

Elettra Avenue, Waterlooville

Noise Assessment

On behalf of **Bridgehouse (Bradford IoM) Limited**

Project Ref: 29169/006 | Rev: Rev01 | Date: September 2013



Document Control Sheet

Project Name: Elettra Avenue, Waterlooville

Project Ref: 29169

Report Title: Noise Assessment

Doc Ref: Rev01

Date: 05/09/13

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Revision	Date	Description	Prepared	Reviewed	Approved
Draft	04/09/2013	For client comment	GT	AL	DW
Rev01	05/09/2013	For Outline Planning Submission	GT	AL	DW

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Executive Summary

Peter Brett Associates LLP (PBA) has been commissioned by Bridgehouse (Bradford IoM) Limited to undertake a noise assessment to support the outline planning application for a proposed Mixed Use Employment, Leisure and Retail Development at former BAE site, Elettra Avenue, Waterlooville.

A baseline noise survey was undertaken between 1st and 2nd May 2012 to establish the noise climate at the nearest noise sensitive receptors. A noise model was prepared to determine the likely noise impact arising from the operation of the proposed development.

The magnitude of development road traffic impact would be classified as negligible in accordance with the criteria defined in the Design Manual for Roads and Bridges.

The industrial noise impact arising from the operation of the proposed development upon the nearest-sensitive receptors would give rise to 'complaints unlikely', in line with the BS4142 assessment criteria agreed with Havant Borough Council.

Fixed plant noise limits have been recommended so the industrial noise from the proposed development is no more than 5 dB below background at the nearest noise sensitive receptors and outline mitigation measures have been recommended for the hotel façade overlooking Hambledon Road.

The assessment demonstrates that there are no significant adverse impacts from the proposed development and that the site is suitable for development of the type proposed. It is therefore considered that the proposed development meets the policy requirements of NPPF and British Standards 4142 and 8233, and therefore the site is considered suitable for the proposed development.

1 Introduction

1.1 Context

- 1.1.1 Peter Brett Associates LLP (PBA) has been commissioned by Bridgehouse (Bradford IoM) Limited to undertake a noise assessment to support the outline planning application for a proposed Mixed Use Employment, Leisure and Retail Development at former BAE site, Elettra Avenue, Waterlooville.
- 1.1.2 The proposals include the provision of a drive-through restaurant, 8-screen cinema, bowling alley and gym, foodstore, restaurants, public house and a 60-bed hotel.
- 1.1.3 This report assesses the likely noise impact arising from the development upon nearby sensitive receptors. In addition, it assesses the internal noise levels likely to be experienced within the bedrooms of the proposed hotel.

1.2 Background

- 1.2.1 A previous noise report was undertaken for the development site in June 2012 (ref.26365/007) as part of the planning application APP/12/00652. The scheme was given outline consent.
- 1.2.2 A revised masterplan has now been submitted and a new noise assessment has been presented within this report. This report builds on much of the previous noise work undertaken for the site including the background noise survey which was carried out a year ago and is considered to still be relevant and applicable.

1.3 Site Location

- 1.3.1 The site is located to the west of the B2150, surrounded by Elettra Avenue and Silverthorne Way (Brambles Farm Industrial Estate).
- 1.3.2 The nearest noise sensitive receptors are located on Hambledon Road at approximately 50 m to the east of the site boundary. There are also residential receptors in the intersection of Hambledon Road with Milton Road at approximately 70 m to the north east of the site boundary. A major new development (Newlands¹), including residential use, will be located to the west of the site. The nearest residential areas in this development will be situated approximately 90 m to the south west of the site boundary.
- 1.3.3 A glossary describing the acoustic terminology contained in this report is presented in **Appendix A**.

¹ www.newlandshampshire.co.uk/vision.php

2 Legislation, Planning and Guidance

2.1 National Policy

The National Planning Policy Framework (NPPF)

- 2.1.1 The National Planning Policy Framework was published in March 2012. In respect of noise, the document states that:

“The planning system should contribute to and enhance the natural and local environment by ...preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of ... noise pollution”.

- 2.1.2 It goes on to advise that:

“Planning policies and decisions should aim to:

Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;

Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;

Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and

Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.”

- 2.1.3 The NPPF revokes Planning Policy Guidance 24 (PPG 24) which was previously used to assess noise impacts of planning applications. PPG 24:

- Outlined the considerations to be taken into account in determining planning applications both for noise-sensitive developments and for those activities that will generate noise;
- Introduced the concept of “Noise Exposure Categories” for residential development, encouraged their use and recommended appropriate levels for exposure to different sources of noise; and
- Advised on the use of planning conditions to minimise the impact of noise.

