



Dice
Environmental
Acoustics

10-12 Botley Road, Hedge End
Residential Planning Noise Assessment

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Contents

EXECUTIVE SUMMARY.....	4
Noise Surveys.....	4
Residential Planning Noise Assessment.....	4
Overheating Assessment.....	4
Plant Noise.....	4
Commercial Noise Assessment.....	5
1. INTRODUCTION.....	6
1.1. Background.....	6
1.2. Limitations.....	6
1.3. Confidentiality.....	6
2. ASSESSMENT METHODOLOGY.....	7
2.1. National Planning Policy Framework.....	7
2.2. British Standard 8233:2014 Guidance on sound insulation and noise reduction for buildings.....	9
2.2.1. Noise Criterion Limits.....	9
2.2.2. Ventilation Requirements.....	10
2.3. Building Regulations Approved Document O: <i>Overheating</i>	11
2.4. World Health Organisation's (WHO) <i>Guidelines for Community Noise</i>	11
2.5. British Standard 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound.....	12
3. SURVEYS.....	14
3.1. Measurement Locations.....	14
3.2. Road Traffic Noise Survey – Botley Road.....	14
3.3. Commercial Noise Survey.....	15
3.4. Noise Survey Conditions.....	16
4. RESIDENTIAL PLANNING NOISE ASSESSMENT.....	17
4.1. Internal Noise Impact for Proposed Dwellings (Non-overheating scenarios).....	17
4.2. Overheating noise assessment.....	18
4.3. External Amenity.....	18
4.4. Proposed Plant.....	18
4.5. BS4142 Assessment.....	19
4.6. Statement of Uncertainty.....	20
4.7. Context.....	21
5. CONCLUSION.....	23
APPENDIX I – LIMITATIONS.....	25
APPENDIX II – GLOSSARY OF ACOUSTIC TERMINOLOGY.....	26
APPENDIX III – FIGURES.....	28
APPENDIX IV – BIBLIOGRAPHY.....	0

Executive Summary

Dice Environmental were commissioned by Planning by Carrington on behalf of Brian Prebble to undertake a Residential Planning Noise Assessment to support a planning application for the change of use from commercial units to a residential development at 10-12 Botley Road, Hedge End .

Noise Surveys

Environmental noise surveys have been completed to quantify the prevailing soundscape at the site. This comprised an unattended logging survey, supplemented with a series of short-term sample measurements around the site associated with the existing commercial premises.

Residential Planning Noise Assessment

A 3D CadnaA noise model has been constructed including all significant noise sources at the site, primarily noise from road traffic on Botley Road. This has been used to predict the noise levels incident upon the facades of the proposed residential development.

Accordingly, appropriate consideration has been given towards the mitigation measures required to ensure that the internal ambient noise level requirements set out in BS8233:2014 can be met for the development. Double-glazing configurations with a minimum performance of $R_w + C_{tr}$ 25 dB would be required to control noise break-in from external sources and achieve the requirements of BS8233. In addition, the assessment has found that a ventilation scheme, providing a performance of $D_{n,e,w} + C_{tr}$ 25 dB will be required within a number of rooms, depending on internal layout and orientation.

Overheating Assessment

All plots meet the noise levels set out in Approved Document O Overheating for bedrooms at night. Open windows can be relied upon as the standard means of cooling for overheating scenarios in all locations.

Plant Noise

Noise limits have been set to apply to all externally located plant units proposed for the site including, but not limited to, kitchen and bathroom extraction units. These are determined in accordance with BS4142.

Commercial Noise Assessment

An assessment has been carried out to determine the impact of the activities associated with the adjacent commercial units, namely the car repairs garage and the fast-food takeaways. The results of the assessment indicate a slight exceedance of the requirements of BS4142. However, when looking at the context, the resultant noise levels fall below those from road traffic noise, which comfortably fall below the lower 50dB threshold as stated within BS8233. Accordingly, it has been determined that the existing commercial noise will not have a significant impact upon the development.

1. Introduction

1.1. Background

Dice Environmental has been commissioned by Planning by Carrington on behalf of Brian Prebble, to provide a Residential Planning Noise Assessment to support a planning application for a the change of use from commercial to residential development at 10-12 Botley Road, Hedge End, to be referred to hereafter as “the site”.

The site is located within Hedge End and is identified as a potential site for residential development. To the immediate east of the site lies 2no. hot food takeaways which have extract and ducting to the rear of the units. To the north of the development lies a car repairs garage and to the west lies parking associated with the car sales unit further along Botley Road. To the south of the development lies Botley Road and the adjoining roundabout.

The key sources of noise impacting upon the site are noise associated with Botley Road and the associated road network. Noise is audible from the car repairs garage, however the majority of the works occur internally with the shutter door closed. Any external works noted were minor and predominantly involved vehicles arriving and leaving.

1.2. Limitations

All limitations of this report are presented in Appendix I.

1.3. Confidentiality

Dice Environmental has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from Dice Environmental; a charge may be levied against such approval.

2. Assessment Methodology

2.1. National Planning Policy Framework

National Planning Policy Framework [1] states that noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. When preparing local or neighbourhood plans, or taking decisions about new development, there may also be opportunities to consider improvements to the acoustic environment.

Local planning authorities' plan-making and decision-taking should take account of the acoustic environment and in doing so consider:

- Whether or not significant adverse effect is occurring or is likely to occur
- Whether or not adverse effect is occurring or is likely to occur; and
- Whether or not a good standard of amenity can be achieved.

In line with the Explanatory Note of the Noise Policy Statement for England [2], this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation.

The Observed Effect Levels are as follows:

- Significant Observed Adverse Effect Level (SOAEL): This is the level of noise exposure above which significant adverse effects on health and quality of life occur;
- Lowest Observed Adverse Effect Level (LOAEL): This is the level of noise exposure above which adverse effects on health and quality of life can be detected;
- No Observed Adverse Effect Level (NOAEL): This is the level of noise exposure at which the noise is noticeable but has no effect at all on health or quality of life.
- No Observed Effect Level (NOEL): This is the level of noise exposure below which noise is not audible.

Table 1 summarises the noise exposure hierarchy, based on the likely average response.

Table 1: Noise exposure hierarchy

Perception	Examples of outcomes	Increasing effect level	Action
No Observed Effect Level			
Not present	No effect	No observed effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No observed adverse effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, 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 small actual or perceived change in the quality of life.	Observed adverse effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour attitude or other physiological response, 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 acoustic character of the area.	Significant observed adverse effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological, e.g., regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable adverse effect	Prevent

The subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation.

