	65
	M04 - 57.0	60	65	65

* Measured daytime L_{Aeq} of Locality.

- 6.3.8 It has been assumed within the table above that construction works would generally only occur during the daytime period as stipulated by the EHO during the formal consultation (08:00 – 18:00 Monday to Friday and 08:00 – 13:00 Saturday with no operations on Sundays or bank holidays, unless for emergency purposes or agreed in advance with the LPA) and as such would be subject to construction noise limits generally in the region of 65dB L_{Aeq} 1hr.

6.4 Mitigation and Control

- 6.4.1 Within the scope of the CEMP, measures would need to be put in place to manage the construction operations and to demonstrate that these limits were not breached. Where breaches of these levels are demonstrated to occur they are likely to be only temporary in nature and occur for a relatively short time duration. The magnitude of any impacts would also be dependent upon the activities occurring at the time as well as the area of the site in which the work is being undertaken. It is recommended that the CEMP cover 'Best Practicable Means' and this be employed, where possible, as the basis against which the minimisation of construction impacts is gauged.
- 6.4.2 The following measures are presented as options that can be explored to control construction noise but would need to be implemented in association with a mechanism that identifies if an actual impact is occurring:

Plant and Equipment

- modern, silenced and well-maintained plant should be used at all times, conforming to standards set out in EU Directives;
- equipment including vehicles should be shut down when not in use;
- engine compartments should be closed when equipment is in use and the resonance of body panels and cover plates should be reduced by the addition of suitable dampening materials. Any rattling noise should be addressed by the tightening of loose parts or the addition of resilient materials;
- semi-static equipment is to be sited and orientated as far as is reasonably practicable away from noise-sensitive receptors and to have localised screening if deemed necessary;
- generators and water pumps required for 24-hour operation should be super-silenced or screened as appropriate;
- crane spindles, pulley wheels, telescopic sections and moving parts of working platforms should be adequately lubricated in order to prevent undue screeching and squealing; and,
- where possible mains electricity should be used rather than generators.

Methods of Working

- Percussive piling should only be considered subject to adequate control derived from prior assessment, and subject to up front agreement with the local authority. Where conditions dictate percussive methods to be unacceptable consideration should be given to reaction piling methods ('silent piling') or vibratory piling methods, together with pre-augering, should it be necessary;
- where practicable, pile caps should be cut and then broken with hydraulic rams to minimise the use of heavy air-powered breakers;
- burning equipment should be used in preference to cold cutting where possible; and,
- large concrete pours (for which an extension of working hours may be necessary) should commence as early as possible within normal working hours so that the activities can be completed within normal working hours as far as possible. These tasks should be agreed in advance with the LPA.

Management of Works Programme

- wherever practicable noisy works, which are audible at the site boundary, should be undertaken during normal daytime hours, e.g. between 08.00 and 18.00 Monday to Friday and between 08.00 and 13.00 on Saturdays;
- routes and programming for the transportation of construction materials, fill, personnel etc. are to be carefully considered in order to minimise the overall noise impact generated by these movements;
- personnel should be instructed on Best Practical Means measures to reduce noise and vibration as part of their site induction training;
- shouting and raised voices should be kept to a minimum e.g. in cases where warnings of danger must be given; and,

- Use of radios should be prohibited except where two-way radios are required for reasons of safety and communication.

6.4.3 In conclusion, potential construction noise (and vibration) impacts should be covered within the scope of a site specific Construction Environmental Management Plan once more detail is available relating to the construction works and programme. The production of this document would require potential impacts to be identified and specific mitigation measures provided where necessary in conjunction with a mechanism to “police” the operations and control noise and vibration. The CEMP would also require to cover a suitable complaints investigation and management procedure.

7 Noise Modelling Assessment –Suitability

7.1.1 This Section of the report will detail the calculation methodologies and assumptions used to inform the noise study.

7.2 Noise Modelling Protocols

7.2.1 The noise model was constructed within the commercially available Braunstein + Berndt GmbH computer noise mapping software SoundPLAN 7.3. Acoustic propagation within the model has been calculated in accordance with the following standards:

- BS5228: 2009 Code of practice for noise and vibration control on construction and open sites; and,
- ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors: Part 2: General method of calculation.

7.3 Foundation of the Noise Model

7.3.1 The noise model was constructed using the following information either provided to Enzygo or assumed as outlined below :

- Detailed AutoCAD OS mapping data of surrounding area; and,
- Detailed site layout drawing ref: 598-SK-103.

7.3.2 It is noted that the proposed site layout has undergone some slight changes since the revision issued above, upon which the noise study is based. The current layout is referenced as 598-PL-101-A and was issued on the 5th March 2015. The revisions made in the latest issue of the layout are mainly cosmetic and very minimal in terms of noise implications. These did not include any significant movement of buildings or facilities or any new buildings and as such did not necessitate a revision to the noise study. The key revisions included:

- “The Hub” has been made more angular in appearance but the location and use of the space remains the same; and,
- The façades of the “Extra Care”, “Supported Living” and “Nursing Home” buildings have been stepped in and out a little more to become more aesthetically pleasing, but the use and general footprints remain the same.

7.3.3 Aside from the listed changes the fundamentals of the site remain unchanged.

7.3.4 In terms of the noise assessment the changes detailed are minimal and are unlikely to significantly alter the conclusions or recommendations drawn within this report. As such the layout assessed within the study suitably and adequately considers the issue of potential noise impacts associated with, and on, the overall development.

8 Noise Impact Assessment – Residential Acceptability

8.1.1 In this section of the report the suitability of the development site for the proposed end use has been considered in accordance with the relevant criteria of the guidance summarised in section 3. This has been separated into the following elements which will be discussed further within this section:

- Impacts of static plant and equipment associated with the facility; and,
- Suitability for residential provision associated with the residential health care aspects.

8.2 Static Plant and Equipment

8.2.1 At this stage of the development no specific information is available relating to the specification of any fixed noise generating plant such as air conditioning fans, refrigeration plant or other fixed noise sources that are to be utilised within the scheme. Further to this, it is understood that the specific location and hours of operation have also to be determined.

8.2.2 As no data is available for the fixed plant, it cannot be included within the predictive modelling assessment. However, it is possible to set plant noise emission limits which could then be used to form the basis of an appropriately worded planning condition to control noise generated by static plant associated with the development.

8.2.3 Within the scope of the design of any such plant the following key issues should be borne in mind:

- Any such external fixed plant should, as far as possible, be located on façades not facing directly onto any sensitive residential receptors (either existing or proposed);
- Where possible static plant should be positioned at ground level, allowing for easier citing of mitigation if and where necessary;
- The noise levels emitted from any such equipment should be attenuated by appropriate source noise control techniques to ensure that they do not exceed the criteria qualified by the LPA in the consultation response. The LPA require any such plant to be designed and specified to achieve a 'rating level' of existing $L_{A90} - 5\text{dB(A)}$ external to any adjacent inhabited property /sensitive receptor (existing or proposed); and,
- Potentially noisy plant and equipment should only be used when necessary and switched off when not in use.

8.2.4 Based upon the above specified design levels and the baseline noise levels qualified within the area it would be necessary for the static plant on the development to accord with the following design parameters at the nearest sensitive receptors. However, depending upon the time duration between the baseline survey informing this study (2015) and the detailed design of the plant it may be prudent to redefine the baseline noise climate at the sensitive receptors to ensure a commensurate level of protection for adjacent residents.

Table 8-1: Static Plant Design Levels

Receptor proximity	Assessment Period	Measured L_{A90} level	LPA specified criteria	Appropriate limit
Receptors to the north off Crossland Dr. (northern receptors) (Measurement positions Loc 1 and 2)	Daytime	49	$L_{A90} - 5\text{dB}$	44
	Night-time	33	$L_{A90} - 5\text{dB}$	28
Receptors to the east off Gaulter Close (Measurement positions Loc 2, 5 and 3)	Daytime	49	$L_{A90} - 5\text{dB}$	44
	Night-time	34	$L_{A90} - 5\text{dB}$	29
Receptors to the south off Lavant Dr. (Measurement position Loc 3)	Daytime	49	$L_{A90} - 5\text{dB}$	44
	Night-time	35	$L_{A90} - 5\text{dB}$	30
Receptors to the west off Havant Farm Close (Measurement positions Loc 1 and 4)	Daytime	53	$L_{A90} - 5\text{dB}$	48
	Night-time	33	$L_{A90} - 5\text{dB}$	28

8.2.5 Once the specifics of the fixed plant/equipment required, including location and hours of operation, are determined, further acoustic assessment would be required in order to ensure that the operation of the equipment does not have a detrimental effect on the noise climate of the area.

