ACOUSTIC CONSULTANTS LTD

Environmental Noise Assessment

Proposed Residential Development
The Poplars, Deddington

Reference: 9263/LN

Client:	
bba architects & planners	

Document Control				
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The report limits itself to addressing solely on the noise aspects as included in this report. We provide advice only in relation to noise and acoustics. It is recommended that appropriate expert advice is sought on all the ramifications (e.g. CDM, structural, condensation, fire, legal, etc.) associated with any proposals in this report or as advised and concerning the appointment. It should be noted that noise predictions are based on the current information as we understand it and on the performances noted in this report. Any modification to these parameters can alter the predicted level. All predictions are in any event subject to a degree of tolerance of normally plus or minus three decibels. If this tolerance is not acceptable, then it would be necessary to consider further measures.

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1. Introduction

BBA Architects appointed Acoustic Consultants Limited to provide a noise assessment for the proposed residential development off Clifton Road, Deddington.

This report provides the results of a noise survey conducting on the site and an assessment of external sources of noise on the sensitive elements of the development.

The noise impact assessment has been undertaken in accordance with the guidance in the National Planning Policy Framework (NPPF), Noise Policy Statement for England (NPSE), National Planning Practice Guidance (NPPG), British Standard 8233:2014 (BS8233) and the local authority criteria which states that:

16. No development shall commence unless and until a report has been submitted to and approved in writing by the local planning authority that shows that all habitable rooms within the dwelling will achieve the noise levels specified in BS8233:2014 (Guidance on sound insulation and noise reduction for buildings) for indoor and external noise levels (if required then the methods for rating the noise in BS4142:2014 should be used, such as for noise from industrial sources). Thereafter, and prior to the first occupation of the dwellings affected by this condition, the dwellings shall be insulated and maintained in accordance with the approved details.

We have been further requested to assess the impact of additional road traffic from the development as it affects noise levels on the surrounding highways.

The author of this report is an Associate Member of the Institute of Acoustics and is considered suitably qualified to undertake this noise impact assessment. This report has been checked by a director of the company with over twelve years' experience in the industry.

2. The Site

The site is located off Clifton Road, Deddington. The site is situated to the east of Deddington Village with residential properties to the north, east and west of the site with fields to the north and south. The main sources of noise affecting the site are road traffic along Castle Street/Clifton Road.

An image of the site location highlighted in red is shown in the figure below.

Figure 1: Site Location

3. British Standard 8233:2014

The planning consent refers to British Standard 8233:2014 for noise levels within all habitable rooms of the proposed dwellings.

This standard, entitled 'Guidance on sound insulation and noise reduction for buildings', provides advice on noise as it affects buildings of all types, giving consideration to various common sources of anonymous noise.

This is considered relevant when assessing noise from existing anonymous noise sources (road and rail traffic) or where noise affecting a site is from a number of sources but transportation noise is dominant.

It outlines design guidance in general terms, and provides criteria for the indoor ambient noise levels (IANLs) for different types of room. These are stated in terms of the 'equivalent continuous sound pressure level' over the reference time period, the $L_{Aeq,\,T}$. The IANLs specified by British Standard 8233 that are relevant to this development are as follows.

Table 1: IANL criteria of British Standard 8233:2014

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

Section 7.7.2 Note 4 of the British Standard states *"Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$ depending on the character and number of events per night. Sporadic noise events could require separate values".*

British Standard 8233:2014 provides no definitive criteria for maximum noise levels from individual events ($L_{Amax,F}$). Section 3.4 of the WHO Guidance states *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 L_{Amax} more than 10-15 times per night (Vallet & Verbey 1991)".*

3.1. Oxfordshire County Council Traffic Noise

The requirements for a noise assessment are set out in the Oxfordshire County Council "Section 38 & 278 Noise Survey" document. The following extract lists the actions required to be included within the assessment.

"So that we can understand what properties are affected OCC require that the developer carries out an independent noise survey.

The results of the survey will be in text and a noise map based on Ordnance Survey Map (current) contoured to show 5dB (A) contours and 1dB (A) contours from 65dB (A) up to 68dB (A).

A separate map showing predicted noise contours will be provided at the same time. The predicted noise contours will derive from the DoT document - Calculation of Road Noise (1988).

The predicted noise contours will take into account the growth in traffic over life of the works and for 15 years after. The growth factor will be based on the National Road Traffic Forecasts (Great Britain) 1997 or update publication.

The prediction map will be used to determine the properties that will require work to reduce the noise affecting them."

The Institute of Environmental Management and Assessment (IEMA) Guidelines for Environmental Noise Impact Assessment, Version 1.2 published in November 2014 categorises the significance of a change in noise level this is summarised as follows and taken from Table 7-14 of the guidance.

