



Report Reference: SA –7440-2

ENVIRONMENTAL NOISE IMPACT ASSESSMENT

PLANNING CONDITION 8

In Conjunction with the
Construction Management Plan
British Standard 5228 – Part 1: 2009

CLIENT:

Baytree Securities Ltd

SITE:

78 Havant Road
Emsworth
Hampshire
PO10 7LH

ORIGINAL BACKGROUND SURVEY DATES:

12th – 16th May 2023

Report By	
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1 EXECUTIVE SUMMARY

1.1 Instruction

Sound Advice Acoustics Ltd have been instructed by Baytree Securities Ltd to provide a noise and vibration impact assessment in accordance with British Standard 5228 – Part 1 and 2: 2009 to determine the impact of noise and vibration from the proposed accommodation scheme at 78 Havant Road, Emsworth, Hampshire, PO10 7LH.

1.2 Scope of Report

British Standard 5228 Part 1 and Part 2: 2009 details the method for calculating and assessing the resultant noise and vibration levels from specific construction activities. The report will rely on the original noise and vibration survey undertaken in support of the original application and determine the following:

- The existing background noise climate in and around the immediate area.
- The resultant noise and vibration levels from the proposed construction works.
- Any proposed mitigation measures to minimise the impact.

1.3 Construction Phases

As this is a new building, the noisy works and potentially vibration impact works are limited to this site and project. The following have been proposed: -

Trenching - approximately 4 weeks

Deliveries and Collections – approximately 52 weeks

General Construction – approximately 52 weeks

1.4 Summary of Report

1.4.1 Construction Hours

The construction of the residential property will only take place between 08:00 to 18:00 Monday to Friday and 08:00 to 13:00 on Saturdays and at no other times.

1.4.2 Background Noise Levels (Measurement Period – Construction Times)

Measurement	Period	L _{Aeq} , 1 hour	L _{Amax} 1 hour	L _{A90} , 1 hour
Position 1	08:00 - 18:00 Monday to Friday	63.9	82.4	59.4
Position 1	08:00 – 13:00 Saturday	66.3	74.6	61.4
Sound Pressure Level – Reference Level $2 \times 10^{-5} \text{ Nm}^{-2}$ - dB				

1.4.3 Airborne Noise Criterion (Residential Properties – Construction Times)

Impact of Residential Amenity Condition 8 – APP/22/00487	Description	Absolute Criterion Level	
		Maximum Level	Average Level
Significant Adverse Impacts	Avoid	L _{Max} , 1 hour 92 dB	L _{Aeq} , 1 hour 74 dB
Adverse Impact	Mitigation measures will be required	L _{Max} , 1 hour 87 dB	L _{Aeq} , 1 hour 69 dB
Acceptable	Compliance	L _{Max} , 1 hour 82 dB	L _{Aeq} , 1 hour 64 dB

1.4.4 Vibration Criterion (Residential Properties – Construction Times)

Impact of Residential Amenity Condition 8 – APP/22/00487	Description	Absolute Criterion Level (VDV – BS 6472 – Part 1: 2008)
Significant Adverse Impacts	Avoid	0.8 ms ^{-1.75}
Adverse Impact	Mitigation measures will be required	0.4 ms ^{-1.75}
Acceptable	Compliance	0.2 ms ^{-1.75}

1.4.5 Resultant Noise and Vibration Levels from Construction Phase

Construction Phase	Duration	Airborne Noise Levels		Vibration Levels
		Maximum	Average	VDV – BS6472-1:2008
Foundations - Trenching	4 Weeks	L _{Max} , 1 hour 70 dB	L _{Aeq} , 1 hour 63 dB	0.1 ms ^{-1.75}
Deliveries / Collections	52 Weeks	L _{Max} , 1 hour 75 dB	L _{Aeq} , 1 hour 67 dB	0.1 ms ^{-1.75}
General Construction of Apartments	52 weeks	L _{Max} , 1 hour 69 dB	L _{Aeq} , 1 hour 61 dB	0.1 ms ^{-1.75}

1.4.6 Specific Mitigations Measures

Construction Phase	Description of Mitigations Measures
Foundations - Trenching	Moveable Acoustic Screens
Deliveries / Collections	Deliveries undertaken 08:00 to 18:00 Monday to Friday only
General Construction of Houses	No specific mitigation measures
Whole Programme	Overall monthly leaflet drop. Toolbox talks onsite. Site Notices.

1.5 Conclusions

The construction of the residential property at 78 Havant Road, Emsworth, Hampshire, PO10 7LH will be undertaken over an approximate 52 week period.

The assessment has indicated that the trenching stage, should have a moveable acoustic screen at a height of 2m and a length of 4m in order to not have an adverse effect on the local residents in terms of noise and vibration. The general building, deliveries and collections from site are unlikely to have an adverse effect on the local residents in terms of noise and vibration. Consideration should be given to implementing a monthly leaflet drop to the nearby residential properties, Toolbox talks for all staff working on site. Deliveries and collections from the site should be undertaken between 08:00 and 18:00 hours only.

2 PLANNING CONDITION

2.1 Planning Condition 8

Prior to commencement of demolition, groundworks and construction at this development site, an assessment of potential noise and vibration arising during construction shall be prepared in accordance with BS 5528: Parts 1 and Part 2, 2009 and A1:2014 - Noise and Vibration Control on Construction and Open Sites. The assessment shall be submitted to and approved in writing by the Local Planning Authority, and all the above works carried out in accordance with the agreed recommendations.

Reason: To minimise disturbance to all nearby sensitive receptors, and to ensure the amenities of nearby residential properties are not impacted upon by any external noise levels and having due regard to policies CS16 and DM10 of the Havant Borough Local Plan (Core Strategy) 2011 and the National Planning Policy Framework.

Therefore, this assessment and report has been undertaken to mitigate and discharge the above Planning Condition 8 accordingly.

3 SITE LAYOUT / PHOTOGRAPHS

3.1 Site Location



4 BACKGROUND NOISE LEVELS

4.1 Original Background Noise Levels

The background noise levels were recorded between 12th – 17th May 2023.

4.2 Recorded Environmental Noise Levels

4.2.1 08:00 – 18:00 Friday 12th May 2023 Position 1

NOISE LEVEL SUMMARY ASSESSMENT				Octave Band Centre Frequency (Hz)								
Date / Time	LAeq	LAmaz	LA90	63	125	250	500	1.0k	2.0k	4.0k	8.0k	16.0k
DAYTIME 07:00 - 23:00 LA90 1 HOUR & Corresponding LAeq 1 HOUR	69.4	96.5	62.1	68.2	63.4	59.1	59.7	67.1	63.1	52.6	43.3	28.1

4.2.2 08:00 – 13:00 Saturday 13th May 2023 Position 1

NOISE LEVEL SUMMARY ASSESSMENT				Octave Band Centre Frequency (Hz)								
Date / Time	LAeq	LAmaz	LA90	63	125	250	500	1.0k	2.0k	4.0k	8.0k	16.0k
DAYTIME 07:00 - 23:00 LA90 1 HOUR & Corresponding LAeq 1 HOUR	66.7	88.0	61.5	67.6	64.8	59.8	59.1	64.9	58.5	46.7	36.6	24.8

4.2.3 07:00 – 07:00 Monday 14th May 2023 Position 1

NOISE LEVEL SUMMARY ASSESSMENT				Octave Band Centre Frequency (Hz)								
Date / Time	LAeq	LAmaz	LA90	63	125	250	500	1.0k	2.0k	4.0k	8.0k	16.0k
DAYTIME 07:00 - 23:00 LA90 1 HOUR & Corresponding LAeq 1 HOUR	66.9	79.9	62.4	68.4	64.4	58.8	59.2	65.3	58.5	47.2	40.6	27.8

4.2.4 07:00 – 07:00 Tuesday 15th May 2023 Position 1

NOISE LEVEL SUMMARY ASSESSMENT				Octave Band Centre Frequency (Hz)								
Date / Time	LAeq	LAmaz	LA90	63	125	250	500	1.0k	2.0k	4.0k	8.0k	16.0k
DAYTIME 07:00 - 23:00 LA90 1 HOUR & Corresponding LAeq 1 HOUR	69.6	102.0	60.4	68.2	63.8	60.9	60.2	66.1	65.2	49.8	46.3	29.5

Sunday's data has not been included as the conditions state that no working is allowed on this day.

4.3 Reference Background Noise Levels – Construction Times

From the original background noise data the following are the minimum 1 hour background noise levels that are likely to occur between 08:00 to 18:00 Monday to Friday and 08:00 to 13:00 on Saturday.

Measurement	Period	L _{Aeq} 1 hour	L _{Amax} 1 hour	L _{A90} 1 hour
Position 1	08:00 - 18:00 Monday to Friday	63.9	82.4	59.4
Position 1	08:00 – 13:00 Saturday	66.3	74.6	61.4

Sound Pressure Level – Reference Level $2 \times 10^{-5} \text{ Nm}^{-2}$ - dB

The above background noise levels are considered representative and have been used to construct the following background noise map of the existing noise climate. The above results indicate the noise level is dominated by the noise from the local roads.

4.4 Background Noise Map

4.4.1 Average Noise Levels



4.4.2 Maximum Noise Levels



5 AIRBORNE NOISE CRITERION

5.1 National Planning Policy Framework (“NPPF”)

5.1.1 Scope of Document

The National Planning Policy Framework (“NPPF”) published in March 2021 sets out the Government’s National Planning Policies for England and how these can be applied by local communities when developing their local plans or deciding planning application to best reflect the needs and priorities of the local communities. Current planning law requires Local Authorities to determine planning applications in accordance with the local development plan unless there are material considerations which require them to reach a different decision.

5.1.2 Specific Reference to Noise

Section 123 of the NPPF which falls under the title “Conserving and enhancing the natural environment” provides the following aims:

“Planning Policies and decisions should aim to:

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

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

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

5.2 Noise Policy Statement for England (“NPSE”)

5.2.1 Scope of Document

The National Policy Statement for England (“NPSE”) published in March 2021 provides guidance on the management of noise from sustainable development without placing unreasonable cost or time restraints on sustainable developments. The document has the following noise policy vision:

“Noise Policy Vision

Promote good health and quality of life through the effective management of noise within context of Government policy on sustainable development”

NPSE defines that the long term vision is supported by the following three Noise Policy Aims:

“Avoid significant adverse impact 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.”