8.3 Residential Provision Assessment – Healthcare Facilities

8.3.1 As previously discussed (Section 3) the release of the NPPF (National Planning Policy Framework) supersedes the guidance of PPG24, however the NPPF does not go as far as to provide an alternative assessment methodology for residential suitability, which formed a key part of the PPG24 document. Therefore, consideration of residential suitability was proposed to the LPA to be undertaken in line with the Noise Exposure Category (NEC) methodology of PPG24 along with consideration of internal limits in accordance with BS8233 and WHO guidelines.

8.3.2 Whilst it is noted that the healthcare facilities proposed on the site are not strictly residential in classification, they do involve residential aspects and as such would share the same minimum amenity requirements. Therefore it is deemed appropriate to consider these elements of the site in accordance with stringent residential limits.

8.3.3 The assessment presented within Tables 7-1 and 7-2 shows that the measured peripheral noise levels would fall into the noise exposure categories (NEC) as detailed. Analysis of the subjective field notes completed during the monitoring survey concluded that traffic movements on the surrounding road network are the dominant noise source of the area. Further noise sources include domestic noise from the nearby residential properties and limited natural noise. Therefore the site will be assessed under the “mixed/ road noise” banding classifications of PPG24.

Residential Noise Assessment – Overnight Period

- 8.3.4 Within PPG24 Note 1 of Annex 1, states that “sites where individual noise events regularly exceed 82dB L_{Amax} several times in any hour should be treated as being in NEC C, regardless of the L_{Aeq} (except where the $L_{Aeq, 8hr}$ already puts the site in NEC “D”)”. Analysis of the data presented within Appendix B indicates that the 82dB criterion is not exceeded a significant number of times at any location during the overnight period. As such it is noted that the data presented within Table 6 1 below is subject to no change as a result of the PPG24 L_{Amax} correction.

Table 8-2: Residential Suitability - Overnight Assessment

Location	Free Field Noise Level $L_{Aeq,T}$	PPG24 Noise Source Assessment Category	PPG24 Noise Exposure Category (NEC)
Location M01	52.4	'Mixed/ Road' Sources	B
Location M02	47.8		B
Location M03	46.8		B
Location M04	52.5		B
Location M05	51.9		B

- 8.3.5 The assessment of the existing noise climate indicates that the site lies within NEC B. PPG24 classified this banding as:

NEC B (and C) cover(s) situations where mitigation should be considered in order to ensure an appropriate noise climate can be achieved.

- 8.3.6 However, the information presented within Table 8-2 is based upon levels quantified around the periphery of the site and therefore to consider noise propagation across the site a 3-D noise model has been constructed (Section 6.0). Within this exercise the noise levels monitored at Locations M01 – M05 have been utilised to give an estimation of the propagation of noise as it decays across the site from the peripheral sources. Due to the dominance of road traffic noise in the area the measured noise levels have been corrected to line source levels representative of the surrounding road network. Levels have been corrected separately for both the daytime and night-time periods.
- 8.3.7 The tolerance between the measured night-time L_{Aeq} noise levels and the model output at these same positions was noted to be within +/- 2dB and as such the noise model is considered to provide a robust representation of the noise propagation across the site. At the outer end of this range (2dB) the model results in an overestimation of noise and as such is considered robust.
- 8.3.8 The results of this modelling exercise for the night-time period is contained within Figure 8-1 below. For clarity the coloured scale has been amended to reflect the PPG24 bandings for “Mixed/ Road Traffic” sources.

Figure 8-1: Overnight Noise Contours (PPG24 NEC bandings)



8.3.9 It is noted that based upon the propagation of noise across the development site the majority of the site would fall within NEC "B" during the overnight period.

8.3.10 However, in order to consider the change in noise propagation characteristics across the site as a result of the development itself the layout Plan (Figure 1-2) has been input into the noise model. The output is presented within Figure 8-2 below:

Figure 8-2: Overnight Noise Contours (PPG24 NEC Bandings) – Site Layout Plan



8.3.11 Implementation of the layout details that the noise climate of the site would change as a result of screening provision from the development buildings, with some sheltered areas of the site

reducing to NEC “A”. The majority of the development site remains within NEC “B”. However, we would note that during the overnight period internal criteria would be more appropriate for the consideration of residential suitability.

- 8.3.12 It is further noted that within the design for the site is a roof terrace within the central area of the Nursing Home building. The roof terrace would be on the roof of a single story element of the building and surrounded on all sides by 2 story elements. As such due to the elevated nature of this roof terrace the overnight noise levels are predicted to be within NEC “A/B”.

Residential Noise Assessment – Daytime Period

- 8.3.13 PPG24 also requires that daytime (07:00 – 23:00) levels be considered within the scope of any residential suitability assessment. Table 8-3 below presents the results of the assessment of the peripheral measured daytime noise levels at each location against the criteria of PPG24.
- 8.3.14 As with the overnight period it is noted that the information within Table 8-3 considers the noise levels at the perimeter measurement positions only.

Table 8-3: Residential Suitability - Daytime Assessment

Location	Free Field Noise Level $L_{Aeq,T}$	PPG24 Noise Source Assessment Category	PPG24 Noise Exposure Category (NEC)
Location M01	59.8	'Mixed/ Road' Sources	B
Location M02	57.3		B
Location M03	53.8		A
Location M04	56.5		B
Location M05	55.5		B

- 8.3.15 The assessment of the existing noise climate at the peripheral monitoring positions during the daytime period indicates that the noise climate during the daytime is similar to the overnight. The majority of the site is identified to be within NEC “B2, with certain areas to the south near the Lavant Dr. elevation reducing to within NEC A. PPG24 classifies these bandings as:

NEC A indicates noise need not be considered as a determining factor in granting planning permission.

NEC B (and C) cover(s) situations where mitigation should be considered in order to ensure an appropriate noise climate can be achieved.

- 8.3.16 The 3D noise model has been revised to consider the daytime period. For the daytime period, the tolerance between the measured noise levels at locations M01 to M05 and the model output was noted to be within +/- 1dB and as such the noise model is considered robust across the majority of the site. The results of this modelling exercise for the daytime period is contained within Figure 8-3 below, with the coloured scale amended to reflect the PPG24 daytime bandings for “Mixed/ Road Traffic” sources.

Figure 8-3: Daytime Noise Contours (PPG24 NEC Bandings)



8.3.17 During the daytime period, the noise contours indicate that the noise climate over the majority of the site area would fall within NEC "B/A".

NEC A indicates noise need not be considered as a determining factor in granting planning permission.

NEC B (and C) cover(s) situations where mitigation should be considered in order to ensure an appropriate noise climate can be achieved.

8.3.18 To the south immediately adjacent to Lavant Dr. there is a possibility that the noise climate may result in an area of NEC "C", however reference to Figure 1-2 details that this not associated with any sensitive element of the development.

8.3.19 As with the overnight assessment the Layout Plan (Figure 1-2) has been input into the daytime noise model, with the output presented within Figure 8-4 below:

Figure 8-4: Daytime Noise Contours (PPG24 NEC Bandings) - Layout Plan



8.3.20 With reference to Figure 8-4 it can be seen that the introduction of the residential building increases the proportion of the site to the centre/east falling within PPG24 NEC "A". Areas around the perimeter of the site remain in NEC "B" due to no screening evident from the building structures.

8.3.21 As previously stated the area of the site identified as NEC "C" (thin yellow contour to the south) relates to an area which would not relate to a sensitive element of the development.

External living space

8.3.22 The site layout plan presented within drawing reference CRM.1112.005.D.008 indicates a number of areas identified as garden amenity spaces. It is noted that the numbers presented below (and in Figure 8-5) relate only to this discussion and are not consistent across other disciplines of the application.

