



Damask Way, Warminster

Construction Noise and Vibration Assessment

Backhouse Housing Limited

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Basis of Report

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Appendix A Technical Glossary

A.1 Acoustic Terminology



1.0 Introduction

SLR Consulting Ltd (SLR) has been commissioned by Backhouse Housing Limited to undertake a construction noise and vibration impact assessment in relation to the below proposed development:

“Outline planning permission for residential development of up to 49 dwellings with associated access, parking, internal roads, public open space, landscape planting, ground level re-profiling and associated infrastructure and works. All matters reserved except for access.”

The Site was the subject of a previous OPA (Wiltshire Council (WC) planning reference: 17/12348/OUT) for 28 no. dwellings. The application was approved by WC in 2019, however the subsequent Reserved Matters Application (RMA) was withdrawn following an unresolved highways objection; there was no objection on acoustics grounds.

Whilst reasonable effort has been made to ensure that this report is easy to understand, it is technical in nature. To assist the reader, a glossary of terminology has been included in **Appendix A**.

A statement of the competence of the engineers associated with this assessment constituting an SQA (Suitability Qualified Acoustician) is enclosed in **Section 8.0**.



2.0 Site Description

2.1 Overview

The Site is located at the approximate National Grid Reference (NGR): x387750, y144130 within WC's administrative area and is bounded by:

- Vacant land consisting of meadows, hedgerows and trees to the north;
- Vacant land (as above) to the east, with Smallbrook Road beyond;
- Residential dwellings to the south, with Upper Marsh Road, Lower Marsh Road, Smallbrook Road and agricultural land beyond; and
- Residential dwellings off Damask Way to the west.
- Vehicular access to the Site will be via Upper Marsh Road.

2.2 Noise Sensitive Receptor Locations

The nearest Noise Sensitive Receptors are listed below. The approximate distance between the Receptor and the Site Boundary is provided in brackets.

- NSR 01: Receptors on Damask Way (shared boundary)
- NSR 02: Receptors on Damask Way (shared boundary)
- NSR 03: Henford House Care Home (20 m)
- NSR 04: Receptors on Upper Marsh Road (shared boundary)
- NSR 05: Turnpike Cottage (50 m)

The nearest Noise Sensitive Receptors (NSRs) and indicative site boundary can be seen below in details in **Figure 2-A**.



Figure 2-A: Noise and Vibration Sensitive Receptor Locations



Image courtesy of Google Earth



3.0 Scope and Guidance

3.1 Noise Guidance

Construction noise from the construction of the development will be assessed in accordance with BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise'. This standard sets out a methodology for predicting noise levels arising from a wide variety of construction and related activities and contains tables of sound power levels generated by a wide variety of mobile and fixed plant equipment.

Compliance with BS 5228-1:2009+A1:2014 is expected as a minimum standard when assessing the impact of construction noise upon the existing noise environment at nearby sensitive receptors.

BS 5228-1:2009+A1:2014 gives several examples of acceptable noise limits for construction or demolition noise. For this assessment as baseline noise data will be available, the ABC method will be used to determine the threshold value at the receptor locations.

Under the ABC method, a threshold value noise level is determined by establishing the existing ambient noise level at each location. This measured ambient noise level is then rounded to the nearest whole 5dB(A) and the threshold noise value for each receptor is then established from Table E.1 of BS 5228-1:2009+A1:2014. This threshold value is the $L_{Aeq,T}$ noise level that should not be exceeded at the receptor location by operations at the Site. In accordance with this method the threshold noise levels for a potentially significant effect are as detailed in **Table 3-1**.

Table 3-1 Construction Noise Residential Receptors - Example Threshold Values

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A A)	Category B B)	Category C C)
Night-time (23.00 – 07.00)	45	50	55
Evenings and weekends ^{D)}	55	60	65
Daytime (07.00 – 19.00) and Saturdays (07.00 – 13.00)	65	70	75
<i>NOTE1 A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level.</i> <i>NOTE 2 If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3 dB due to construction activity.</i> <i>NOTE 3 Applied to residential receptors only.</i>			



Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A A)	Category B B)	Category C C)
A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values. B) Category B: threshold values to use when the ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values. C) Category C: threshold values to use when the ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values. D) 19.01 – 23.00 weekdays, 13.01 – 23.00 Saturdays and 07.01 – 23.00 Sundays.			

If the threshold value is exceeded, then the effect of construction noise upon nearby receptors may be significant. BS 5228-1:2009+A1:2014 states that the significance of the effect will depend upon “other project-specific factors, such as the number of receptors affected and the duration and character of the impact” (Paragraph E.3.2). Professional judgement will be used to determine whether an effect is considered to be significant, and commentary explaining the reasons for this judgement will be provided.

3.2 Vibration Guidance

BS 5228-2:2009 +A1:2014 ‘Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration’ sets out a methodology for predicting vibration levels arising from a wide variety of construction and open site activities. BS 5228-2 in turn refers to other standards, guidance and calculation methods. The latest version of which includes BS 6472 series on human response to vibration in buildings, BS 4866 for measurement and evaluation of structural vibration and BS 7385 series on damage levels from ground borne vibration.

The Peak Particle Velocity (PPV) is considered to the simplest common indicator for perceptibility and the risk of damage to structures, following these British Standards.