5.2.2 Lowest Observed Adverse Effect Level (“LOAEL”)

The NPSE defines a concept, often used in toxicology, in section 2.20:

“LOAEL – Lowest Observed Adverse Effect Level: This is the level above which adverse effects on health and quality of life can be detected.”

5.2.3 Significant Observed Adverse Effect Level

The NPSE provides a definition of another level and defines it in section 2.21:

“SOAEL – Significant Observed Adverse Effect Level:

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

The NPSE states makes reference to the SOAEL in paragraph 2.22:

“It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different time.”

5.2.4 First Aim of the NPSE

The first aim of the NPSE is:

“Avoid significant adverse impact on health and quality of life”

It is considered that to meet the first aim of the NPSE the resultant noise levels as a result of the proposed development should be below the Significant Observed Adverse Effect Level – SOAEL at the noise sensitive properties.

5.2.5 Second Aim of the NPSE

The second aim of the NPSE is:

“Mitigate and minimise adverse impacts on health and quality of life”

It is considered that to meet the second aim of the NPSE the resultant noise levels as a result of the proposed development should be below the Significant Observed Adverse Effect Level – SOAEL but above the Lowest Observed Adverse Effect Level – LOAEL at the nearest noise sensitive properties.

5.2.6 Third Aim of the NPSE.

Where possible, the noise levels as a result of the proposed development at the nearest residential property should be lower than the existing noise levels improving the noise climate for the local community.

5.2.7 Night Noise Guidelines (“NNGL”)

The European Union and the World Health Organisation jointly published a document entitled “Night Noise Guidelines” in 2009 (“NNGL”). The overall goal of the document was detailed within the summary pages:

“The goal of the NNGL project was to provide and expand scientific advice to the European Commission and its Member States in developing future legislation in the area of night noise exposure, control and surveillance. The key objective of the project was to reach a consensus of experts and key stakeholders on the following subjects:

- a) Guideline values for night noise to protect the public from adverse health effects.....”

5.2.8 No Observed Adverse Effect Level (NOAEL)

The section entitled “Threshold for Observed Effects” within the executive summary of the NNGL a list of the absolute level at which there is sufficient evidence available for the no observed adverse effect level (NOAEL):

Effect of Noise	Description	Indicator	Threshold , dB (NOAEL)
Biological Effects	EEG awakening	L _{Amax,inside}	35
	Motility, onset of motility	L _{Amax,inside}	32
	Changes in duration of various stages of sleep, in sleep structure and fragmentation of sleep	L _{Amax,inside}	35
Sleep Quality	Waking up in the night and / or too early in the morning	L _{Amax,inside}	42

5.2.9 Assumption of NOAEL and LOAEL

It is assumed for the purposes of the assessment of noise in this case that the No Observed Adverse Effect Levels (“NOAEL”) defined in the Night Noise Guidelines are numerically the same as the Lowest Observed Adverse Effect Levels (“LOAEL”) defined within the Noise Policy Statement for England.

5.2.10 Vulnerable Groups

In setting the LOAEL and the SOAEL within the scope of the NPSE, consideration should be given to the statement within under the title “Vulnerable Groups” which indicates that young children, elderly adults and shift workers should be considered vulnerable groups and more likely to be effected by unwanted noise.

5.2.11 No Observed Adverse Effect Level (NOAEL)

I would consider it appropriate to base the NOAEL on the NNGL threshold for observed adverse biological effects in respect of motility or the onset of motility i.e. the person asleep becomes capable of movement.

Noise Policy Statement for England	External Noise Criteria	Time Period
Lowest Observed Adverse Effect Level (LOAEL)	$L_{A_{Max}}$ 52 dB	24 hours per day
Sound Pressure Levels (dB) Reference level $2 \times 10^{-5} \text{ Nm}^{-2}$ – 1m from any Noise Sensitive Facade		

5.2.12 Significant Observed Adverse Effect Level (SOAEL)

I would consider it appropriate to base the SOAEL on the NNGL threshold for the no observed adverse effects in respect of sleep quality and waking up in the night or too early in the morning between 07:00 and 23:00 hours and the no observed adverse biological effects in respect of EEG awakening:

Noise Policy Statement for England	External Noise Criteria	Time Period
Significant Observed Adverse Effect Level (SOAEL)	$L_{A_{Max}}$ 72 dB	08:00 to 18:00 Monday to Friday
	$L_{A_{Max}}$ 62 dB	All other times
Sound Pressure Levels (dB) Reference level $2 \times 10^{-5} \text{ Nm}^{-2}$ – 1m from any Noise Sensitive Facade		

5.3 National Planning Practice Guidance (“NPPG”)

On 6th March 2014 the Department for Communities and Local Government (“DCLG”) launched an online resource providing a National Planning Practice Guidance. The section entitled “Noise” provides the following general advice and relates to paragraph 123 of the NPPF.

5.3.1 Observed Effect Levels

The NPPG references the 2 absolute levels detailed in the NPSE and the single absolute level detailed in the NNG.

Observed Effect Level	Description
Significant Observed Adverse Effect Level SOAEL	The level of noise exposure above which significant adverse effects on health and quality of life occurs.
Lowest Observed Adverse Effect Level LOAEL	The level of noise exposure above which adverse effects on health and quality of life can be detected.
No Observed Adverse Effect Level NOAEL	The level of noise exposure below which no effect at all on the health and quality of life can be detected.

5.3.2 Noise Exposure Hierarchy

The NPPG provides useful guidance on decisions involving noise ensuring they take into account the social and economic benefits but without causing undesirable exposure from unwanted noise:

Perception	Example of Outcome				Increasing Effect Level	Action
	Can Noise be Heard	Change in Behaviour	Change in Character of Area	Change in Quality of Life		
Not Noticeable	No	No	No	No	No Observed Effect	No Specific Measures
Noticeable and not Intrusive	Yes	No	Slight	No	No Observed Adverse Effect	No Specific Measures
Noticeable and Intrusive	Yes	Small	Yes	Perceived	Lowest Observed Adverse Effect	Mitigate and Reduce to a Minimum
Noticeable and Disruptive	Yes	Material	Yes	Diminished	Significant Observed Adverse Effect	Avoid
Noticeable and very Disruptive	Yes	Extensive and Regular	Yes	Significant Harm	Unacceptable Adverse Effect	Prevent

5.3.3 How can adverse effects of Noise be Mitigated.

The NPPG details four broad types of mitigation to reduce noise which include: Engineering, layout, using planning conditions or obligations and mitigation.

5.4 British Standard 5228 Part 1:2009

5.4.1 Scope of Standard

The scope of British Standard 5228: 2009 is defined at the beginning of the document:

“This code of practice gives recommendations for the basic methods of noise control relating to construction and open sites where work activities / operations are likely to generate significant noise levels. The standard gives some basic recommendations concerning methods of predicting, measuring and assessing the impact of noise.”

The document goes on to details an important point in section 6 which relates to the attitude of the operator and its direct impact on the nearby residential properties.

“Attitude of Site Operator- It is well established that people’s attitudes to noise can be influenced by their attitudes to the source or activity itself. Noise from a site will tend to be accepted more readily by local residents, if they consider the contractor is taking all possible measures to avoid unnecessary noise.”

5.4.2 Section 8 – Control of Noise

Where possible the quietest method of working or machinery should be selected and consideration given to temporary enclosing to minimise the noise emissions of specific noise sources on a construction site. (Control of noise at source).

Noise levels can also be reduced by locating noisy works as far away from noise sensitive properties or introducing localised screening or earth bungs (Controlling the spread of noise)

All reasonably practicable means should be employed to ensure the protection of local communities and of people on constructions sites from the detrimental effects of noise.

Appendix E offers example criteria for the assessment of the significance of noise effects. There are two basic methods of Assessment:

- Significance based on fixed noise limits
- Significance based on noise change

5.5 British Standard 4142: 2014+A1: 2019

5.5.1 Scope of Standard

British Standard 4142: 2014+A1: 2019 describes the method for rating and assessing noise of an industrial or commercial outdoors comparing it against the underlying background noise climate and determining the effect of people inside or outside of the building. The standard defines the scope within section 1.1 and 1.2

“1.1. This British Standard describes the method for rating and assessing sound of an industrial and/or commercial nature which includes:

- a) Sound from industrial and manufacturing processes.
- b) Sound from fixed installations which comprise mechanical or electrical plant and equipment.
- c) Sound from the loading and unloading of goods and materials at industrial and/or commercial premises.
- d) Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes”

1.2 This standard is applicable to the determination of the following levels at outdoor locations:

- a) Rating levels for sources of an industrial and/or commercial nature
- b) ambient, background and residual sound levels.”

5.5.2 Terms and Definitions

Symbol	Term	Definition
AP	Assessment Position	Position externally at the façade property under investigation at which the assessment is undertaken which is usually 1m from the 1 st floor bedroom window.
EP	Equivalent Position	Position at which the background noise levels are measured if there is no access to the assessment position or if source under investigation is audible.
$L_s = L_{Aeq, T}$	Specific Level	The average continuous equivalent sound pressure level of the source at the assessment position.
$L_{Ar, Tr}$	Rating Level	The average continuous equivalent sound pressure level of the source at the assessment position with a correction to account for the characteristic features.
$L_r = L_{Aeq, T}$	Residual Level	The average continuous equivalent sound pressure level at the assessment position without the source operating.
$L_{A90, T}$	Background Level	The sound pressure level that is not exceeded 90% of the time at the assessment position.
$L_a = L_{Aeq, T}$	Ambient Level	The totally encompassing sound at the assessment position including the residual and specific noise.

5.5.3 Field Calibration Check

Prior to undertaking the measurements on site and after the measurements have been completed the field calibrator is applied to the microphone, pre-amplifier and integrating sound level meter to check its operation.

5.5.4 Feature Correction

Ref	Method	Type of Correction	Description	Correction
9.2	Subjective	Tonality	Tone is just perceivable at the assessment position	+2 dB
			Tone is clearly perceivable at the assessment position	+4 dB
			Tone is high perceptible at the assessment position	+6 dB
		Impulsivity	Impulsivity is just perceivable at the assessment position	+3 dB
			Impulsivity is clearly perceivable at the assessment position	+6 dB
			Impulsivity is highly perceivable at the assessment position	+9 dB
		Other Character	Neither Tonal nor Impulsive but distinctive	+3 dB
9.3	Objective	25 – 125 Hz	15 dB difference between adjoining 1/3 rd octaves	+6 dB
		160 – 400 Hz	8 dB difference between adjoining 1/3 rd octaves	+6 dB
		500 – 10,000 Hz	5 dB difference between adjoining 1/3 rd octaves	+6 dB
9.4	Reference	FFT Tone	Reference method using FFT analysis of specific source.	0 to +6 dB

5.5.5 Assessment

The significance of the resulting noise on the residential property depends on the margin by which it exceeds the background noise levels. British Standard 4142: 2014+A1: 2019 provides the following guidance within section 11.