- 2.1.4 The NPPF indicates that the Noise Policy Statement for England (NPSE) should be used to define “*significant adverse impacts*”. A summary of the NPSE is provided below.

Noise Policy Statement for England (NPSE)

- 2.1.5 The Noise Policy Statement for England was published in March 2010. The document seeks to clarify the underlying principles and aims in existing policy documents, legislation and guidance that relate to noise. It also sets out the long term vision of Government noise policy: “*To promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development*”

- 2.1.6 The NPSE clarifies that noise should not be considered in isolation of the wider benefits of a scheme or development, and that the intention is to minimise noise and noise effects as far as is reasonably practicable having regard to the underlying principles of sustainable development.

2.2 Noise Guidance

British Standard 4142: 1997 Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas

- 2.2.1 British Standard 4142: 1997 *Method for rating industrial noise affecting mixed residential and industrial areas* (BS 4142) is intended to be used to assess whether noise from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises is likely to give rise to complaints from people residing in nearby dwellings. In this instance, it has been used to set noise limits for items of fixed plant.
- 2.2.2 The procedure contained in BS 4142 for assessing the likelihood of complaints is to compare the “*specific noise level*”, which is the measured or predicted noise level from the source in question immediately outside the dwelling, with the background noise level. Where the noise contains a “*distinguishable discrete continuous note (whine, hiss, screech, hum etc.) or if there are distinct impulses in the noise (bangs, clicks, clatters or thumps), or if the noise is irregular enough to attract attention*” then a correction of +5 dB is added to the specific noise level to obtain the “*rating level*” or L_{Ar} .
- 2.2.3 The likelihood of noise provoking complaints is assessed by subtracting the background noise level from the rating noise level. BS 4142 states:
- “*A difference of around 10 dB or higher indicates that complaints are likely. A difference of around 5 dB is of marginal significance. A difference of -10 dB is a positive indication that complaints are unlikely.*”
- 2.2.4 The standard also notes that:

“*The greater this difference the greater the likelihood of complaints.*”

British Standard 8233: 1999 Sound Insulation and Noise Reduction for Buildings – Code of Practice

- 2.2.5 British Standard 8233 sets out recommended indoor noise levels in habitable rooms for dwellings, such as living room and bedrooms, when they are unoccupied. These recommended levels are given in **Table 2.1**.

Table 2.1: Recommended Internal Ambient Noise Levels

Criterion	Typical Situation	Design Range $L_{Aeq,T}$ dB	
		Good	Reasonable
Reasonable resting/sleeping conditions	Living rooms	30	40
	Bedrooms ¹	30	35
¹ For a reasonable standard in bedrooms at night, individual noise events (measured with F time-weighting) should not normally exceed 45 dB L_{Amax} .			

Calculation of Road Traffic Noise (CRTN): 1998

- 2.2.6 CRTN is a Department for Transport (DfT) memorandum that describes the procedure to calculate the road traffic noise at a given receptor location.
- 2.2.7 Section III (The Measurement Method) describes the shortened measurement procedure to be undertaken within 3 consecutive hours between 10.00 and 17.00hrs. A formula is presented to calculate the noise level in dB $L_{A10,18h}$ based on these measurements.
- 2.2.8 This guidance is used by the noise modelling software.

Method for Converting the UK Road Traffic Noise Index $L_{A10,18h}$ to the EU Noise Indices for Road Noise Mapping: 2006

- 2.2.9 This report was prepared by the Transport Research Laboratory and Casella Stanger on behalf of the Department for Environment, Food and Rural Affairs (Defra) in January 2006.
- 2.2.10 It presents a methodology to convert the noise index for traffic noise derived from CRTN, $L_{A10,18h}$, into the noise indicators required by the Environmental Noise Directive (EU Noise Indices) L_{den} and L_{night} . For road traffic noise, supplementary noise indicators are also presented $L_{Aeq,12h}$ (07:00-19:00), known as L_{day} , $L_{Aeq,4h}$ (19:00-23:00), known as $L_{evening}$ and $L_{Aeq,16h}$ (07:00-23:00).