3.2.1 Guidelines for Human Perceptibility

Humans are known to be very sensitive to vibration, where threshold of perception typically lies in the peak particle velocity range of 0.14 mm/s to 0.3 mm/s. Vibrations above these values can disturb, startle, cause annoyance or interfere with work activities. At higher levels they can be described as unpleasant or even painful.

Vibrations at very low magnitude can be perceptible to people and can interfere with residential amenity and working environments. Vibrations transmitted from site activities can cause anxiety and annoyance, where some individuals are likely to be more sensitive than others. BS 6472-1 sets down vibration dose values at which minimal adverse comment is likely to be provoked from occupants being subjected to vibration.

The Standard provides guidance on the effects of vibration levels, and these are based upon the use of PPV. The information in **Table 3-2** below has been taken from Table B1, BS 5228-2 and acts as a useful reference point when considering acceptable vibration levels transmitted from Site to residential receptors.

Table 3-2 Guideline Vibration Levels and Effects



Vibration Level* (PPV) mm/s	Effect
0.14	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3	Vibration might be just perceptible in residential environments.
1.0	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior-warning and explanation has been given to residents.
10	Vibration is likely to be intolerable for any more than a very brief exposure to this level.
* The values apply to a measurement position representative of the entry point into the receptor, such that a transfer function (from external to internal) needs to be applied only if external predictions are available. Single or infrequent occurrences at these levels do not necessarily correspond to the stated effect in every case, rather they are provided to give an initial indication of potential effect and can be informed by further available guidance from BS 6472 series.	

3.2.2 Guidelines for Cosmetic Building Damage

Table B2 of BS 5228-2 offers (PPV) vibration guide values for cosmetic damage, in line with those from BS 7835-2:1993 'Evaluation and measurement for vibration in buildings'.

For residential or light commercial buildings, values of 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz are quoted as threshold guidelines. The guide values summarised in **Table 3-3** relate primarily to transient vibration which does not give rise to resonant responses in structures.

Table 3-3 Transient Vibration Guide Values for Cosmetic Damage

Type of Building	Peak component particle velocity in frequency range of predominant pulse *	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above
Unreinforced or light framed structures Residential or light commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz **	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above **
* Values referred to are at the base of the buildings. ** At frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded.		

Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification at resonance, particularly at lower frequencies; then the guideline values may need to be reduced by up to 50 %. On this basis, continuous vibration limits in unreinforced or light framed



structures, residential or light commercial buildings are often quoted from 7.5 mm/s at 4 Hz with maximum displacement of 0.6 mm.

An inherent problem from vibrations is that they can cause structure-borne noise which can be an irritant to occupiers and may cause loose fittings to rattle and move. In certain circumstances it is possible for the vibration to be sufficiently intense to cause minor damage. Typically, this is described as 'cosmetic damage' and would be seen as the initiation or extension of cracks or damage; for example, in wall plaster; rather than the cause for major structural distress.

In more severe cases, it is possible that large areas of plaster, loose roof tiles or chimney pots can be adversely affected. Extensive studies carried out in the UK and overseas document that actual damage to structures or their finishes resulting from well-controlled construction and demolition vibrations is rare.

3.2.3 Underground Services

With respect to underground services, BS 5228-2 provides some guidance used by statutory undertakers for the maximum level of vibrations to which their services should be subjected. The following criteria in **Table 3-4** are conservative and otherwise recommended by BS 5228-2 in the absence of specific criteria to protect underground services.

Table 3-4 Guideline Values for Vibration on Buried Pipework to Protect Underground Services

Pipe material	Guideline vibration level (PPV) mm/s at the pipe
Intermittent or transient vibrations	30
Continuous vibrations	15

BS 5228-2 explains the upper PPV value of 30 mm/s gives rise to a dynamic stress equivalent to nominally 5 % of the allowable working stress in typical concrete and less so in iron or steel. For dilapidated brickwork sewers, the values should be reduced by 20 – 50 %. But for most metal and reinforced concrete service pipes, these PPV values are expected to be quite tolerable.

Other guideline values outside of British Standards have been noted from German equivalent DIN 4150-3. This standard gives guidance values which, if complied with, will not result in damage on the type of structure.

For buried pipework, DIN 4150-3 provides guideline values for evaluating the effect assuming that pipes have been laid with 'current technology'. Additional considerations will need to be made if mechanical processes in the ground could have effects on pipes, or where there are different stress conditions at pipework junctions.

The following guideline values of **Table 3-5** for vibration velocity are provided per pipework material, to be used when evaluating the effects of short-term vibration on buried pipework and when measured on the pipe itself. These guideline values for foundations also apply to the first 2 m nearest the building of service pipes connected to the premises.

Table 3-5 Guideline Values for Evaluating the Short-Term Vibration on Buried Pipework

Pipe material	Guideline vibration level (PPV) mm/s at the pipe
Steel, welded	100



Pipe material	Guideline vibration level (PPV) mm/s at the pipe
Vitrified clay, concrete, reinforced concrete, prestressed, metal (with or without flange)	80
Masonry, plastics (including down pipes)	50

The guideline values of **Table 3-5** may be reduced by 50 % when evaluating the effects of long-term vibration on buried pipework.



4.0 Construction Vibration Assessment

4.1 Methodology

The detail of this section includes statements to the known Site conditions further to physical overground and underground surveys, based on referenced information.

