



ACOUSTIC CONSULTANTS LTD
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Noise Impact Assessment

**Proposed Mixed Use Development Site
Bartons Road, Havant**

**Reference: 8443/PR/BL
Date: September 2220**

Client:	Acoustic Consultant:
	 ACOUSTIC CONSULTANTS LTD <i>noise and acoustic specialists since 1987</i>

Document Control

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The report has been prepared in good faith, with all reasonable skill and care, based on information provided or available at the time of its preparation and within the scope of work agreement with the Client. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above. The report is provided for the sole use of the named Client and is confidential to them and their professional advisors. No responsibility is accepted to other parties.

The report limits itself to addressing solely on the external 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

Fortitudo Ltd appointed Acoustic Consultants Limited to carry out an environmental noise assessment and provide noise assessment and advice for the proposed mixed use development on land at Bartons Road, Havant.

The assessment takes into consideration the local authority requirements and considers the impact of road traffic noise from Bartons road to the north and Petersfield road to the west, existing plant noise to the south east and Havant & Waterlooville FC crowd noise to the east during a football match on the proposed development.

In addition, this report also sets plant noise limits for any plant use within the application site for the premises based on the measured background noise levels and British Standard 4142:2014+A1:2019.

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 4142:2014+A1:2019 (BS4142), British Standard 8233:2104 (BS8233) and World Health Organisation (WHO) 1999.

The author of this report is a full Member of the Institute of Acoustics with more than 10 years' experience within the field and as such is considered suitably qualified to undertake a noise impact assessment.



2. The Site

The site is located on land at Bartons Road / Peterfield Road, Havant. The site was previously occupied by a commercial building which has now been demolished. The proposal is to erect three new residential blocks of flats (Block A to C).

To the north is the Barton road and to the west is Petersfield road which are considered to be the main sources of noise affecting the development site. To the east and south east of the site respectively is the Havant & Waterlooville FC Stadium and The Westleigh public house. Operational noise from the public house premise was considered negligible when compared to crowd noise from the stadium, and plant noise and therefore no further assessment is in our opinion required.

Also, to the south east there is West Leigh Service Station and Motorwork car sales. Operational noise from this commercial premises was considered negligible when compared to road traffic noise along Petersfield Rd and therefore no further assessment is in our opinion required.

Also to the south east is SSE Services PLC building and associated plant and substation.

The google site location and site plan is provided below in Figure 1 and Figure 2.

Figure 1: Proposed Site Location



[illegible]



3. Planning Policy

3.1. National Planning Policy Framework

The National Planning Policy Framework (NPPF) was published in March 2012 and revised in July 2021. Section 15 entitled 'Conserving and enhancing the natural environment' addresses noise as a requirement of planning. Paragraph 174 states:

"174. Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."

Paragraph 185 states:

"185. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation. "

The document does not prescribe any assessment methodology or criteria to assess the adverse effect of noise, and refers you to the NPSE.

3.2. Noise Policy Statement for England

The NPPF refers to the Noise Policy Statement for England (NPSE). This was published in March 2010 and aims to provide clarity regarding current policies and practices to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion and applies to all



forms of noise including environmental noise, neighbour noise and neighbourhood noise.

The NPSE sets out the long term vision of Government noise policy. This long term vision is supported by three noise policy aims as follows:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life."*

The NPSE introduces the concept of "Significant adverse" and "Adverse" impacts of noise which relate to the noise policy aims. These are applied as follows:

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

The Noise Policy Statement for England (NPSE) states that noise levels above the Lowest Observed Adverse Effect Level are acceptable in planning where reduced to a minimum.

With regard to where there is potential for noise impact it states the following in relation to the second noise policy aim:

"The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur."



The NPSE does not provide any assessment criteria for the noted effect levels and each case must be considered on its merits. The NPSE does, however, emphasise that in dealing with noise Local Planning Authorities are required to take a balanced approach in considering the benefits of development as against any adverse effects which arise. Paragraph 2.18 of the NPSE is particularly relevant in this respect and states:

"There is a need to integrate consideration of the economic and social benefits of the activity or policy under examination with proper consideration of the adverse environmental effects, including the impact of noise on health and quality of life. This should avoid noise being treated in isolation in any particular situation, i.e. not focusing solely on the noise impact without taking into account other related factors."

The planning need is outside the scope of noise and acoustics and will need to be addressed by others.

3.3. National Planning Practice Guidance, Noise (NPPG)

The National Planning Practice Guidance (NPPG) on noise, referred to here, is based on the current version (July 2019) as provided on the Planning Guidance Website. It 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."*

The document provides generic guidance on how to determine the impact of noise and what factors could be a concern. It includes the option types to mitigate any adverse effects of noise stating that there are four broad types of mitigation. These are engineering, layout, using planning conditions or obligations and noise insulation.

Paragraph 5 of the NPPG provides a table identifying the effect level and examples of effect relating to the impact effect levels provided in the NPSE. The table is duplicated on the following page.

Table 1: NPPG Noise – Perception of Effect Levels

Response	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not Present	No Effect	No Observed Effect	No specific measures required
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for	Observed Adverse Effect	Mitigate and reduce to a minimum



Response	Examples of Outcomes	Increasing Effect Level	Action
	some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.		
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

The table does not provide any objective assessment which equates to the noted effect levels.

The NPPG identifies that where noise is audible it is not necessarily intrusive. The effect and impact on people is based primarily on the level of noise.

The Noise Policy Statement for England (NPSE) states that noise levels above the Lowest Observed Adverse Effect Level are acceptable in planning where reduced to a minimum when taken into account against all other planning considerations.

Section 4 of this report identifies guidance which is considered to provide noise criteria equivalent to effect levels below the Lowest Observed Adverse Effect Level. This is where the perception of noise is "not noticeable" or "noticeable but not intrusive" as indicated in Table 1 above.



4. Assessment Criteria

The following sections outline the most appropriate design criteria for the development to assess road, plant and sports crowd noise and identifies guidance which is considered to provide noise criteria equivalent to or below the LOAEL described in NPPG and NPSE, i.e. *"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."*

4.1. Road Traffic Affecting Dwellings

British Standard 8233:2014 entitled "Guidance on sound insulation and noise reduction for buildings" came into effect on 28th February 2014. Section 7.7.2 Table 4 of the British Standard 8233:2014 provides internal ambient noise levels for dwellings from noise sources 'without a specific character'.

The British Standard guideline states that noise levels should not exceed those as noted in Table 2 of the British Standard. These criteria are based on the guidance provided within WHO 1999 and are summarised below:

Table 2: British Standard 8233:2014 Internal Noise Criteria

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

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 BS8233 provides no definitive criteria for maximum noise levels from individual events ($L_{Amax,F}$). Section 3.4 of the "Guidelines for Community Noise" published by the World Health Organisation in 1999 (WHO 1999) 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)"*.

4.2. Plant & Commercial Noise affecting Dwellings

For industrial and commercial noise the most relevant guidance is provided within British Standard 4142:2014+A1:2019. The methods described in the British Standard use outdoor sound levels to assess the likely effects of sound upon people who might be inside or outside a dwelling or other premises used for residential purposes.

The initial estimate principle is that of establishing the 'difference' between the 'rating level' and the 'background sound level'.



The 'rating level' is the 'specific sound level' of the source over a period of one hour during the day (07:00 to 23:00 hours) and over a period of 15 minutes during the night (23:00 to 07:00 hours). Clause 9 entitled 'Rating Level' states:

"Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level."

An acoustic character correction should be added to the 'specific sound level' if it exhibits any tonality, impulsivity, other specific characteristics and/or intermittency at the assessment location. The value of the character correction varies, dependent on the prominence of the character of the sound source at the assessment location.

In Clause 11 of the Standard, entitled 'Assessment of the Impacts', it states:

"Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (see Clause 8) from the rating level (see Clause 9), and consider the following.

- Typically, the greater this difference, the greater the magnitude of the 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.*
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."*

Based on the initial assessment outcomes of British Standard 4142, and depending on context, it is our opinion that the NOEL, LOAEL and SOAEL levels stated in the Noise Policy Statement for England would generally fall within the following categories when considered in conjunction with the effect levels of the NPPG Noise.

Table 3: BS4142 Difference in Relation to Effect Levels

BS4142 Assessment Difference	Corresponding Effect Level*	Action*
≤ -10 dB	No Observed Effect	No specific measures required
-9.9 dB to 0 dB	No Observed Adverse Effect	No specific measures required
	Lowest Observed Adverse Effect Level	
0.1 dB to 5 dB	Observed Adverse Effect	Mitigate and reduce to a minimum



BS4142 Assessment Difference	Corresponding Effect Level*	Action*
	Significant Observed Adverse Effect Level	
5.1 dB to 10 dB	Significant Observed Adverse Effect	Avoid
≥10.1 dB	Unacceptable Adverse Effect	Prevent

* BS4142 states that "where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration". Therefore the assessment levels and effect levels above are not definitive and can be modified due to context.

It should be noted that the numerical outcome only represents the initial estimate of impact, as stated in the first paragraph of Clause 11, and that contextual matters should be considered before determining what the potential impact is. This paragraph states:

The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.

Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (see Clause [8](#)) from the rating level (see Clause [9](#)).

NOTE 1 More than one assessment might be appropriate.

The second part of Clause 11 sets out three contextual matters that should be taken into account once the initial numerical estimate has been determined. It is important to note that the three listed is not exhaustive and all pertinent factors should be considered.