Design Manual for Roads and Bridges (DMRB)

- 2.2.11 Potential impacts associated with off-site operational traffic have been considered against the guidance set out in The Design Manual for Road and Bridges (DMRB, 2011), which provides detailed guidance on noise and vibration assessment for road schemes in the UK. DMRB gives guidance and interpretation on the magnitude of noise impact from road traffic sources and it includes example semantic scales for classifying the magnitude of the impact, as shown in **Table 2.2**.

Table 2.2: DMRB Long Term Impact Scale

Change in Noise Level dB(A)	Magnitude of Impact
0	No change
0.1 - 2.9	Negligible
3.0 – 4.9	Minor or low
5.0 – 9.9	Moderate or medium
10+	Major or high

- 2.2.12 The criteria above reflect key benchmarks that relate to human perception of sound. A change of 3 dB is considered to be the smallest change in noise that is perceptible in the long term, and a 10 dB change is approximately a halving or doubling of loudness.
- 2.2.13 The criteria set out in **Table 2.3** have been used to assess the potential long term impact of off-site road traffic noise.

British Standard 7445: 2003 Description and measurement of environment noise – Part 1: Guide to quantities and procedures

- 2.2.14 BS 7445-1 describes methods and procedures for measuring noise from all sources which contribute to the total noise climate of a community environment, individually and in combination. The results are expressed as equivalent continuous A-weighted sound pressure levels, $L_{Aeq,T}$.
- 2.2.15 BS 7445-1 states that sound level meters that are used should conform to Type 1 (or Type 2 as a minimum) as described in BS EN 61672:2003 Electroacoustics. Sound Level Meters should be calibrated according to the instructions of the manufacturer and field calibration should be undertaken at least before and after each series of measurements.

ISO 9613 – 2: 1996 Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation

- 2.2.16 This standard provides a calculation method for the prediction of noise propagation outdoors at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level under meteorological conditions favourable to propagation.

3 Methodology

3.1 Consultation with Havant Borough Council

- 3.1.1 Consultation was undertaken as part of the previous application for the site with the Environmental Health Officer (EHO) at Havant Borough Council (HBC).
- 3.1.2 In these discussions it was agreed that to protect amenity of nearby dwellings fixed plant noise associated with the development should be assessed against BS 4142:1997. The BS 4142 criteria to be used in the assessment is that the cumulative rating level from all plant should be 5 dB below the background noise levels at the receptors.
- 3.1.3 For the hotel, the EHO advised that mitigation measures should be outlined to achieve internal noise levels recommended in BS 8233 ('good' design target).

3.2 Noise Survey

- 3.2.1 A baseline noise survey to establish the existing noise climate surrounding the site was undertaken between 1st and 2nd May 2012.
- 3.2.2 The noise survey was undertaken at locations representative of the nearest existing and proposed sensitive receptors. **Figure 1** shows the noise survey locations and **Table 3.1** presents a description of the locations.

Table 3.1: Noise Survey Location Description

Location	Description	Dominant Source	Measurement Period
1	App. 25m from main road	B2150	45 minutes daytime / 45 minutes night-time
2	App 4m from main road	B2150/Milton Road	45 minutes daytime / 45 minutes night-time
3	App. 25m from main road	B2150	45 minutes daytime / 45 minutes night-time
4	App. 10m from main road	B2150	4 hours 24 minutes daytime

- 3.2.3 The noise measurements recorded the parameters L_{Aeq} , L_{A90} , L_{A10} and L_{Amax} dB. In addition, sound recording was made in all measurements.
- 3.2.4 The weather conditions remained suitable for the completion of noise surveys throughout - dry with temperatures above 13°C during the day and 4°C during the night with average wind speeds below 1m/s during the day and night.

Instrumentation

- 3.2.5 Two Type 1 sound level meters were used for the survey. Each was mounted at a height of 1.5m above the ground and at a minimum of 3 m away from any reflective surface.

3.2.6 The noise instrumentation has valid laboratory certification, which is available upon request. Field calibrations were performed before and after the measurements with no significant fluctuation recorded.

3.2.7 The instrumentation used in the noise monitoring is listed in **Table 3.2**.

Table 3.2: Noise Instrumentation used in the Survey

Item	Type	Manufacturer	Serial Number	Laboratory Calibration Date
Sound Calibrator	4231	Brue! & Kjaer	2619372	20 January 2012
Hand-Held Analyzer	2250	Brue! & Kjaer	2626230	20 January 2012
Hand-Held Analyzer	2250	Brue! & Kjaer	2626231	20 January 2012
Prepolarized free-field ½ " Microphone	4189	Brue! & Kjaer	2621208	20 January 2012
Prepolarized free-field ½ " Microphone	4189	Brue! & Kjaer	2621209	20 January 2012

3.3 Noise Model and Calculations

3.3.1 A computer noise model using SoundPLAN version 7.2 has been prepared to determine the likely noise impact arising from the proposed development.