- Area 1: Ground level amenity space to the north western corner of the application site. Grid Noise Map (Figures 8-2, 8-4 and 8-5) at 1.5m above ground.
- Area 2: roof terrace amenity area. The central area of the Nursing Home Building is single floor with the roof terrace on the top. The surrounding elements of the Nursing Home Building are 2 story. Grid Noise Map (Figures 8-2, 8-4 and 8-5) at 5m above ground.
- Area 3: Ground level amenity space to the north eastern central area of the application site. Grid Noise Map (Figures 8-2, 8-4 and 8-5) at 1.5m above ground.
- Area 4: Ground level amenity space to the southern area of the application site. Grid Noise Map (Figures 8-2, 8-4 and 8-5) at 1.5m above ground.

8.3.23 For reference, these areas are highlighted in red on figure 8-5 below.

Figure 8-5: Proposed Garden Amenity Areas



8.3.24 The indicative noise contours presented above detail that Areas 2 to 4 would be acceptable for amenity space with regard to noise, being within NEC "A" (below 55dB(A)).

8.3.25 With regard to Area 1, this is demonstrated to be within NEC "B" and as such would need some level of mitigation to ensure acceptable noise prevails within this area.

8.4 Internal Noise Assessment.

8.4.1 In order to provide a rounded assessment of the proposed development it is pertinent to consider internal noise criteria within the residential aspects of the development, specifically during the overnight period when people would be residing within the dwellings. To facilitate this the guidance of BS8233 has been considered, specifically the guidance of 35dB $L_{Aeq, 16 \text{ hours}}$ (daytime) and 30 dB $L_{Aeq, 8 \text{ hours}}$ (overnight).

8.4.2 Therefore, any sound insulation proposed within the design of the dwellings should ensure that internal noise levels are brought down to meet these limits for both the daytime and overnight periods.

8.4.3 The noise model has been further analysed to provide noise levels at each of the façades of the proposed buildings, as these would vary significantly from the levels monitored at the peripheral monitoring locations due to distance and screening reductions. The predicted façade noise levels are referenced in accordance with the coloured scales presented within Table 8-4 below. This scale has been derived in order to provide information to developers relating to the required construction detail of each façade, specifically with regard to glazing and ventilation provision. The rationale behind each selected scale value and colour is detailed within Table 8-4 below.

Table 8-4: Appendix C Coloured Scale Derivation

Scale Colour	Façade Value	Rationale
Overnight Period		
Green	<46dB(A)	These façades would require standard 4/12/4 thermal double glazed units and no alternative ventilation provision. This is based up on achieving an internal L_{Aeq} of 30dB(A) and assuming a façade correction of -13dB for a partially open window for ventilation (+3dB façade correction).
Yellow	46<dB(A)>58	These façades would require standard 4/12/4 thermal double glazed units and alternative ventilation provision. This is based upon achieving an internal L_{Aeq} of 30dB(A) and assuming a façade correction of -25dB(A) ^{*(1)} (+3dB façade correction). This would require that windows remain closed to achieve the required level of acoustic protection; as such, alternative forms of ventilation would be required.
Red	>58dB(A)	These façades would require enhanced double glazed units and alternative ventilation provision if glazing is included in the façade. Based on the level of attenuation required (greater than 25dB(A)) façades in this band would require to be considered on an individual basis, if glazing is specified. Without any glazed element standard blockwork would be wholly acceptable.
Daytime Period		
Green	<51dB(A)	These façades would require standard 4/12/4 thermal double glazed units and no alternative ventilation provision. This is based on achieving an internal L_{Aeq} of 35dB(A) and assuming a façade correction of -13dB for a partially open window for ventilation (+3dB façade correction).
Yellow	<51dB(A)>63	These façades would require standard 4/12/4 thermal double glazed units and alternative ventilation provision. This is based upon achieving an internal L_{Aeq} of 35dB(A) and assuming a façade correction of -25dB(A) ^{*(1)} (+3dB façade correction). This would require that windows remain closed to achieve the required level of acoustic protection; as such, alternative forms of ventilation would be required.
Red	>63dB(A)	These façades would require enhanced double glazed units and alternative ventilation provision if glazing is included in the façade. Based on the level of attenuation required (greater than 25dB(A)) façades in this band would require to be considered on an individual basis, if glazing is necessary. Without any glazed element standard blockwork would be wholly acceptable.

^{*(1)} **The façade attenuation of 25dB(A) is based upon a standard 4/12/4 double glazing as specified by Pilkington Glass.**

8.4.4 The results of the predictive façade calculations are presented within Appendix C (Figures C-1 to C-2) of this report. Generally standard 4/12/4 glazing would be acceptable across the development although certain façades would require alternative forms of ventilation provision.

8.5 Acoustic Ventilation Systems

8.5.1 As a result of the level of attenuation required to be achieved by certain façades of the development, alternative means of ventilation would be required in order that the windows do not need to be opened for this purpose.

8.5.2 This could be by means of one of the following methods:

- localised acoustic trickle ventilation (type acoustic ventilator as specified in the Noise Insulation Regulations). Acoustic trickle ventilators are typically situated within the window frame and can be specified to afford varying degrees of protection against the ingress of noise. A number of commercial trickle ventilation products are available from a range of manufacturers offering attenuation in the range of 31dB to 50dB depending on the manufacturer and the specific product; or,
- a whole building system via internal duct work venting onto a quieter façade/the roof of the building.

8.5.3 Should the final development scheme include a whole building system the associated duct work, and any fans would require being adequately treated and silenced so as to prevent mechanical noise becoming an issue within any of the interconnected rooms. This would be controlled and mitigated within the full, final design for the development.

9 Conclusion

- 9.1.1 A noise assessment has been completed for submission in support of an application for a Healthcare and wellbeing Campus including residential elements on a parcel of land at off Oak park, Havant.
- 9.1.2 A noise survey has been completed at the site to quantify the existing noise climate of the area. The survey concluded that the noise climate is dominated by infrastructure noise associated with the surrounding road network.

9.2 Construction

- 9.2.1 As a result of the level of information available only a qualitative construction noise has been completed identifying operational limits and potential control measures. However, subject to the implementation of appropriate controls on construction activities where necessary within a CEMP the condition proposed by the LPA within the scoping exercise should be achieved.

9.3 Static Plant and Equipment

- 9.3.1 At this stage of the development no specific information is available relating to the specification of any fixed noise generating plant associated with the development. As such it is proposed that this aspect of the development be controlled by a suitably worded planning condition similar to that proposed by the EHO during the consultation formal scoping exercise.

9.4 Residential Suitability

- 9.4.1 The noise monitoring details that the external noise environment during both the daytime and overnight periods would be categorised in line with the PPG24 as between NEC "A" and "B". However, with the implementation of the proposed indicative layout the areas of NEC "A" vastly increased during both the daytime and overnight periods.
- 9.4.2 Given the PPG24 categorisations detailed above, specific acoustic mitigation measures would be a requirement of the development at this site in order to achieve an appropriate noise climate within sensitive external areas specifically that identified as Area 1 on Figure 8-5. This would be achieved by the provision of appropriately positioned and specified acoustic fencing.
- 9.4.3 Furthermore, consideration of internal noise has also been undertaken within the scope of this study, with the conclusion being drawn that based upon the model constructed 4/12/4 double glazing would be sufficient across the site although certain façades would require alternative forms of ventilation to prevent the need to open the windows for this purpose. This is identified within Figures C-1 and C-2 of Appendix C.

9.5 General Conclusion

- 9.5.1 Overall it is concluded that there are no significant issues relating to noise impacts associated with the proposed development that could not be controlled by the implementation of appropriate acoustic mitigation strategies at the site as detailed within this report.
- 9.5.2 As such noise should not be classified as a material factor that would preclude the development from being granted full planning permission for a residential end use.

REFERENCES

National Planning Policy Framework (NPPF) March 2012

Noise Policy Statement for England (NPSE) March 2010

Planning Practice Guidance – Noise December 2014

Department for Communities and Local Government - Planning Policy Guidance Note 24, 1994

British Standards Institution. British Standard 8233: Guidance on Sound Insulation and Noise Reduction for buildings', 2014.