In terms of context British Standard 4142:2014 states:

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

- 1) 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. Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.*
- 2) The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to*



compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.

NOTE 3 Consideration ought to be given to evidence on human response to sound and, in particular, industrial and/or commercial sound where it is available. A number of studies are listed in the "Effects on humans of industrial and commercial sound" portion of the "Further reading" list in the Bibliography.

- 3) *The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure **good internal and/or outdoor acoustic conditions**, such as:*
- i) façade insulation treatment;*
 - ii) ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and*
 - iii) acoustic screening."*

4.3. World Health Organisation 'Guidelines for Community Noise'

The World Health Organisation 'Guidelines for Community Noise' published in 1999 gives the following description of community noise.

"Community noise (also called environmental noise, residential noise or domestic noise) is defined as noise emitted from all sources except noise at the industrial workplace. Main sources of community noise include road, rail and air traffic, industries, construction and public work, and the neighbourhood. Typical neighbourhood noise comes from premises and installations related to the catering trade (restaurant, cafeterias, discotheques, etc.); from live or recorded music; sport events including motor sports; playgrounds; car parks; and domestic animals such as barking dogs."

This includes "sport events" and as such is applicable to the crowd noise generated at Havant & Waterlooville Football Club existing grounds to the east of the proposed site. The site consist of apartments with no external amenity spaces, as such internal noise levels need to be considered. For noise levels internally to dwellings WHO states:

"In Dwellings. The effect of noise in dwellings, typically, are sleep disturbance, annoyance and speech interference. For bedrooms the critical effect is sleep disturbance. Indoor guideline values for bedrooms are 30 L_{Aeq} for continuous noise and 45 L_{Amax} for single sound events. Lower noise levels may be disturbing depending on the nature of the noise source."



And

"To enable casual conversation indoors during daytime, the sound level of interfering noise should not exceed 35 dB L_{Aeq} ."

According to the WHO guidance, moderate annoyance is caused by noise levels exceeding 35 $L_{Aeq(T)}$ dB internally. With relation to the adverse effect level we would consider this the threshold of the Lowest Observed Adverse Effect Level. The noise level of the crowd may be noticeable but not intrusive and is considered acceptable in planning terms.

The equivalent noise level is determined over a specific time period. The World Health Organisation guidelines for residential development are typically equivalent noise levels calculated over a 16-hour daytime period.

In our opinion, a 16-hour assessment period of crowd noise during a football match may not truly reflect the noise impact as it takes into account times of use and non-use. We would propose an alternative, more stringent but appropriate assessment time period of two hour, L_{Aeq} (2 hour), as this is the typical time period that people will be present within the stadium, assuming 15 minutes prior to kick off, the 90 minute match and 15 minutes of half time.

Therefore, we would suggest the more stringent target noise level of 35 dB L_{Aeq} (2 hour) is more suitable for the more sensitive evening time internally to dwellings.

The WHO criteria were reviewed in a report by the National Physical Laboratory (reference CMAM16) which states:

"Exceedance of the WHO guideline values does not necessarily imply significant noise impact and indeed, it may be that significant impacts do not occur until much higher levels of noise exposure are reached."

Therefore, it is not necessarily the case that where these levels are exceeded the noise will adversely affect nearby residential properties.



5. Noise Monitoring

A partially attended noise monitoring exercise was undertaken at two different locations between the 10th July 2020 to 13th July 2020 to determine the noise levels affecting the proposed development. In addition, a fully attended noise survey was also carried out on the 10th July 2020 to determine plant noise levels currently affecting the site.

5.1. Monitoring Equipment

Sound Pressure Levels were measured using an NTI XL2 sound level meter with a half-inch condenser microphone. The equipment is checked annually using a Quality System meeting the requirements of British Standard EN ISO/IEC 17025:2005 and in accordance with British Standard EN 10012:2003 and traceable to the National Standards. This equipment was checked and calibrated as noted below and the certificates are available for inspection. Table 4 provides the equipment and calibration status.

Table 4: Equipment and Calibration Status

Equipment Description / Manufacturer / Type	Serial Number	Date of Calibration	Calibration Certification Number
SLM, Cirrus Research, CR:171C	G080650	04/06/19	271343
Microphone, Cirrus Research, MK224	210551D	04/06/19	129446
Calibrator, Cirrus Research, CR:515	84377	04/06/19	129444
SLM, NTI, XL2	A2A-11053-E0	22/04/20	34610
Pre-Amp, NTI, MA220	5871	22/04/20	34610
Microphone, NTI, MC230A	9276	22/04/20	34609
Calibrator, Nor-1251	35227	27/08/19	32692

The measurement systems were checked before and after use with the calibrators and no significant drift was detected.

5.2. Weather Conditions

During the noise monitoring exercise the weather conditions were dry, with an average temperature of approximately between 7 and 26 degrees centigrade and with low wind speeds generally below 5m/s. The weather conditions are not expected to have adversely affected the measurement process.

5.3. Noise Monitoring Procedure

Two long term partially attended noise monitoring exercises were carried out at two different locations between 13:00 hours on the 10th July 2020 and 12:15 hours on the 13th July 2020. The measurements were carried out at 'Monitoring Location A' along Barton Road and 'Monitoring Location B' along Petersfield Road. Both microphones

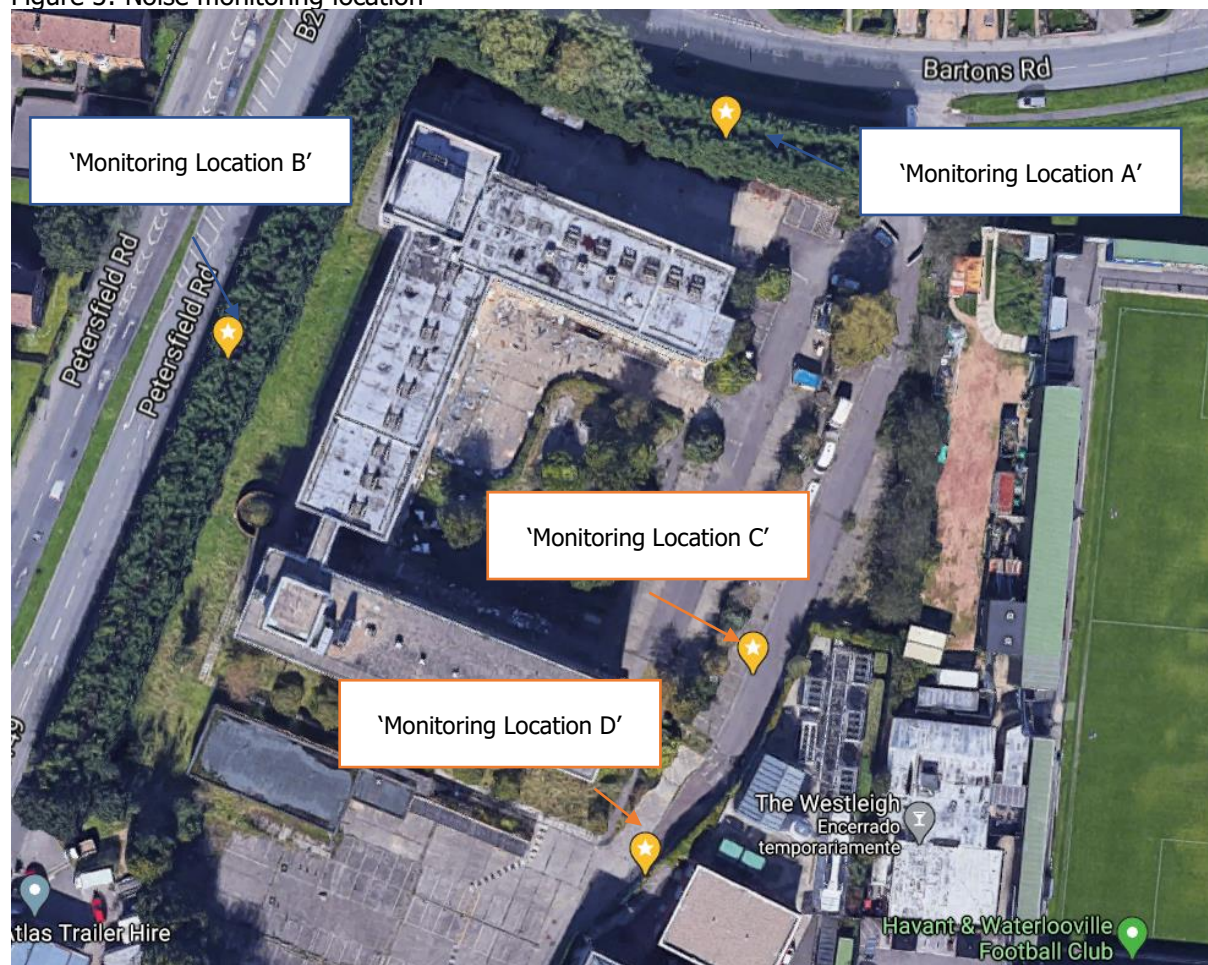
were considered to be approximately 1.5 metres above the ground and within the site boundary and at least 2 metres away from the existing boundary wall and fence; see Figure 3 below. The purpose of these monitoring exercises was to determine road noise levels affecting the site. This was considered to form the predominant noise source affecting the site.