These factors include:

-
- The source and absolute level of the noise together with the time of day it occurs. Some types and level of noise will cause a greater adverse effect at night than if they occurred during the day – this is because people tend to be more sensitive to noise at night as they are trying to sleep. The adverse effect can also be greater simply because there is less background noise at night;
 - For non-continuous sources of noise, the number of noise events, and the frequency and pattern of occurrence of the noise; and
 - The spectral content and general character of the noise. The local topology and topography should also be taken into account along with the existing and, where appropriate, the planned character of the area.

More specific factors to consider when relevant:

- Where applicable, the cumulative impacts of more than one source should be taken into account, along with the extent to which the source of noise is intermittent and of limited duration.
- Consideration should also be given to whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time. In both cases a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations.
- If external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended.

2.2. British Standard 8233:2014 Guidance on sound insulation and noise reduction for buildings

2.2.1. Noise Criterion Limits

The scope of this standard [3] is the provision of recommendations for the control of noise in and around buildings. It suggests appropriate criteria and limits for different situations, which are primarily intended to guide the design of new buildings or refurbished buildings undergoing a change of use, rather than to assess the effect of changes in the external noise climate.

The standard suggests ambient noise levels in dwellings from external noise sources should not exceed the values given in Table 2.

Table 2: BS8223 Recommended indoor ambient noise level limits

Activity	Location	Limit $L_{Aeq,T}$ (dB)	
		Daytime (07:00-23:00)	Night-time (23:00-07:00)
Suitable resting/sleeping conditions	Living Room	35	-
	Bedroom	35	30
Dining	Dining room	40	-

BS8233 goes on to recommend noise levels for external amenity spaces (i.e., gardens, balconies etc.). According to BS8233;

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, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. 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 might be warranted.

BS8233 goes on to say:

In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited.

2.2.2. Ventilation Requirements

Where a partially open window cannot be relied upon to provide an adequate level of facade sound insulation, it is necessary to consider alternative ventilation for habitable rooms. Section 8.4.5.4 of BS8233 states:

The Building Regulations' supporting documents on ventilation [4, 5, 6] recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice.

Alternatively, acoustic ventilation units (see 7.7.2) are available for insertion in external walls. These can provide sound reduction comparable with double glazed windows. However, ducted systems with intakes on the quiet side of the building might be required in very noisy situations, or where appearance rules out through-the-wall fans.

Section 7.7.2 states:

NOTE 5: If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level.

2.3. Building Regulations Approved Document O: Overheating

Approved Document O of the Building Regulations 2010 *Overheating* (ADO) [7] concerns ventilation and overheating requirements in dwellings. Requirement O1(2)(a) concerns the maximum acceptable noise levels in homes during overheating scenarios. These represent a 10 dB relaxation on the noise levels set out in BS8233 [3] and WHO Guidelines [8] that apply in non-overheating scenarios. Table 3 sets out these limits.

Table 3: Internal noise level limits in overheating scenarios

Location	Time	Noise limits in overheating conditions
Bedroom	Daytime (07:00-23:00)	$L_{Aeq,16h}$ 45 dB
	Night (23:00-07:00)	$L_{Aeq,8h}$ 40 dB
		L_{AFmax} 55 dB not exceeded more than 10 times per night

2.4. World Health Organisation's (WHO) Guidelines for Community Noise

The WHO *Guidelines for Community Noise* [8] offer advice with regard to setting noise criteria applicable to sleep disturbance. Section 4.2.3 specifies:

If the noise is not continuous, L_{Amax} or SEL are used to indicate the probability of noise-induced awakenings. Effects have been observed at individual L_{Amax} exposures of 45 dB or less. Consequently, it is important to limit the number of noise events with a L_{Amax} exceeding 45 dB.

The guidelines go on to state:

At night, sound pressure levels at the outside façades of the living spaces should not exceed 45 dB L_{Aeq} and 60 dB L_{Amax} , so that people may sleep with bedroom windows open. These values have been obtained by assuming that the noise reduction from outside to inside with the window partly open is 15 dB.

The sound insulation performance value of 15 dB for a façade containing a partially open window accords with the guidance offered in BS8233 [3]. The guidelines reference a study by Vallet & Vernet [9], which concluded that:

For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{AFmax} more than 10-15 times per night.

Accordingly, this assessment has utilised the 10th highest measured maximum noise level from the night-time period and allows for an assessment of a typical maximum noise level in determining façade sound insulation performance.

2.5. British Standard 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound

BS4142 [10] describes methods for rating and assessing sound of an industrial or commercial nature which includes:

- Sound from industrial and manufacturing processes
- Sound from fixed installations which comprise mechanical and electrical plant and equipment
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from processes or premises, such as that from forklift trucks, or that from train or ship movements on or around an industrial or commercial site.

The procedure detailed in the standard compares the measured or predicted noise level, 'the specific noise level', from any of the above detailed noise sources with the background sound level at a residential dwelling. The measured background sound level at a receptor should be reliable and should not necessarily ascertain a lowest measured background sound level, but rather to quantify what is typical.

The specific noise level also acknowledges the following reference time intervals depending upon whether the noise source operates during daytime or night-time periods:

- Daytime (07:00-23:00): 1 hr; and,
- Night-time (23:00-07:00): 15 minutes.

There are a number of 'penalties' which can be attributed to the specific sound level depending upon the 'acoustic features' of the sound under investigation as follows. These penalties vary in their weighting depending upon the severity of the acoustic feature, as follows:

Tonality

- +2 dB: where the tonality is just perceptible
- +4 dB: where the tonality is clearly perceptible
- +6 dB: where the tonality is highly perceptible

Impulsivity

- +3 dB: where the impulsivity is just perceptible

-
- +6 dB: where the impulsivity is clearly perceptible
 - +9 dB: where the impulsivity is highly perceptible

Intermittency

- +3 dB: where the intermittency is readily distinctive against the acoustic environment

In addition to the above acoustic features, there is a penalty for 'other sound characteristics' of +3 dB where a sound exhibits characteristics that are neither tonal nor impulsive, though are readily distinctive against the acoustic environment.

BS4142 goes on to state that the rating level is equal to the specific sound level if there are no such features present or expected to be present.

Assessment of the rating level relative to the background noise level can yield the following commentary:

- Typically, the higher the rating level is above the background sound level, the greater the magnitude of impact.
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.