World Health Organisation Guidelines for Community Noise, 1999

World Health Organisation Night Noise Guidelines for Europe, 2009

Department of Health - Health Technical Memorandum (HTM) 08-01: Acoustics, March 2013

British Standards Institution. British Standard 5228: Code of practice for noise and vibration control and open sites, Part 1 (+A1) 2014, Part 2 2009

British Standards Institution. British Standard 7385: Evaluation and measurement for Vibration in Buildings Part 1:1990 and Part 2:1992

British Standards Institution. British Standard 6472: Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting. Part 1 2008.

International Organisation for Standardisation 9613 Acoustics – Attenuation of Sound during Propagation Outdoors, 1993

Appendix A – Calibration Certification

Calibration Report

Certificate No.:15101

01dB Type: Solo Black 01 Serial no: 65396

Customer: Enzygo Ltd
Address: The Granary, Woodend Lane, Cromhall,
Gloucestershire. GL12 8AA.
Contact Person: Mark Harrison.

Instrument software version: V1.403 2728
Microphone : 01dB Type: MCE212 Serial no: 142607 Sens:-26.29dB
Preamplifier 01dB Type: PRE21S Serial no: 15479
Calibrator: Cirrus Type: 515 Serial no: 59522 Level:94.00dB

This sound level meter has been calibrated as specified in BS 7580. PART 1: 1997. The results are traceable to NPL, UK.
Measurement Results:

Calibration of sound level meter - BS7580 Clause 5.4	Passed
Noise test - BS 7580 Clause 5.5.2	Passed
Level Linearity Test - BS 7580, Clause 5.5.3	Passed
Frequency weightings: A Network - BS 7580 Clause 5.5.4	Passed
Frequency weightings: B Network - BS 7580 Clause 5.5.4	Passed
Frequency weightings: C Network - BS 7580 Clause 5.5.4	Passed
Frequency weightings: Flat Network - BS 7580 Clause 5.5.4	Passed
Time weightings F and S - BS7580 Clause 5.5.5	Passed
Peak response - BS7580 Clause 5.5.6	Passed
RMS accuracy - BS7580 Clause 5.5.7	Passed
Time weighting I - BS7580 Clause 5.5.8	Passed
Integrating Test : Time averaging - BS7580 Clause 5.5.9	Passed
Integrating Test : Pulse range - BS7580 Clause 5.5.10	Passed
Integrating Test : Sound exposure level - BS7580 Clause 5.5.11	Passed
Overload SPL Test - BS 7580 Clause 5.5.12	Passed
Overload Leq Test - BS 7580 Clause 5.5.12	Passed
Acoustic tests - BS 7580 Clause 5.4 and 5.6	Passed
Summation of acoustic tests - BS 7580 Clause 5.5.4	Passed

The sound level meter in the configuration tested
conforms to the requirements of BS 7580 Part 1.

Comment:
Correct level with associated calibrator is 93.9dB(A).

Environmental conditions:

Pressure: 101.485 kPa Temperature: 24.4 °C Relative humidity: 42.1 %RH

Date of calibration: 20/12/2013

Date of issue: 20/12/2013

Supervisor: Darren Batten Tech IOA
Engineer


Michael Tickner

Software version: 6.0d



Campbell Associates

www.campbell-associates.co.uk

Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)

University of
Salford
MANCHESTER

Page 1 of 2

APPROVED SIGNATORIES

Claire Lomax ☒ Andy Moorhouse ☐

Gary Phillips ☐ Danny McCaul ☐



acoustic calibration laboratory

The University of Salford, Salford, Greater Manchester, M5 4WT, UK

<http://www.acoustics.salford.ac.uk>

t: 0161 295 3930/0161 295 3319 f: 0161 295 4456 e: c.lomax1@salford.ac.uk

Certificate Number: 01733/2

Date of Issue: 28 March 2014

VERIFICATION OF A SOUND LEVEL METER

FOR:	Enzygo Ltd STEP Business Centre Wortley Road Deepcar Sheffield S36 2UH
FOR THE ATTENTION OF:	Mark Harrison
CALIBRATION DATE:	28 March 2014
TEST PROCEDURE:	CTP08 (Laboratory Manual)

Sound Level Meter			
Manu:	01dB	Model:	Solo Serial No: 65446
Microphone			
Manu:	01dB	Model:	MCE212 Serial No: 142686
Preamp			
Manu:	01dB	Model:	PRE 21 S Serial No: 15989

Test Engineer (initial):



Name: Gary Phillips

This certificate provides traceability of measurement to recognised national standards, and to the units of measurement realised at the National Physical Laboratory or other recognised national standards laboratories. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)

Page 2 of 2

Certificate Number: 01733/2

Date of Issue: 28 March 2014

SET-UP INFORMATION

The instrument version was Master 01 V1.404. The tests were performed with the pre-amplifier connected via the supplied microphone extension cable to the instrument's microphone input socket. The reference range, reference SPL, primary indicator range, pulse range and linearity range as specified by the manufacturer have been used. The instrument was adjusted to read 93.8 dB (A) in response to a laboratory sound calibrator. This reading was obtained from the calibration certificate of the calibrator, and information in the manufacturer's instruction manual. The instrument was calibrated without a windshield. Consult manufacturer's instructions if using a windshield.

MEASUREMENTS

The levels of self-generated noise were:	A:	10.9 dB*
	B:	8.5 dB*
	C:	9.6 dB*
	Z:	14.3 dB*

*Under-range indicated on instrument

THE SOUND LEVEL METER WAS VERIFIED ACCORDING TO THE PROCEDURE GIVEN IN BS7580: Part 1 1997 WITH THE FOLLOWING EXCEPTIONS:

As no sound calibrator was submitted, a suitable laboratory sound calibrator was used for the initial set up.

As no sound calibrator was submitted, it was not possible to obtain a response to an associated sound calibrator.

A stricter test than that specified in 5.5.10 and 5.5.11 of BS 7580 has been used by not applying the low level signal.

STATEMENT OF RESULT:

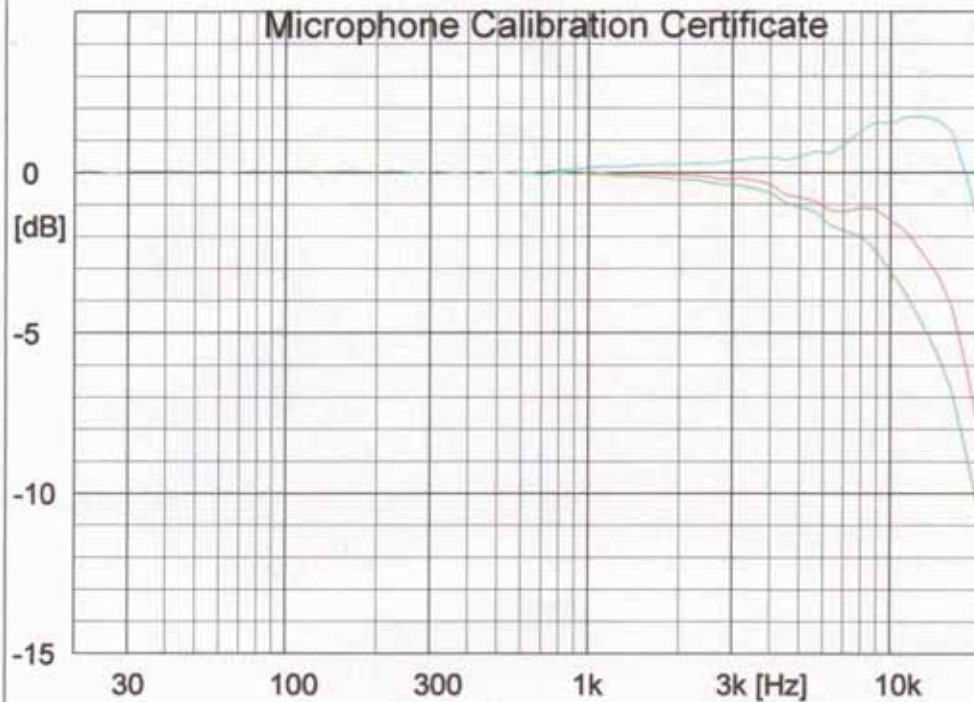
THE SOUND LEVEL METER CONFORMS TO THE TOLERANCES SPECIFIED IN BS7580: PART1 1997

Instruments used in the verification procedure were traceable to National Standards. The method of acoustic calibration employed a standard sound pressure calibrator for the 1 kHz test whilst the tests at 125 Hz and 8 kHz were performed by the electrostatic actuator method. The uncertainty of the Laboratory's 1 kHz calibrator was ± 0.10 dB. The uncertainty of the standard calibrator is not included in the applied tolerances. It is assumed that the sound level meter was manufactured in accordance with BSEN60651: 1994 Type 1, and BSEN60804: 1994 Type 1.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements. All measurement results are retained at the acoustic calibration laboratory for at least four years.