Table 2: IEMA Impact from the Change in Sound Levels (Table 7-14)

<table>
<tr><th>Sound Level Change LpT</th><th>Long-term impact classification</th><th>Short-term impact classification</th></tr>
<tr><td>≥ 0 dB and < 1 dB</td><td rowspan="2">Negligible</td><td>Negligible</td></tr>
<tr><td>≥ 1 dB and < 3 dB</td><td>Minor</td></tr>
<tr><td>≥ 3 dB and < 5 dB</td><td>Minor</td><td>Moderate</td></tr>
<tr><td>≥ 5 dB and < 10 dB</td><td>Moderate</td><td rowspan="2">Major</td></tr>
<tr><td>≥ 10 dB</td><td>Major</td></tr>
</table>

4. Noise Survey

A noise monitoring exercise was carried on site between 12th October 2021 and 14th of October 2021 to determine the noise levels likely to impact upon the proposed residential development.

4.1. Monitoring Equipment

Sound Pressure Levels were measured using three Class 1 sound level meters with a half-inch condenser microphones, using the 'fast' setting. The equipment is checked regularly using a Quality System meeting the requirements of British Standard EN ISO/IEC 17025:2017 "General requirements for the competence of testing and calibration laboratories"; in accordance with British Standard EN 10012:2003 "Measurement management systems. Requirements for measurement processes and measuring equipment"; and traceable to the National Standards.

This equipment was checked and calibrated as noted below and the certificates are available for inspection.

Table 4: Equipment and Calibration Status

Equipment Description / Manufacturer / Type	Serial Number	Date of Calibration	Calibration Certification Number
SLM, NTI, XL2	A2A-11053-E0	22/04/2020	34610
Pre-Amp, NTI, MA220	5871	22/04/2020	34610
Microphone, NTI, MC230A	9276	22/04/2020	34609
Calibrator, Nor-1251	35227	02/10/2020	35886

The measurement system was checked before and after use with the noted calibrator and no significant drift was detected.

4.2. Weather Conditions

Conditions during the survey were generally dry and clement, with an average temperature approximately 14-16 degrees Celsius and wind speeds not normally exceeding 5 metres per second. These weather conditions are not expected to have adversely affected the measured noise data.

4.3. Monitoring Procedure

4.3.1. Noise Monitoring

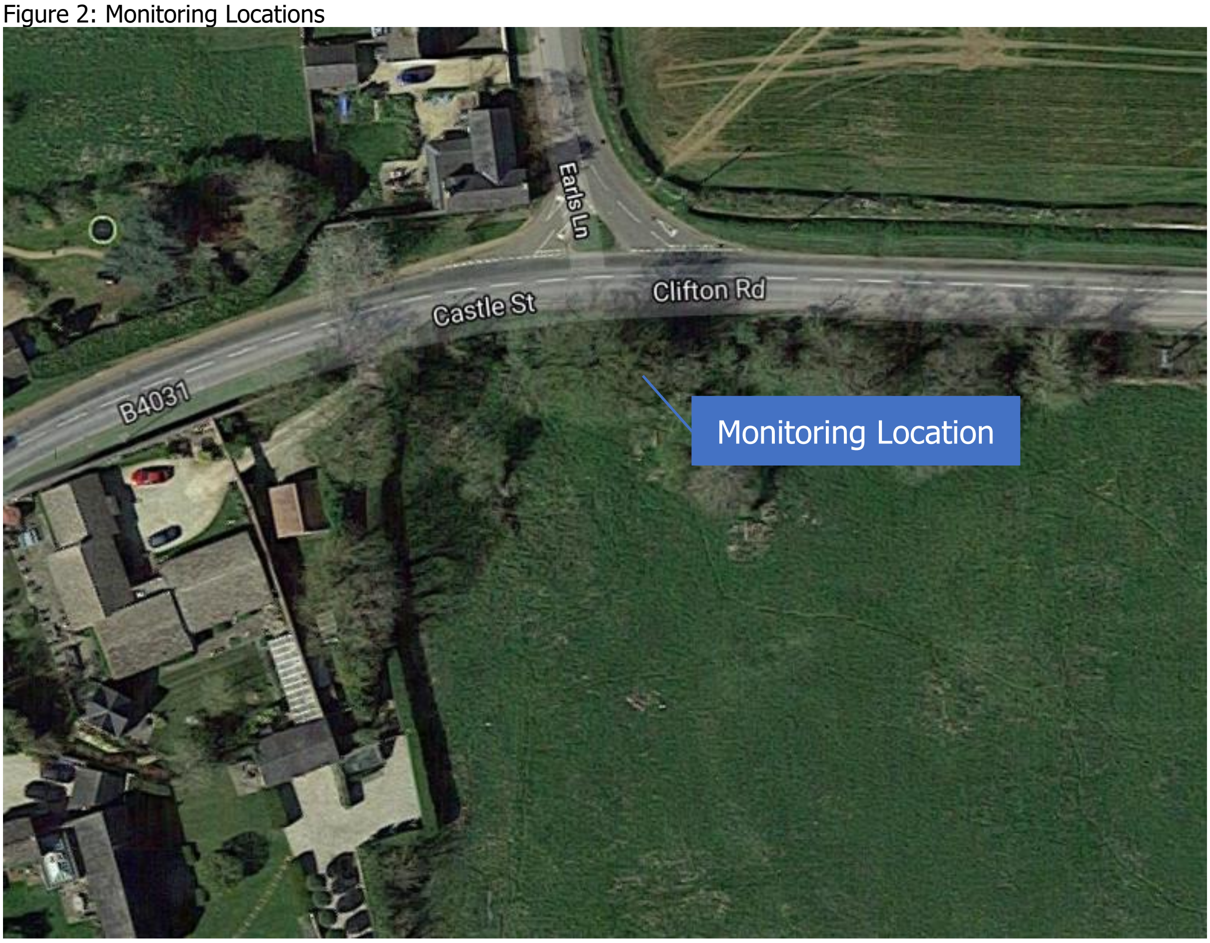
In order to assess the existing ambient noise climate at the site, two sets of long-term monitoring equipment were set up between 14th October 2021 and 15th of October the 2021.