With the above in mind, it is common that a Local Planning Authority will specify their own criteria for the rating level relative to the background sound level and, where this is the case, this criterion usually takes precedence over a simple comparison of the rating level against the background sound level.

BS4142 includes the following text in relation to areas with low and very low noise levels:

Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.

3. SURVEYS

3.1. Measurement Locations

Dice Environmental has conducted a background and ambient noise survey over an entire weekend and weekday period. The noise survey took place over the following period:

- 13:07 Thursday 11th January 2024 to 10:22 Monday 15th January 2024.

The measurement was undertaken at the following position:

- Noise Measurement Position 1 (NMP1): A background and ambient noise survey was undertaken to the north of the proposed residential dwellings at a height of 1.5m. Noise at this location combined of road traffic and low levels of commercial noise.

A full-time history of the measured noise data is given in Appendix V. A summary of the measured sound pressure levels at NMP1 is presented in Table 4.

Table 4: Summary of measured noise levels at NMP1

Date Range	Period	Ambient sound level, $L_{Aeq,T}$, dB	Background sound level dB $L_{A90,T}$	
			Range	Typical*
11 th Jan. 24 to 15 th Jan. 24	Daytime (07:00-23:00)	56	32-57	48
	Nighttime (23:00-07:00)	46	31-56	35

*Based on modal values occurring within each stated time period

3.2. Road Traffic Noise Survey – Botley Road

Dice has conducted a Road Traffic Noise Survey in accordance with the procedure within Calculation of Road Traffic Noise (CRTN) [11] in order to measure the level of noise generated by vehicles using Botley Road. The Noise Survey took place over the following period:

- 10:36 to 13:38 15th January 2024.

The survey was undertaken at the following location:

- Noise Measurement Position 2 (NMP2): Dice undertook a road traffic measurement Botley Road at an approximate distance of 40m from the nearest kerbside. The survey was undertaken on the southwestern boundary of the site at approximately 1.5m above ground.

A summary of the measured sound pressure levels is presented in Table 5.

Table 5: Summary of measured noise levels at NMP2

Period Start Time	Average Measured Sound Pressure Levels, Free-Field (dB)		10 th highest $L_{Amax,f}$
	$L_{Aeq,T}$	$L_{A10,T}$	
11:00 15/01/2024	58.6	59.7	67.1
12:00 15/01/2024	58.6	59.9	
13:00 15/01/2024	59.3	60.5	
$L_{Aeq,16hr}$ as calculated from CRTN	57.0		
$L_{Aeq,8hr}$ as calculated from CRTN and TRL [12]	49.4		

The L_{Amax} parameter tabulated is obtained by outputting the $L_{Amax,f}$ parameter for each 1-minute interval during the survey. These are ordered in declining intensity and the 10th highest selected.

3.3. Commercial Noise Survey

Dice has conducted a Noise Survey of the activities associated with the surrounding commercial premises, namely the car repairs garage, associated parking and food takeaways. Attended measurements were undertaken to determine the specific sources associated with the commercial premises whilst a long-term unattended measurement was undertaken to quantify the results over a larger measurement period. The Noise Surveys took place over the following periods:

- 10:28 to 11:27 11th January 2024 to capture plant noise; and
- 12:33 12th January 2024 to 13:13 15th January 2024 to capture noise associated with the car repairs garage.

The survey was undertaken at the following positions:

- Noise Measurement Position 3 (NMP3). Dice undertook a long-term noise survey to the north of the site at approximately 10m from the nearest noise source associated with the garage; and
- Noise Measurement Position 4 (NMP4) Dice undertook a short-term noise survey adjacent to the existing plant associated with the adjacent hot food takeaways. The microphone was situated at a height of 3.5m at approximately 1m from the outlet of the nearest plant.

A summary of the measured sound pressure levels is presented in Table 6

Table 6: Summary of measured noise levels at NMP3 and NMP4

Noise Measurement Position (NMP)	Period Start Time	Average Measured Sound Pressure Levels, Free-Field (dB)
		$L_{Aeq,T}$
NMP3	Car Repair Garage	56.1 @10m
NMP4	Takeaway Plant	61.6 @1m

Figure 1 below demonstrates the approximate noise measurement positions.

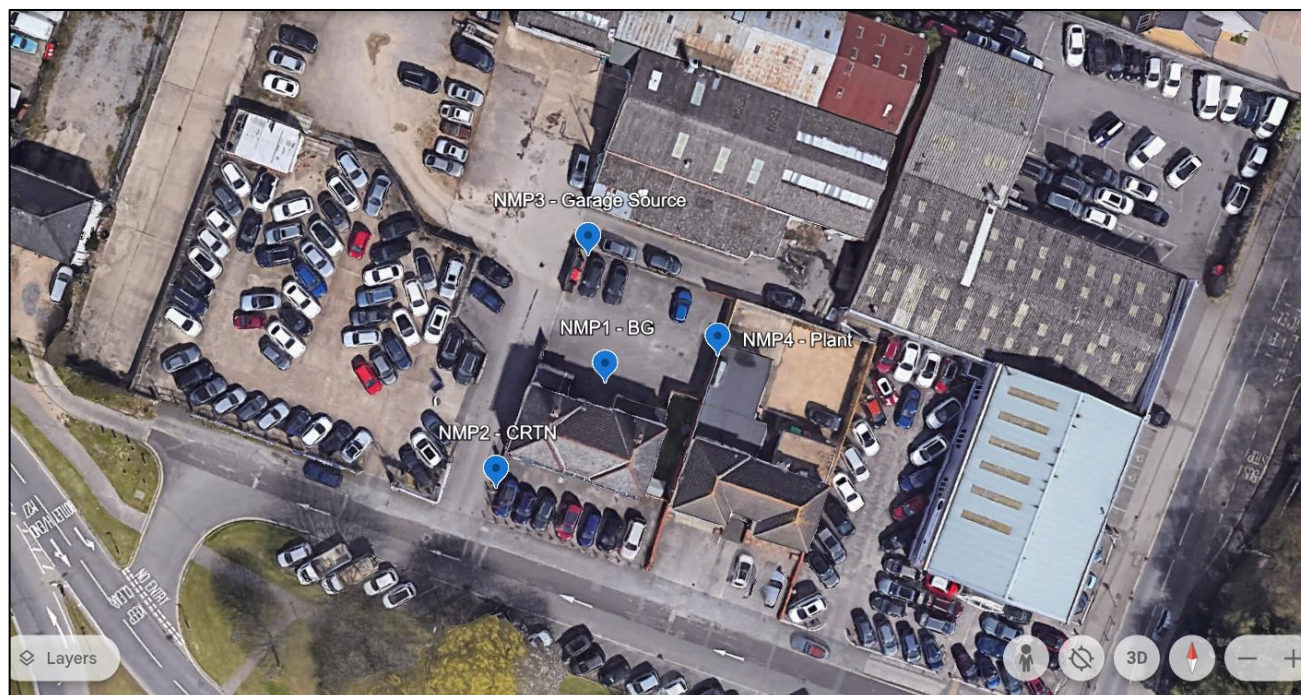


Figure 1: Noise Measurement Positions (NMP's)

3.4. Noise Survey Conditions

The weather conditions during the noise surveys were conducive towards the measurement of environmental noise being fine and dry with wind speeds below 5 m/s.