This certificate provides traceability of measurement to recognised national standards, and to the units of measurement realised at the National Physical Laboratory or other recognised national standards laboratories. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

Microphone Calibration Certificate



25 March 2014

University of
Salford
MANCHESTER

01dB MCE212

Serial No: 142686

Nominal

Capacitance: 20.0 pF

Polarization Voltage: 0V

Free field response

Actuator response

acoustic calibration laboratory

The University of Salford, The Crescent,
Salford, Greater Manchester, M5 4WT

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Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)

University of
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MANCHESTER

Page 1 of 2

APPROVED SIGNATORIES

Claire Lomax [☒] Andy Moorhouse [☐]

Gary Phillips [☐] Danny McCaul [☐]



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Certificate Number: 01733/1

Date of Issue: 28 March 2014

VERIFICATION OF A SOUND LEVEL METER

FOR:	Enzygo Ltd STEP Business Centre Wortley Road Deepcar Sheffield S36 2UH
FOR THE ATTENTION OF:	Mark Harrison
CALIBRATION DATE:	28 March 2014
TEST PROCEDURE:	CTP08 (Laboratory Manual)

Sound Level Meter

Manu: 01dB Model: Solo Serial No: 65445

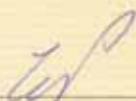
Microphone

Manu: 01dB Model: MCE212 Serial No: 103452

Preamp

Manu: 01dB Model: PRE 21 S Serial No: 14979

Test Engineer (initial):



Name: Gary Phillips

Certificate of Calibration

Issued by University of Salford (Acoustics Calibration Laboratory)

Page 2 of 2

Certificate Number: 01733/1

Date of Issue: 28 March 2014

SET-UP INFORMATION

The instrument version was Master 01 V1.404. The tests were performed with the pre-amplifier connected via the supplied microphone extension cable to the instrument's microphone input socket. The reference range, reference SPL, primary indicator range, pulse range and linearity range as specified by the manufacturer have been used. The instrument was adjusted to read 93.8 dB (A) in response to a laboratory sound calibrator. This reading was obtained from the calibration certificate of the calibrator, and information in the manufacturer's instruction manual. The instrument was calibrated without a windshield. Consult manufacturer's instructions if using a windshield.

MEASUREMENTS

The levels of self-generated noise were:	A:	10.3 dB*
	B:	9.1 dB*
	C:	10.8 dB*
	Z:	16.6 dB*

*Under-range indicated on instrument

THE SOUND LEVEL METER WAS VERIFIED ACCORDING TO THE PROCEDURE GIVEN IN BS7580: Part 1 1997 WITH THE FOLLOWING EXCEPTIONS:

As no sound calibrator was submitted, a suitable laboratory sound calibrator was used for the initial set up.

As no sound calibrator was submitted, it was not possible to obtain a response to an associated sound calibrator.

A stricter test than that specified in 5.5.10 and 5.5.11 of BS 7580 has been used by not applying the low level signal.

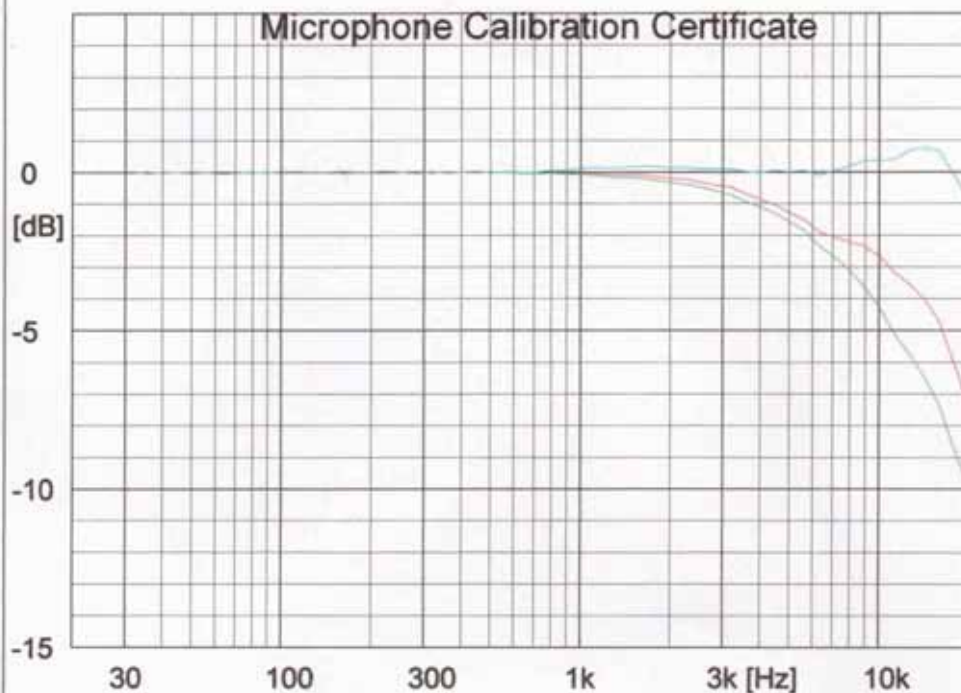
STATEMENT OF RESULT:

THE SOUND LEVEL METER CONFORMS TO THE TOLERANCES SPECIFIED IN BS7580: PART1 1997

Instruments used in the verification procedure were traceable to National Standards. The method of acoustic calibration employed a standard sound pressure calibrator for the 1 kHz test whilst the tests at 125 Hz and 8 kHz were performed by the electrostatic actuator method. The uncertainty of the Laboratory's 1 kHz calibrator was ± 0.10 dB. The uncertainty of the standard calibrator is not included in the applied tolerances. It is assumed that the sound level meter was manufactured in accordance with BSEN60651: 1994 Type 1, and BSEN60804: 1994 Type 1.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements. All measurement results are retained at the acoustic calibration laboratory for at least four years.

This certificate provides traceability of measurement to recognised national standards, and to the units of measurement realised at the National Physical Laboratory or other recognised national standards laboratories. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.



25 March 2014

University of
Salford
MANCHESTER

01dB MCE212

Serial No: 103452

Nominal

Capacitance: 20.0 pF

Polarization Voltage: 0V

Free field response

Actuator response

acoustic calibration laboratory

The University of Salford, The Crescent,
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<http://www.cae.salford.ac.uk/calibration/>

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f: 0161 295 4442 e: s.jomax1@salford.ac.uk

Certificate of Calibration



Certificate Number: **100883**

Date of Issue: **29 December 2014**

Instrument

Manufacturer: **Cirrus Research plc**

Type: **Acoustic Callibrator**

Model Number: **CR:515**

Serial Number: **59522**

Calibration Procedure

The sound calibrator detailed above has been calibrated to the published data as described in the operating manual and in the half-inch configuration. The procedures and techniques used are as described in IEC 60942:2003 Annex B – Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK:224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 kPa using the manufacturer's data.

Date of Calibration: **29 December 2014**

Initial Calibration Results

Measurement	Level (dB)	Frequency (Hz)	Distortion (% THD + Noise)
1	93.88	1000.3	0.24
2	93.89	1000.3	0.27
3	93.89	1000.3	0.25
Average	93.89	1000.3	0.25
Uncertainty	± 0.13	± 0.1	± 0.10

The reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level.