Difference	Assessment of Impact
+10 dB	Indication of a significant adverse impact
+5 dB	Indication of an adverse impact
+0 dB	Indication of low impact

5.6 Proposed Criterion

The following is the maximum and average noise level criterion between 08:00 to 18:00 Monday to Friday and 08:00 to 13:00 on Saturdays to ensure compliance with BS 5228.

Impact of Residential Amenity	Description	Absolute Criterion Level	
		Maximum Level	Average Level
Significant Adverse Impacts	Avoid	L _{Max} , 1 hour 92 dB	L _{Aeq} , 1 hour 74 dB
Adverse Impact	Mitigation measures will be required	L _{Max} , 1 hour 87 dB	L _{Aeq} , 1 hour 69 dB
Acceptable	Compliance	L _{Max} , 1 hour 82 dB	L _{Aeq} , 1 hour 64 dB

6 VIBRATION CRITERION

6.1 British Standard 7385 – Part 1: 1990 / ISO 4866: 1990 (“BS7385”)

Evaluation and measurement of vibration in buildings –

Part 1: Guide to the measurement of vibrations and evaluation of their effects on buildings.

6.1.1 Scope of Document

This standard establishes the basic principles for carrying out vibration measurements and processing data with regard to evaluating vibration effects on buildings. The standard relates only to measurements undertaken within buildings, once they have been constructed, but provide useful range of typical responses to various standard sources.

6.1.2 Typical Range of Structural Response to Various Sources

Table 1 within section 6 of the standard provides a useful table on the likely response of standard buildings to ground borne vibration.

Vibration forcing function	Frequency Range	Particle Displacement	Particle Velocity	Particle Acceleration
Traffic – Road, Rail	1 to 80 Hz	1 to 200 μm	0.2 to 50 mms^{-1}	0.02 to 1 ms^{-2}
Acoustic – Traffic Outside	10 to 250 Hz	1 to 1,100 μm	0.2 to 30 mms^{-1}	0.02 to 1 ms^{-2}

The above table provides a range of vibration responses within a building and towards the upper limits may give rise to concerns.

6.2 British Standard 7385-2:1993 (“BS7385”)

Evaluation and measurement for vibration in buildings –

Part 2: Guide to damage levels from ground borne vibration.

6.2.1 Scope of Document

This document provides guidance on the levels of ground borne vibration that could give rise to damage in buildings. It identifies the factors which influence the vibration response of buildings and describes the basic procedure for carrying out a vibration survey.

6.2.2 Transient Vibration Guide Values for Cosmetic Damage

Line	Type of Building	Peak Component Particle Velocity (PPV)	
		4 to 15 Hz	15 Hz and Above
1	Reinforced framed structures Industrial and heavy buildings	50 mms ⁻¹ at 4 Hz and above	
2	Light framed structures Residential type buildings	15 mms ⁻¹ at 4Hz to 20 mms ⁻¹ at 15 Hz	20 mms ⁻¹ at 15 Hz 50 mms ⁻¹ at 40 Hz

6.3 British Standard ISO 4866: 2010 (“BS4866”)

Mechanical vibration and shock –

Vibration of fixed structures –

Guidelines for the measurement of vibrations and evaluation of their effects on structures.

6.3.1 Scope of Document

This standard extends BS7385 but updates the original 1990 version of the standard. The document provides a similar table on the likely building response to standard vibration but also includes a useful classification in Appendix B.

6.3.2 Grouping of Buildings

Building Group	Building Type
1	Ancient or historical buildings built using traditional construction methods
2	Modern buildings and structures.

6.3.3 Structure Category

Category of Structure	Building Structure Type
1	Heavy industrial multi-storey buildings. Concrete or steel framed with concrete floors – Earthquake proof.
2	Timber framed building, or lightweight steel or concrete framed with concrete floors
3	Timber frame or single storey lightweight constructions with light steel cladding.
4	Two storey domestic houses traditional brick and block construction re-enforced concrete floors, block work.
5	Multi-storey residential buildings. In-situ concrete floors, lightweight construction.
6	Two storey domestic houses with traditional brick and block construction with lightweight timber floors
7	Pre-fabricated lightweight homes made from timber, often constructed off site.
8	Ruins or historic buildings.

6.3.4 Foundation Category

Foundation Type	Description of Foundation
A	Linked re-enforced piles, stiff concrete raft, linked timber piles or gravity retaining walls.
B	Independent re-enforced concrete piles, spread wall footing or timber piles and rafts.
C	Lightweight retaining walls, large stone footings, strip foundations, plate foundations or no foundations.

6.3.5 Types of Soil

Foundation Type	Description of Foundation
a	Unfissured rocks, fairly solid rocks or cemented sand.
b	Horizontally bedded soils, very firm or compacted non-cohesive soils.
c	Horizontally bedded soils, poorly compacted firm or moderately form non-cohesive soils.
d	All types of sloping surfaces and potential slip planes.
e	Loose non-cohesive soils (sands, gravels, boulders etc.), soft cohesive soils, (clays) organic soils (peat).
f	Land fill type sites.

6.4 Classification of Buildings – Resistance to Vibration

Class of Building		Structural Category							
		1	2	3	4	5	6	7	8
Vibration Decreasing (Down Table)	1	Aa							
	2	Ab	Aa	Aa	Aa				
	3		Ab, Ba	Ab, Ba	Ab	Aa, Ab			
	4		Ac, Bb	Bb	Ac	Ac, Ba, Bb			
	5		Bc	Ac		Bc	Ba		
	6		Af		Ad	Bd	Bb, Ca	Ba	
	7			Af	Ae	Be	Bc, Cb	Bb, Ca	
	8						Be, Cc	Bc, Cb	
	9		Bf				Cd	Bd, Cc	Aa
	10			Bf			Ce	Be, Cd	Ab
	11				Cf	Cf		Ce	Ba
	12						Cf		Bc, Ca

6.5 British Standard ISO 2631-1:1997 (“BS2631”)

Mechanical vibration and shock –

Evaluation of human exposure to whole body vibration – Part 1: General Requirements.

6.5.1 Scope of Document

This document defines the method for defining and measuring whole body vibration. More importantly, it defines between 0.5 and 80 Hz the level of vibration which is likely to be perceivable.

6.5.2 Comfort reactions to Vibration Environments

Acceleration (Peak) W_k Weighted	Perception of Whole Body Vibration (Sitting Down)
0.015 ms^{-2}	50 th Percentile of alert and fit persons can detect peak vibration at this magnitude
0.010 ms^{-2}	Median Perception of 0.15ms ⁻¹ lower interquartile range
0.020 ms^{-2}	Median Perception of 0.15ms ⁻¹ upper interquartile range

6.6 British Standard 6472-1:2008 (“BS6472”)

Guide to evaluation of human exposure to vibration in buildings –

Part 1: Vibration source other than blasting.

6.6.1 Scope of Document

This document provides guidance on predicting the human response to vibration in buildings over the frequency range 0.5 Hz to 80 Hz. This part of the standard describes how to determine the vibration dose value, VDV from frequency-weighted vibration measurements.

6.6.2 Vibration Dose Value Ranges for Adverse Comment

Place and Time (Residential Buildings)	Adverse Comment		
	Low Probability	Possible	Probable
Day Time – 16 Hour (07:00 to 23:00)	0.2 to 0.4 $\text{ms}^{-1.75}$	0.4 to 0.8 $\text{ms}^{-1.75}$	0.8 to 1.6 $\text{ms}^{-1.75}$
Night Time – 8 Hour (23:00 to 07:00)	0.1 to 0.2 $\text{ms}^{-1.75}$	0.2 to 0.4 $\text{ms}^{-1.75}$	0.4 to 0.8 $\text{ms}^{-1.75}$

6.6.3 Estimated Vibration Dose Value

Both BS2631 and BS6472 provide a formula to determine the Vibration Dose Value from the weighted acceleration values assuming the weightings shown in figure 1 of BS6472, (W_b) which is commonly defined as fourth root of the time integral of the fourth power of the acceleration after it has been frequency weighted.

6.7 DIN 4150 – Part 3: 1999 (“D4150”)

Structural vibration –

Part 3: Effects of vibration on structures.

6.7.1 Scope of Document

This standard provides a specific method of measuring and evaluating the effects of vibration on structures designed primarily for static loadings. It provides a useful table of vibration levels for evaluating the effect of short term vibration on buildings.

6.7.2 Guideline Values for Vibration Velocity – Short Term Effects

Type of Structure		Guideline Velocity Values		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz
1	Commercial Buildings	20 ms ⁻¹	20 to 40 ms ⁻¹	40 to 50 ms ⁻¹
2	Dwellings and Buildings of similar occupancy	5 ms ⁻¹	5 to 15 ms ⁻¹	15 to 20 ms ⁻¹
3	Sensitive Buildings	3 ms ⁻¹	3 to 8 ms ⁻¹	8 to 10 ms ⁻¹

6.8 Assessing vibration - A Technical Guideline: 2006 (“DEC”)

Department of Environment and Conservation’s (DEC) - Australia

Assessing Vibration – A Technical Guideline.

6.8.1 Scope of Document

The Department of Environment and Conservation in Australia produced a very useful document entitled “Assessing Vibration – A Technical Guide” in which provide guidance to the interpretation and use of BS6472. The document provides useful guidance on acceptable levels of vibration in residential properties, and though it was published in Australia, it is based on BS6472 which is very relevant for sites within the UK.