At the monitoring location the main and dominant noise source was road traffic from the B4031 Clifton Road to the north.

4.3.2. Monitoring Locations

The monitoring location is displayed below in Figure 2.

Figure 2: Monitoring Locations

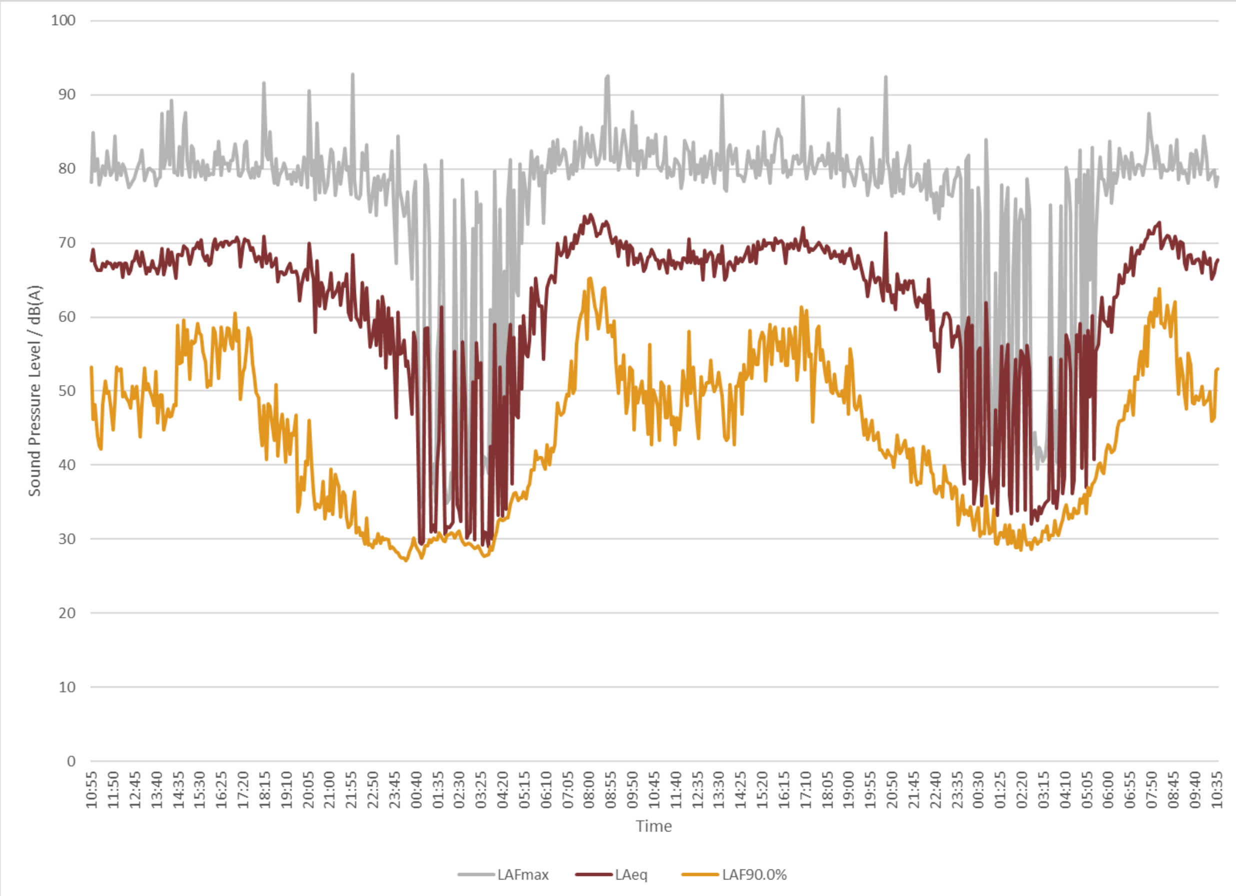


4.4. Measured Noise Levels

4.4.1. Monitoring Location 1

The relevant data from the survey is the A-weighted L_{eq}, and L_{max}, spectral values and L_{A90} values which are displayed below in both tabulated and graph form below. The variation in noise levels is provided below:

Chart 1: Measured location 1 noise levels



From the measured road traffic noise data, we have determined the following free-field octave band design 'daytime' and 'night-time' equivalent noise levels at the monitoring location:

Table 5: Logarithmically averaged noise data from location 1

Period	Parameter	Sound Pressure Level per Octave Band / dB								dB(A)
		63	125	250	500	1000	2000	4000	8000	
Day	L_{eq16hr}	67	63	61	62	67	61	50	43	68
Night	L_{eq8hr}	58	52	50	5	56	52	45	38	59
	L_{Fmax}	80	73	71	73	78	75	69	62	81

5. Noise Modelling

To determine noise levels across the site, noise modelling has been undertaken using computer modelling package Cadna:A by DataKustik and the typical traffic counts above. The software predicts road traffic noise propagation using the method of 'Calculation of Road Traffic Noise' (1988).