Adjusted Calibration Results

Measurement	Level (dB)	Frequency (Hz)	Distortion (% THD + Noise)
1	94.01	1000.3	0.19
2	94.02	1000.3	0.12
3	94.02	1000.3	0.30
Average	94.02	1000.3	0.20
Uncertainty	± 0.13	± 0.1	± 0.10

The reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level.

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Environmental Conditions

Pressure: 103.08 kPa
Temperature: 24.4 °C
Humidity: 27.4 %

Evidence of Pattern Approval

The manufacturer's product information indicates that this model of sound calibrator has been formally pattern approved to IEC 60942:2003 Annex A to Class 1. This has been confirmed with the Physikalisch-Technische Bundesanstalt (PTB).

Statement of Calibration

As public evidence was available, from a testing organisation responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, the sound calibrator tested is considered to conform to all the Class 1 requirements of IEC 60942:2003.

Calibration Laboratory

Laboratory: Cirrus Research plc
Acoustic House, Bridlington Road, Hunmanby
North Yorkshire, YO14 0PH, United Kingdom

Test Engineer: David Mawtus



Appendix B – Noise Monitoring Dataset

Location M01 - SU 7197 0721
 Periods 1h
 Start 03/02/2015 13:51
 End 04/02/2015 13:51
 Location Solo 065446
 Weighting A
 Data type Leq
 Unit dB

Period start	Leq	Lmin	Lmax	L90	L10
03/02/2015 13:51	59.9	50.0	78.1	54.1	61.7
03/02/2015 14:51	59.8	51.3	74.4	55.5	61.9
03/02/2015 15:51	60.5	51.7	72.7	56.4	62.5
03/02/2015 16:51	60.6	50.5	78.6	56.3	62.3
03/02/2015 17:51	59.3	47.9	70.1	54.4	61.6
03/02/2015 18:51	58.4	46.3	67.0	52.8	61.1
03/02/2015 19:51	56.4	43.3	66.4	49.5	59.6
03/02/2015 20:51	56.0	43.0	77.0	48.5	58.9
03/02/2015 21:51	55.1	39.3	72.6	43.9	58.3
03/02/2015 22:51	52.2	36.1	69.6	39.1	56.0
03/02/2015 23:51	49.8	32.6	65.4	35.2	53.8
04/02/2015 00:51	47.5	31.4	65.9	33.7	50.6
04/02/2015 01:51	45.6	29.6	68.2	31.5	45.3
04/02/2015 02:51	44.0	28.4	65.4	31.0	45.7
04/02/2015 03:51	47.5	30.6	66.5	32.9	49.9
04/02/2015 04:51	54.4	34.8	68.0	39.4	58.5
04/02/2015 05:51	58.3	42.9	72.3	50.4	61.4
04/02/2015 06:51	60.7	49.3	70.2	55.8	63.3
04/02/2015 07:51	62.5	52.6	81.2	57.4	63.7
04/02/2015 08:51	60.6	49.6	79.3	55.8	62.8
04/02/2015 09:51	59.8	50.6	76.5	54.9	62.0
04/02/2015 10:51	58.9	49.0	68.7	53.9	61.5
04/02/2015 11:51	60.2	46.5	83.9	53.8	61.4
04/02/2015 12:51	59.5	48.6	73.3	53.9	61.8

File M02 - SU 7208 0721
 Periods 15m
 Start 03/02/2015 15:15
 End 03/02/2015 16:00
 Location Solo 065396
 Weighting A
 Data type Leq
 Unit dB

Period start	Leq	Lmin	Lmax	L90	L10
03/02/2015 15:15	61.8	46.5	86.3	51.6	60.4
03/02/2015 15:30	57.7	47.0	65.4	52.6	60.3
03/02/2015 15:45	57.8	47.7	68.0	51.3	60.7
Overall	59.6	46.5	86.3	51.7	60.4
Period start	Leq	Lmin	Lmax	L90	L10
03/02/2015 17:10	58.5	50.0	72.8	54.3	60.2
03/02/2015 17:25	58.8	49.2	71.5	53.7	61.1
Overall	58.6	49.2	72.8	54.0	60.7
Period start	Leq	Lmin	Lmax	L90	L10
03/02/2015 18:50	56.6	44.9	65.5	48.1	60.2
03/02/2015 19:05	56.6	43.2	66.0	46.4	60.6
Overall	56.6	43.2	66.0	47.4	60.3
Period start	Leq	Lmin	Lmax	L90	L10
03/02/2015 20:30	53.2	40.5	62.4	43.8	57.7
03/02/2015 20:45	52.6	41.5	62.8	43.2	57.0
Overall	52.9	40.5	62.8	43.5	57.4
Period start	Leq	Lmin	Lmax	L90	L10
03/02/2015 22:32	50.5	38.1	70.2	39.6	54.6
03/02/2015 22:47	48.4	36.3	63.4	38.7	51.9
Overall	49.6	36.3	70.2	39.1	53.4
Period start	Leq	Lmin	Lmax	L90	L10
04/02/2015 01:15	48.7	33.0	75.2	34.5	47.8
04/02/2015 01:30	43.3	32.4	58.3	34.2	44.7
04/02/2015 01:45	35.1	31.5	48.4	32.4	35.7
04/02/2015 02:00	40.6	30.7	57.2	32.1	42.0
Overall	44.4	30.7	75.2	32.7	43.6
Period start	Leq	Lmin	Lmax	L90	L10
04/02/2015 04:31	45.5	32.1	62.1	33.1	48.0
04/02/2015 04:46	48.1	34.6	66.8	36.3	51.2
04/02/2015 05:01	47.9	35.1	58.6	38.2	52.7
04/02/2015 05:16	53.2	38.4	69.8	41.6	57.3
Overall	49.7	32.1	69.8	35.1	53.6

Period start	Leq	Lmin	Lmax	L90	L10
04/02/2015 07:43	59.1	49.4	67.0	52.5	61.9
04/02/2015 07:58	60.2	48.5	72.6	54.0	62.2
Overall	59.7	48.5	72.6	53.0	62.0
Period start	Leq	Lmin	Lmax	L90	L10
04/02/2015 09:24	57.3	45.8	68.3	50.2	60.5
04/02/2015 09:39	57.8	47.0	66.2	51.1	61.0
Overall	57.6	45.8	68.3	50.7	60.9
Period start	Leq	Lmin	Lmax	L90	L10
04/02/2015 11:03	56.6	44.9	66.3	49.0	59.6
04/02/2015 11:18	56.5	46.2	64.7	49.2	59.8
Overall	56.5	44.9	66.3	49.2	59.7
Period start	Leq	Lmin	Lmax	L90	L10
04/02/2015 12:43	56.8	45.9	69.5	49.5	59.6
04/02/2015 12:58	57.0	44.3	70.9	49.0	60.2
Overall	56.9	44.3	70.9	49.2	60.0

File M03 - SU 7204 0707
 Periods 1h
 Start 03/02/2015 13:39
 End 04/02/2015 13:39
 Location Solo 065445
 Weighting A
 Data type Leq
 Unit dB

Period start	Leq	Lmin	Lmax	L90	L10
03/02/2015 13:39	53.4	47.4	71.3	50.3	54.9
03/02/2015 14:39	54.2	48.5	68.4	51.5	55.9
03/02/2015 15:39	54.8	48.7	60.6	52.2	56.6
03/02/2015 16:39	54.7	49.7	68.2	52.2	56.1
03/02/2015 17:39	53.0	46.6	61.0	50.3	54.6
03/02/2015 18:39	52.3	45.6	58.6	49.3	54.2
03/02/2015 19:39	50.3	42.6	59.1	46.7	52.5
03/02/2015 20:39	48.5	41.5	57.0	44.6	51.0
03/02/2015 21:39	49.2	39.4	60.8	44.1	51.7
03/02/2015 22:39	46.3	36.7	59.1	40.0	49.5
03/02/2015 23:39	46.8	34.6	57.3	39.5	50.0
04/02/2015 00:39	46.4	34.4	58.0	38.0	50.0
04/02/2015 01:39	42.0	31.8	57.9	34.3	45.6
04/02/2015 02:39	38.9	30.8	51.4	33.2	42.0
04/02/2015 03:39	40.3	32.8	54.4	34.1	43.5
04/02/2015 04:39	47.1	34.8	56.9	38.2	50.7
04/02/2015 05:39	52.1	42.5	61.8	47.3	54.7
04/02/2015 06:39	54.6	46.4	69.1	51.4	56.4
04/02/2015 07:39	55.9	49.7	72.3	53.1	57.2
04/02/2015 08:39	55.4	47.8	70.7	52.4	57.1
04/02/2015 09:39	54.8	48.0	66.2	52.0	56.5
04/02/2015 10:39	54.1	47.3	61.7	51.1	56.0
04/02/2015 11:39	53.4	46.7	74.1	50.0	54.8
04/02/2015 12:39	53.5	46.2	63.9	50.4	55.3