The general methodology of assessment has included:

- Identification of vibration sensitive receptors above and below ground.
- Statement of geology.
- Identification of demolition and construction methods likely to give rise to perceptible vibration.
- Prediction of likely vibration levels and effects.
- Proposal of working restrictions to avoid significant offsite vibration impacts.

4.2 Vibration Sensitive Receptors

The British Standard approach to vibration assessment advocates a survey of the sensitivity of the neighbourhood to vibration. This report considers Vibration Sensitive Receptors (VSRs) as buildings/structures and occupants of those buildings, as well as underground utilities.

VSRs have been defined in this section based on a 100 m proximity to the Site.

The response of a building to groundborne vibration is affected by the type of foundation, underlying ground conditions, the building construction and the state of repair of the building.

This assessment has been based upon both the collection physical surveying of the Site and surroundings, generally required to further explain the susceptibility of any one VSR or confirm the location of any underground services route, further described below.

4.2.1 Statement of Geology

The geology of the area has been considered by way of a reasonably worst case assumption, utilised a low impedance ground media.

4.2.2 Vibration Pathways

In general, the geology of the ground between the vibration source and VSR building affect the frequency of vibration input to a building. Stiffer foundations result in higher natural frequencies of the building soil system and higher input frequencies are often associated with harder ground.

4.3 Construction Activities

4.3.1 Outline Construction Methodology

The means of construction have not been defined at this stage of the Project. The nature of construction includes typically considered 'vibratory activities' such as piling and ground compaction, in the formation of the respective support of new building structures and in the formation of new ground slabs.

The exacting methods for construction of piles and/or ground slabs remains unknown, however SLR have been advised that the expectation is that a Continuous Flight Auger (CFA) piling rig is to be utilised to minimise vibration impact at existing dwellings.



Notwithstanding, it has been considered that a range of compaction equipment will also be available to the Contractor.

4.3.2 Reference Vibration Levels for Construction Activities

The following summary **Table 4-1** has been provided as a summary of vibratory activities considered through demolition and construction phases, from a range of references, conversion methods and/or baseline prediction methods. All sources have been provided at a nominal 10 m in PPV (mm/s) to provide these sources for direct comparison.

Table 4-1 Reference Vibration Levels for Demolition and Construction Activities

Phase	Type	PPV at 10 m (mm/s)	Source
Construction	Excavator breaker ^a	1.50	FTA, Table 7-4
	Large bulldozer	1.50	
	Loaded trucks	1.28	
	Hand breaker	0.60	
	Impact piling ^b	11.2	BS 5228-2, Table E1 re. TRL & FTA, Table 7-4
	Vibratory piling ^c	3.0 / 2.4 / 3.8	
	Auger drilling ^d	0.4 / 1.0	BS 5228-2, Table E1 re. TRL
	Large roller ^e	4.3 / 6.1	
	Small roller ^e	1.0 / 1.4	

^a Small hydraulic hammer mounted on an excavator to 12t.

^a Assuming piles driven to refusal, using 2 kJ hammer energy per blow (e.g. small impact piling rig).

^b For all operations / steady state operations / start-up and run-down operations.

^c For transient and continuous operations.

^d For steady state operations / start-up and run-down operations at 50 % probability of vibration level exceedance. Large roller assumes single vibrating drum of 2.1 m width and 1.8 mm (high) amplitude setting (e.g. Atlas Copco Dynapac CA2500D), with small roller of dual 1.2 m drums and single 0.5 mm amplitude setting (e.g. Bomag 120 AD-5).

The proposed construction activities have been considered possible to cause perceptible levels of off-site vibration. Those likely to create higher PPVs in the environment, as associated with impact piling or large format rollers, have been considered outwardly unsuitable for use given the proximity of VSRs to the Site.

4.3.3 Prediction Methodology

Vibration assessments are normally formed only where significant sources of percussive or steady state vibration can be identified from the proposed site working methods.



The prediction vibration levels according to the code of practice has been inherently limited by contained methods and available research relevant to the source under assessment. The general prediction method has considered from the FTA using simplified propagation calculations in SI units using:

$$PPV_{equip} = PPV_{ref} \left(\frac{10}{D} \right)^B$$

Where PPV_{ref} and 10 m are the PPV and distance of the reference values from **Table 4-1** above **Table 4-1**, PPV_{equip} and D describe the equated PPV and new offset distance D , with B defining the site coefficient or geometric constant.

A value of 1.5 has been taken to describe B with average ground conditions consisting of surface sands, or firm soils and rock applicable to the statement of geology.

Energy from the proposed equipment would be transmitted into the ground, where transformed and potentially perceived as vibration. This factor attenuates with distance. The magnitude and attenuation of ground vibration would be dependent on several factors as including:

- Type of equipment to be used.
- Frequency of vibration.
- Ground conditions.
- Topography.

Given the above factors there will remain some variability and uncertainty in ground borne vibration predictions without site-specific measurement data. The provided formula has been given on an empirical basis to arrive at levels at a receiving point but can only be considered a conservative first assessment given that various factors (such as any variability of ground strata, coupling efficiency between equipment and soil, losses at foundations or between floors, or amplification within the centre of rooms etc) would not be accounted.

The above prediction model may also be used in the calibration of data measured on site if necessary to understand at various distance from the machinery in operation.