In addition, two fully attended noise surveys were also carried at two different locations on the 10th July 2020 around 13:00 hours at 'Monitoring Location C', approximately 7 metres away from the existing plant boundary fence and at Monitoring Location D' next to the existing substation boundary fence and facing the louvred door; see Figure 3 below. The microphones were considered to be approximately 1.5 metres above the ground. The purpose of these monitoring exercises was to determine plant noise levels affecting the site.

It was determined that plant noise was audible against the background noise at the 'Monitoring Location C' and 'Monitoring Location D'.

All meters used during the monitoring exercise above had their meter clock synchronized. All monitoring locations are shown in Figure 3 below:

Figure 3: Noise monitoring location



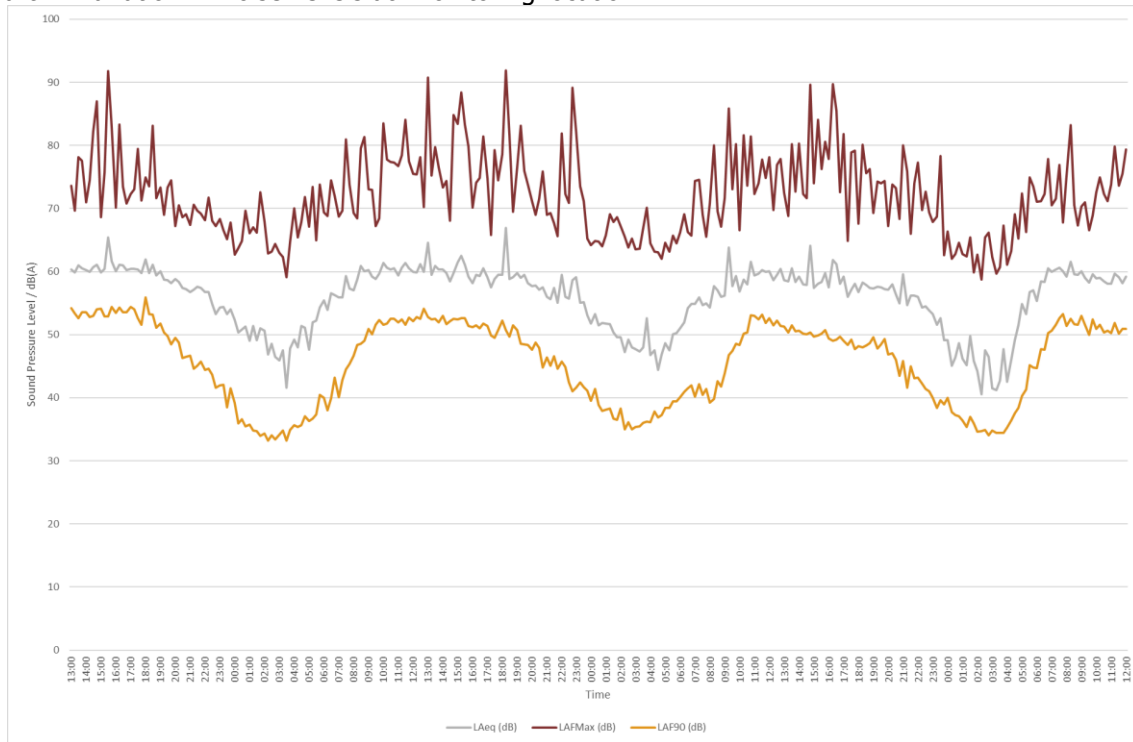


5.4. Measured Noise Levels

5.4.1. Long Term 'Monitoring Location A'

A chart of the variation in ambient noise levels with time is provided below:

Chart 1: Variation in Noise Levels at 'monitoring location A'



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

Table 5: Measured Octave Band Design Noise at 'monitoring location A'

Parameter	63	125	250	500	1000	2000	4000	8000	dB(A)
Day $Leq_{(16hr)}$	66	61	58	55	56	51	42	34	60
Night $Leq_{(8hr)}$	57	53	48	47	50	45	35	25	52
Night $L_{max(F)}$	77	74	69	69	71	66	55	45	74

We have also determined the following background noise levels $LA_{90, 15 min}$ currently at the site which will be used latter in this report to assess plant noise impact at the proposed dwellings.

Table 6: Measured background noise levels $LA_{90, 15 min}$ at 'Monitoring Location A'

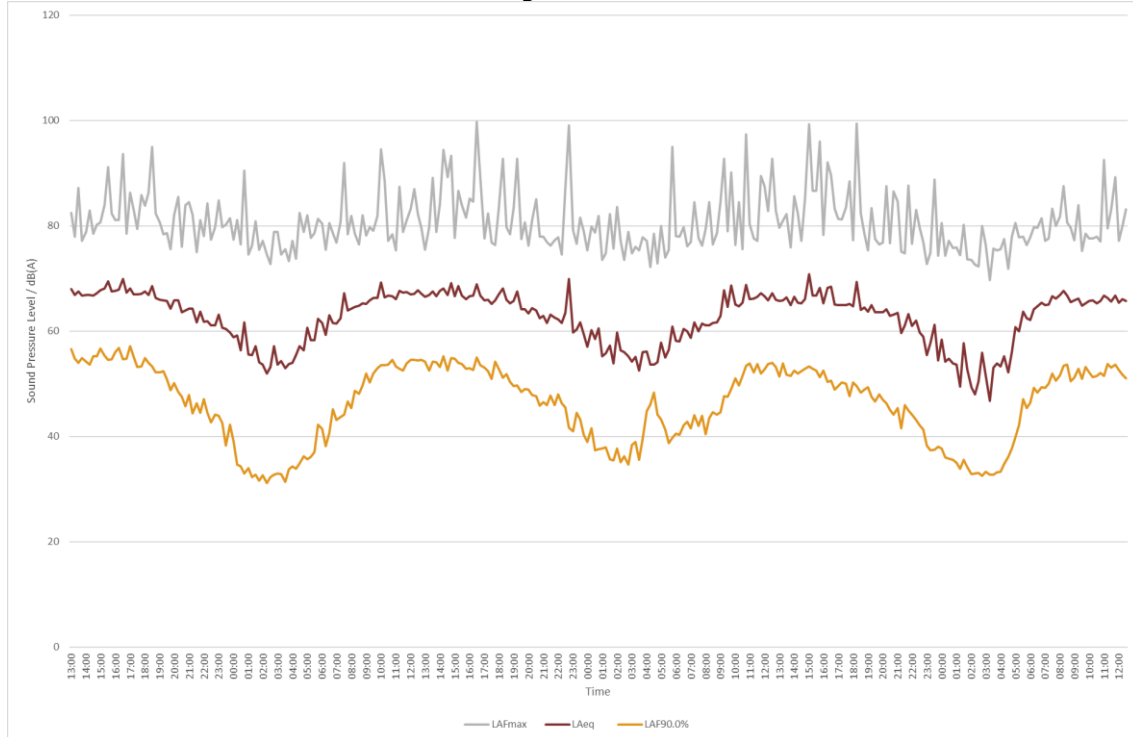
Period	$LA_{90, 15 min}$	
	Range	Mode
Day (07:00 - 23:00)	39 - 56	52
Evening (19 - 23:00)	41 - 52	45
Night (23:00 - 07:00)	33 - 50	36



5.4.2. Long Term 'Monitoring Location B'

A chart of the variation in ambient noise levels with time is provided below:

Chart 2: Variation in Noise Levels at 'monitoring location B'



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

Table 7: Measured Octave Band Design Noise at 'monitoring location B'

Parameter	63	125	250	500	1000	2000	4000	8000	dB(A)
Day $L_{eq,(16hr)}$	67	63	64	61	63	58	49	42	66
Night $L_{eq,(8hr)}$	60	54	54	53	56	51	43	38	58
Night $L_{max(F)}$	78	71	74	75	80	75	64	56	82

We have also determined the following background noise levels $L_{A90, 15 \text{ min}}$ currently at the site which will be used latter in this report to assess plant noise impact at the proposed dwellings.

Table 8: Measured background noise levels $L_{A90, 15 \text{ min}}$ at 'Monitoring Location B'

Period	$L_{A90,15min}$	
	Range	Mode
Day (07:00 - 23:00)	40 - 57	53
Evening (19 - 23:00)	41 - 52	48
Night (23:00 - 07:00)	31 - 49	33