The noise survey was completed using the following noise measurement equipment.

Table 7: Noise Measurement Equipment

Position	Description	Manufacturer & Type	Serial No.	Calibration Expiry
NMP1 & NMP3	Sound Level Meter	01dB Solo	65211	20 Jun. 25
	Pre-amplifier	01dB-Metravib Pre21S	15766	
	Microphone	01dB MCE 212	181856	
	Calibrator	01dB-Metravib CAL31	84062	
NMP2 & NMP4	Sound Level Meter	01dB Fusion	11536	28 Sep. 25
	Pre-amplifier	01dB PRE22	1915033	
	Microphone	GRAS 49CE	291871	
	Calibrator	01dB-Stell Cal21	34113643 (2011)	

The sound level meters/were field-calibrated on site prior to and after the measurements were taken. No significant drift was witnessed.

4. Residential Planning Noise Assessment

In order to accurately assess noise propagation across the site, a 3D noise model has been constructed using the modelling software CadnaA. The following assumptions, inputs and considerations have been included in the model:

- Terrain data taken from DEFRA Data Services Platform [13];
- Planning layout drawing as described in Section 1;
- Existing buildings that provide shielding from any of the noise sources;
- NMP2 has been successfully used to calibrate the model;
- A reflection order of 2 has been used in all calculations;
- Building heights are as supplied by the client; and
- Noise levels generated using ISO 9613-1 [14] and ISO 9613-2 [15] as incorporated into CadnaA software.

4.1. Internal Noise Impact for Proposed Dwellings (Non-overheating scenarios)

In order to accurately determine the noise level within habitable rooms, noise levels at 1 m outside the façades have been calculated in the noise model for the proposed layout.

Table 13 of BS6262-2 [16] suggests that a standard double-glazing unit with configuration 4mm glass/12mm cavity/4mm glass affords a sound insulation performance in the order of R_w 29 dB; however, this is for a pink noise spectrum. The same unit, weighted for road traffic noise using the '+ C_{tr} ' correction, has a sound insulation performance of approximately $R_w + C_{tr}$ 25 dB and so this value, along with the attenuation values for further glazing configurations, has been used to determine internal noise levels.

BS8233 [3] also recommends that a partially open window provides approximately 15 dB attenuation, and this value is also used in the following.

In order to achieve the noise criteria stated within the BS8233 and WHO Guidelines [8] for bedrooms and living areas, a range of glazing specifications are required. Figures 2 and 3 of Appendix III presents the minimum glazing sound insulation performance required to achieve the WHO's noise criteria across each façade. Table 8 relates this to a typical glazing configuration and ventilation strategy for achieve this.

Table 8: Typical glazing configuration and sound insulation requirements

Sound insulation performance, $R_w + C_{tr}$ (dB)	Typical glazing configuration (mm)	Ventilation strategy*
<15	4/12/4	Open windows
16		$D_{n,e,w} + C_{tr} \geq 16$ dB trickle vent
18		$D_{n,e,w} + C_{tr} \geq 18$ dB trickle vent
20		$D_{n,e,w} + C_{tr} \geq 20$ dB trickle vent
22		$D_{n,e,w} + C_{tr} \geq 22$ dB trickle vent
25		$D_{n,e,w} + C_{tr} \geq 25$ dB trickle vent

* Based on a single trickle vent per window. If more than one vent is to be used, the performance should increase by 3dB with every doubling of the number of vents, i.e., +3dB for 2 vents, +6dB for 4 vents, etc.

4.2. Overheating noise assessment

Analysis of the noise model indicates that all locations are suitable for open windows to provide cooling in overheating scenarios, as the noise limits of ADO [7] will be exceeded. This is shown in Figure 5 in Appendix III.

4.3. External Amenity

The predicted noise levels in the gardens of the new properties will be up to $L_{Aeq,16h}$ 48 dB for the proposed properties without any mitigation measures. This falls below the lower guideline value of $L_{Aeq,16h}$ 50 dB recommended in BS8233. Accordingly, no measures of mitigation will be required.

4.4. Proposed Plant

Consideration should be given to potential noise arising from the proposed plant associated with the development, such as kitchen and bathroom extraction fans, upon the existing noise sensitive dwellings. Table 9 illustrates the calculation of plant rating level limits for the daytime and night-time periods based on BS4142 [10]. These limits apply to all plant units operating simultaneously.

Table 9: Plant noise limits

Period	Representative background level $L_{A90,T}$ (dB)	Plant rating level $L_{Ar,Tr}$ (dB)
Day (07:00-23:00)	48	48
Night (23:00-07:00)	35	35

It should be noted that the emission limit is a rating level which can include for a range of penalties or 'acoustic feature corrections' as detailed in BS4142:2014 and as such the actual measured or calculated sound pressure level outside the closest habitable window could be up to 18dB lower than the rating level values presented here.

At this stage in the design there is no information available regarding the proposed plant units to be installed at the site, so it has not been possible to carry out a full plant noise assessment. Once selections have been made, an assessment should be carried out to ensure that the limits can be met.

Once this is done, it is considered that the likelihood of adverse comment arising as a result of noise from the plant will be low and that the NOAEL will be achieved, which would be barely noticeable and not intrusive, resulting in the following:

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.

4.5. BS4142 Assessment

The following numerical assessments have been provided in accordance with BS4142 [10] to provide a comparison between rating sound levels of the combined activities associated with the adjacent commercial units against the typical sound levels existing prior to development.