4.3.4 Equated Offset Distances

The following offset distances have been equated from the proposed activities mindful of a 7.5 mm/s lower threshold for cosmetic damage occurring within lightweight framed buildings from continuous vibrations, in addition to the 1.0 mm/s and 0.3 mm/s thresholds for human perception and complaint.



Offset values are summarised below in **Table 4-2**

Table 4-2 Predicted Offset Distances for Demolition and Construction Activities

Predicted Offset Distances for Proposed Ground Investigation Works (m)				
Phase	Type	Cosmetic Damage ≥ 7.5 mm/s PPV	Residential Complaint ≥ 1.0 mm/s PPV	Residential Perception ≥ 0.3 mm/s PPV
Construction	Excavator breaker	2 ^a	18	93
	Large bulldozer	2 ^a	18	93
	Loaded trucks	1 ^a	14	73
	Hand breaker	1 ^a	4	23
	Vibratory piling (all operations)	2.5	50	≈ 250
	Auger drilling (continuous)	1 ^a	2	13
	Auger drilling (transient)	1 ^a	10	50
	Small roller (steady state)	1 ^a	10	50
	Small roller (start-up / run-down)	1 ^a	16	84
^a Offset distance proposed as conservative minimum to surrounding structures or underground services.				

It has been realised in following of **Table 4-2**, that during the construction phase:

- The likelihood of cosmetic damage occurring would be low relevant to the nature of activities and with advised offset distances adhered to.
- Complaint from residential locations would be most likely if working within 20 m of a sensitive receptor. Vibration may remain perceptible for residential locations within 100 m of the works.

Similarly, for the construction phase:

- Vibratory piling is likely to cause complaint within residential environments 50 m of the works, therefore alternative techniques should be used, such as CFA (which has already been identified) is a reasonable approach to mitigation.

The project team have advised this is the expected approach.



- The likelihood of complaint from residential locations might only remain from transience of rotary bored piling and during close working approaches of compaction. Vibration may remain perceptible for residential locations within 85 m of the works.

4.4 Vibration Mitigation Measures for Inclusion in the CEMP

The demolition and construction vibration assessments within this report have provided that specific control measures will be required for sensitive receptors locations.

The project is recommended to include a commitment for best practice as outlined within BS 5228 series. The details of which have inferred general control measures that have been elaborated in this section for information the Contractor to adhere to.

Several safeguards exist to minimise the effects of construction and demolition vibration (and noise) as including:

- Various EC Directives and UK Statutory Instruments that limit emissions of a variety of construction plant.
- Guidance set out in BS 5228 that covers noise and vibration control on construction and open sites.
- Powers that exist for local authorities under Sections 60 and 61 of the Control of Pollution Act 1974 to control environmental noise and pollution on demolition sites.

It has been envisaged that Section 61 consent under the Control of Pollution Act (1974) could be used as a safeguarding control by the Contractor, (if necessary) to agree all working methods and mitigation prior to commencement.

4.4.1 General Measures

Generic measures described below have been listed to illustrate the range of techniques available on balance of a proportionate approach to controlling offsite impacts. The adoption of Best Practicable Means, as defined in the Control of Pollution Act 1974, is usually the most effective means of controlling vibration (and noise) from open sites. Within the constraints of efficient site operations and the requirements of the relevant British Standards, the following is advisable *as far as practicable*:

- Limit the use of vibratory plant to lesser sensitive periods of the day, i.e. do not use particularly impacting plant early in the morning or later into the afternoon.
- Limit the number of plant items in use at any one time.
- Ensure that the least vibratory emitting plant is used where more than one variant may be available.
- All plant items should be properly maintained and operated according to the manufacturers' recommendations in such a manner as to avoid causing excessive vibration and noise.
- Any plant maintenance operations should occur as far away from noise-sensitive receptors as possible.
- All plant should be sited so that vibration impact at nearby noise-sensitive properties is minimised.
- Works should not be undertaken outside of the hours agreed with the local authority.

Further best practicable means have been highlighted below to further reduce the possibility of adverse noise impacts from demolition construction activities.



4.4.2 Selection of Piling Method

With respect to construction operations, the selection of piling technique has been reviewed an important first step to minimise resulting, off-site vibration impacts.

Piling should be limited to rotary bored methods (e.g. pre-auger, auger, DSM) and avoid the use of impact and/or vibratory methods, of significantly greater vibration emissions.

4.4.3 Selection of Equipment

The size and type of plant used for both demolition and construction activities has been viewed as important in controlling off-site PPV levels and associated effects at VSRs.

- In the case of specific equipment to be used that has not been considered within this report, the Contractor should provide manufacturers-stated data and/or measurements of vibration emission.
- The size of excavator-mounted breakers should be minimised during the demolition phase.
- The size of rollers used in compaction of the construction phase should be minimised, relevant to the size of roller drum and amplitude of drum. Low settings shall always be used, where available.
- Start-up and run-down of all vibratory rollers as far away as practical from VSRs.

4.4.4 Offset Distance Recommendations

To avoid the possibility of cosmetic damage, no identified works should occur within advised offset distances. Any vibratory activities should be ideally provided as far as practicable away from building structures.

The possibility of damage to underground services has been considered low from identified vibratory works, where similar offset distances have been adhered to. Notwithstanding, any specific asset-owner guidance shall be adhered to with respect minimum allowable offset distances.

4.4.5 Underground Services

It has been assumed that various actions will occur by the Contractor with respect to underground services and prior to the commencement of works.