5.1. Modelling Parameters

The noise predictions have been undertaken using supplied plans of the proposed site and the following general modelling parameters:

- The site layout is based on Google Maps imagery and the provided plans.
- The sloped topography of the site and surrounding area has been taken into account using open-source online Lidar data.
- The modelled noise levels of road traffic on Clifton Road was calibrated to a receiver positioned at the monitoring location.
- Building heights are taken from provided elevations.
- The ground is considered hard and reflective.
- The noise maps predict noise levels across the site from the noted noise sources at a height of 1.5 metres above the ground.
- Building evaluation levels are reported as the worst-case level per façade, as bedrooms and traditional daytime spaces are located on both ground and first floors.

5.2. Noise Modelling Results

Predicted noise emission maps for equivalent noise levels during the daytime ($L_{Aeq,16hour}$) and night-time ($L_{Aeq,8hour}$) are provided below in the figures below.

Figure 3: Predicted $L_{Aeq,\ 16\ hour}$ dB

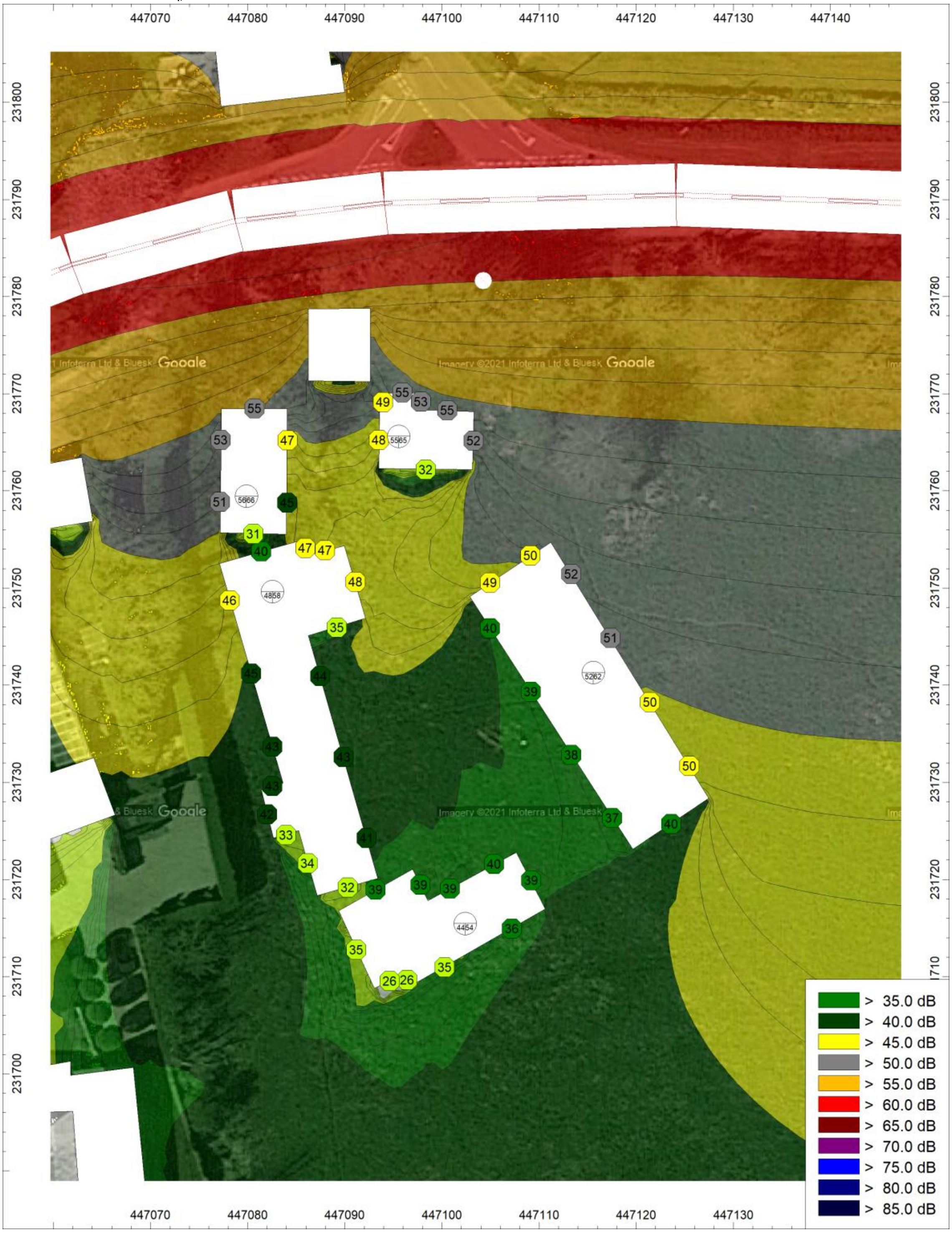


Figure 4. Predicted $L_{Aeq\ 8\ hour}$ dB

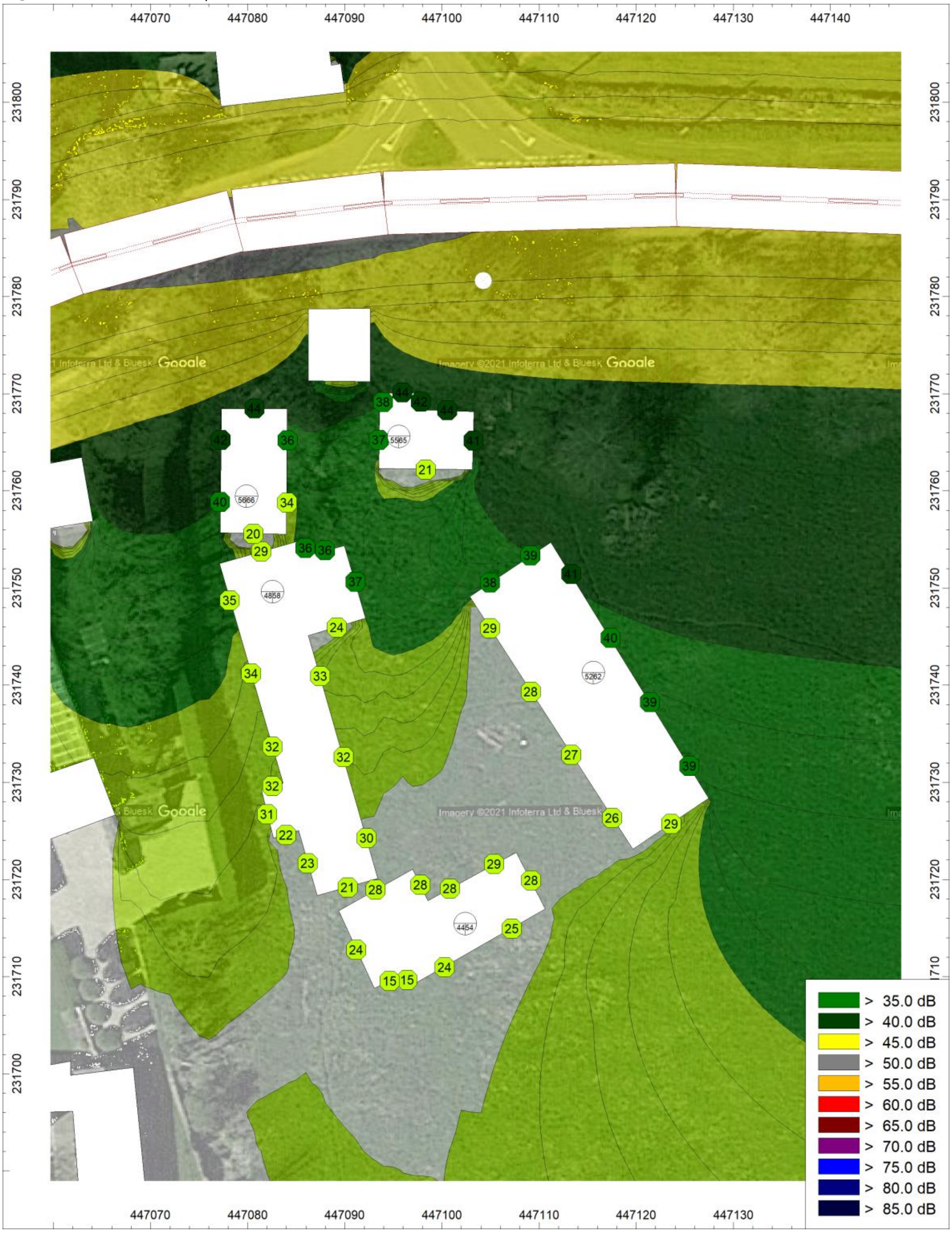
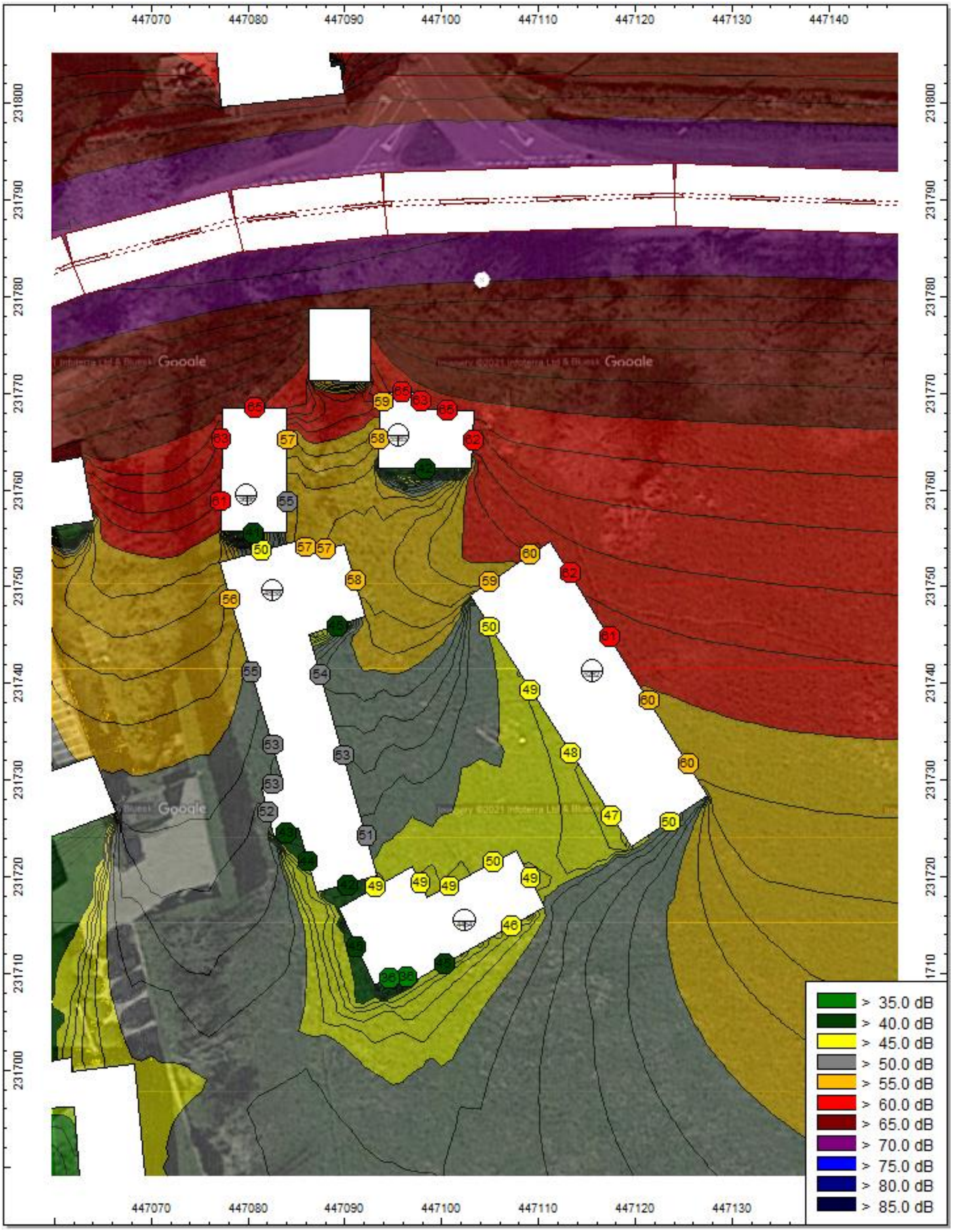