File M04 - SU 7198 0713
 Periods 15m
 Start 03/02/2015 14:10
 End 03/02/2015 14:40
 Location Solo 065396
 Weighting A
 Data type Leq
 Unit dB

Period start	Leq	Lmin	Lmax	L90	L10
03/02/2015 14:10	56.1	49.2	61.0	52.7	58.2
03/02/2015 14:25	55.8	50.2	66.3	52.4	57.6
Overall	56.0	49.2	66.3	52.6	57.9
Period start	Leq	Lmin	Lmax	L90	L10
03/02/2015 16:02	58.4	53.0	69.4	55.6	60.3
03/02/2015 16:17	57.6	51.8	64.5	54.4	59.5
Overall	58.0	51.8	69.4	55.0	59.9
Period start	Leq	Lmin	Lmax	L90	L10
03/02/2015 17:43	55.7	49.1	61.1	52.6	57.5
03/02/2015 17:58	56.5	50.6	63.5	53.7	58.2
Overall	56.1	49.1	63.5	53.2	57.8
Period start	Leq	Lmin	Lmax	L90	L10
03/02/2015 19:23	55.8	47.6	63.1	51.9	58.2
03/02/2015 19:38	54.3	45.9	62.3	50.4	56.9
Overall	55.1	45.9	63.1	50.9	57.6
Period start	Leq	Lmin	Lmax	L90	L10
03/02/2015 21:02	52.7	42.3	61.6	47.2	55.5
03/02/2015 21:17	51.3	44.5	60.3	46.6	54.0
Overall	52.1	42.3	61.6	46.8	54.8
Period start	Leq	Lmin	Lmax	L90	L10
03/02/2015 23:09	49.0	38.0	63.5	39.9	52.2
03/02/2015 23:24	47.8	37.2	59.9	38.9	52.0
03/02/2015 23:39	49.0	39.0	60.6	40.7	52.3
03/02/2015 23:54	58.7	35.7	87.5	37.2	48.0
Overall	53.8	35.7	87.5	39.0	51.6
Period start	Leq	Lmin	Lmax	L90	L10
04/02/2015 02:21	42.1	31.3	60.3	33.4	43.0
04/02/2015 02:36	41.6	32.5	58.3	34.1	44.1
04/02/2015 02:51	40.6	32.1	54.6	33.6	43.4
04/02/2015 03:06	39.7	30.5	54.5	32.2	43.0
Overall	41.1	30.5	60.3	33.3	43.4

Period start	Leq	Lmin	Lmax	L90	L10
04/02/2015 05:37	54.1	44.3	63.6	47.9	56.8
04/02/2015 05:52	52.9	44.2	61.1	47.3	55.6
04/02/2015 06:07	54.5	46.6	63.7	49.6	57.3
04/02/2015 06:22	56.0	46.1	65.0	50.6	58.9
Overall	54.5	44.2	65.0	48.7	57.4
Period start	Leq	Lmin	Lmax	L90	L10
04/02/2015 08:17	59.3	54.4	70.6	56.2	61.0
04/02/2015 08:32	58.7	54.1	63.2	55.9	60.6
Overall	59.0	54.1	70.6	56.0	60.9
Period start	Leq	Lmin	Lmax	L90	L10
04/02/2015 09:58	56.6	50.4	61.0	53.6	58.5
04/02/2015 10:13	57.7	51.5	70.5	53.9	59.1
Overall	57.2	50.4	70.5	53.7	58.9
Period start	Leq	Lmin	Lmax	L90	L10
04/02/2015 11:36	55.4	49.9	61.2	52.0	57.5
04/02/2015 11:51	55.2	48.6	62.4	51.9	57.5
Overall	55.3	48.6	62.4	51.9	57.5
Period start	Leq	Lmin	Lmax	L90	L10
04/02/2015 13:20	55.8	49.2	64.7	52.5	57.8
04/02/2015 13:35	56.7	49.4	63.2	53.1	58.7
Overall	56.3	49.2	64.7	52.8	58.4

File M05 - SU 7203 0712
 Periods 15m
 Start 03/02/2015 14:43
 End 03/02/2015 15:13
 Location Solo 065396
 Weighting A
 Data type Leq
 Unit dB

Period start	Leq	Lmin	Lmax	L90	L10
03/02/2015 14:43	55.2	47.8	66.3	51.7	57.2
03/02/2015 14:58	58.1	44.1	86.0	47.8	56.1
Overall	56.9	44.1	86.0	48.8	56.8
Period start	Leq	Lmin	Lmax	L90	L10
03/02/2015 16:35	56.4	50.1	61.4	53.5	58.1
03/02/2015 16:50	56.5	50.5	62.0	53.9	58.0
Overall	56.4	50.1	62.0	53.7	58.1
Period start	Leq	Lmin	Lmax	L90	L10
03/02/2015 18:16	55.4	49.6	61.9	52.3	57.4
03/02/2015 18:31	54.3	47.1	62.1	50.2	56.5
Overall	54.9	47.1	62.1	51.1	56.9
Period start	Leq	Lmin	Lmax	L90	L10
03/02/2015 19:56	52.8	45.9	58.2	48.6	55.4
03/02/2015 20:11	52.2	44.1	58.6	47.7	54.4
Overall	52.5	44.1	58.6	48.2	54.9
Period start	Leq	Lmin	Lmax	L90	L10
03/02/2015 21:35	52.1	40.9	69.5	45.9	54.6
03/02/2015 21:50	51.7	42.5	64.5	45.8	54.6
03/02/2015 22:05	55.2	40.7	72	45.8	56.2
Overall	53.3	40.7	72.0	45.8	55.0
Period start	Leq	Lmin	Lmax	L90	L10
04/02/2015 00:11	47.0	33.5	67.8	35.6	49.8
04/02/2015 00:26	46.6	34.3	58.7	37.5	49.9
04/02/2015 00:41	46.4	35.3	60.4	37.9	49.5
04/02/2015 00:56	44.3	33.5	56.0	36.2	47.7
Overall	46.2	33.5	67.8	36.6	49.4
Period start	Leq	Lmin	Lmax	L90	L10
04/02/2015 03:28	41.4	31.6	53.1	32.5	45.5
04/02/2015 03:43	41.7	32.4	58.2	33.9	44.8
04/02/2015 03:58	40.7	32.9	54.0	34.0	43.1
04/02/2015 04:13	40.9	31.8	54.1	33.1	43.4
Overall	41.2	31.6	58.2	33.2	44.3