- The asset owner will be made aware of the works and specific relation of proposed activities in relation to the asset.
- Underground assets will be physically identified in-situ and prior to commencement, in relation to any areas where ground investigation works are to occur.
- Any specific working requirements of the asset owner established through further liaison will be accounted for in the proposed working methods further to those highlighted within this preliminary investigation.

4.4.6 Training

The contractor's site induction programme and site rules must include good working practice instructions for site staff/managers and contractors to help minimise vibration impacts whilst working on the site.

Good working practice guidance/instructions should include, but not be limited to, the following points:

- Awareness of sensitive locations relative to the works site.
- Advocated offset distances and potential effects outlined within this assessment.



- Advocated practices required by asset owners of underground services.
- Plant used intermittently should be shut down between operational periods.
- Prompt reporting of any defective equipment/plant so that corrective maintenance can be taken.

4.4.7 Maintenance

A weekly inspection of all plant shall be made to ensure that:

- Any plant found to be requiring interim maintenance should be identified by the operator and repairs undertaken by a qualified engineer as soon as possible.
- Regular and effective maintenance of plant can play an important part in keeping vibration and noise levels under control.

4.4.8 Public Relations

Public relations should reflect the Contractor endeavouring to be a good neighbour and ensure suitable lines of communication, e.g.:

- Nominate a point of contact for issues relating to the site.
- Support a liaison committee.
- Give advance notice and explanation of activities that might cause complaint. A letter drop has been viewed as a suitable form of advanced notice.
- Keep systematic records of complaints and the remedial actions taken.
- Follow up complaints with correspondence and action.
- Ensure that site staff are environmentally aware and are trained to cope with issues. Seek to co-operate and avoid being adversarial.
- Hold a liaison meeting and provide information as freely as possible.
- Create a good impression by running a tidy and efficient site.

4.4.9 Action Plan

The following details the actions which should be undertaken following a complaint being received, namely:

- A complaints response system shall be maintained by the contractor for the site enabling any complaints regarding vibration to be reported and appropriate action taken.
- An investigation shall be instigated as soon as possible following receipt of the complaint to identify the cause of the complaint.
- Such an investigation may involve the identification and cessation of the activity or activities considered to be the cause of the complaint and/or the investigation of mitigation measures to reduce emission levels from the activity or activities.
- Any deviation from agreed working practices shall be identified immediately and conformance to the working practice reinstated.



5.0 Construction Noise Impact Assessment

An assessment of construction noise has been completed with reference to BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites'.

To set the Threshold Value SLR has referred to prior noise surveying undertaken at the site in 2025. The full details of the baseline environmental sound survey were presented in the Noise Impact Assessment ref: 425.066850.00001 Rev 2.0 dated 26th March 2026.

Measurements between 16th-20th at LTP1A experienced an equipment fault and have not been reported.

An additional walkover was undertaken on the night of the 3rd of June 2025 to further investigate the site during the evening and early night period. No significant noise sources were noted, and LTP1B was subsequently reinstalled between the 10th -11th June 2025 for 2025 to gather additional data.

Sound level measurements at Locations LTP2 on the 16th to 20th May 2025 were viewed to be a directly representative of proposed key site boundaries with transportation sources to the south of the site.

Observation Position OP1 was considered in respect to potential measurement of leisure noise relating to the Hunters Moon Holiday Park, however there was not any significant entertainment or leisure noise warranting measurement and qualitative discussion of findings was provided alternately.

5.1 Prior Baseline Survey

5.1.1 Overview

The relevant monitoring locations to each identified receptor have been noted and as a result noise monitoring locations derived and deemed appropriate as follows.

These locations are also shown in **Figure 5-A** as below.

- LTP1A – Representative of NSR's in Damask Way.
- LTP1B - Representative of rear of NSR's along Upper Marsh Way .
- LTP2 - Representative of NSR's along Upper Marsh Way/Smallbrook Road



Figure 5-A: Indicative Environmental Sound Survey Locations



Image courtesy of Google Earth

5.1.2 Measurement Details

At all monitoring locations, the microphone was placed 1.5 m above local ground level in free-field conditions, i.e. at least 3.5 m from the nearest vertical reflecting surface.

The following noise level indices were recorded:

$L_{Aeq,T}$ – The A-weighted equivalent continuous noise level over the measurement period, T .

$L_{A90,T}$ – The A-weighted noise level exceeded for 90 % of the measurement period.

$L_{A10,T}$ – The A-weighted noise level exceeded for 10 % of the measurement period.

$L_{Amax(F)}$ – The maximum A-weighted noise level during the measurement period.

5.1.3 Noise Climate

The sound climate is controlled toward the site boundaries by road traffic on the A36 significantly distant to the southern boundary.

Towards the site interior the sound climate is therefore less significantly controlled by anthropomorphic sound sources with a greater tendency to ecological biophonic sound sources correlating with the proximity of the nature reserve to the north-east.

5.1.4 Weather

The period of surveying incorporated weather conditions that were conducive for sound surveying works.



Temperatures ranged from 10 to 20 °C, average wind speeds remained below 5 m/s and there was an absence of any significant rain.

The above conditions are therefore considered to be suitable for obtaining representative measurements.

5.1.5 Baseline Noise Level Results

A summary of the baseline survey results is shown in **Table 5-1** and **Table 5-2** below.