Figure 5 - Predicted L_{Amax} dB



6. Internal Ambient Noise Levels

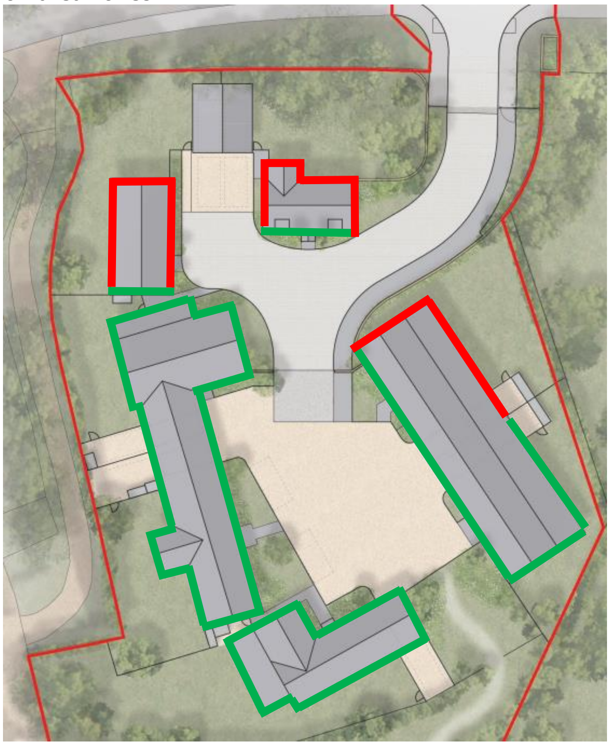
6.1. Noise Mitigation Calculation Method

Calculations for the internal ambient noise levels have been undertaken using the calculation method provided British Standard 8233:2014. The calculations have been undertaken using the building façade constructions below, measured road traffic data and noise map values noted above.

Alternative constructions to those noted below could be used, however they would need to be assessed to ensure they control external noise to within the BS 8233:2014 recommended internal ambient noise level criteria.

The calculations are based on the dimensions to the worst-case rooms in each façade. The mitigation areas are marked into coloured zones, which are referenced later in the report.