6.8.2 Acceptable Values for Continuous or Impulsive Vibration

Location of Measurements	Assessment period	Preferred Values		Maximum Values	
		z-axis	x and y axis	z-axis	x and y axis
Residential Properties	Day Time (07:00 to 23:00)	0.010 ms ⁻²	0.0071 ms ⁻²	0.020 ms ⁻²	0.014 ms ⁻²
	Night Time (23:00 to 07:00)	0.007 ms ⁻²	0.005 ms ⁻²	0.014 ms ⁻²	0.010 ms ⁻²

6.8.3 Acceptable Vibration Does Values for Intermittent Vibration

Location of Measurements	Assessment period	Preferred Values	Maximum Values
		z-axis	z-axis
Residential Properties	Day Time (07:00 to 23:00)	0.20 ms ^{-1.75}	0.40 ms ^{-1.75}
	Night Time (23:00 to 07:00)	0.13 ms ^{-1.75}	0.26 ms ^{-1.75}

6.8.4 Vibration Criteria Presented in Different Units

Location of Measurements Residential Properties	Assessment period	Preferred Values	Maximum Values
		z-axis	z-axis
rms Acceleration	Day Time (07:00 to 23:00)	0.010 ms ⁻²	0.020 ms ⁻²
	Night Time (23:00 to 07:00)	0.007 ms ⁻²	0.014 ms ⁻²
rms Velocity	Day Time (07:00 to 23:00)	0.20 mms ⁻¹	0.40 mms ⁻¹
	Night Time (23:00 to 07:00)	0.14 mms ⁻¹	0.28 mms ⁻¹
Peak Velocity	Day Time (07:00 to 23:00)	0.28 mms ⁻¹	0.56 mms ⁻¹
	Night Time (23:00 to 07:00)	0.20 mms ⁻¹	0.40 mms ⁻¹

6.9 Proposed Criterion

The following is the maximum and average noise level criterion between 08:00 to 18:00 Monday to Friday and 08:00 to 13:00 on Saturdays to ensure compliance with condition 8 of planning permission APP/22/00487.

Impact of Residential Amenity Condition 8 – APP/22/00487	Description	Absolute Criterion Level (VDV – BS 6472 – Part 1: 2008)
Significant Adverse Impacts	Avoid	0.8 ms ^{-1.75}
Adverse Impact	Mitigation measures will be required	0.4 ms ^{-1.75}
Acceptable	Compliance with Q30 & Q32	0.2 ms ^{-1.75}

7 SOURCE LEVELS

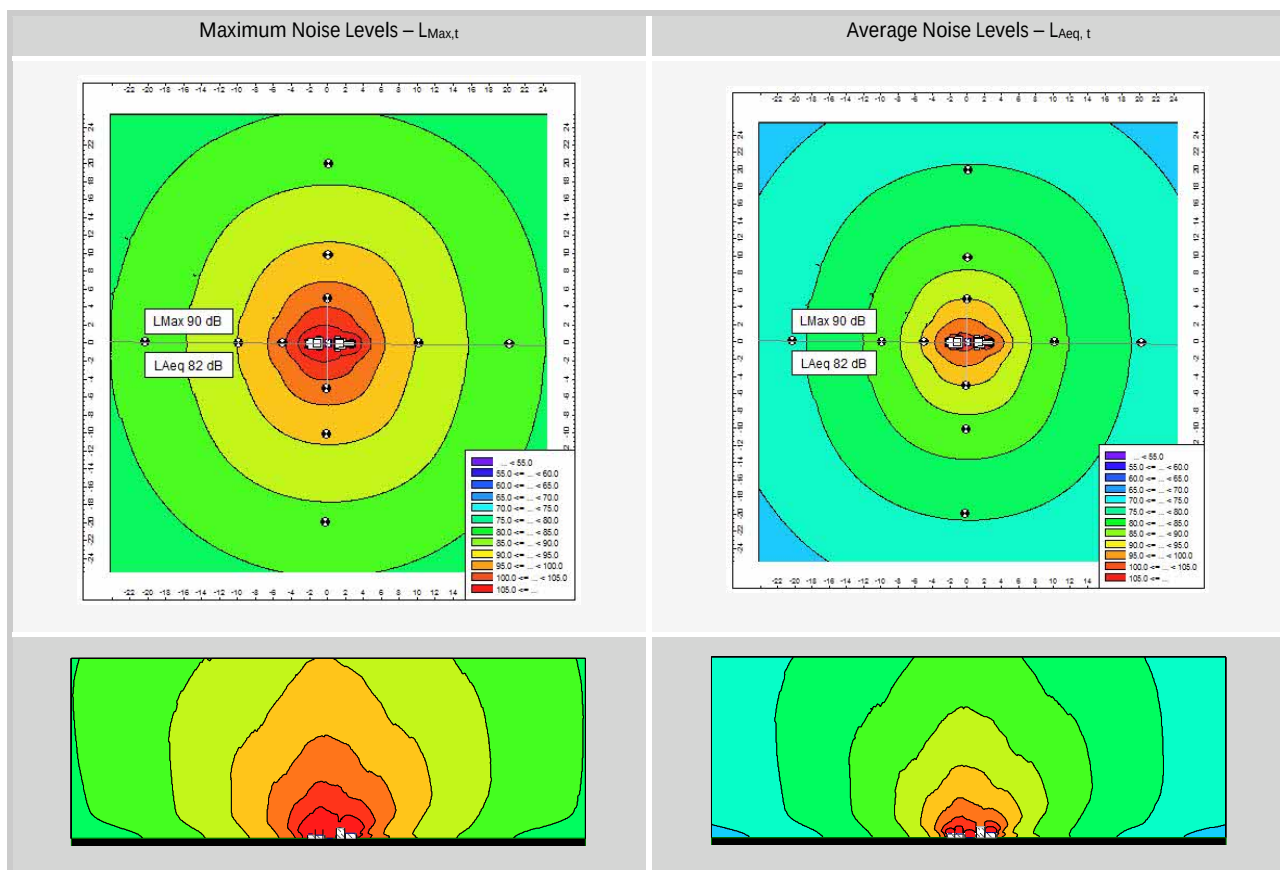
7.1 Foundations - Trenching

7.1.1 British Standard 5228 – Part 1 Sound Pressure Levels

Ref	Equipment	Power	Size	Octave Band Centre Frequency								Sum
				63	125	250	500	1K	2K	4K	8K	Lp(10)
C.4.64	Tracked Excavator	223kW	40t	77	86	75	75	71	69	64	55	77
C.2.33	Articulated Dump Truck	187	13t	85	87	77	75	76	73	69	62	81

Sound Pressure Levels at 10m from the centre of the unit – Reference $2 \times 10^{-5} \text{ Nm}^{-2}$ (dB)

7.1.2 Noise Maps of Equipment



7.1.3 Notes on Source

The trenches will be formed by digging out the required areas, applying suitable shuttering and then pouring concrete into the trench foundations. The depth of the trenches range up to 2.5m in some areas. The waste material will be moved away from the trench using a standard dumper truck. For reference the VDV Vibration level when assessed in accordance with British Standard 6472-Part 1: 2008 is likely to be around $0.2 \text{ ms}^{-1.75}$ at a distance of 20 m from the foundation trenching.

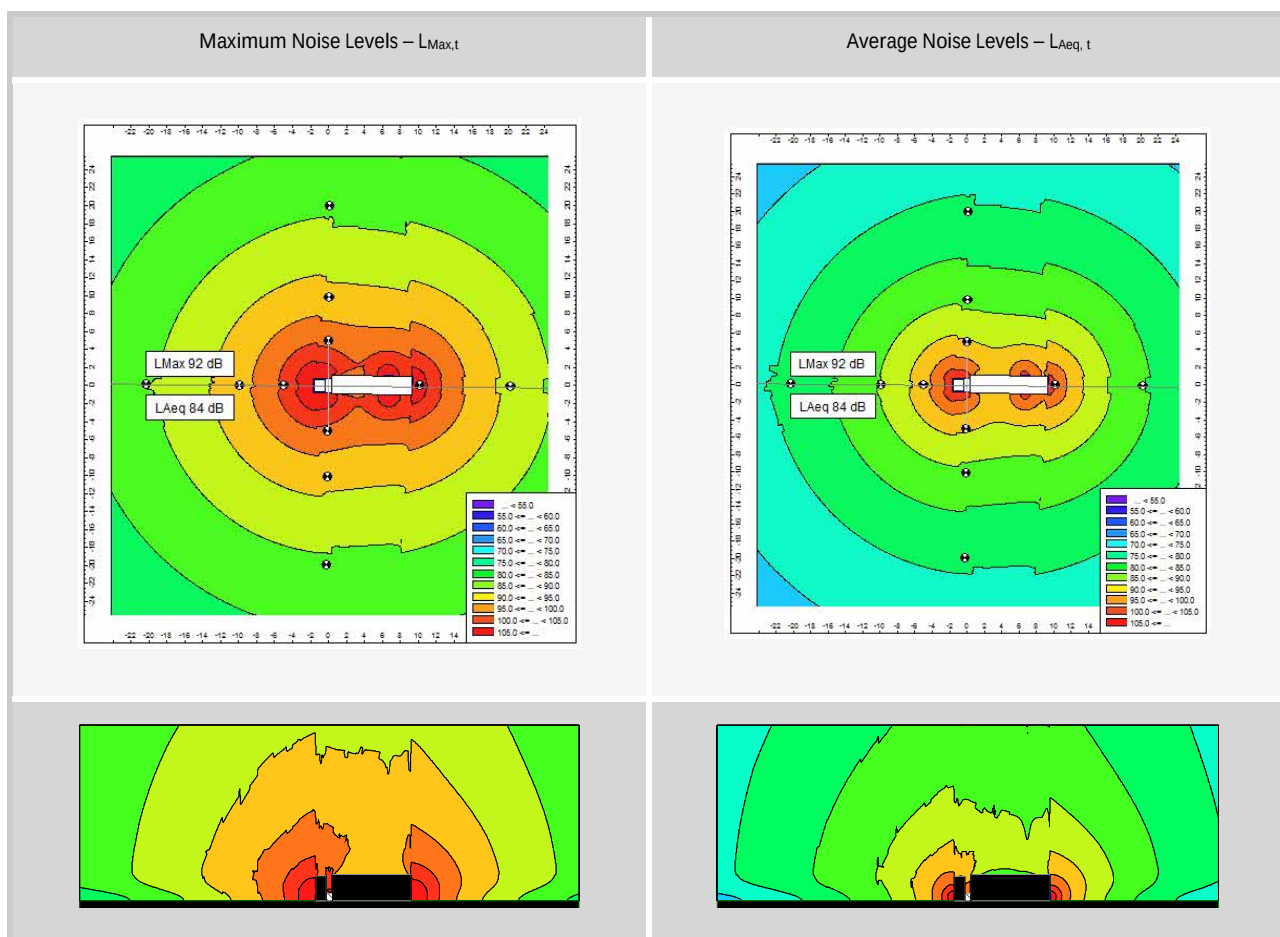
7.2 Deliveries / Collections from Site

7.2.1 British Standard 5228 – Part 1 Sound Pressure Levels

Ref	Equipment	Power	Size	Octave Band Centre Frequency								Sum
				63	125	250	500	1K	2K	4K	8K	Lp(10)
C.11.4	Lorry on Access road	350kW	44t	82	80	78	75	76	78	75	69	83
C.8.21	Skip Wagon	--	--	82	84	78	75	71	70	65	59	78

Sound Pressure Levels at 10m from the centre of the unit – Reference $2 \times 10^{-5} \text{ Nm}^{-2}$ (dB)

7.2.2 Noise Maps of Equipment



7.2.3 Notes on Source

All materials will be delivered to site 2 or 3 times per week within the proposed construction hours using standard articulated Lorries. Skips will be delivered and collected from the site 3 or 4 times per week again within the proposed construction hours. For reference the VDV Vibration level when assessed in accordance with British Standard 6472-Part 1: 2008 is likely to be around $0.1 \text{ ms}^{-1.75}$ at a distance of 20 m from the delivery vehicles.