3.3.2 The model was setup having regard to the drawing No. 13484-Sk10 rev A, prepared by Davis Weatherill Partnership, dated August 2013.

3.3.3 The propagation of the industrial noise has been calculated using the methodology described in ISO 9613-2. OS mapping and topographical data² have been incorporated into the model.

3.3.4 As agreed with HBC, fixed plant noise sources have been included in the model to consider the industrial activities from the proposed development (i.e. ventilation, chillers etc.). Details of the noise source assumptions used in the model are presented in **Appendix B**.

3.3.5 In addition to industrial activities within the site, the changes to the traffic flows on the B2150 have been incorporated into the model to determine the potential change in noise levels and impact upon the nearest existing and proposed residential receptors. The traffic data used in the model is presented in **Appendix B**.

3.3.6 The road traffic calculations in the model have been undertaken following the methodology described in CRTN. The impact of operational traffic noise on surrounding roads has been predicted by calculating the Basic Noise Level (BNL) for the year of completion (2020). This does not take into consideration the distance between the carriageway and any receptor and

² Topographical survey undertaken by Lewis Brown in March 2012.

instead only predicts the change in noise at a position alongside each carriageway. Corrections for traffic speed and heavy vehicles percentage have been incorporated.

- 3.3.7 The changes in noise levels as a result of the proposed development traffic have been assessed against the DMRB criteria presented in **Table 2.2**.
- 3.3.8 In addition to the future traffic scenarios indicated above, a baseline scenario has been incorporated into the model for validation purposes against the noise survey results. The difference between measured and model results does not exceed 1.5 dB, hence within a good correlation. Results of the validation are presented in **Appendix B**.

3.4 Assessment

- 3.4.1 The noise impact arising from the fixed plant on the proposed development has been assessed in accordance with BS 4142 (i.e. reference time period of 1 hour during daytime and 5 minutes during night-time).
- 3.4.2 The noise-sensitive receptors considered in the assessment are presented in **Table 3.3** and **Figure 2**. The associated survey location is also presented with the numbering system outlined in **Table 3.1**.

Table 3.3: Noise-Sensitive Receptors

Receptor	Representative Survey Location
1 – 2 Fennel Close	1
2 -1a Milton Road	2
3 – 72 Hambledon Road	3
4 – Committed Development, South west of development site	3
5 – Hotel Facades	N/A

- 3.4.3 Noise limits for fixed plant are recommended at the noise-sensitive receptors having regard to BS4142 and the design targets agreed with HBC (i.e. Rating Level of 5 dB below measured background noise levels).
- 3.4.4 Details of the fixed plant and equipment are not available at this stage. However, plant data from a similar cinema complex has been used for the model. Sound Power Levels and location (i.e. roof plant) have been assumed for the operation of the other plant items during daytime and night-time to test the deliverability of the recommended limits. Results are presented in **Appendix B**. Calculations should be revised at the detailed design stage when this information is available.
- 3.4.5 Further calculations have been undertaken within the model to predict the noise levels at the facades of the proposed hotel. A cumulative effect scenario of industrial and road traffic noise sources has been considered to determine the likely mitigation required to comply with the bedroom good design standard in BS 8233, as agreed with HBC.

- 3.4.6 Break-in noise calculations (noise transmission from outside to inside bedrooms) have been undertaken. Calculations have been based on the Building Envelope Insulation spreadsheet prepared by Building Research Establishment (BRE). These calculations should be revised at the detailed design stage once room layouts and a window schedule are finalised.

4 Results and Assessment

4.1 Noise Survey

- 4.1.1 A summary of the noise survey results is presented in **Table 4.1 – 4.3**. A complete set of results is presented in **Appendix D**.