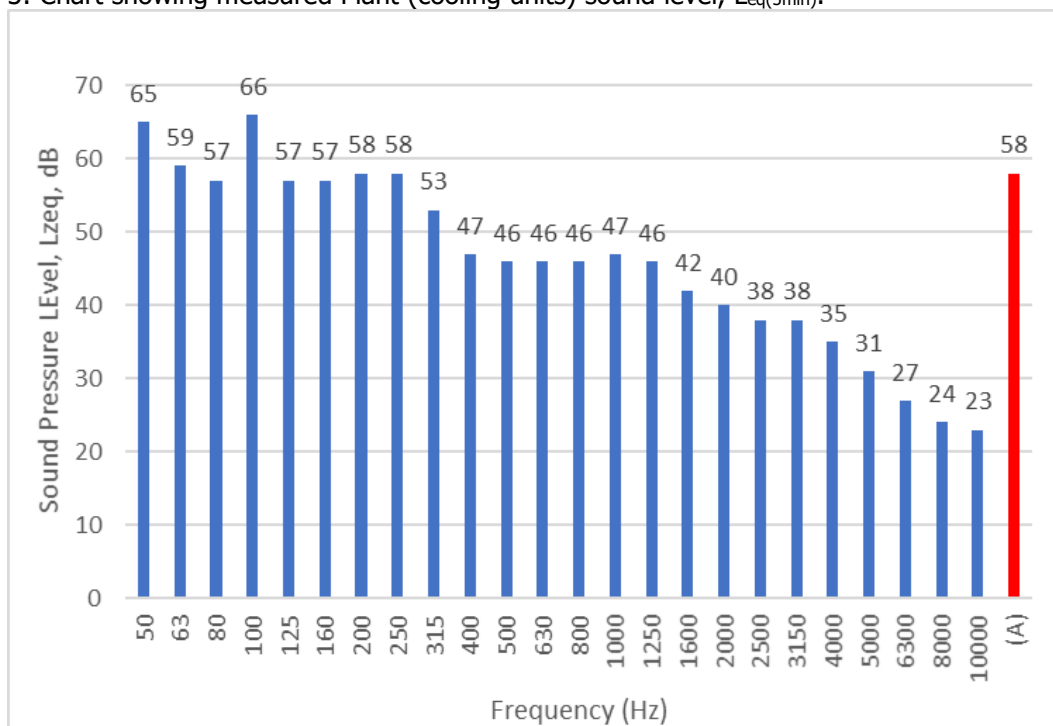
5.4.3. Short Term 'Monitoring Location C –Plant Noise (Cooling Units)

From the measured plant noise (cooling units) data during the measurement period of approximately 5:00 minutes, we have determined the following free-field octave equivalent noise levels at the monitoring location. The plant noise was considered stable and continuous with no significant fluctuation in noise and character.

Table 9: Measured Octave Band Design Plant Noise at monitoring location C (approx. 10 metres from nearest and noisiest unit)

Parameter	63	125	250	500	1000	2000	4000	8000	dB(A)
Day $L_{eq,(1hr)}$	66	67	62	51	51	45	40	30	58

Chart 3: Chart showing measured Plant (cooling units) sound level, $L_{eq}(5min)$.



5.4.4. Short Term 'Monitoring Location D –Substation Noise (via Louvred Door)

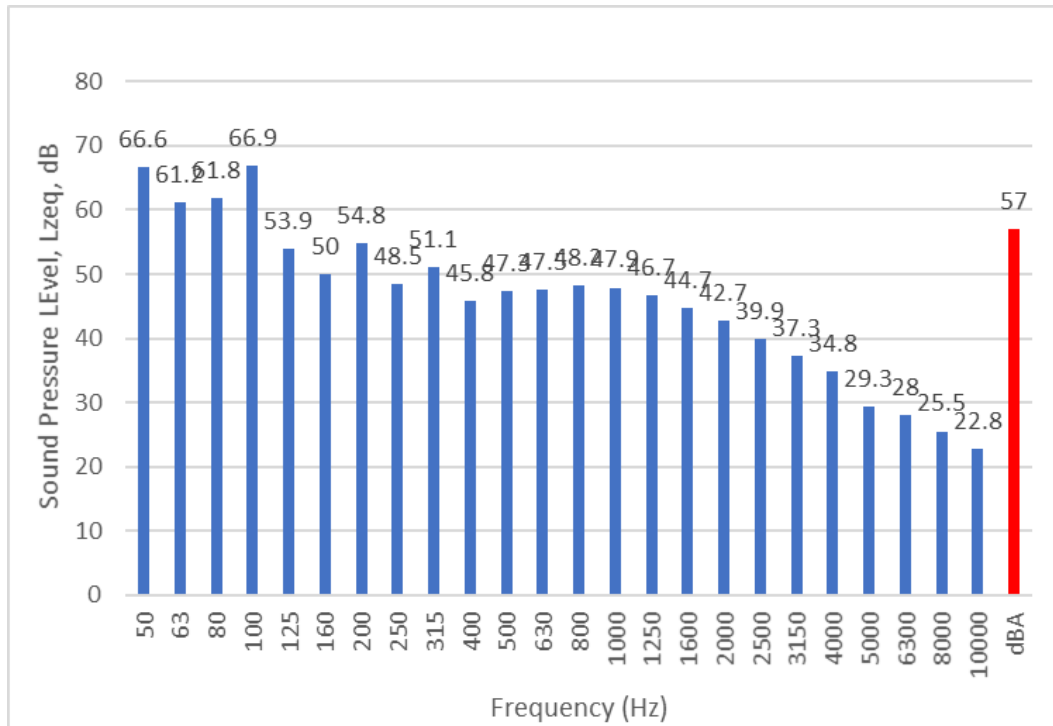
From the measured plant noise (substation's louvred door) data during the measurement period of approximately 5:00 minutes, we have determined the following free-field octave equivalent noise levels at the monitoring location. The plant noise was considered stable and continuous with no significant fluctuation in noise and character.

Table 10: Measured Octave Band Design Plant Noise at monitoring location D (approx. 5 metres from noisiest louvred door)

Parameter	63	125	250	500	1000	2000	4000	8000	dB(A)
Day $L_{eq,(1hr)}$	69	67	57	52	52	48	40	31	57



Chart 4: Chart showing measured Plant (Substation's Louvred Door) sound level, $L_{eq}(5min)$.





6. Transportation Noise Assessment

6.1. Noise Modelling

To determine noise levels across the site, noise modelling has been undertaken using computer modelling package Cadna:A by DataKustik and the measured data noted above.

Road traffic noise was considered to be the most onerous and predominant noise sources in the area and therefore this was the noise source used to build our noise model. The software predicts road and rail traffic noise propagation using the method of 'The Calculation of Road Traffic Noise 1988' (CRTN'88), and a verification model has been created to ensure the measured and predicted levels are comparable.

6.2. Noise Modelling Parameters

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

- The noise model has been completed using the data at 'Monitoring Location A' and 'Monitoring Location B' for road traffic noise.
- To determine the noise levels across the site and surrounding areas, this has been taken as a hard-reflective ground which is a worst-case scenario.
- Reflections from opposite façades have been determined via the correction method (+1.5 dB), as defined in CRTN.
- The proposed building heights are based on provided architectural drawings. Receivers for each storey are considered to be at the proposed window midpoint height

6.3. Noise Modelling Results

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



Figure 4: Predicted Daytime $L_{Aeq, 16\text{hours}}$ Noise Map due to Road Traffic Noise