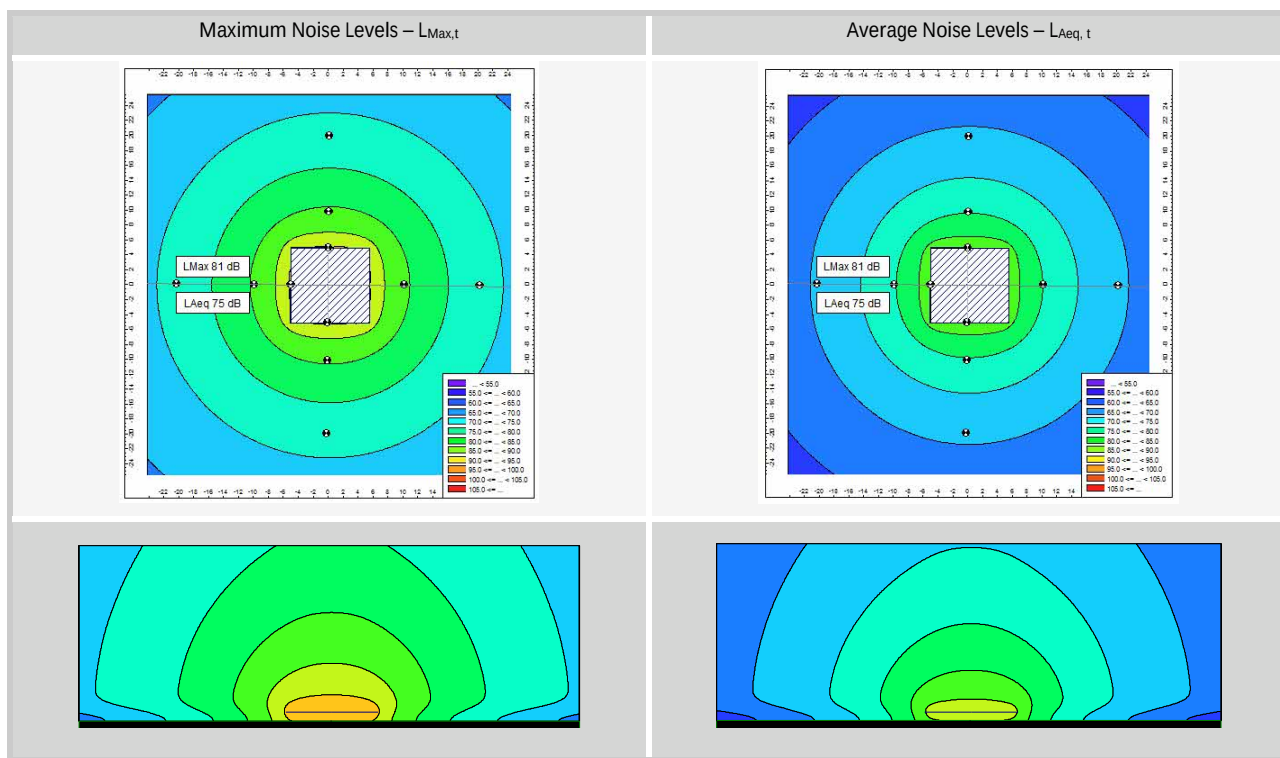
7.3 Building of Dwellings

7.3.1 British Standard 5228 – Part 1 Sound Power Levels

Ref	Equipment	Power	Size	Octave Band Centre Frequency								Sum
				63	125	250	500	1K	2K	4K	8K	Lp(10)
C.4.55	Telescopic Handler	75kW	3.7t	82	72	63	65	67	64	56	49	70
C.2.31	Articulated Dump Truck	187kW	23t	80	76	73	70	69	66	63	58	74
--	General Activity	--	--	63	65	65	66	65	69	67	64	73

Sound Pressure Levels at 10m from the centre of the unit – Reference $2 \times 10^{-5} \text{ Nm}^{-2}$ (dB)

7.3.2 Noise Maps of Dwellings



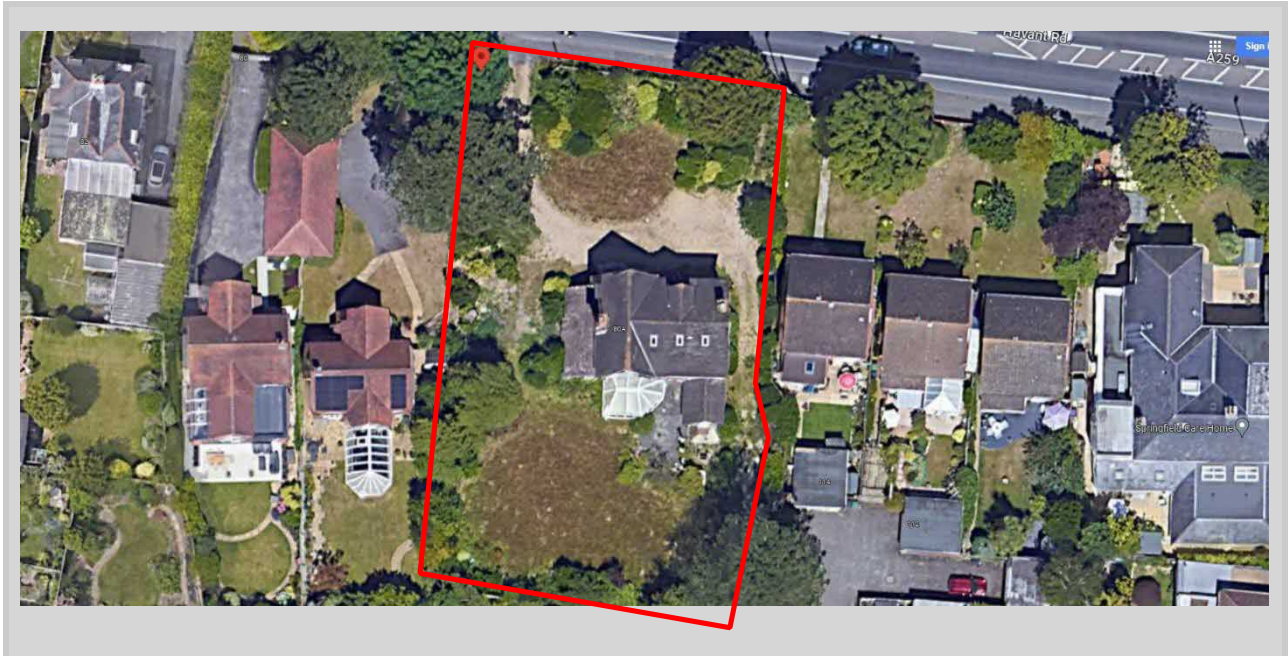
7.3.3 Notes on Source

Once the foundation are formed the construction of the dwellings involves the delivery of the various materials adjacent to the site and then the building, including brick laying, roofing and internal fitting out. There will be some landscaping and installation of fences etc. to form the external amenity areas. For reference the VDV Vibration level when assessed in accordance with British Standard 6472-Part 1: 2008 is likely to be around $0.1 \text{ ms}^{-1.75}$ at a distance of 20 m from the general construction activities.

8 ASSESSMENT OF CONSTRUCTION PHASES

8.1 Foundation – Trenching

8.1.1 Location Plan of Works



8.1.2 Duration of Works

It is understood that the trenching will take around 4 weeks in total to complete, working between the hours of 08:00 and 18:00 Monday to Friday and 08:00 to 13:00 on Saturdays.