Table 4.1: Summary Daytime Short Term Measurements

Location	Duration, T HH:MM:SS	$L_{Aeq,T}$ dB	$L_{A90,T}$ dB
1	00:45:00	66	60
2	00:45:00	71	59
3	00:45:00	58	54

Table 4.2: Summary Night-Time Short Term Measurements

Location	Duration, T HH:MM:SS	$L_{Aeq,T}$ dB	$L_{A90,T}$ dB
1	00:45:00	53	34
2	00:45:00	59	29
3	00:45:00	48	30

Table 4.3: Summary Long Term Measurements

Location	Period	Duration, T HH:MM:SS	$L_{Aeq,T}$ dB	$L_{A90,T}$ dB
4	Daytime	4:24:54	70	62

4.2 Offsite Road Traffic

- 4.2.1 The BNL has been calculated for the 2020 baseline scenario and the 2020 With Development scenario using traffic flow information prepared by PBA and based on the proposed development phasing. The years of assessment were agreed during consultations.
- 4.2.2 The differences in the predicted BNLs are then calculated to ascertain the change in noise level due to the development. This is shown in **Table 4.4**.

Table 4.4: Change in Traffic Noise Levels

Link	BNL (dB)		
	2020 Baseline	2020 With Development	Development Impact: 2020 With Development minus 2020 Base
Hambledon Road	64.3	64.5	+0.2

- 4.2.3 The likely noise impact arising from the road traffic generated by the proposed development would be +0.2 dB. The magnitude of this impact would be classified as negligible in accordance with the DMRB Long Term Impact Scale criteria defined in **Table 2.2**.

4.3 Proposed Hotel

- 4.3.1 Noise levels were calculated on the different floors of the hotel overlooking Hambledon Road. **Table 4.5** presents the highest predicted facade noise level for the daytime.

Table 4.5: Highest External Noise Levels Daytime

Facade	Daytime $L_{Aeq,16h}$ dB
Proposed Hotel overlooking Hambledon Road	66

- 4.3.2 Outline mitigation is presented in the following section to meet the internal noise levels within bedrooms, as agreed with HBC. The night-time noise levels are predicted to be lower than those calculated for the daytime period, hence, the mitigation has been derived from the daytime noise levels as it is considered that for a hotel use sleeping conditions should also be preserved during the daytime.

5 Mitigation

5.1 Fixed Plant Noise Limits

- 5.1.1 **Tables 5.1** presents the design rating levels (noise limits) proposed at 1 m from the nearest facades of the noise sensitive receptors in line with the agreement with HBC.

Table 5.1: Design Rating level at Nearest Noise-Sensitive Receptors

Nearest Affected Noise-Sensitive Properties	Daytime		Night Time	
	Measured Background dB L _{A90,1hr}	Design Rating Limit dB L _{ArTr}	Measured Background dB L _{A90,5mins}	Design Rating Limit dB L _{ArTr}
2 Fennel Close	59	54	31	26
1a Milton Road	59	54	28	23
72 Hambleton Road	54	49	29	24
Committed Development, South west of development site	54	49	28	23

- 5.1.2 It should be noted that when determining compliance with these noise limits, a 5 dB correction must be applied if any of the acoustic features presented in section 8 (Rating Level) of BS 4142 are likely to occur, such as whine, hiss, screech, hum, bangs, thumps, etc.
- 5.1.3 Consideration has been given to the cumulative noise impact in determining the noise limits for fixed plant.
- 5.1.4 Calculations have been done using the noise model, and a sound power level of 95 dB during the day and 60 dB during the night would meet the criteria. The Sound Power Level of individual plant items may be lower, however, to ensure that this total Level is not exceeded.
- 5.1.5 Compliance with the above noise limits will mean that the likelihood of complaints from existing nearest sensitive receptors due to noise will be below 'marginal significance' and therefore no loss of amenity would be expected to occur. This is in accordance with the assessment levels presented in **Table 2.1** and the criteria agreed with HBC.

5.2 Proposed Hotel

- 5.2.1 Outline mitigation measures are indicated in **Table 5.2** for the most exposed façade of the hotel within the development to achieve the bedroom 'good' BS 8233 internal noise levels with the windows closed.
- 5.2.2 **Table 5.2** presents the Weighted Sound Reduction Index (R_w) dB for glazing units. Example of the glazing unit (glass width mm / air gap width mm / glass width mm) to meet the R_w specification is also provided.