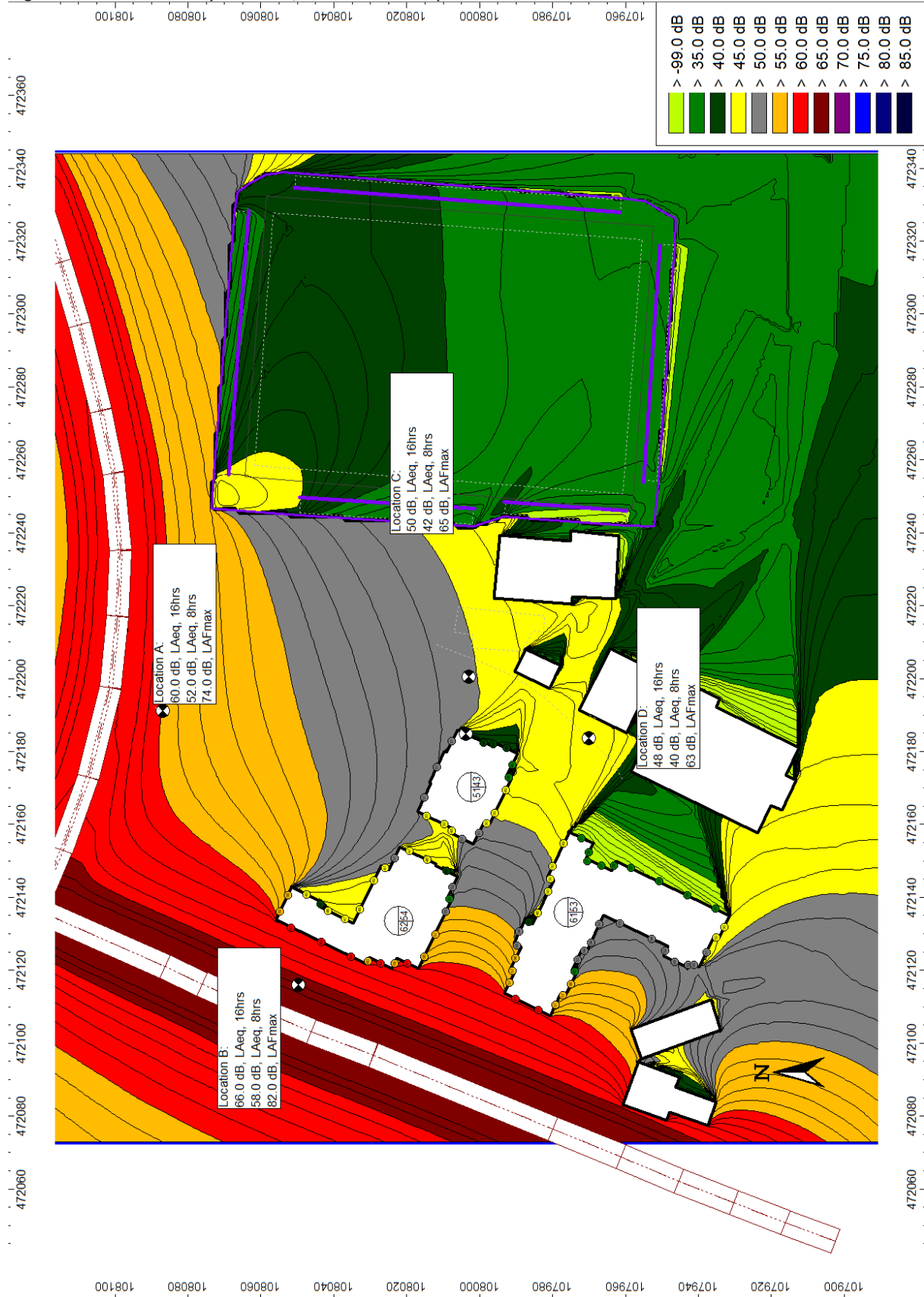


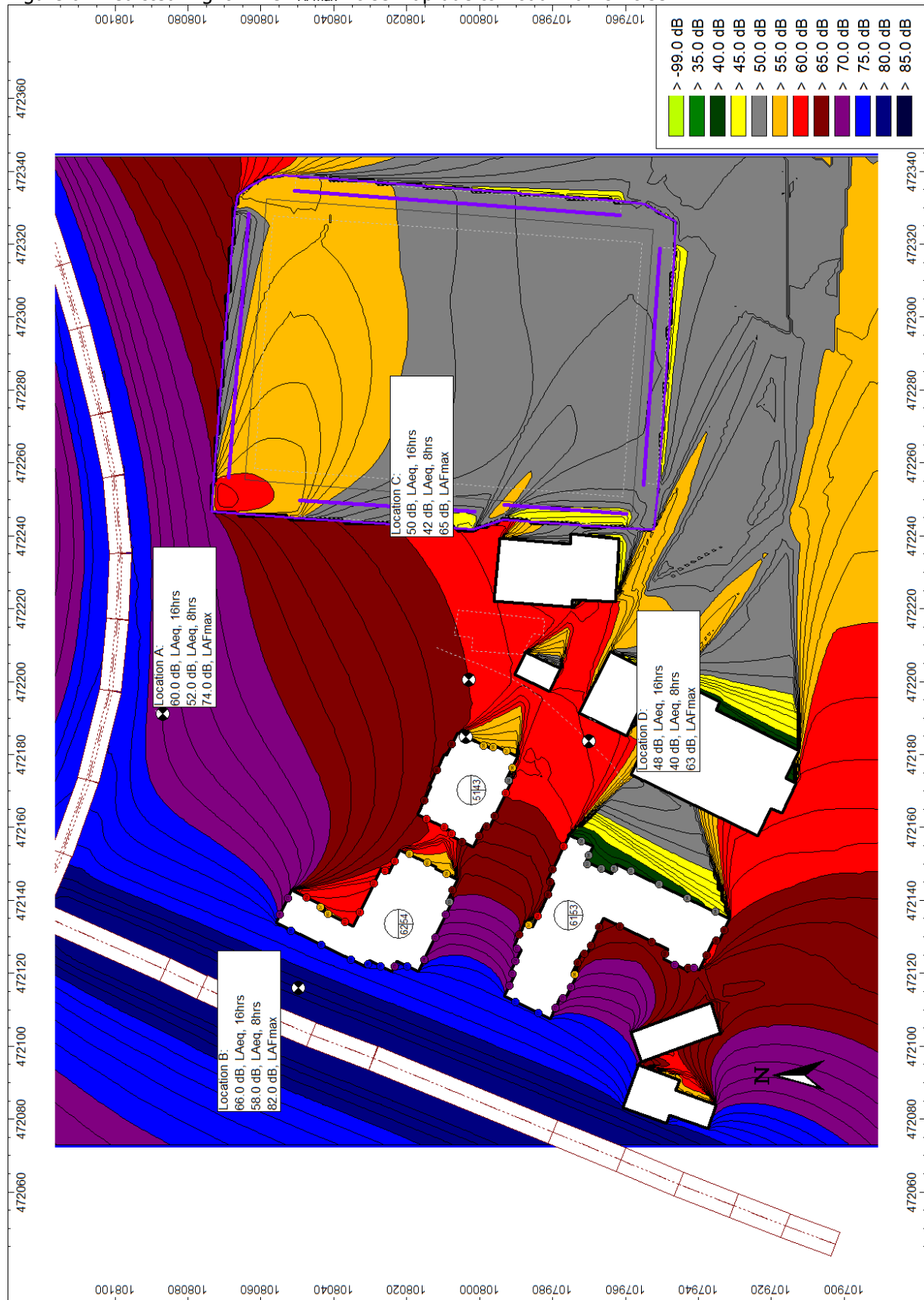


Figure 5: Predicted Night Time $L_{Aeq, 8hrs}$ Noise Map due to Road Traffic Noise





Figure 6: Predicted Night Time L_AF_{max} Noise Map due to Road Traffic Noise





6.4. Building Mitigation Measures

It will be necessary to design the building fabric of the residential properties to control road traffic noise levels internally.

6.4.1. Calculation Method

Calculations for the internal ambient noise levels due to road traffic noise have been undertaken using the calculation method provided in Annex G Section G.2 of British Standard 8233:2014, the building facade construction specified below and the octave band free-field design equivalent noise levels and maximum noise levels taken from the measured noise spectra noted above.

The calculations assume the following based on supplied architectural drawings (Worst Case rooms):

- Room size: 20m² to living rooms and 7m² to bedrooms
- Windows: 11m² to living rooms and 10m² to bedrooms
- Façade: mostly glazing
- Ventilation: 2 open per living room and 1 open per bedroom

We advise that building elements, having the sound insulation performances noted below, be incorporated into the design of the façades including the windows, doors, floor, and the building roof.

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 and Local Authority recommended internal ambient noise level criteria.

A colour code mitigation maps was created to outline the different noise mitigation measures required for daytime and night time bedrooms and living rooms on each façade of the proposed residential buildings; see Appendix 2 below. This map also outlines mitigation measures required to control other sources of noise such as external plant noise and football crowds' noise; see section 7 and 8 below.

6.4.2. External Wall Construction

The proposed external walls to the development can be of a conventional construction comprising of either masonry or light weight metal/timber frame construction.

- The masonry construction could comprise of at least two skins of block (one of density 1850 Kg/m³, 100mm cavity, 100mm block (density of 400 Kg/m³). The inner skin of block would be plastered.

Or,

- The light weight construction could comprise of a twin frame (minimum construction with two layers of board each side of the stud (minimum density 20 Kg/m³) and 50mm of mineral wool insulation within the cavity.

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

Table 11: Required Minimum Sound Reduction Index of External Wall

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k	Rw
R (dB)	15	25	42	53	57	62	68	60	52

Any alternative constructions should achieve the above noted performance.

6.4.3. Roof Construction

The exact construction of the roof is unknown. The roof could be constructed using traditional techniques, such as a timber construction with concrete tiles (minimum density 30 Kg/m²) with a loft space and a plasterboard ceiling above the habitable rooms. Alternatively, the roof can be a flat 130mm concrete construction, of a density at least 230 kg/m². This construction is expected to achieve the following sound reduction index:

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

Table 12: Required Minimum Sound Reduction Index of Roof

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k	Rw
R (dB)	39	42	40	43	51	58	63	63	49

Any alternative constructions should achieve the above noted performance. Please note that any proposed plant located on the roof might affect noise levels within proposed rooms below.

6.4.4. Window Construction

The windows on all elevations could be openable. However, they need to be sealed airtight to control external noise within the areas noted above. The windows should be selected to achieve the following minimum sound reduction indices:

Table 13: Required sound reduction indices of windows

Colour Code Facade	Room	Sound Reduction Index / dB per Octave Band (Hz)								Rw (dB)	Typical Construction
		63	125	250	500	1k	2k	4k	8k		
Blue	Bedrooms	22	27	29	36	41	42	52	50	39	10/12/6.4
	Living Rooms	20	25	22	33	40	43	44	44	36	10/12/4
Orange	Bedrooms	20	25	22	33	40	43	44	44	36	10/12/4
	Living Rooms	20	24	20	25	35	38	35	36	31	4/12/4
Yellow	Bedrooms	20	24	20	25	35	38	35	36	31	4/12/4
	Living Rooms	20	24	20	25	35	38	35	36	31	4/12/4

Colour Code Facade	Room	Sound Reduction Index / dB per Octave Band (Hz)								R _w (dB)	Typical Construction
		63	125	250	500	1k	2k	4k	8k		
	Bedrooms	20	25	22	33	40	43	44	44	36	10/12/4
	Living Rooms	20	24	20	25	35	38	35	36	31	4/12/4
	Bedrooms	20	24	20	25	35	38	35	36	31	4/12/4
	Living Rooms	20	24	20	25	35	38	35	36	31	4/12/4
	Bedrooms	No glazing requirements are needed									
	Living Rooms										

6.4.5. Ventilation Provision

There should be no un-attenuated vents or openings in the building façades. There will need to be suitably attenuated ventilation provisions in the habitable rooms where specific noise mitigation measures are required. The ventilation provisions should include the necessary sound attenuation in order that the ingress of external noise is controlled to be compatible with the building fabric.

The supplier should provide test data confirming the ventilation system meets the below performance.

For the rooms we have assumed one vent open per space. The minimum performance for these vents is provided below. The supplier should provide test data confirming ventilation meets the below performance.