Figure 6: Site layout mitigation area zones.



6.2. External Wall Construction

Within all zones the external walls can be of a conventional construction comprising either masonry or light weight metal/timber frame.

The cavity wall construction could comprise of at least two skins of masonry block separated by a 100mm cavity. This construction is expected to achieve the following sound reduction indices:

Table 3: Required minimum sound insulation performance of external walls

Location	Sound Reduction Index / dB per Octave Band (Hz)								R_w (dB)
	63	125	250	500	1k	2k	4k	8k	
All Zones	31	38	46	45	55	66	77	70	52

On green facades only the lightweight construction could comprise of a single frame (minimum 100mm) construction with two layers of board each side of the stud (minimum density 20 Kg/m^2) and 50 millimetre of mineral wool insulation within the cavity.

6.3. Roof Construction

Within all zones the dwellings could have a roof constructed using traditional techniques, such as a timber construction with concrete/slate tiles (minimum mass per unit area of 30 Kg/m^2) with a loft space and a plasterboard ceiling above the habitable rooms.

The above constructions are expected to achieve the following sound reduction indices:

Table 4: Required minimum sound insulation performance of roof

Location	Sound Reduction Index / dB per Octave Band (Hz)								R_w (dB)
	63	125	250	500	1k	2k	4k	8k	
All Zones	26	31	39	47	52	58	58	58	49

6.4. Window Construction

The windows on all elevations could be openable. However, with the exception of the green areas they need to be sealed airtight to control external noise and adequate levels of ventilation should be provided by alternative, attenuated means. The windows should be constructed from sturdy good quality frames with airtight compression seals.

The sound insulation performance for the windows should achieve the following as a minimum. The supplier should confirm the performance is achievable with the chosen systems.

Table 5: Required minimum sound insulation of windows

Location	Required Windows Sound Reduction Index (dB) per Octave Band (Hz)							R_w (dB)	Typical Construction
	63	125	250	500	1k	2k	4k		
All Zones	20	24	20	25	35	38	35	31	4/12/4

6.5. Ventilation Provisions

There will be a need for suitable attenuated ventilation provisions to the habitable rooms in the red and green zones. This could be achieved via acoustic trickle vents or a centralised mechanical ventilation system. As follows are summarised the single figure element normalised level differences ($D_{,n,e,w}$ + C_{tr}) (in the open position) required for trickle vents to habitable rooms in the mitigation zones shown above.

Table 6: Required sound reduction of ventilation

Colour Code	Required Ventilation Sound Reduction Index (dB) per Octave Band (Hz)							$D_{n,e,w}$ (dB)	Typical Construction
	63	125	250	500	1k	2k	4k		
	30	35	35	36	34	29	33	32	Standard Trickle

The ventilation supplier should confirm the above performance is achievable when tested to the current British Standards.

Rooms in the green zone can be ventilated with natural ventilation via an open window which will achieve a $D_{,n,e,w}$ of 15 dBA.

6.6. Effect of Mitigation Measures

With the mitigation measures installed to habitable rooms of the dwellings in the rooms noted above, the predicted internal noise levels are below British Standard 8233:2014 and WHO (1999) criteria and, on this basis, we would consider noise to be below the lowest observed adverse.

6.7. Effect of Mitigation Measures

With the noted building fabric construction, and suitable ventilation provisions, the predicted internal noise levels within the proposed dwellings are within the criteria of British Standard 8233:2014 of 35 dB $L_{Aeq\ (16\ hour)}$ in the daytime rooms, and 30 dB $L_{Aeq\ (8\ hour)}$ and 45 dB $L_{Amax(F)}$ in the night-time rooms.

7. Changes in Road Traffic

Information on existing and proposed traffic on the B4031 Castle/Clifton Road has been provided in the Transport Statement P19-1601 prepared by the Pegasus Group.

The Transport Statement provides existing and predicted traffic during the peak periods. Whilst this does not fully comply with the requirements of the Oxford Council guidance it is our view that this is sufficient to consider the change in road traffic noise from a small development.

Table 3.1 provides the results of an automatic traffic count survey undertaken between the 14th and 21st January 2020. This is duplicated below.

Figure 8: ATC traffic data

14/01/2020-21/1/2020 ATC	Eastbound	Westbound
Average AM Peak Hour Traffic Flow (0700-0800)	104	236
Average PM Peak Hour Traffic Flow (1700-1800)	156	161
85th Percentile Speeds	26.65mph	28.45mph
85th Percentile Speeds adjusted to DMRB CA185 wet weather speeds	29.13mph	30.93mph

Table 5.1 of the Transport Assessment gives the predicted AM and PM Peak two-way trips from the proposed development.

This states that *"the seven age restricted dwellings could generate a maximum of one two-way vehicular movement in both the AM and PM peak periods".* For the purposes of predicting noise this would be an additional Eastbound and Westbound vehicle movement during both peak periods.

Predictions of road traffic noise are undertaken using the prediction method of "Calculation of Traffic Noise" (1988) published by the Department of Transport Welsh Office (CRTN). This predicts noise levels based on a number of factors including traffic speed, volume, % of HGV's, surface type and incline as well as the propagation and reflection of sound in the environment.