The sound predictions in this assessment have been undertaken using a proprietary software-based noise model, CadnaA, which implements the full range of UK noise-based calculation methods. The calculation algorithms set out in ISO9613-2 [15] have been used and the model assumes:

- Proposed Scheme Layout;
- Site elevations have been taken as existing using 1m DTM Lidar data available through DEFRA [13];
- A worst-case assessment has been undertaken with activities occurring at 100% capacity each hour;
- A reflection order of 2 has been used in all calculations;
- Operations will occur during the daytime period only, as such the nighttime assessment has been omitted; and,
- Noise levels generated using ISO9613-1 [14] and ISO9613-2 [15] as incorporated into CadnaA software.

Figure 5 of Appendix III demonstrates the resultant noise levels at the proposed NSR's due to the existing operations. The assessment has determined a specific sound level of 47dB. This figure has been used for the BS4142 assessments below.

Table 10 below identifies applicable acoustic penalties based on the proposed operations of the development.

Table 10: Identification of applicable acoustic penalties

Source	Penalty	Applicable?	Attributable Penalty	Comment
	Tonality	No	--	No tonality characteristics included.
	Impulsivity	Yes	+3	Impulsive elements associated with the car repairs garage
	Intermittency	Yes	+3	Intermittent characteristics associated with the car repairs garage.
	Other Sound Characteristic	No	--	No further character correction included.

Table 11: BS4142 Assessment of Proposed Development

Results	Day 07:00-23:00	Commentary
Background sound level, dB $L_{A90,T}$	48	Representative background sound levels at the NSR.
Reference time interval	1-hour	
Specific sound level, dB $L_{Aeq,T}$	47	Highest off-site values established from calculations undertaken within CadnaA model. Rounded from 46.8
Acoustic feature correction, dB	+6	A 6dB feature correction has been applied to account features.
Rating level, dB L_{Ar,T_r}	53	Specific sound level plus acoustic feature correction.
Excess of rating over background sound level	+5	Exceeds BS4142 requirements.
Assessment indicates likelihood of *depending on context	The rating level exceeds the representative background sound level within the external amenity area. However, road traffic noise is the dominant noise source in this location, and the specific sound level can be seen to fall below the lower criterion of 50dB in accordance with BS8233. Accordingly, when looking at context, noise levels within the external amenity should fall within the range for comfort and enjoyment.	
Uncertainty of the assessment	Uncertainty was minimized by measuring over an extended period and at a location directly representative of the nearest proposed NSRs.	

4.6. Statement of Uncertainty

Uncertainty has been considered as a limit to the accuracy of any noise assessment, including associated steps of measurement, calculation, or prediction. Factors have been considered to include (but not limited to) the following:

-
- The inherent accuracy limitation of methodology in Standards and guidance.
 - Variability in meteorological conditions.
 - The accuracy of sound source input data of a calculation.

It has been a requirement of the assessment standard BS4142 [10] to minimise uncertainty to a level commensurate with the intention of the assessment objective. Measures taken in this assessment to minimise uncertainty have included:

- Baseline sound levels have been measured over a reasonably long period and therefore provide a good indication of representative background and residual sound levels.
- Baseline sound level measurements undertaken in accordance with recognised Standards, using a tall environmental windshield and during acceptable weather conditions e.g. low wind speeds and precipitation.
- A proxy measurement location was used to provide a representative basis for background sound levels at the nearest receiver locations.
- Field calibration checks were undertaken before and after measurements to record very low levels of equipment drift.
- The calculations have been conservative as not to under-predict the resulting impacts.

These measures have been considered to reduce uncertainty to a level considered not to have any significance to the outcome of this assessment.

4.7. Context

The numerical assessments in the above tables have highlighted an indication of an adverse impact at the proposed noise sensitive properties against the representative background sound level during the daytime period.

It has been acknowledged that this assessment needs to be considered in context, following the requirements of BS4142 [10]. The concept of “context” has been notably emphasised in Section 11 of BS4142 when considering numerical impacts established from applying the standard.

Whilst the BS4142 assessment has predicted an exceedance of the existing background sound level, the resultant noise level from the commercial operations fall below the predicted noise levels from the local road traffic network, which in turn meet the lower external criterion of 50dB as stated within BS8233 for comfort and enjoyment of external amenity space.

If mitigation measures are required, a 2.4m high fence around the external amenity areas would reduce the resultant noise levels to those lowest practicable, whilst still resulting in a +4dB exceedance of the background noise levels however the aesthetics of the development should also be taken into consideration when deciding on the outcome of the planning application.

When taking context into deliberation, the assessed sound sources have been viewed to support a “low impact” in accordance with BS4142 and in the environment in which they have been proposed, where possible effects of the proposal have been considered.

5. CONCLUSION

Dice Environmental has been commissioned by Planning by Carrington on behalf of Brian Prebble to provide a Residential Planning Noise Assessment to support a planning application for a residential development at 10-12 Botley Road, Hedge End .

The assessment has been completed with due regard to the requirements of Eastleigh Borough Council and the guidance as stated within BS4142 and BS8233.

Environmental noise surveys have been completed to quantify the prevailing noise environment, dominated by road traffic noise and commercial noise.

This noise survey has been used to develop a 3D computer model of noise propagation across the site including all significant noise sources and with full topography, and to inform a scheme of mitigation measures required to ensure a commensurate level of protection against noise for future occupants.

Accordingly, appropriate consideration has been given towards the mitigation measures required to ensure that the internal ambient noise level requirements set out in BS8233 [3] can be met for the development. Double-glazing configurations of $R_w + C_{tr}$ 25dB would be required to control noise break-in from external sources and achieve the requirements of BS8233. In addition, the assessment has found that, with a partially open window, some rooms exceed the internal noise criteria. Accordingly, a scheme of alternative ventilation will be required with a minimum performance of 25dB.

All units are predicted to fall below the noise levels set out in Approved Document O *Overheating* for bedrooms at night. Accordingly, open windows can be relied upon as the standard means of cooling for overheating scenarios in these locations.

An assessment has been carried out to determine the impact of the operations of the adjacent commercial units upon the proposed development. The results of the assessment indicate that the requirements of BS4142 [10] are slightly exceeded within the external amenity areas of the proposed development. However, when looking at the context, the resultant noise levels fall below those from road traffic noise, which comfortably fall below the lower 50dB threshold as stated within BS8233. Accordingly, it has been determined that the existing commercial noise will not have a significant impact upon the development.