8.1.3 ON/OFF Time Correction

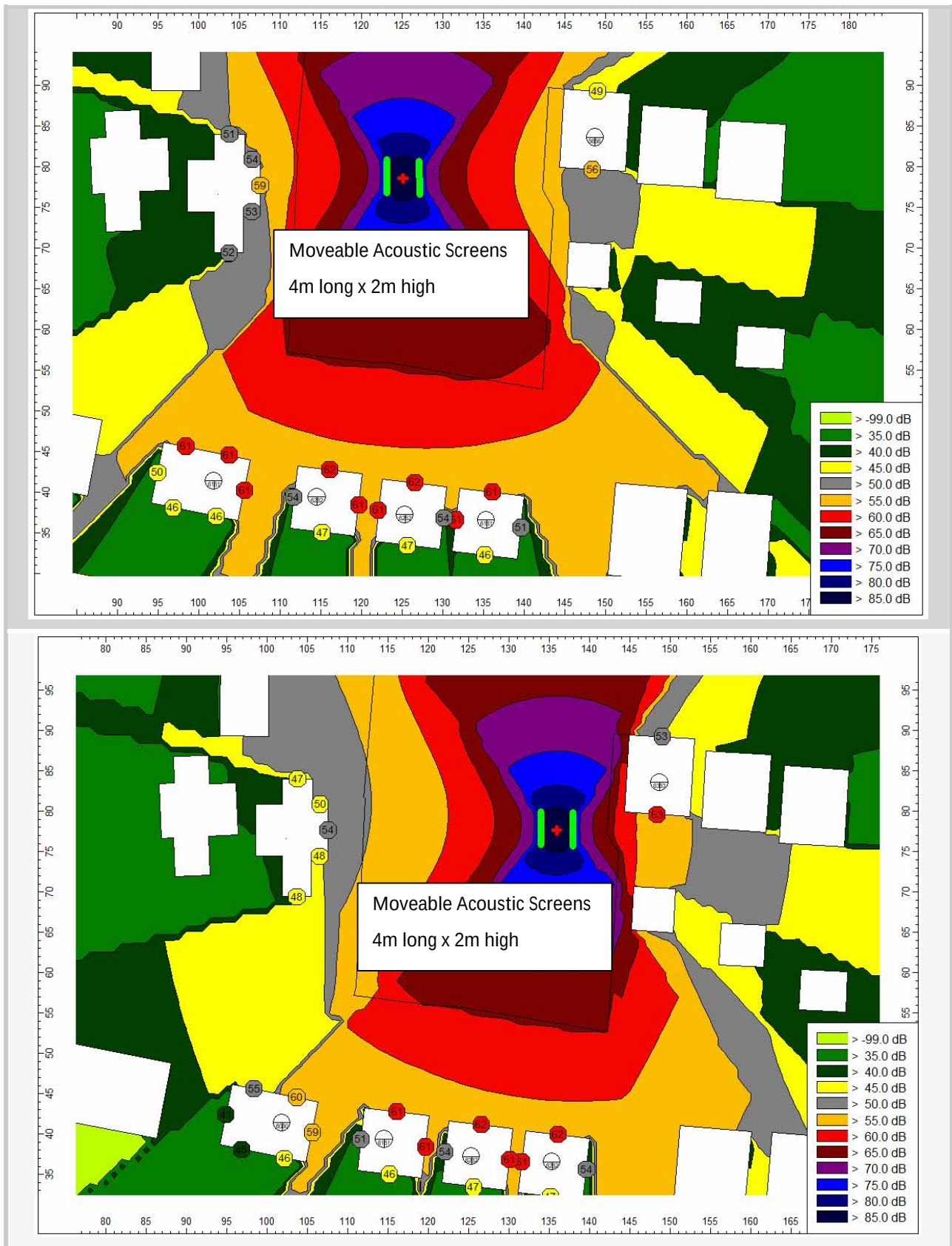
The following table demonstrates the reduction that has been applied to the Sound Power Level (L_w) taking into account the time period that the equipment is going to be used on site.

Equipment	Sound Power Level (dB)	On/Off Time Correction	Resultant Level (dB)
Excavator & Dump Truck	113.0	-6	107.0

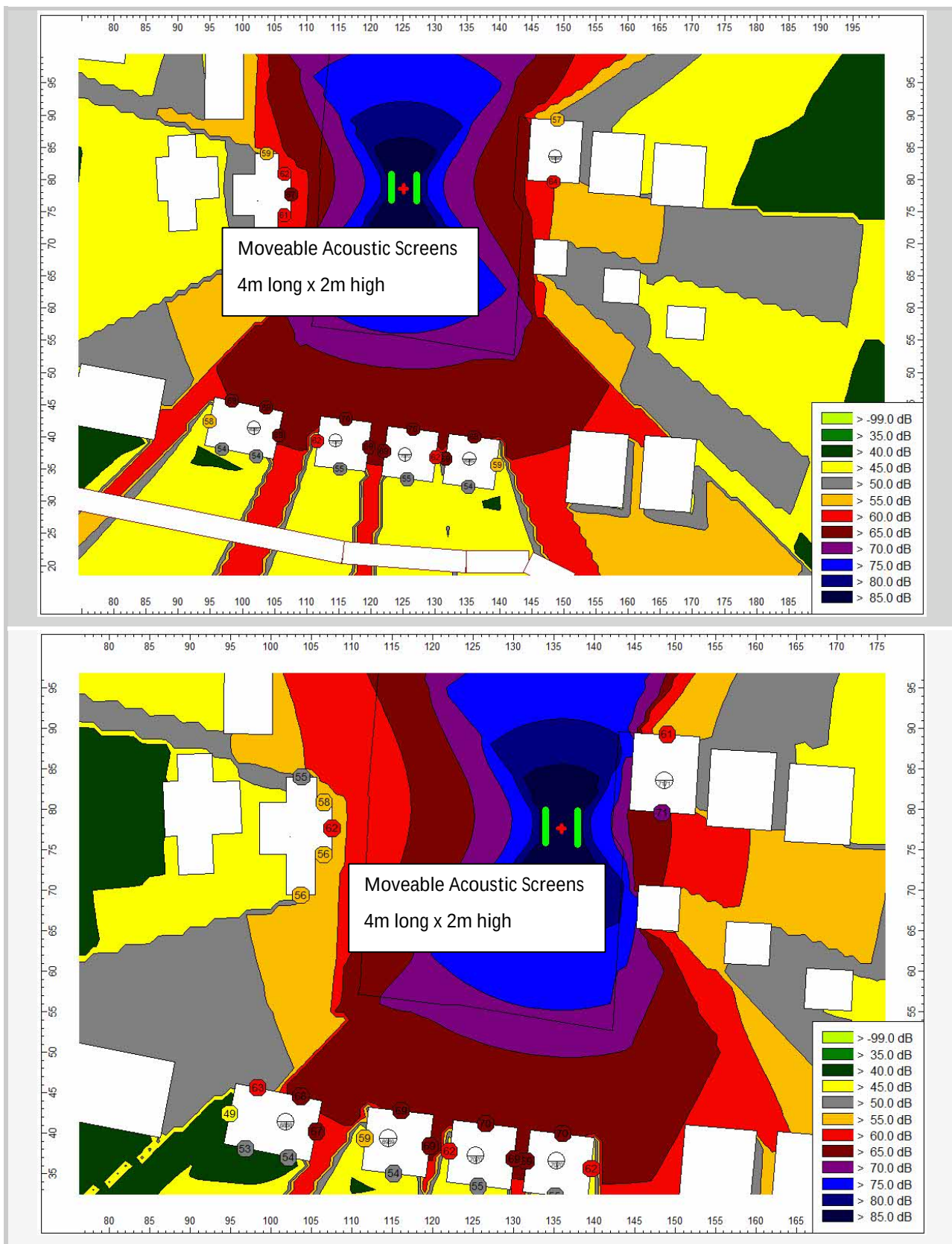
8.1.4 Assessment of Trenching Phase

Source	Operating Times			Source Position
Trenching	08:00 to 18:00 Monday to Friday 09:00 to 21:00 Saturday			Generally Over the Entire Site
Assessment Position	Residential properties to the East and West of the site			
Item	Maximum Level	Average Level	Vibration Level	Commentary
Predicted Noise	$L_{Max,70}$ dB	$L_{Aeq,t}$ 63 dB	$0.1 \text{ ms}^{-1.75}$	Predicted 1m from the façade of the residential property
Criterion	$L_{Max,t}$ 78 dB	$L_{Aeq,t}$ 64 dB	$0.2 \text{ ms}^{-1.75}$	
Assessment	Complies	Complies	Complies	Complies with the requirements
Conclusions	Further mitigation measures are required. Refer to general site mitigation measures.			

8.1.5 Noise Maps of Works (Average Noise Levels)



8.1.6 Noise Maps of Works (Maximum Noise Levels)



It can be seen from sections 8.1.5 and 8.1.6 that while trenching is carried out, that the contractor uses a moveable acoustic screen each side of the excavator during the four week process.

8.2 Deliveries and Collection for Site

8.2.1 Location Plan of Works



8.2.2 Duration of Works

It is understood that deliveries and collections to the site will be undertaken for the duration of the whole development of the site for around 52 weeks between the hours of 08:00 and 18:00 Monday to Friday and 08:00 to 13:00 on Saturdays.

8.2.1 ON/OFF Time Correction

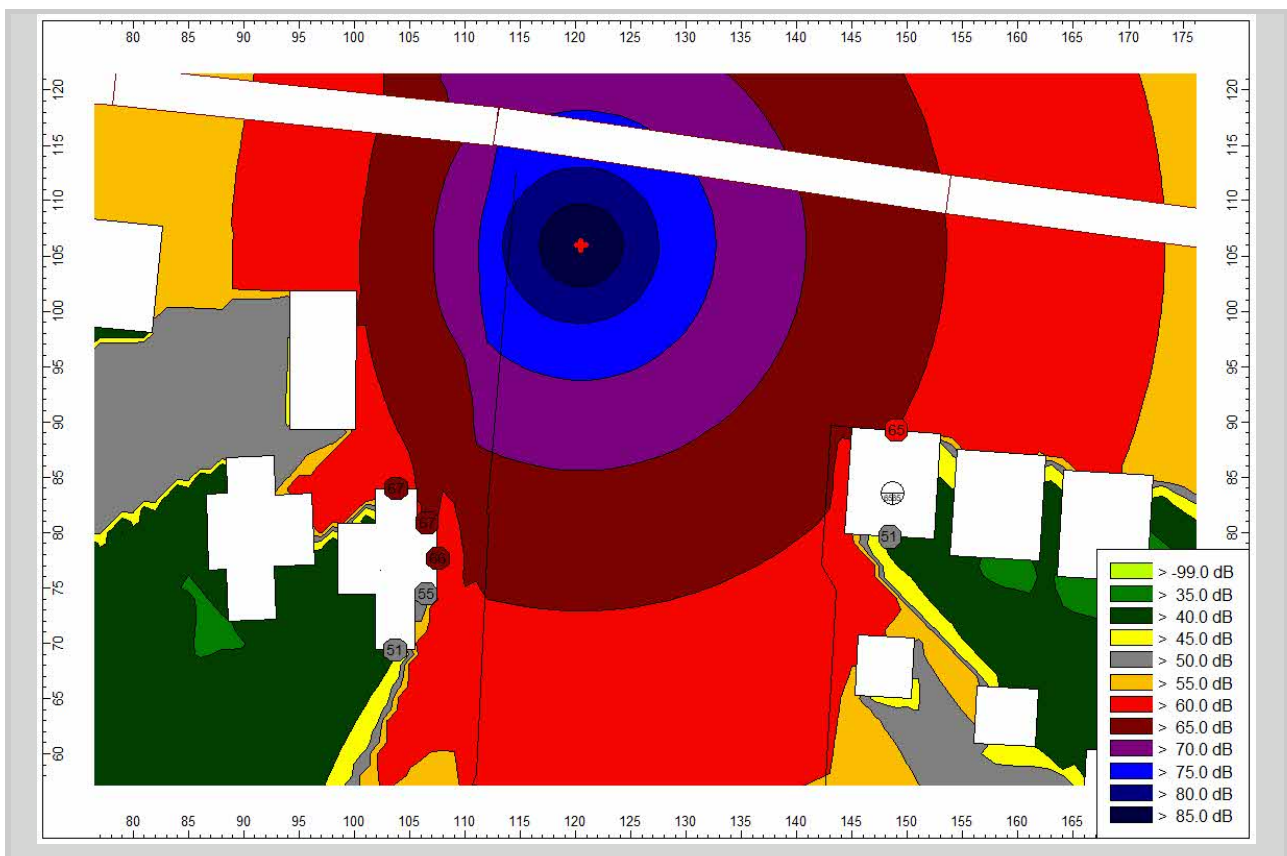
The following table demonstrates the reduction that has been applied to the Sound Power Level (Lw) taking into account the time period that the equipment is going to be used on site.