Table 5-1 LTPB - Summary of Measured Noise Levels, Free-Field, dB

Date	Period	Logarithmic Average, $L_{Aeq,T}$	Median dB $L_{A90,T}$	10 th Highest dB $L_{Amax(F)}$
10/06/2025	Daytime 13:30-23:00	43	38	57
	Night Time 23:00-07:00	42	34	56
11/06/2025	Daytime 07:00-13:30	46	42	61

Table 5-2 Location 3 - Summary of Measured Noise Levels, Free-Field, dB

Date	Period	Logarithmic Average, $L_{Aeq,T}$	Median dB $L_{A90,T}$	10 th Highest dB $L_{Amax(F)}$
16/05/2025	Daytime 12:45 -23:00	48	33	68
	Night-time 23:00-07:00	44	25	62
17/05/2025	Daytime 07:00-23:00	47	32	69
	Night-time 23:00-07:00	45	31	59
18/05/2025	Daytime 07:00-23:00	48	33	71
	Night-time 23:00-07:00	44	28	62
19/05/2025	Daytime 07:00-14:15	48	33	69
	Night-time 23:00-07:00	46	31	65
20/05/2025	Daytime 07:00-10:15	49	35	65

5.2 Noise Sensitive Receptors

This assessment will consider the impact of construction noise upon the following Receptors:

- NSR 01: Receptors on Damask Way (shared boundary)
- NSR 02: Receptors on Damask Way (shared boundary)
- NSR 03: Henford House Care Home (20 m)
- NSR 04: Receptors on Upper Marsh Road (shared boundary)



- NSR 05: Turnpike Cottage (50 m)

The construction noise limit at each receptor during the Weekday hours of 07:00 - 19:00 and Saturday 07:00 - 13:00 is detailed in **Table 5-3** below.

The limit has been determined using the ABC method detailed in BS 5228-1:2009+A1:2014 and the survey data summarised above in Section 4.6.

Table 5-3: Threshold Construction Noise Limits dB(A)

Receptor	Threshold Noise Limit (dB)
NSR 01: Receptors on Damask Way (shared boundary)	65
NSR 02: Receptors on Damask Way (shared boundary)	65
NSR 03: Henford House Care Home (20 m)	65
NSR 04: Receptors on Upper Marsh Road (shared boundary)	65
NSR 05: Turnpike Cottage (50 m)	65

5.3 Construction Staging

5.3.1 Summary of assessments

The development has been divided into two phases or zones, these phases are identified as:

- Phase 1: Construction of Access from Upper Marsh Road
- Phase 2: Construction of Development Site

The following scenarios have been assessed:

- **Phase 1:**
 - Stage 1: Site Clearance and Enabling works
- **Phase 2:**
 - Stage 1: Site Clearance and Enabling works
 - Stage 2: Piling
 - Stage 3: Substructure works.

Figure 5-B below details the proposed Phases and indicative development area of the Site.

Figure 5-B: Indicative Phase and Development Locations





Image courtesy of Clifton Emery Design. Drawing No. 240707L0202 "Illustrative Layout"

For the purposes of this construction noise assessment, the noise level during typical construction activity stages have been determined below. The following Tables outline the items of plant which would typically be utilised during each activity, and the equipment sound power levels (determined from BS 5228:2009+A1:2014), and the percentage on-time of each item of plant.

For the purposes of the noise assessment, it is assumed in the first instance that the construction of each Stage will be in isolation.

It is accepted that the construction activities may vary from the activities presented, but as it would not be feasible to assess all construction configurations, the assessments undertaken in this report are considered a robust representation of anticipated construction noise levels.

5.4 Stage 1 - Site Clearance and Enabling works

Site clearance and enabling works typically include:

- Site working area establishment / securement.
- Service relocation and/or stopping up.
- Soft strip of retained features.
- Demolition (where applicable) and site clearance.
- Site investigation works / remedial activities (where required).

Table 5-4 details plant that is typically utilised during site clearance and enabling works.

Table 5-4: Stage 1 - Site Clearance and Enabling works - Plant List



Type of Machinery	Source Type	Quantity on Site	Sound Power Level, dB	Percentage Use
Tracked Excavator	Point	2	107	80 %
Spreading Fill (Dozer)	Point	2	109	25 %
Vibratory Roller	Point	2	102	30 %
Lorry (Unloading Tipper Truck)	Point	2	108	40 %
Concrete Truck Mixer	Point	2	103	17 %
Road Sweeper at 15 kmph	Line	2	104	10 %

5.4.1 Stage 2 - Piling

Table 5-5 details plant that is typically utilised during piling. There is potential that the piling rig used on site will be the SR-35 Hydraulic Rig, as such, data from this rig has been used to supplement the assessment. The ancillary plant associated with this has yet to be specified, therefore typical plant Sound Power Level data has been taken from BS 5228-1:2009+A1:2014.

Table 5-5: Piling - Plant List

Type of Machinery	Source Type	Quantity on Site	Sound Power Level, dB	Percentage Use
SR-35 Piling Rig ¹	Point	1	75	50 %
Concrete Drum	Point	1	99	80 %
Concrete Pump (pumping)	Point	1	112	70 %
Cherry Picker Genie	Point	1	95	60 %
Compressor	Point	1	102	50 %
Concrete Truck Mixer	Point	1	103	17 %
Tracked Excavator	Point	1	107	80 %
Dumper Trucks	Point	2	106	20 %

5.5 Stage 3 - Substructure works

Substructure works typically include:

- Creation and installation of new concrete / steel Substructure (i.e. concrete boxes, timber/steel frames etc.).
- Application of façades and finishes to newly construction-built form.
- Internal fit outs and plant/machinery installations.