Table 5.2: Mitigation Measures – Glazing Units

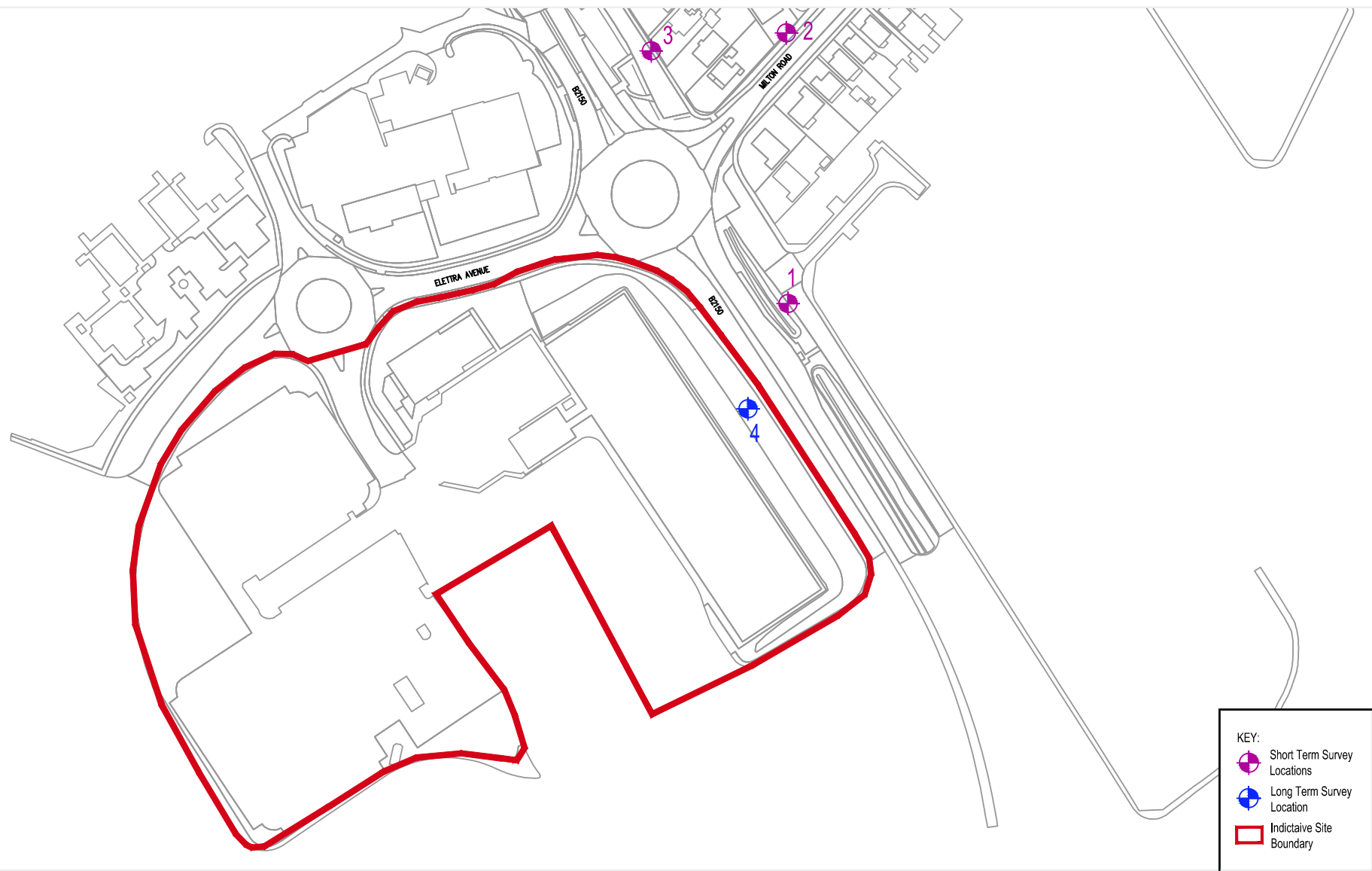
Facade	Predicted Daytime $L_{Aeq,16h}$ dB	Required $L_{Aeq,T}$ dB from BS 8233	Glazing R_w dB	Glazing Example
Proposed Hotel overlooking Hambledon Road	66	30	41	8.4/24/14.8

- 5.2.3 In order to achieve this performance, the windows will have to be kept closed. Therefore alternative means of ventilation will be required using mechanical systems. It is recommended that opening windows be used to allow occupiers the choice of whether to open the windows for purge ventilation.
- 5.2.4 The mitigation outlined above is indicative and is not intended for procurement of building elements. Requirements for alternative ventilation should also be considered at the detailed design stage, so that the hotel can be ventilated without the requirement for opening windows. The specification of the ventilation system(s) should ensure that the required internal noise levels are not compromised.