Equipment	Sound Power Level (dB)	On/Off Time Correction	Resultant Level (dB)
Deliveries & Collections	115.0	-6	109.0

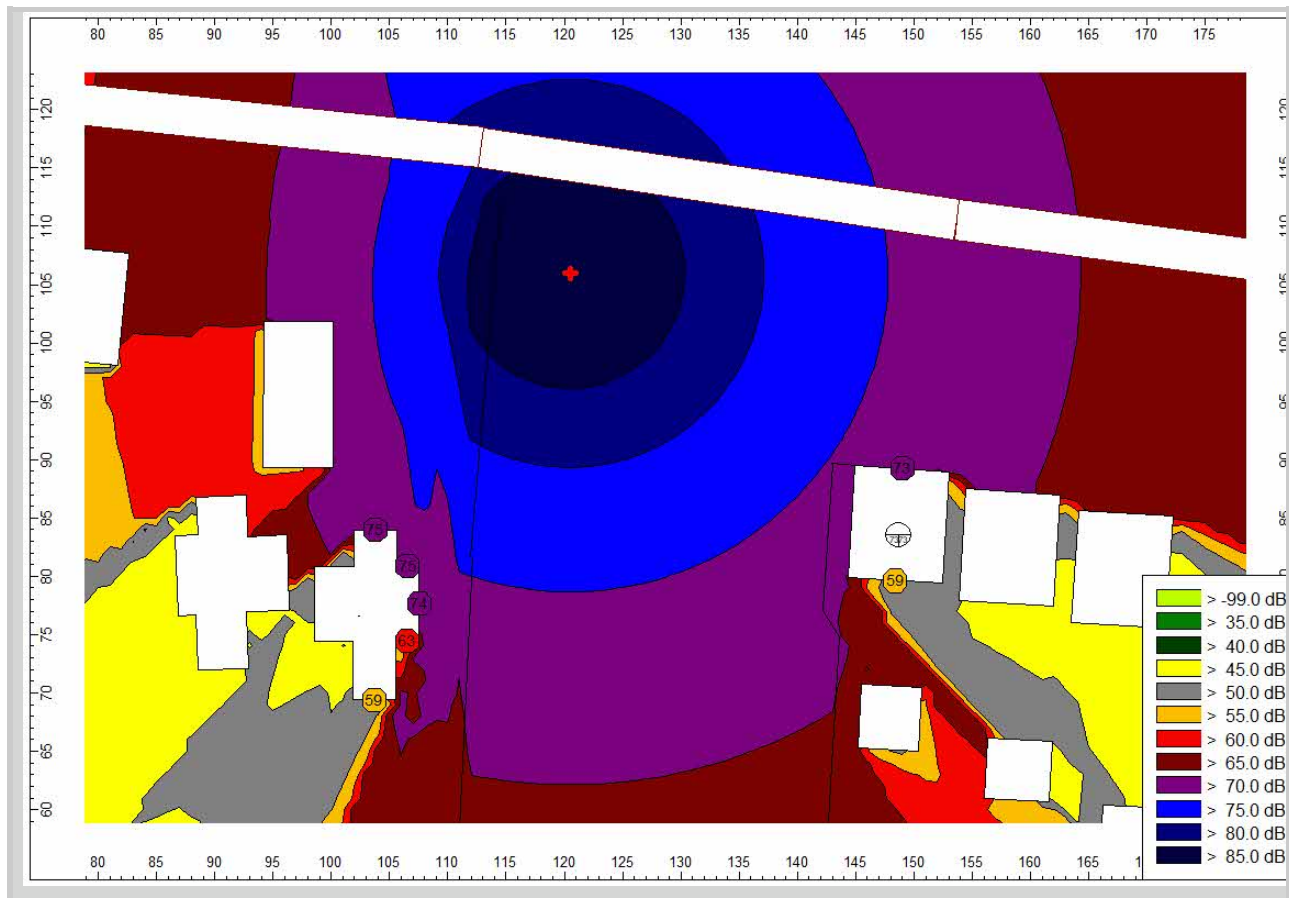
8.2.2 Assessment of Deliveries & Collections

Source	Operating Times			Source Position
Deliveries and Collections	08:00 to 18:00 Monday to Friday 09:00 to 21:00 Saturday			Generally at the Font of the Site
Assessment Position	Residential properties to the East and West of the site			
Item	Maximum Level	Average Level	Vibration Level	Commentary
Predicted Noise	L _{Max} , 75dB	L _{Aeq,t} 67 dB	0.1 ms ^{-1.75}	Predicted 1m from the façade of the residential property
Criterion	L _{Max,t} 82 dB	L _{Aeq,t} 64 dB	0.2 ms ^{-1.75}	
Assessment	Complies	Almost Complies	Complies	Complies with the requirements
Conclusions	Mitigation measures will be required. Deliveries should only be undertaken between 09:00 and 16:00 Monday to Friday only.			

8.2.3 Noise Maps of Works (Average Noise Levels)

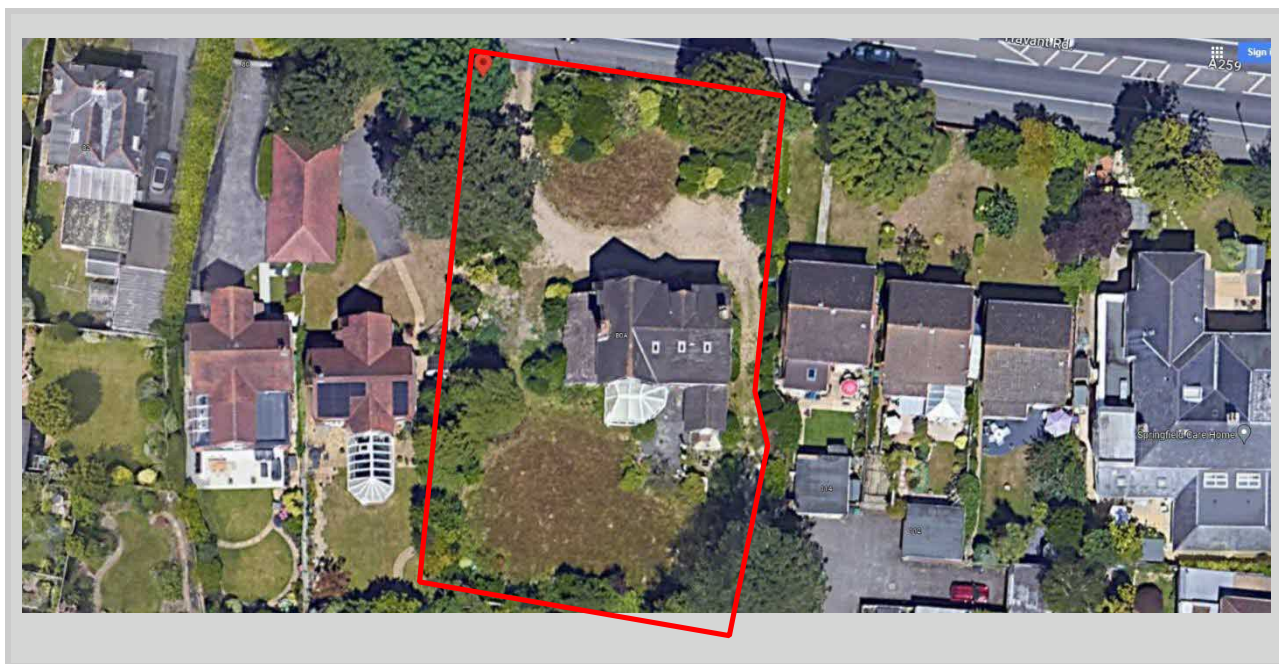


8.2.1 Noise Maps of Works (Maximum Noise Levels)



8.3 General Construction Phase

8.3.1 Location Plan of Works



8.3.2 Duration of Works

It is understood that deliveries and collections to the site will be undertaken for the duration of the whole development of the site for around 52 weeks between the hours of 08:00 and 18:00 Monday to Friday and 08:00 to 13:00 on Saturdays.