The assessment is based upon robust and worst-case assumptions and demonstrates that, in principle and subject to the incorporation of the identified mitigation measures, there should be no adverse impact at the proposed dwellings as a result of existing noise. The site is suitable for the promotion of residential development.

Appendix I – Limitations

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between Dice Environmental and the Client as indicated in Section 1.2.
2. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
3. Dice Environmental cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by Dice Environmental is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by Dice Environmental in this connection without their explicit written agreement there to by Dice Environmental.
4. Where a noise survey is required to inform the assessment, Dice Environmental will endeavour to ensure that all noise measurements taken are robust, representative and reliable in order to inform an accurate noise impact assessment. Where limitations or constraints exist which prevent a suitable noise survey being completed, Dice Environmental will take all reasonable steps to make the client fully aware of any such limitations or constraints with a view to achieving the best possible outcome for the client. Where additional sound surveys are required, over and above those specified in our scope of works, then Dice Environmental reserves the right to charge additional fees.
5. Where mitigation measures are specified in our report, it should be noted that these measures are relative to a specific sound source, both in terms of the measured sound pressure level and the character of the source. Where either the sound pressure level or the character of the sound varies following completion of the sound survey, Dice Environmental cannot be held responsible for any subsequent variations in the proposed mitigation performance.

Appendix II – Glossary of Acoustic Terminology

Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character, and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsivity may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.

The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq} , L_{A90} etc., according to the parameter being measured.

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

An indication of the range of sound levels commonly found in the environment is given in the Table A1.

Table A1: Typical Sound Pressure Levels

Sound Pressure Level dB(A)	Location/Example
0	Threshold of hearing
20-30	Quiet bedroom at night
30-40	Living room during the day
40-50	Typical office
50-60	Inside a car
60-70	Typical high street
70-90	Inside factory
100-110	Burglar alarm at 1m away
110-130	Jet aircraft on take off
140	Threshold of pain

Table A2: Terminology

Descriptor	Explanation
Ambient Noise	Encompassing sound, at a given place, being usually a composite of sounds from many sources near and far.
C_{tr}	Sound insulation performance spectrum adaptation term that accounts for the A-weighted urban traffic noise spectrum.
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (20 μ Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with the 'A' frequency weighting to compensate for the varying sensitivity of the human ear to sound at different frequencies.
$D_{n,e,w}$	Weighted element normalized level difference. A single-number quantity that describes the sound insulation of ventilators.
$L_{Aeq, T}$	A-weighted, equivalent continuous sound pressure level. L_{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.
L_{Amax}	L_{Amax} is the maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' time-weighting response.
$L_{A,r,Tr}$	Sound rating level. The A-weighted L_{eq} sound level of an industrial noise during a specified time period, adjusted for tonal character and impulsivity.
L_{10} & L_{90}	If a non-steady noise is to be described, it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L_{10} index to describe traffic noise.
Free-Field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally, this is measured outside and away from buildings.
Fast	A time-weighting used in the root mean square section of a sound level meter with a 125-millisecond time constant.
Pink Noise Spectrum	Noise whose power spectral density is inversely proportional to frequency.
Residual Noise	The ambient sound remaining when the specific sound is suppressed.
R_w	Weighted Sound Reduction Index. A single number quantity which characterises the airborne sound insulation of a material or building element over a range of frequencies, based on laboratory measurements.
Slow	A time-weighting used in the root mean square section of a sound level meter with a 1000-millisecond time constant.
Specific Noise	Noise from the sound source under investigation as defined in BS4142, method for rating industrial noise affecting mixed residential and industrial areas.