It is envisaged that this stage would include the erection of buildings details the plant utilised during this stage. **Table 5-6** summarises the indicative plant schedule proposed.

Table 5-6: Substructure Works - Plant List

¹ <https://www.soilmec.co.uk/wp-content/uploads/2020/12/SR35-EVO.pdf>



Type of Machinery	Source Type	Quantity on Site	Sound Power Level, dB	Percentage Use
Concrete Truck Mixer	Point	2	103	17 %
Cherry Picker Genie	Point	2	95	60 %
Lorry (unloading)	Point	2	108	40 %
Petrol Saw	Point	3	109	40 %
Tracked Excavator (rubber tracks)	Point	2	107	80 %
Dumper Trucks	Point	2	106	20 %
Poker Vibrator	Point	2	97	40 %
Mobile Crane Operation	Point	2	95	90 %
Telescopic Forklift (17m) JCB 540	Point	2	107	80 %
Hand Tools (hammers)	Point	4	98	40 %
Concrete Pump (pumping)	Point	2	112	70 %
Road Sweeper at 15 kmph	Line	2	104	10 %

5.6 Noise Prediction Methodology

Using the sound power levels and associated percentage on-times shown in the tables above, noise levels from each construction activity have been predicted at the nearest noise sensitive receptors to the Site.

The predictions have been undertaken using the proprietary noise modelling software CadnaA which incorporates the methodology outlined in BS 5228:2009+A1:2014.

It should be noted that the below constitute specific modelling factors, which are not strictly included within the simplified method of calculation stated.

The models assume:

- A ground absorption factor of 0.5.
- A reflection factor of 2.
- A daytime receiver height of 1.5 m.
- The attenuation and reflections provided by the surrounding buildings.
- A 2.5 m high acoustic hoarding (rigid board, with minimum surface mass 10kg/m²) around the perimeter of the Site

During Stage 1 and 2 of each sub phase, it has been assumed that most of the plant will be operating at ground level. A height of 2 m above ground level of each item of plant has been assumed.

During Stage 3, substructure works, some plant will be operating at increased heights. A height of 12 m above ground level of each item of plant (that will operate at height) has been assumed.

The location of each item of plant during each stage of construction has been positioned across the Site. At times plant would be closer and further away from the receptor.

5.7 Predicted Noise Levels and Assessment

With reference to the methodology above, the predicted noise levels for each phase and stage of the construction works at each of the nearest noise-sensitive receptors are shown in **Table 5-7** below.



The Table also compares the predicted noise levels with the threshold value adopted for the assessment.

Noise levels have been predicted at a height of 1.5 m which is representative of a ground-floor window for each receptor.

Table 5-7: Predicted Noise levels and Assessment, $L_{Aeq,T}$ dB

Receptor	Phase	Stage	Predicted Noise Level (dB $L_{Aeq,T}$)	Threshold Value (dB $L_{Aeq,T}$)	Difference (dB)
1	1	1	71.6	65	+6.6
	2	1	70.3		+5.3
		2	72.4		+7.4
		3	72.8		+7.8
2	1	1	70.1	65	+5.1
	2	1	53.6		-11.4
		2	53.5		-11.5
		3	56.6		-8.4
3	1	1	64.2	65	-0.8
	2	1	51.6		-13.4
		2	50.7		-14.3
		3	55.1		-9.9
4	1	1	60.4	65	-4.6
	2	1	57		-8
		2	54.3		-10.7
		3	59.6		-5.4
5	1	1	55.8	65	-9.2
	2	1	55.2		-9.8
		2	54.9		-10.1
		3	60.8		-4.2



It can be seen from, **Table 5-7** that the noise limit for construction noise will be met at the majority of the nearest NSR's assessed during the various phases and stages of construction.

Although noise levels are exceeded during some limited exercises as listed below:

- Phase 1 – Stage 1 Site Clearance – NSR01 and NSR02
- Phase 2 – Stage 1 Site Clearance – NSR01
- Phase 2 – Stage 2 Piling – NSR01
- Phase 2 – Stage 3 Substructure – NSR01

With the implementation of a Construction Environmental Management Plan (CEMP), empirical evidence suggests noise impact levels from construction may be reduced by up to 5 dB(A).

In which circumstances Phase 2 – Stage 2 Piling and Stage 3 Substructure would be the primary outstanding concern at NSR01 with minor exceedances of identified thresholds in the region of 2dB remaining.

Example mitigation measures that may be included in the CEMP are included in **Section 5.8**.

It is also highlighted that this assessment is based on the Annex to BS 5228 2009+A1:2014 source noise levels from “typical” plant.

It should be evident that the contractor could now proactively select equipment with lower noise levels than indicated and proactively minimise leaving engines running etc, near sensitive receptors when equipment is not in direct use, using this modelling assessment as an “upper worst-case guideline” and accordingly select smaller or quieter plant, or using plant to the minimum required frequency and period to readily mitigate source noise levels during construction.

Both the concrete pump (as sized), and the unloading of lorries have been indicated to be significant sources, when working in this area. Thus, particular attention should be paid to equipment selection, siting, and minimising the duration of these activities when in relative proximity to Damask Way.