Table 14: Required Minimum Sound Insulation Performance of Vents

Table 1.7: Required Minimum Sound Insulation Performance of Vents											
Colour Code Facade	Room	Required Ventilator Sound Insulation Performance, $D_{n,e}$ per Octave Band (Hz)								$D_{n,e,w}$ (dB)	Typical Construction
		63	125	250	500	1k	2k	4k	8k		
Blue	Bedrooms	30	37	37	36	47	49	55	61	44	Titon - SF X V75 / SFSA C75 (open) (*)
	Living Rooms										
Orange	Bedrooms	32	32	37	37	36	36	35	40	37	Titon - Trimvent 4000 (*)
	Living Rooms	30	35	35	36	34	29	33	34	32	Titon - XS13 4400 EA+XC13 412 Canopy (Open) (*)
Yellow	Bedrooms										
	Living Rooms										
Green	Bedrooms	No ventilation requirement/ this rooms can be ventilated via partially open window									
	Living Rooms										
	Bedrooms	Rooms facing existing plant to the east are required to be mechanically ventilated in accordance with BS4142 assessment; see section 7 below									
	Living Rooms										

(*) Alternatively, a suitably attenuated mechanical system could be installed

6.4.6. 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.

Calculations for the worst-case rooms is provided below:

Bedrooms:

Building Facade Construction									
External Element		63	125	250	500	1000	2000	4000	8000
Acoustic Trickle Vent - SF X V75 / SFSA C75 (open) - 44 Dnew	$D_{n,w}$	30	37	37	36	47	49	55	61
	Number of	1							
		0.00100	0.00020	0.00020	0.00025	0.00002	0.00001	0.00000	0.00000
Wall: User Defined		15	25	42	53	57	62	68	60
	Area	0							
		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Double Glazed: 10/12/6.4 - 39 Rw		22	27	29	36	41	42	52	50
	Area	10.0							
		0.00631	0.00200	0.00126	0.00025	0.00008	0.00006	0.00001	0.00001

With suitably attenuated mechanical system

Calculations to BS EN 12354									
	63	125	250	500	1000	2000	4000	8000	
Sum	0.00630957	0.001995262	0.001258925	0.000251189	7.94328E-05	6.30957E-05	6.30957E-06	0.00001	
10log sum	-22	-27	-29	-36	-41	-52	-50		
10log S/A	-0.24485668	-0.244856677	0.963674839	2.034256668	2.684112348	0.520763802	-0.67070856	-0.67070856	
correction factor +3	3	3	3	3	3	3	3	3	
Octave Band	63	125	250	500	1000	2000	4000	8000	dBA
Day, $L_{eq(16\text{ hour})}$	43.8	34.8	35.0	26.0	23.7	15.5	-4.7	-9.7	30
Night $L_{eq(8\text{ hour})}$	35.8	24.8	24.0	17.0	15.7	7.5	-11.7	-14.7	21
Night-time $L_{night(10\text{ hour})}$	54.8	42.8	45.0	40.0	40.7	32.5	10.3	4.3	44

With Trickle/ Wall vents

Calculations to BS EN 12354									
	63	125	250	500	1000	2000	4000	8000	
Sum	0.00730957	0.002194789	0.001458452	0.00049666	9.98502E-05	7.51184E-05	9.32953E-06	1.07413E-05	
10log sum	-21.3610797	-26.58607315	-28.36107966	-33.03941223	-40.00651048	-41.24253794	-50.3014046	-49.6894274	
10log S/A	-0.24485668	-0.244856677	0.963674839	2.034256668	2.684112348	0.520763802	-0.67070856	-0.67070856	
correction factor +3	3	3	3	3	3	3	3	3	
Octave Band	63	125	250	500	1000	2000	4000	8000	dBA
Day, $L_{eq(16\text{ hour})}$	44	35	36	29	25	16	-3	-9	31
Night $L_{eq(8\text{ hour})}$	36	25	25	20	17	8	-10	-14	22
Night-time $L_{night(10\text{ hour})}$	55	43	46	43	42	33	12	5	45

Living Rooms:

Building Facade Construction									
External Element		63	125	250	500	1000	2000	4000	8000
Acoustic Trickle Vent - SF X V75 / SFSA C75 (open) - 44 Dnew	$D_{n,w}$	30	37	37	36	47	49	55	61
	Number of	2							
		0.00090	0.00018	0.00018	0.00022	0.00002	0.00001	0.00000	0.00000
Wall: User Defined		15	25	42	53	57	62	68	60
	Area	0							
		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Double Glazed: 10/12/4 - 36 Rw		20	25	22	33	40	43	44	44
	Area	10.5							
		0.00472	0.00149	0.00298	0.00024	0.00005	0.00002	0.00002	0.00002
A1: Corner Living Wall +4dB performance for lower traffic noise on site	R	35	42	50	49	59	70	81	74
	Area	2							
		3.19781E-05	6.38047E-06	1.01124E-06	1.27307E-06	1.27307E-07	1.01124E-08	8.03253E-10	4.0258E-09
A2: Corner Living Window +4dB (Rw39) performance for lower traffic noise on site	R	26	31	33	40	45	46	56	54
	Area	10							
		0.001072491	0.000339151	0.00021399	4.26966E-05	1.35019E-05	1.07249E-05	1.07249E-06	1.69978E-06

With suitably attenuated mechanical system

Calculations to BS EN 12354									
	63	125	250	500	1000	2000	4000	8000	
Sum	0.00582357	0.001837843	0.003192553	0.000280485	6.08202E-05	3.43866E-05	1.98604E-05	2.04909E-05	
10log sum	-22.348107	-27.35691673	-24.95861911	-35.52090323	-42.15952313	-44.63611356	-47.02012576	-46.88439195	
10log S/A	2.2956172	2.295617204	3.480689442	4.465260805	4.960716666	2.676062402	1.442155017	1.442155017	
correction factor +3	3	3	3	3	3	3	3	3	
Octave Band	63	125	250	500	1000	2000	4000	8000	dBA
Day, $L_{eq(16\text{ hour})}$	45.9	36.9	41.5	28.9	24.8	15.0	2.4	-4.4	34

With Trickle/ Wall vents

Calculations to BS EN 12354									
	63	125	250	500	1000	2000	4000	8000	
Sum	0.00672245	0.002017192	0.00371902	0.000501133	7.91729E-05	4.51934E-05	2.25749E-05	2.11572E-05	
10log sum	-21.7247265	-26.95252746	-24.72125027	-33.00046984	-41.01423565	-43.4492475	-46.46373445	-46.7454108	
10log S/A	2.2956172	2.295617204	3.480689442	4.465260805	4.960716666	2.676062402	1.442155017	1.442155017	
correction factor +3	3	3	3	3	3	3	3	3	
Octave Band	63	125	250	500	1000	2000	4000	8000	dBA
Day, $L_{eq(16\text{ hour})}$	47	37	42	31	26	16	3	-4	35



7. Industrial Noise Assessment

To the south east of the site is SSE Services PLC building and associated plant (cooling units) and substation (with louvred doors). These were considered to form the dominant plant noise levels in the south east area of the site. Noise Levels are considered loud enough and might affect rooms located at the rear of proposed blocks B and C.

7.1. Industrial Noise Modelling Parameters

To determine plant noise levels across the site, noise modelling has been undertaken using computer modelling package Cadna:A by DataKustik and the measured data noted above at Monitoring Locations 'C' and 'D'.

Cadna:A software uses the calculation method of ISO 9613 to predict noise levels. The model is based on noise levels measured at Monitoring Location 'C' and 'D' which were calibrated within the model by using two noise source areas representing the existing cooling units and substation louvred door noise emissions. Primarily plant noise propagation is determined by distance, reflections, and barriers.