6 Conclusion

- 6.1.1 A noise assessment has been undertaken to support the outline planning application of a proposed Mixed Use Employment, Leisure and Retail Development at former BAE site, Elettra Avenue, Waterlooville.
- 6.1.2 This report assesses the likely noise impact arising from the development upon nearby sensitive receptors. In addition, it assesses the internal noise levels likely to be experienced within the bedrooms of the proposed hotel.
- 6.1.3 A baseline noise survey was undertaken between 1st and 2nd May 2012 to establish the noise climate at the nearest noise sensitive receptors.
- 6.1.4 A noise model was prepared to determine the likely noise impact arising from the operation of the proposed development. Noise sources include fixed plant and road traffic. Existing and proposed receptors were assessed.
- 6.1.5 The magnitude of development road traffic impact would be classified as negligible in accordance with the criteria defined in DMRB.
- 6.1.6 Fixed plant noise limits have been recommended and outline mitigation measures in the form of glazing recommendations have been recommended for the hotel façade overlooking Hambledon Road.
- 6.1.7 The assessment demonstrates that there are no significant adverse impacts from the proposed development. It is therefore considered that the proposed development meets the policy requirements of NPPF and British Standards 4142 and 8233 and therefore the site is considered suitable for the proposed development.

Figure 1: Noise Survey Locations



Offices throughout
the UK and Europe
www.peterbrett.com

Client

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Limited

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Elettra Avenue, Waterloo

Noise Survey Locations

Mark	Revision		Drawn	Date
Date	10.05.2012	FIGURE 1		
Scale	N.T.S			
Drawn by	ZB			
Checked by	EO			

Figure 2: Noise Receptor Locations

Appendix A Glossary of Acoustic Terminology

Appendix A: Glossary of Acoustic Technology

Decibel (dB)	A unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure levels the reference quantity is 20 uPa. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), L_{Ax}	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
$L_{A90,T}$	The A weighted noise level exceeded for 90% of the measurement period, T. ETSU-R-97 states that this descriptor should be used for both the background noise level and the wind farm noise.
$L_{A10,T}$	The A weighted noise level exceeded for 10% of the measurement period, T.
$L_{Aeq,T}$	The equivalent continuous sound level – the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). $L_{Aeq,T}$ is used to describe many noises and can be measured directly with an integrating sound level meter.
L_{day} , $L_{evening}$, L_{night}	They are the equivalent continuous A-weighted sound pressure determined over a day (07:00 – 19:00), evening (19:00 – 23:00) and night (23:00 - 07:00).
Rating Level, $L_{Ar,T}$	The specific noise level plus any adjustments for the characteristic features of the noise.
Weighted sound reduction index R_w	Single number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies.
Basic Noise Level (BNL)	BNL is obtained from the traffic flow, the speed of the traffic, the composition of the traffic, the gradient of the road and the road surface.

Appendix B Noise Model Assumptions

Appendix B: Noise Model Assumptions

Validation

The noise model has been validated against the survey location alongside Hambledon Road (Location 4) for which a continuous 4 hour measurement was taken, enabling comparison with the $L_{Aeq,16h}$ in the model. A change in noise levels of 3 dB is stated in DMRB to be the minimum perceptible under normal conditions. Therefore, if the measured and modelled results are within ± 3 dB it is considered to demonstrate a good correlation.

A receptor was incorporated in the baseline scenario of the model at the monitoring location.

Table C.1 presents the comparison of measured and predicted noise levels.

Table B1: Noise Model Validation

Location	Measured $L_{Aeq,4}$ dB Daytime	Modelled $L_{Aeq,16h}$ dB Daytime	Difference (Model-Measured)
4	70.2	71.3	+1.1

Noise Model Input – Road Traffic at Hambledon Road

Table B.2: Hambledon Road Traffic Noise Data

Year and Scenario	18hr Flow	%HGV
2012 Base	31948	3
2020 Base	33407	3
2020 Base + Development	35087	3

Noise Impact – Fixed Plant Limits – Deliverability Test

A sound power limit for the fixed plant at the industrial and commercial units has been tested such that the BS 4142 criterion agreed is not exceeded. It is assumed that the plant would operate for 24 hours continuously.