8.3.1 ON/OFF Time Correction

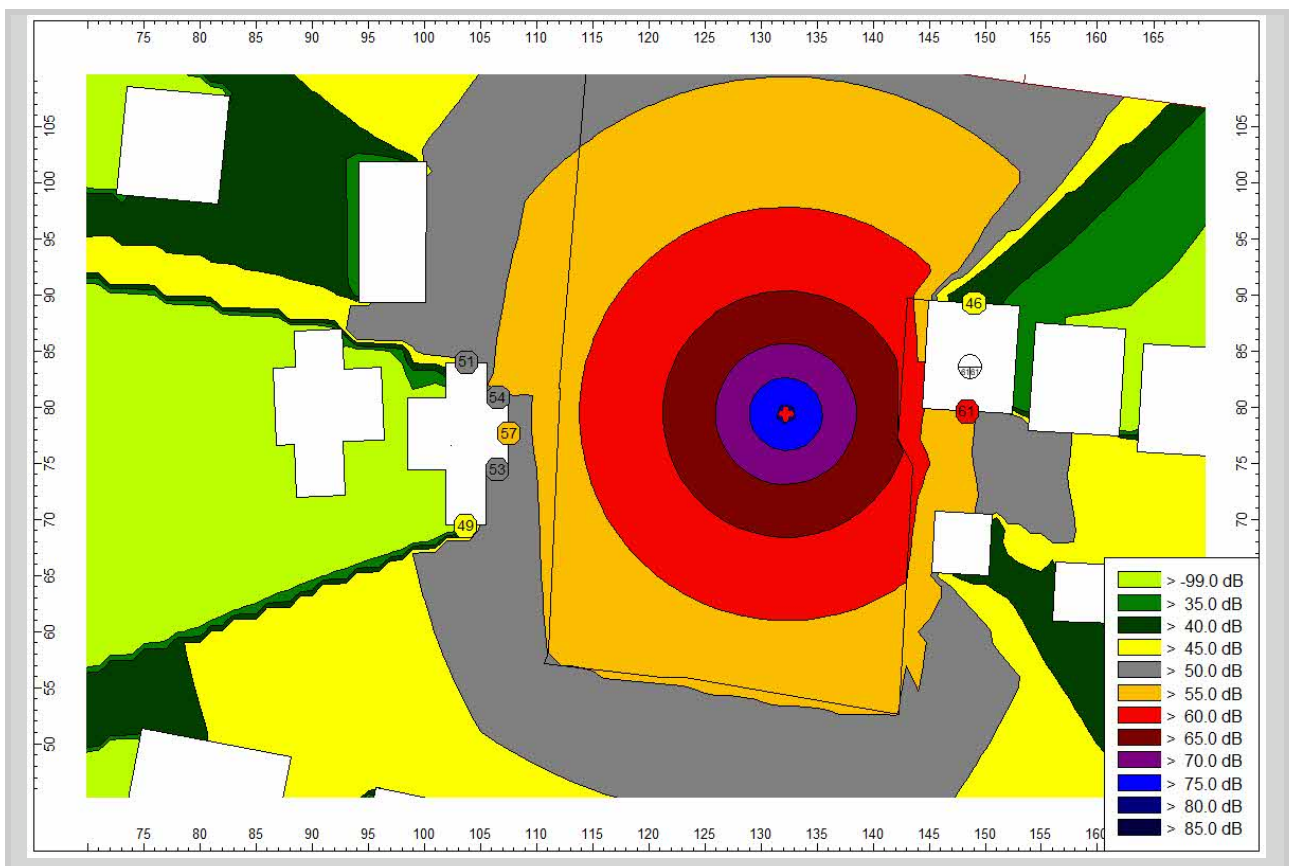
The following table demonstrates the reduction that has been applied to the Sound Power Level (Lw) taking into account the time period that the equipment is going to be used on site.

Equipment	Sound Power Level (dB)	On/Off Time Correction	Resultant Level (dB)
General Building	106.0	-8	98.0

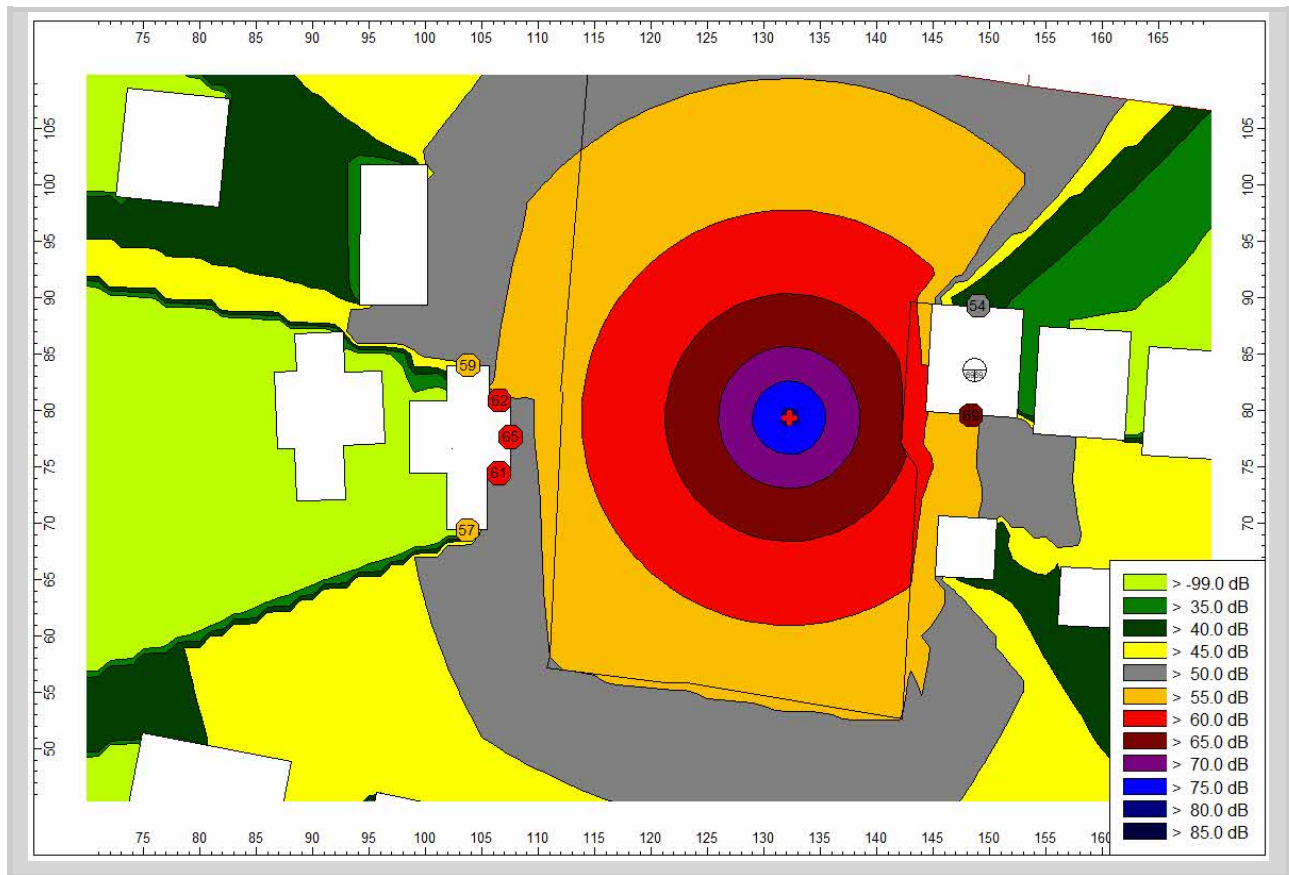
8.3.2 Assessment of Construction Phase

Source	Operating Times			Source Position
General	08:00 to 18:00 Monday to Friday 08:00 to 21:00 Saturday			Generally Over the Entire Site
Assessment Position	Residential properties to the East and West of the site			
Item	Maximum Level	Average Level	Vibration Level	Commentary
Predicted Noise	L _{Max} , 69 dB	L _{Aeq,t} 61dB	0.1 ms ^{-1.75}	Predicted 1m from the façade of the residential property
Criterion	L _{Max} , 82 dB	L _{Aeq,t} 64 dB	0.2 ms ^{-1.75}	
Assessment	Complies	Complies	Complies	Comply with the requirements
Conclusions	Further mitigation measures are required. Refer to general site mitigation measures.			

8.3.3 Noise Maps of Works (Average Noise Levels)



8.3.4 Noise Maps of Works (Maximum Noise Levels)



9 CONCLUSIONS

9.1 Reference Background Noise Levels – Construction Times

From the original background noise data the following are the minimum 1 hour background noise levels that are likely to occur between 08:00 to 18:00 Monday to Friday and 08:00 to 13:00 on Saturday.

Measurement	Period	L _{Aeq} , 1 hour	L _{Amax} 1 hour	L _{A90} , 1 hour
Position 1	08:00 - 18:00 Monday to Friday	63.9	82.4	59.4
Position 1	19:00 – 13:00 Saturday	66.3	74.6	61.4
Sound Pressure Level – Reference Level $2 \times 10^{-5} \text{ Nm}^{-2}$ - dB				

The above background noise levels are considered representative and have been used to construct the following background noise map of the existing noise climate. The above results indicate the average noise level is dominated by the noise from the local roads.

9.2 Airborne Noise Criterion (Residential Properties – Construction Times)

Impact of Residential Amenity	Description	Absolute Criterion Level	
		Maximum Level	Average Level
Significant Adverse Impacts	Avoid	L _{Max} , 1 hour 92 dB	L _{Aeq} , 1 hour 74 dB
Adverse Impact	Mitigation measures will be required	L _{Max} , 1 hour 87 dB	L _{Aeq} , 1 hour 69 dB
Acceptable	Compliance with Condition 13 of F/11/70108	L _{Max} , 1 hour 82 dB	L _{Aeq} , 1 hour 64 dB

9.3 Vibration Criterion (Residential Properties – Construction Times)

Impact of Residential Amenity	Description	Absolute Criterion Level (VDV – BS 6472 – Part 1: 2008)
Significant Adverse Impacts	Avoid	0.8 ms ^{-1.75}
Adverse Impact	Mitigation measures will be required	0.4 ms ^{-1.75}
Acceptable	Compliance with Q30 & Q32	0.2 ms ^{-1.75}

9.4 Resultant Noise and Vibration Levels from Construction Phase

Construction Phase	Duration	Airborne Noise Levels		Vibration Levels
		Maximum	Average	VDV – BS6472-1:2008
Foundations - Trenching	4 Weeks	L _{Max} , 1 hour 70 dB	L _{Aeq} , 1 hour 63 dB	0.1 ms ^{-1.75}
Deliveries / Collections	52 Weeks	L _{Max} , 1 hour 75 dB	L _{Aeq} , 1 hour 67 dB	0.1 ms ^{-1.75}
General Construction of Houses	52 weeks	L _{Max} , 1 hour 69 dB	L _{Aeq} , 1 hour 61 dB	0.1 ms ^{-1.75}

Therefore, the likelihood of residential disturbance from vehicular related movements is low and the above calculated level should be used for guide purposes only.

9.5 Specific Mitigations Measures

Construction Phase	Description of Mitigations Measures
Foundations - Trenching	Moveable Acoustic Screens
Deliveries / Collections	Deliveries undertaken 08:00 to 18:00 Monday to Friday only
General Construction of Houses	No specific mitigation measures
Whole Programme	Overall monthly leaflet drop. Toolbox talks onsite. Site Notices.

9.6 Conclusions

The construction of the residential property at 78 Havant Road, Emsworth, Hampshire, PO10 7LH will be undertaken over an approximate 52 week period.

The assessment has indicated that the trenching stage, should have a moveable acoustic screen at a height of 2m and a length of 4m in order to not have an adverse effect on the local residents in terms of noise and vibration. The general building, deliveries and collections from site are unlikely to have an adverse effect on the local residents in terms of noise and vibration. Consideration should be given to implementing a monthly leaflet drop to the nearby residential properties, Toolbox talks for all staff working on site. Deliveries and collections from the site should be undertaken between 08:00 and 18:00 hours only.

##End of Report##