The development results in a small number of additional vehicle movements, there is no other material alteration to the traffic flow or physical properties of the road due to the proposals. Therefore, any changes in noise are related directly to the number of vehicles.

The AM traffic flow (both ways) changes from 340 to 342 vehicles. The PM traffic flow (both ways) changes from 317 to 319 vehicles. This results in an increase in noise of 0.03 decibels in both peak periods.

According to the IEMA guidelines this has a negligible impact on road traffic noise levels and will not be noticeable by nearby residents.

Similar changes in noise levels are expected at other times of the day and night.

On the basis of the above the additional road traffic generated by the development will not be noticeable to nearby residents and will have on observed effect. On this basis the impact is considered acceptable.

8. Summary & Conclusions

BBA Architects appointed Acoustic Consultants Limited to provide a noise assessment for the proposed residential development off Clifton Road, Deddington.

This report provides the results of a noise survey conducting on the site and a noise impact assessment of external sources.

Noise mitigation advice is provided in this report in the form of building façade constructions and ventilation provisions to the internal spaces of the scheme. With the proposed fabric construction and suitable ventilation provisions, the predicted internal equivalent noise levels due to external noise, with mitigation, are within the British Standard 8233:2014 criteria for good conditions.

We would consider external noise to be suitably controlled within all habitable rooms of the development as required in the planning condition.

The impact on noise from additional traffic has also been considered. Traffic noise has been predicted based on the data contained within the Transport Assessment and assessed against the IEMA guidelines. This is predicted to have a negligible impact on road traffic noise levels and will not be noticeable by nearby residents.

On the basis of the above the additional road traffic generated by the development will not be noticeable to nearby residents and will have on observed effect. The impact is considered acceptable.

9. Appendix 1 – Glossary of Acoustic Terminology

A-weighted sound pressure pA – value of overall sound pressure, measured in pascals (Pa), after the electrical signal derived from a microphone has been passed through an A-weighting network

A-weighted sound pressure level, L_{pA} - quantity of A-weighted sound pressure given by the following formula in decibels (dBA)

$L_{pA} = 10 \log_{10} (p_A/p_0)^2$

where:

p_A is the A-weighted sound pressure in pascals (Pa);
p_0 is the reference sound pressure (20 μPa)

Background sound level, $L_{A90,T}$– A-weighted sound pressure level that is exceeded by the residual sound assessment location for 90% of a given time interval, T, measured using weighting F and quoted to the nearest whole number of decibels

Break-in - noise transmission into a structure from outside.

Decibel (dB) – The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithms are taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$ – value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, T = t2 – t1, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:

$$L_{Aeq,T} = 10\lg_{10}\left\{(1/T)\int_{t_1}^{t_2}[p_A(t)^2/p_0^2]\mathrm{d}t\right\} \quad (1)$$

where:

p_0 is the reference sound pressure (20 μPa); and

$p_A(t)$ is the instantaneous A-weighted sound pressure (Pa) at time t

NOTE The equivalent continuous A-weighted sound pressure level is quoted to the nearest whole number of decibels.

Facade level – sound pressure level 1 m in front of the façade. Facade level measurements of L_{pA} are typically 1 dB to 3 dB higher than corresponding free-field measurements because of the reflection from the facade.

Free-field level – sound pressure level away from reflecting surfaces. Measurements made 1.2 m to 1.5 m above the ground and at least 3.5 m away from other reflecting surfaces are usually regarded as free-field. To minimize the effect of reflections the measuring position has to be at least 3.5 m to the side of the reflecting surface (i.e. not 3.5 m from the reflecting surface in the direction of the source).

Octave and Third Octave Bands – The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example, two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands. For example third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

Sound pressure level – Sound pressure level is stated on many of the charts. It is the amplitude of the acoustic pressure fluctuations in a sound wave, fundamentally measured in Pascals (Pa), typically from 20 micro-Pascals to 100 Pascals, but commonly simplified onto the decibel scale.

Sound reduction index, R – laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.

Specific sound level, $L_s = L_{Aeq,Tr}$ – equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r.
Structure-borne noise – audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements

Rating level, $L_{Ar,Tr}$ – Specific sound level plus any adjustment for the characteristic features of the sound.

Reverberation Time, T – The reverberation time is defined as the time taken for a noise level in an enclosed space to decay by 60 dB from a steady level, once the noise source has stopped. It is measured in seconds. Often a 60 dB decay cannot be measured so the reverberation time is measured over a lesser range and corrected back to the time for a 60 dB drop assuming a constant decay rate. Common parameters are T20 (time taken for a 20 dB decay multiplied by three) and T30 (time taken for a 30 dB decay multiplied by two).

Vibration Dose Value, VDV – measure of the total vibration experienced over a specified period of time.

Estimated Vibration Dose Value, eVDV – estimation of the total vibration experienced over a specified period of time. This is usually based on the number of events and shortened measurement data.

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. The weighted sound reduction index is used to characterize the insulation of a material or product that has been measured in a laboratory (see BS EN ISO 717-1).

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