From a previous assessment done at a cinema complex similar to this proposed 8-screen cinema, the sound power level of the fixed plant associated with this cinema has been set to 88 dB(A) during the day and 78 dB(A) at night. A representative Sound Power Level L_{WA} of 95 dB(A) during the daytime and 60 dB(A) during the night-time, have been tested at each of the other building units. **Tables C.6 – C.7** set out the Rating level and background levels based on these sound power levels for the daytime and night-time at each receptor.

Table B.3: Daytime BS 4142 Assessment for Fixed Plant

Location	Background Noise Level dB $L_{A90,T}$	Design Rating Limit dB L_{ArTr}	Calculated Rating Level dB $L_{Ar, Tr}$	$L_{Ar, Tr} - L_{A90, T}$
2 Fennel Close	59	54	51	-8
1a Milton Road	59	54	47	-12
72 Hambledon Road	54	49	48	-6
Committed Development, South west of development site	54	49	43	-11

Table B.4: Night-time BS 4142 Assessment for Fixed Plant

Location	Background Noise Level dB $L_{A90,T}$	Design Rating Limit dB L_{ArTr}	Calculated Rating Level dB $L_{Ar, Tr}$	$L_{Ar, Tr} - L_{A90, T}$
2 Fennel Close	31	26	24	
1a Milton Road	28	23	18	
72 Hambledon Road	29	24	21	
Committed Development, South west of development site	28	23	22	

Appendix C Survey Results

Appendix C: Survey Results

Table C.1: Daytime Short Term Measurement Location 1

Date	Start Time	Reading	L _{Aeq,15min}	L _{A90,15min}	L _{A10,15min}	L _{AFmax, 15min}
02.05.2012	11:50:06	A	66.3	60.1	68.9	80.6
02.05.2012	12:46:32	B	65.9	59.8	68.8	82.0
02.05.2012	13:38:59	C	65.6	59.2	68.5	77.8

Table C.2: Daytime Short Term Measurement Location 2

Date	Start Time	Reading	L _{Aeq,15min}	L _{A90,15min}	L _{A10,15min}	L _{AFmax, 15min}
02.05.2012	12:12:04	A	69.8	59.3	73.3	81.8
02.05.2012	13:03:34	B	71.2	58.9	74.7	91.8
02.05.2012	14:03:15	C	71.9	59.0	75.8	86.2

Table C.3: Daytime Short Term Measurement Location 3

Date	Start Time	Reading	L _{Aeq,15min}	L _{A90,15min}	L _{A10,15min}	L _{AFmax, 15min}
02.05.2012	12:28:57	A	57.9	54.1	60.1	67.6
02.05.2012	13:21:13	B	57.8	53.9	60.1	68.2
02.05.2012	14:20:01	C	58.3	54.4	60.1	76.6

Table C.4: Night-Time Short Term Measurement Location 1

Date	Start Time	Reading	L _{Aeq,15min}	L _{A90,15min}	L _{A10,15min}	L _{AFmax, 15min}
01.05.2012	23:27:14	A	56.7	39.4	59.5	73.6
02.05.2012	00:38:22	B	51.1	31.5	54.1	70.9
02.05.2012	01:30:54	C	46.7	30.7	46.9	66.8

Table C.5: Night-Time Short Term Measurement Location 2

Date	Start Time	Reading	L _{Aeq,15min}	L _{A90,15min}	L _{A10,15min}	L _{AFmax, 15min}
02.05.2012	00:04:44	A	60.5	30.8	54.2	84.0
02.05.2012	00:56:38	B	59.0	28.0	49.2	81.1
02.05.2012	01:48:45	C	56.6	29.1	47.8	79.8

Table C.6: Night-Time Short Term Measurement Location 3

Date	Start Time	Reading	L _{Aeq,15min}	L _{A90,15min}	L _{A10,15min}	L _{AFmax, 15min}
02.05.2012	00:20:51	A	49.6	31.3	52.7	68.6
02.05.2012	01:13:37	B	47.8	30.2	50.8	64.7
02.05.2012	02:05:51	C	43.2	28.5	42.6	61.6

Table C.7: Daytime Long Term Measurement Location 4

Date	Start Time	Duration	L _{Aeq,T}	L _{A90,T}	L _{A10,T}	L _{AFmax,T}
02.05.2012	11:32:21	1:00:00	70.2	62.3	73.6	79.1
02.05.2012	12:32:21	1:00:00	70.0	61.7	73.4	79.7
02.05.2012	13:32:21	1:00:00	70.0	61.9	73.3	81.7
02.05.2012	14:32:21	1:00:00	70.4	62.4	73.7	86.3