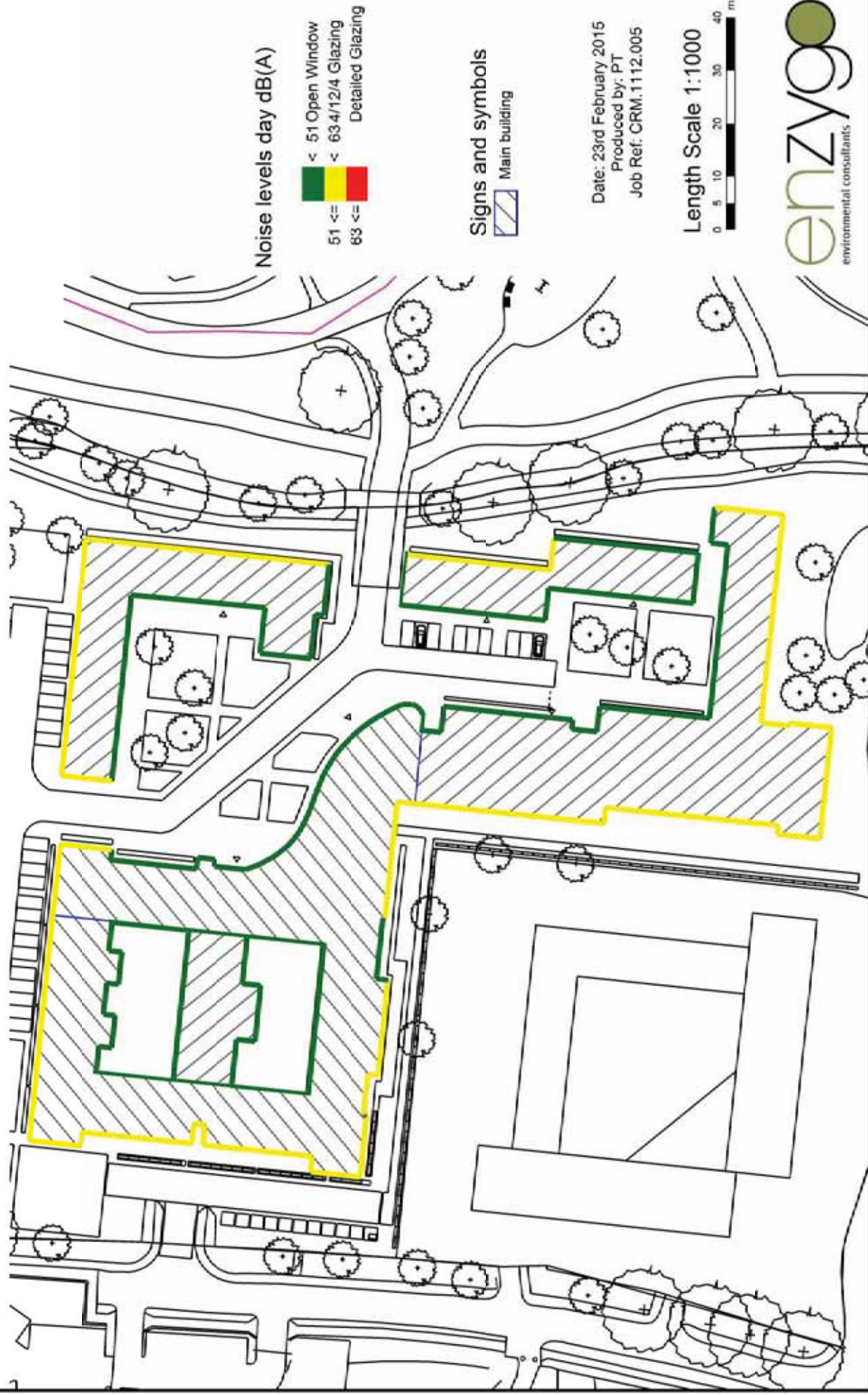
Period start	Leq	Lmin	Lmax	L90	L10
04/02/2015 06:40	56.1	47.5	63.4	51.0	58.6
Overall	56.1	47.5	63.4	51.0	58.6
Period start	Leq	Lmin	Lmax	L90	L10
04/02/2015 06:55	56.1	47.8	62.1	51.8	58.4
04/02/2015 07:10	56.7	49.5	62.4	53.2	58.8
04/02/2015 07:25	57.5	51.3	65.3	54.2	59.7
Overall	56.8	47.8	65.3	52.9	59.0
Period start	Leq	Lmin	Lmax	L90	L10
04/02/2015 10:31	55.9	50.1	63.6	53.0	57.7
04/02/2015 10:46	55.7	49.1	61.4	52.4	57.7
Overall	55.8	49.1	63.6	52.6	57.7
Period start	Leq	Lmin	Lmax	L90	L10
04/02/2015 12:10	56.3	46.0	78.2	49.7	55.9
04/02/2015 12:25	55.2	48.9	61.9	51.7	57.2
Overall	55.8	46.0	78.2	50.6	56.9

Appendix C – Façade Map Outputs

CRM.1112.005 - Oak Park, Havant

Indicative Daytime Facade Calculations (Ref. Table 8-4 of Report CRM.1112.005.NO.R.001)

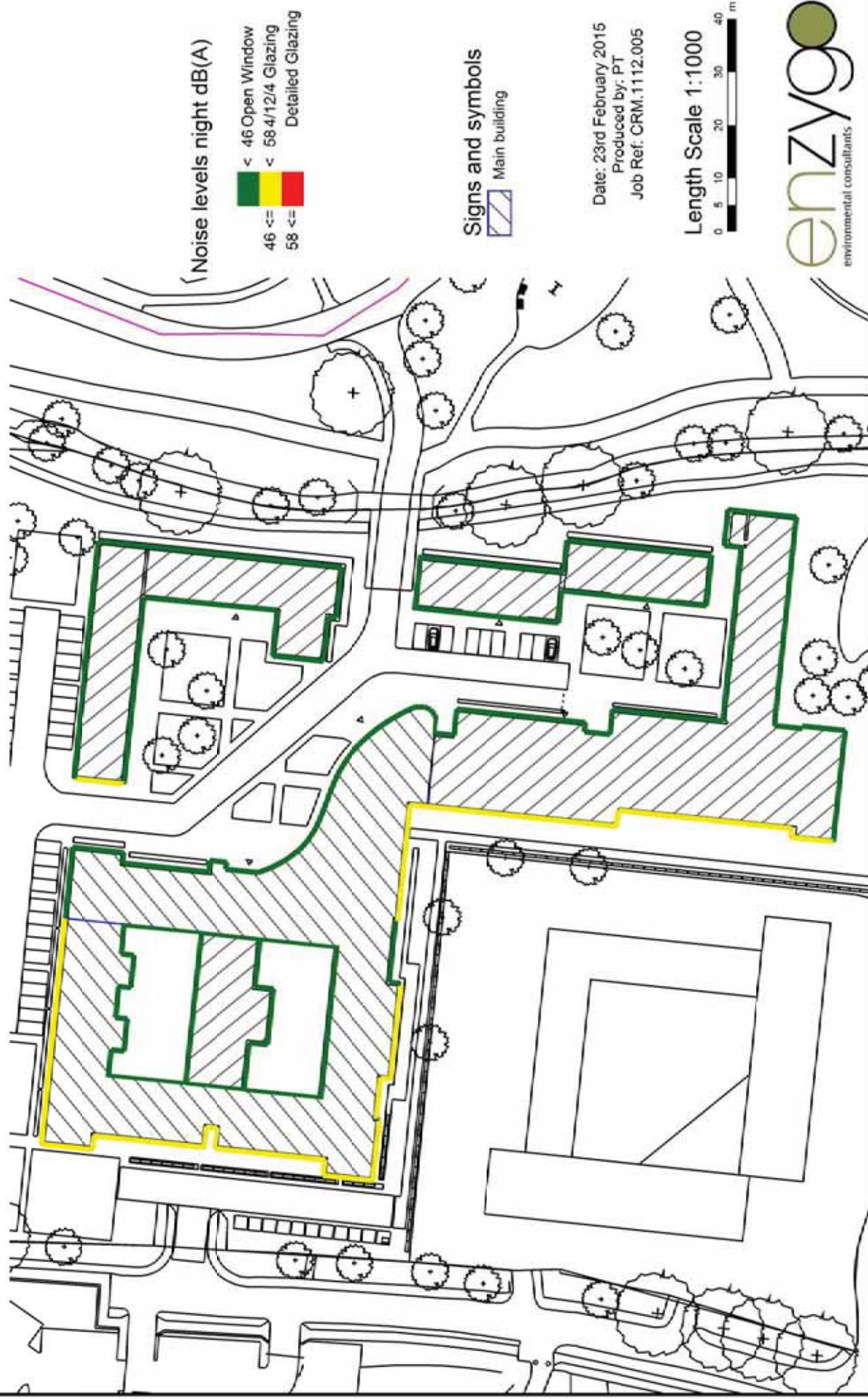
Figure C-1



CRM.1112.005 - Oak Park, Havant

Indicative Overnight Facade Calculations (Ref. Table 8-4 of Report CRM.1112.005.NO.R.001)

Figure C-2





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