Appendix III – Figures

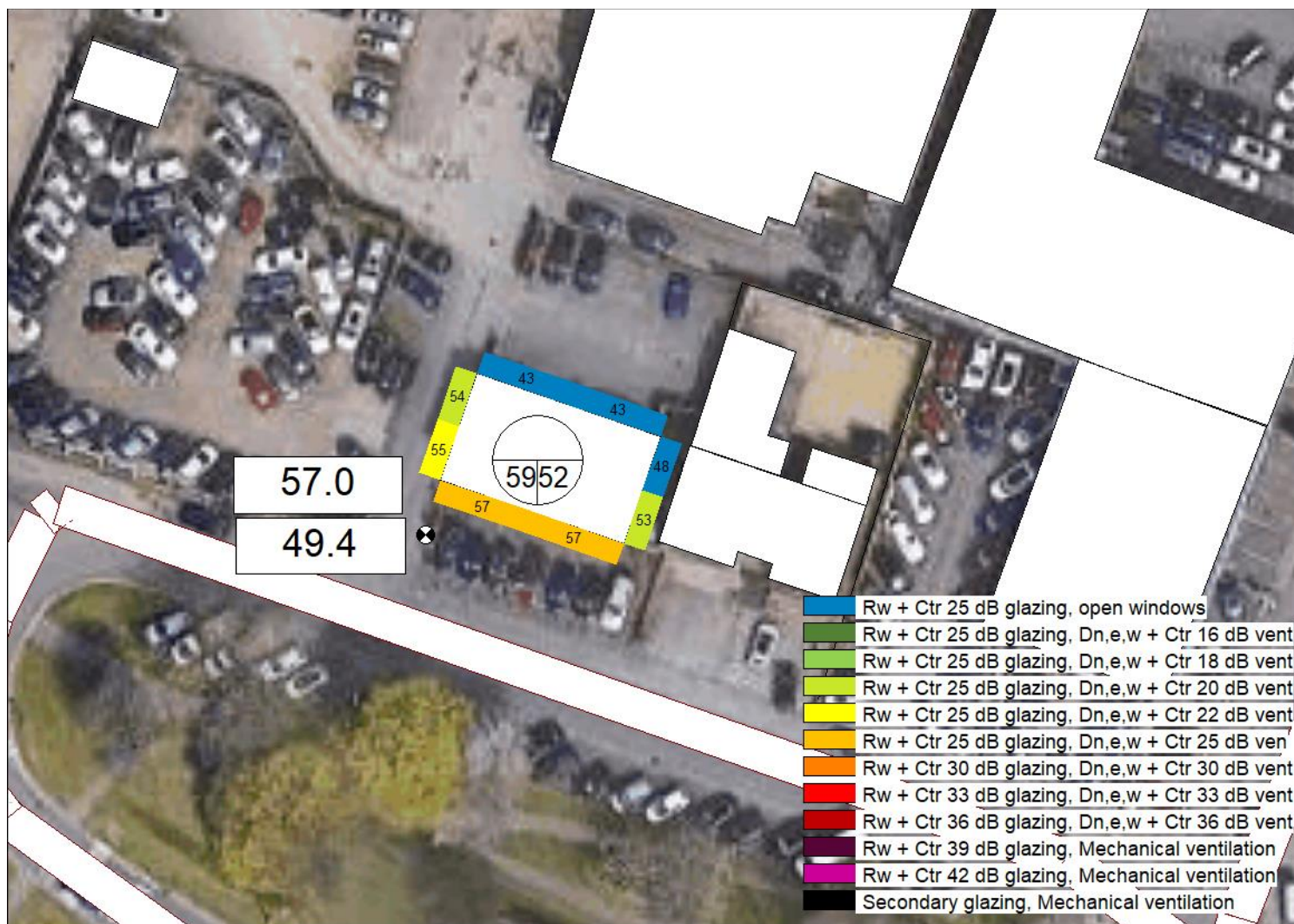


Figure 2: BS8233:2014 Assessment – Daytime L_{Aeq}

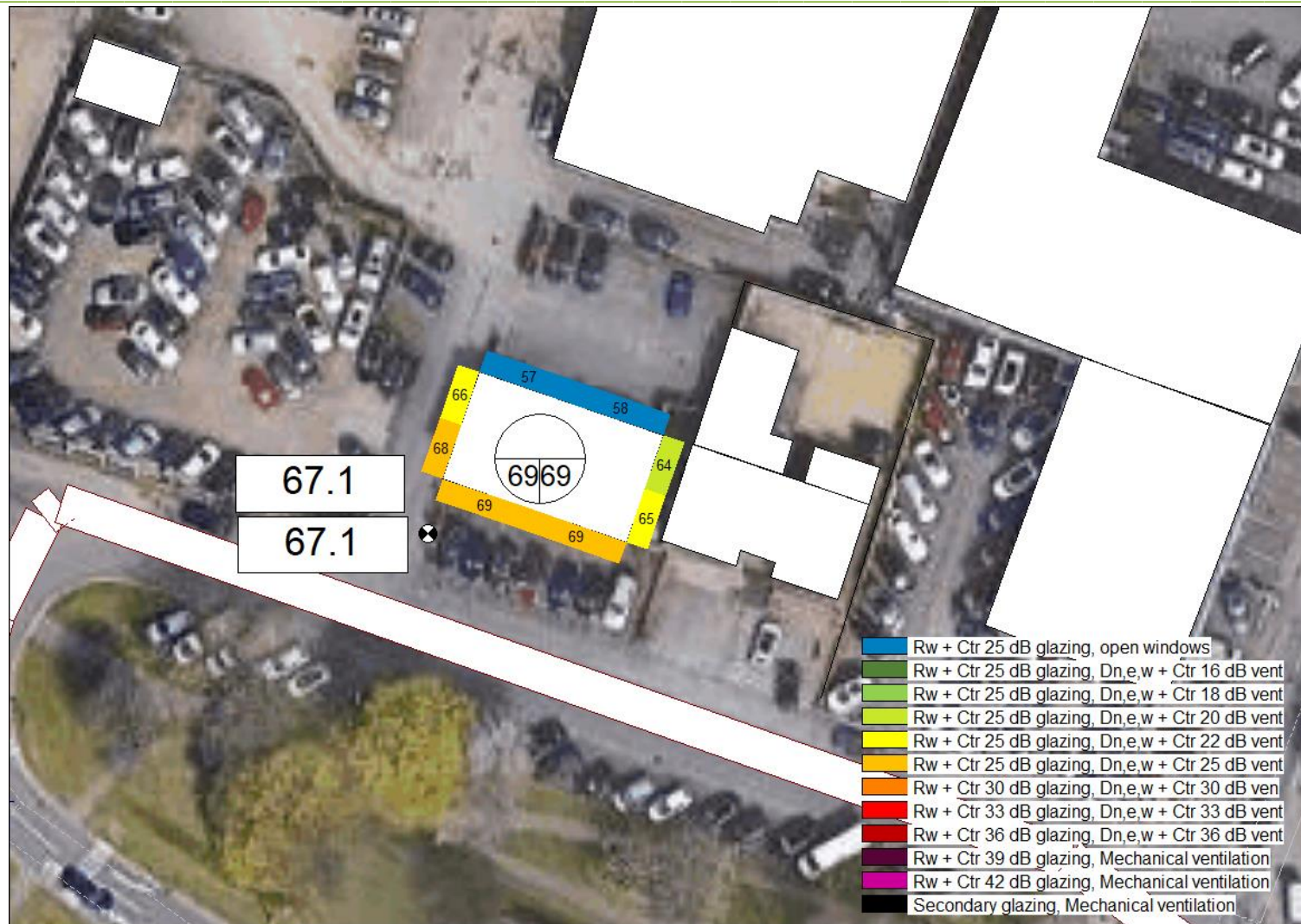


Figure 3: BS8233:2014 Assessment – Night-time L_{Max}



Figure 4: BS8233:2014 Assessment – External Amenity