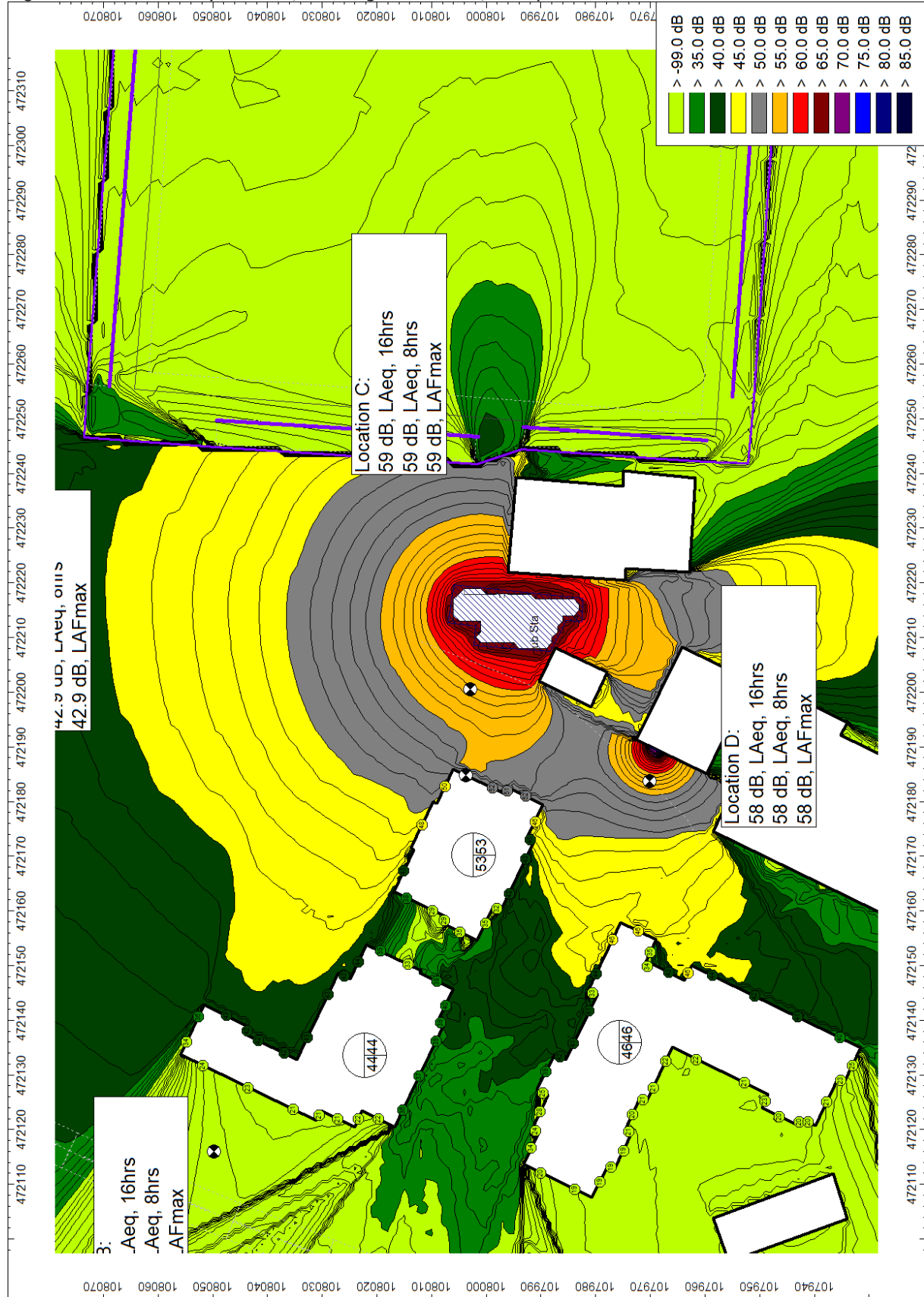
The noise predictions have been undertaken using the supplied architectural plans and the following general modelling parameters:

- The noise model has been completed using the data at 'Monitoring Location C' and 'Monitoring Location D' for plant noise.
- To determine the noise levels across the site and surrounding areas, this has been taken as a hard-reflective ground which is a worst-case scenario.
- The order of Reflections is 2, and all buildings are reflective. .
- The proposed building heights are based on provided architectural drawings. Receivers for each storey are considered to be at the proposed window midpoint height

7.2. Plant Modelling Results

Noise levels have been predicted based on the parameters set out above. The following noise model provides the daytime and night time predicted noise levels.

Figure 7: Predicted Daytime LAeq, 1 hr / Night Time LAeq, 1 5min plant noise levels





7.3. BS 4142:2014 Plant Noise Assessment

Noise from industrial activity (existing plant noise) as it affects the proposed noise sensitive residential properties is assessed in accordance with BS4142:2014.

7.3.1. Specific Sound Level

The specific sound level at the worst-case receiver which are dwellings located to the east within Block B and Block C is as follows:

Table 15: Plant noise predictions at worst case receivers

Receiver Location	Daytime L_{Aeq} , 1 hr	Night Time L_{Aeq} , 15 min
Block B		53dB
Block C		46dB

7.3.2. Background Noise Level

From the measured data obtained at the monitoring location above, we have determined a design background sound level to be 52 dB L_{A90} , 1 hr and 33 dB L_{A90} (15 min) during the daytime and night-time period (worst-case) respectively.

7.3.3. Character Correction

Character corrections should be added to the "specific sound level" if the "specific sound level" exhibits any *tonality*, *impulsivity*, *other specific characteristics* and/or *intermittency* at the assessment location. Based on our site visit the character corrections to be applied are as follows:

- **Tonality** – The plant noise was not considered to be tonal
- **Impulsivity** – The plant was not considered to be impulsive
- **Intermittency** – The plant operation was not intermittent and was running continuously. It is assumed that all plants units (cooling units) were operating during our site visit.
- **Other Sound Characteristics** – A correction of +3dB for other Sounds Characteristics was applied.

7.3.4. Initial Estimate of Impact

On the basis of the above, the British Standard 4142:2014 initial estimate at the most sensitive location is as follows:

Table 16: British Standard 4142:2014 Initial Estimate at worst case receiver (Block B)

Parameter	Daytime	Night Time
Background Level, L_{A90} (T)	52dB	33dB
Specific Sound Level, L_{Aeq} (T)	53 dB	53 dB
Acoustic Character Correction	+3 dB	+3 dB
Rating Level	56 dB	56 dB
Excess of rating over background level	+4	+23 dB



This means that the rating noise level will result in a British Standard 4142:2014 assessment 'difference' of +4 dB during the daytime and +23dB during the night time assessment periods at the proposed rear noise-sensitive receivers.

As such, it is an indication that the existing industrial (plant noise) operations will be of an adverse impact on the proposed dwellings. However, the context on the site must also be considered.

7.3.5. Context

Section 11 of British Standard 4142:2014, entitled 'Assessment of the Impacts', states the following regarding context.

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

Good Acoustic Conditions

"The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:

- i) facade insulation treatment;*
- ii) ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and*
- iii) acoustic screening."*

It is therefore reasonable to state that, where the proposed dwellings are designed to minimise the ingress of industrial noise, acceptable acoustic conditions can be achieved.

The design target is to achieve a Rating Noise Level as determined in accordance with British Standard 4142:2014 which does not exceed the internal daytime noise criteria within a dwelling of 35dB $L_{Aeq}(16\text{hour})$ during the day and 30 dB $L_{Aeq}(8\text{hour})$ during night within the habitable rooms.

This can be achieved by applying the "Building Façade Mitigation Measures" as stated in Section 6.4 used to control Transportation Noise Levels to BS8233:2014 internal noise levels.

The windows should be selected to achieve the following minimum sound reduction indices; this is also shown in more detail in the mitigation noise map mark up in Appendix 2.



Table 17: Required sound reduction indices of windows to rooms affected mainly by Plant Noise

Colour Code Facade	Room	Sound Reduction Index / dB per Octave Band (Hz)								R _w (dB)	Typical Construction
		63	125	250	500	1k	2k	4k	8k		
	Bedrooms	20	25	22	33	40	43	44	44	36	10/12/4
	Living Rooms	20	24	20	25	35	38	35	36	31	4/12/4
	Bedrooms	20	24	20	25	35	38	35	36	31	4/12/4
	Living Rooms	20	24	20	25	35	38	35	36	31	4/12/4

In addition, the ventilation provisions to the rooms located at the rear facade of the proposed development should include the necessary sound attenuation in order that the ingress of external noise is controlled to be compatible with the building fabric. This rooms will require mechanical ventilation such as a domestic MVHR system that will reduce *"the need to have windows open so as to provide rapid or purge ventilation"*.

The required sound level difference of the ventilation system to 'habitable rooms' should be, at a minimum, 33 dB(A). This is the difference between the outside façade level and the level inside a furnished room at one-and-a-half metres from the vent.

It is the responsibility of the vent supplier to confirm that the chosen ventilation system will achieve the sound level differences stated above.

Plant Noise Ingress

Based on the predicted rating levels and mitigation measures outlined above, the predicted internal absolute levels are as follows:

Table 18: Comparison with British Standard 8233:2014 at Worst-Case Receiver (Block B)

Time Period	Predicted External Rating Level / dB L _{Ar}	Predicted Internal Rating Level / dB(A)	Within Internal BS8233 Criteria?
Daytime	56	28	YES
Night-time	56	28	YES

With the noted building fabric construction and ventilation provisions, the predicted internal noise levels are within British Standard 8233:2014 criteria. Therefore, we would consider plant noise can be suitably controlled to the proposed dwellings and the impact would be low internally.



8. Football Stadium Noise Assessment

The Havant & Waterlooville Football Club stadium includes a number of covered standing area, with the largest western stand located relatively close to the eastern boundary of the site.

The Havant & Waterlooville FC stadium is known to have a maximum capacity of 5,250 people, although typical attendances for games this 2019/ 2020 season is 1266 with a highest attendance of 1,749 people.

The methodology below assess the potential impact of crowd noise from the existing Stadium at the proposed development.

8.1. Prediction Methodology

Data for noise from football stands is not available. We have predicted noise emission based on the noise level of different types of speech (Stated in Figure 4.1 of the DfES Building Bulletin 93 2003) including normal speech, raised voice and shouting.

For the assessment it is considered that people will be present within the stadium for two hours; 15 minutes prior to kick off, the 90 minute match and 15 minutes of half time. The assessment considers that each person would be speaking for approximately half of this time as follows:

- 48 minutes talking
- 10 minutes raised voice
- 2 minutes shouting

This equates to a noise emission per person of 64 dB L_{Aeq} (2 hours) at a distance of 1 metre, whilst within the stadium. For the purposes of the assessment it is assumed all people are within the identified stands as shown on the ground floor plan drawings. Noise from the pitch is considered negligible when compared to noise produced from the crowd during a football match.

8.2. Crowd Noise Modelling

The modelling has been undertaken using noise mapping software Cadna:A by Datakustik. This uses the calculation method of ISO 9613 to predict noise levels.

Each identified covered stand area has been populated with an area source. The sound power level of this area source is based on the proposed capacity of each area and the noise emission of each person derived above. The area source is at a height of 1.5 metres representative of head height.

One noise models has been created and represents the highest attendance of 1,749 people this season of 2019/2020. The main stadium stand located on the west side of the football grounds and also the closer in relation to the proposed development has



a maximum capacity of 560 people. Our model assumed that from the total 1,749 people, 560 will be located within this stand. Therefore, the model considers the closest stand in relation to the proposed residential dwellings to be always at full capacity. This is again considered a worst case scenario and not realistic based on recent average attendance figures.

The scenario for the maximum capacity of 5,250 people is in reality unlikely to occur except in very exceptional circumstances and would not be considered representative of a typical use. The record attendance was against Swansea City on the 16th January 2008, which again is very untypical and unlikely to occur in the near future.

8.3. **Crowd Noise Modelling Results**

The noise model results for the maximum crowd attendance during 2019/2020 is as follows:

Figure 8: Noise emission of maximum crowd during 2019/2020





8.4. Crowd Noise Assessment

The predicted noise level at the nearest noise sensitive residential properties from the stadium at full capacity is 51 dB $L_{Aeq}(2 \text{ hours})$.

According to the WHO guidance, moderate annoyance is caused by noise levels exceeding 35 $L_{Aeq(T)}$ dB internally. With relation to the adverse effect level we would consider this the threshold of the Lowest Observed Adverse Effect Level. The noise level of the crowd may be noticeable but not intrusive and is considered acceptable in planning terms.

Rooms facing the football stadium will require building mitigation measures to control the levels of plant noise (from SSE Services PLC building). This includes closed windows and mechanical ventilation; see section 7 above.

These measures are also considered sufficient to control an external crowd noise level of 51dB $L_{Aeq}(2 \text{ hours})$, and with these measures in place the internal level will be well below the criteria of 35 $L_{Aeq(T)}$ dB.

Therefore, with the noted building fabric construction and ventilation provisions, the predicted internal noise levels are within WHO/ British Standard 8233:2014 criteria.

We would consider crowd noise can be suitably controlled to the proposed dwellings and the impact would be low internally.



9. Plant Noise Control

Plant units associated with the proposed accommodation and commercial use have the potential to operate 24 hours a day. As such we have provided plant noise limits over the 24-hour period based on the monitoring data obtained above and British Standards 4142:2014+A1:2019.

We have provided noise limits for plant noise at the existing and proposed sensitive receivers on and around the site.

The limits at the existing receivers are based on the baseline noise levels and BS 4142:2014+A1:2019. The limits at the proposed development are based on good practice guidelines for a development of this type and the planning consent.

Based on the above criteria and the assessment time periods stated, the maximum Rating Noise limits of noise from plant associated with the development are as follows.

These limits should be determined at the façade of the nearest existing sensitive receivers:

Table 19: Plant Noise Rating Level Limits

Time Period	Limits at Existing and Proposed Receivers $L_{Ar(T)}$
Daytime (07:00 to 19:00 hrs)	52 dB $L_{Ar(1 \text{ hour})}$
Evening (19:00 to 23:00 hrs)	45 dB $L_{Ar(1 \text{ hour})}$
Night Time (23:00 to 07:00 hrs)	33 dB $L_{Ar(15 \text{ min})}$

With plant meeting the above limits, the impact will be low in terms of BS4142 and the NPPG, at the sensitive receivers on and around the site.

Please note the limits at the proposed sensitive receivers could be increased if a suitably form of attenuated ventilation is provided based on the final operating noise level of the plant. This could be addressed by condition if required.

It is considered that with suitable engineering noise control measures, the above noise limits should be achieved.



10. Summary & Conclusions

Fortitudo Ltd appointed Acoustic Consultants Limited to carry out an environmental noise assessment and provide noise assessment and advice for the proposed mixed use development on land at Bartons Road, Havant.

The assessment takes into consideration the local authority requirements and considers the impact of road traffic noise from Bartons road to the north and Petersfield road to the west, existing plant noise to the south east and Havant & Waterlooville FC crowd noise to the east during a football match on the proposed development.

In addition, this report also sets plant noise limits for any plant use within the application site for the premises based on the measured background noise levels and British Standard 4142:2014+A1:2019.

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 4142:2014+A1:2019 (BS4142), British Standard 8233:2104 (BS8233) and World Health Organisation (WHO) 1999.

With the noted building fabric construction, and suitable ventilation provisions as stated above in this report, the predicted internal noise levels within the proposed dwellings from road traffic noise, plant noise and crowd noise are within the criteria of WHO / British Standard 4142+A1:2019 and 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.

As such, we would consider external noise to be suitably controlled within the habitable rooms of the proposed residential development and good internal conditions can be achieved.

We have provided noise limits for plant noise at the existing and proposed sensitive receivers on and around the site. With plant meeting the above limits, the impact will be low in terms of BS4142 and the NPPG, at the sensitive receivers on and around the site.

We would consider that the development, subject to noise control measures, will achieve the aims of the NPPF at the existing and proposed receivers around the site.



11. Appendix 1 – Glossary of Acoustic Terminology

A-weighted sound pressure p_A – 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 μ Pa)

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:

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

where:

p_0 is the reference sound pressure (20 μ Pa); 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).

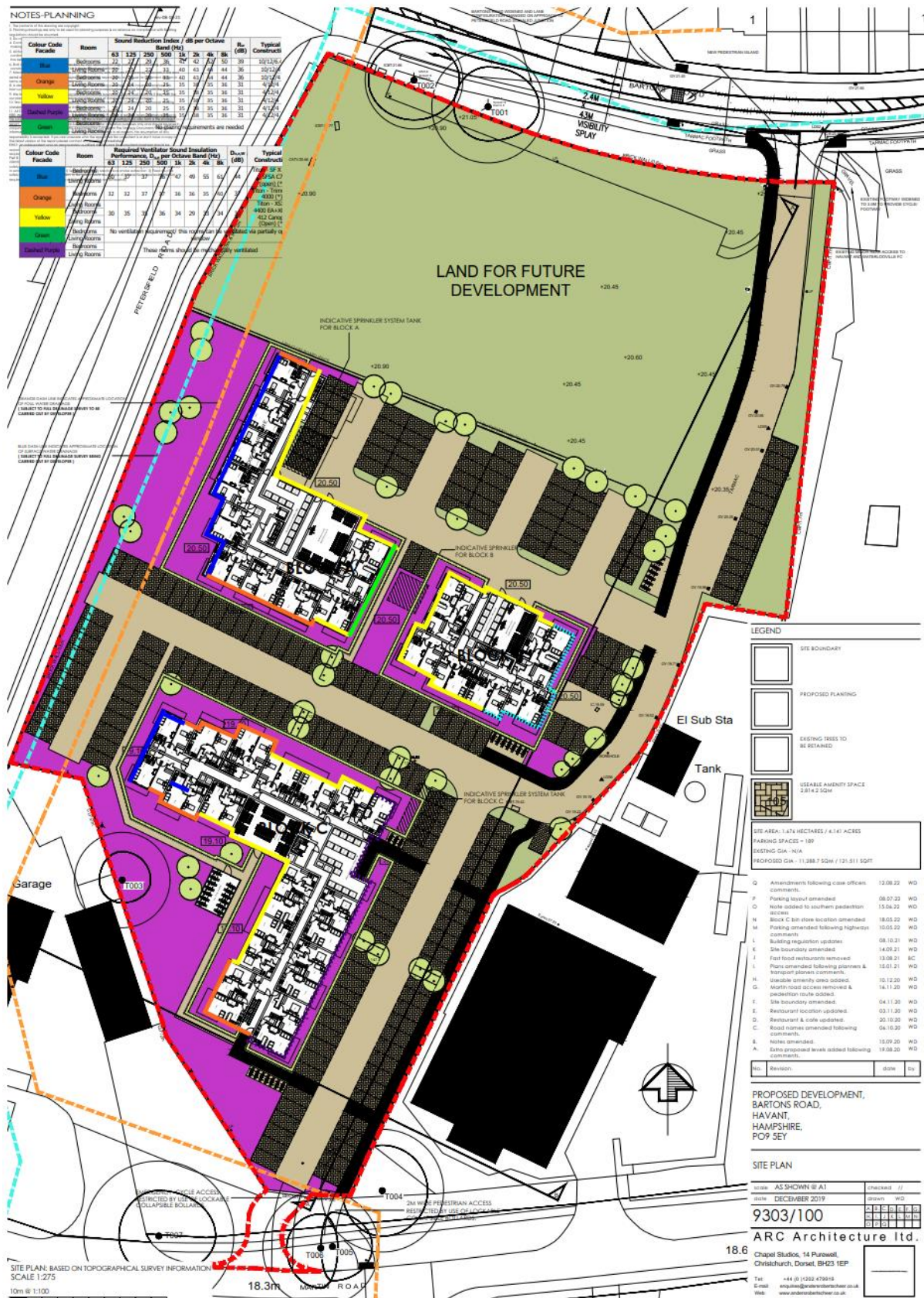
Vibration Dose Value, VDV – measure of the total vibration experienced over a specified period of time.



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).

12. Appendix 2 – Mitigation Map Mark up





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