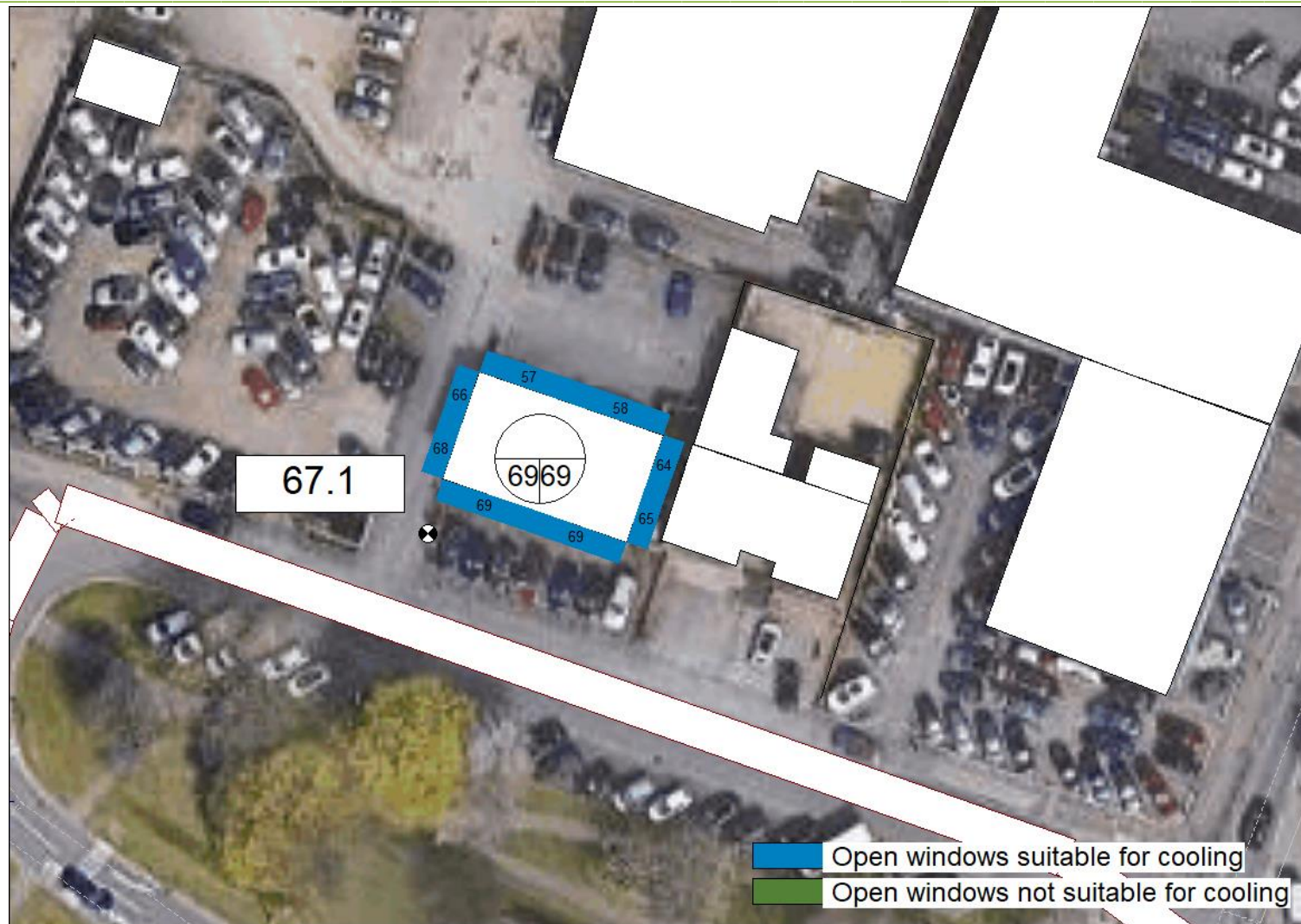


Figure 5: Overheating Assessment

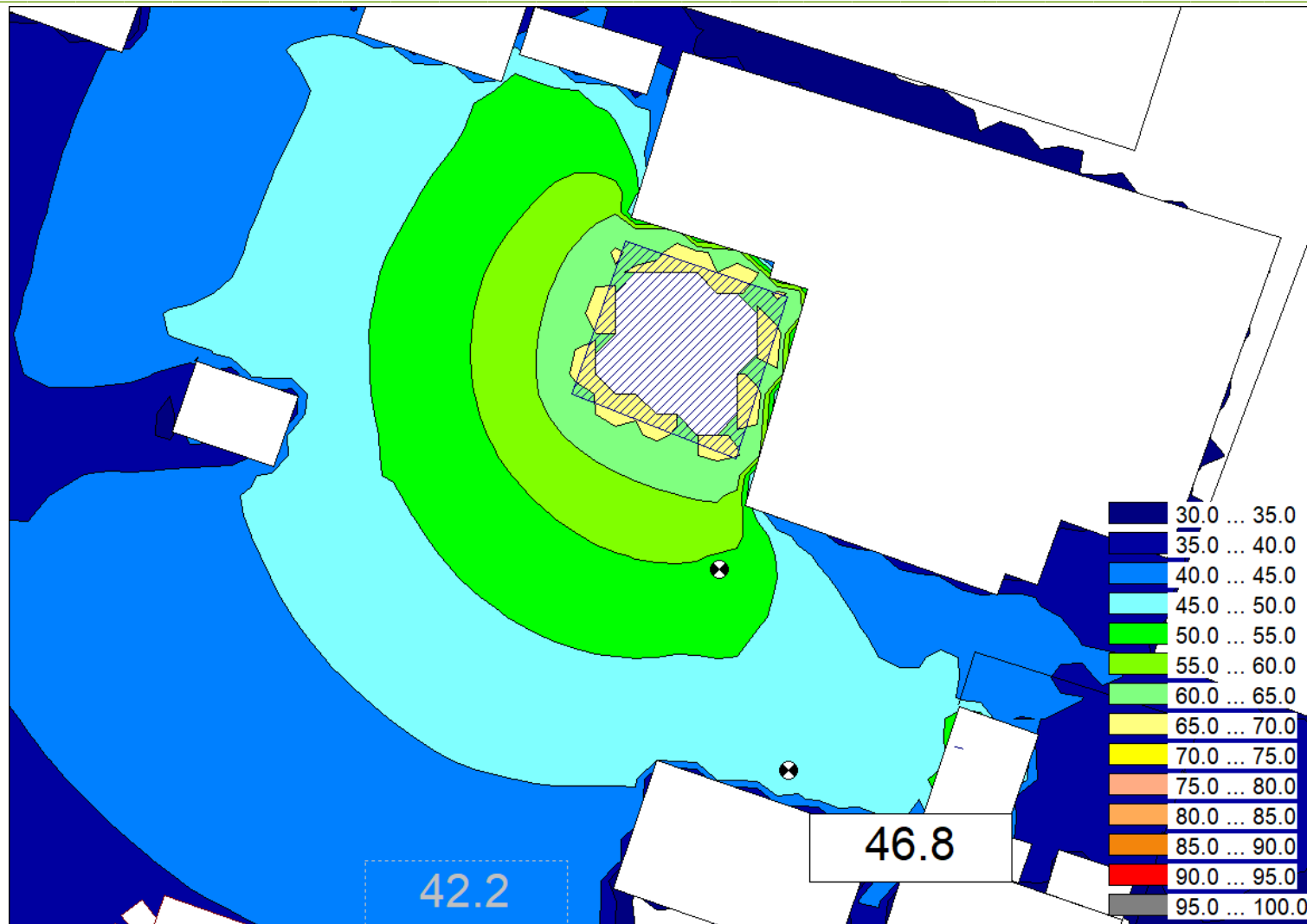


Figure 6: BS4142:2014 – Commercial Assessment

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