Mitigation could also include HGV unloading strictly to a compound area further east, to mitigate the cumulative impact of this source also. With forklifts being utilised for “in site” distribution of materials if safe to do so.

Once the above is considered and a CEMP is implemented, it is anticipated that impacts should largely meet the indicated BS5228:2009+A1:2014 threshold at each receptor during all phases.

To further capture potential issues or exceedances a schedule of noise monitoring may be proposed. Further details are proposed in **Section 5.8**.



5.8 Noise Mitigation Measures for Inclusion in the CEMP

5.8.1 General Measures- Noise

Several safeguards exist to minimise the effects of construction noise which include:

- the various EC Directives and UK Statutory Instruments that limit noise emissions of a variety of construction plant;
- guidance set out in BS 5228-1:2009+A1:2014, that covers noise control on construction and open sites; and
- the powers that exist for local authorities under Sections 60 and 61 of the Control of Pollution Act 1974 to control environmental noise and pollution on demolition sites.
- It is recommended that the precise mitigation measures to control noise from the works are agreed with the local authority prior to the works starting. Generic measures below are given to illustrate the range of techniques available.
- The adoption of Best Practicable Means, as defined in the Control of Pollution Act 1974, is usually the most effective means of controlling noise from sites. Within the constraints of efficient site operations and the requirements of the relevant British Standards, the following is advisable:
 - limit the use of particularly noise plant, i.e. do not use particularly noisy plant early in the morning;
 - limit the number of plant items in use at any one time;
 - plant maintenance operations should be undertaken as far away from noise-sensitive receptors as possible;
 - phasing the works to maximise the benefit from perimeter structures;
 - any compressors brought on to site should be silenced or sound reduced models fitted with acoustic enclosures;
 - reduce the speed of vehicle movements;
 - all pneumatic tools should be fitted with silencers or mufflers;
 - ensure that operations are designed to be undertaken with any directional noise emissions pointing away from noise-sensitive receptors where practicable;
 - when replacing older plant, ensure that the quietest plant available is considered wherever possible; any deliveries/spoil removal vehicles should be programmed to arrive and depart during daytime hours only.
 - drop heights must be minimised when loading vehicles with rubble.
 - care should be taken when loading vehicles to minimise disturbance to local residents. Vehicles should be prohibited from waiting within the site with their engines running;
 - all plant items should be properly maintained and operated according to the manufacturers' recommendations in such a manner as to avoid causing excessive noise. All plant should be sited so that the noise impact at nearby noise-sensitive properties is minimised;
 - local hoarding, screens or barriers should be erected as necessary to shield particularly noisy activities; and



- any problems concerning noise from construction works can sometimes be avoided by taking a considerate and neighbourly approach to relations with local residents. Works should not be undertaken outside of the hours agreed with the local authority.

Experience from other sites has shown that by implementing these measures, typical noise levels from construction works can be reduced by 5 dB(A) or more.

Further best practice means are set out below to further reduce the possibility of adverse noise impacts from construction activities.

5.8.2 Training

The contractor's site induction programme and site rules must include good working practice instructions for site staff/managers and contractors to help minimise noise whilst working on the site.

Good working practice guidance/instructions should include, but not be limited to, the following points:

- Avoid un-necessary revving of engines;
- plant used intermittently should be shut-down between operational periods;
- avoid reversing wherever possible;
- drive carefully and within the site speed limit at all times; and
- report any defective equipment/plant as soon as possible so that corrective maintenance can be taken.

5.8.3 Maintenance

A weekly inspection of all plant shall be made to ensure that:

- Any plant found to be requiring interim maintenance should be identified by the operator and repairs undertaken by a qualified engineer as soon as possible.
- Regular and effective maintenance of plant can play an important part in keeping noise levels under control.
- Always ensure that doors fitted to acoustic enclosures around fixed plant remain closed, the fitting of self-closing mechanisms is advisable.

5.8.4 Public Relations

Endeavour to be good neighbours, i.e.:

- get to know the neighbours, be concerned about them and try to understand their problems, encourage them to know the site personnel, listen as well as talk,
- hold a liaison meeting and provide information as freely as possible; and
- create a good impression by running a tidy and efficient site.
- Ensure lines of communication, e.g.:
- nominate a point of contact for issues relating to the site,
- support a liaison committee,
- give advance notice and explanation of activities that might cause complaint,
- keep systematic records of complaints and the remedial actions taken, and



- follow up complaints with correspondence and action.
- Ensure that site staff are environmentally aware and are trained to cope with issues.
- Do not rely on the letter of the law where there are obvious problems but culpability cannot be easily proved; be prepared to be flexible.



6.0 Monitoring

6.1.1 Noise and Vibration Monitoring

In the event of complaints, a programme of noise and vibration monitoring could be implemented as a proactive measure to demonstrate that construction activities remain below acceptable noise thresholds, that Best Practicable Means (BPM) are being applied, and that vibration levels (PPV) remain below building-damage thresholds during active work phases.

Off-site or boundary noise and vibration monitoring could be undertaken by a suitably qualified person appointed specifically for this purpose, particularly if changes to construction methodology, machinery, or site layout occur relative to those described in this assessment.

Where warranted, a complaint procedure and measurement methodology should be agreed prior to the commencement of site works, for example following the approach set out in BS 4866:2010.

If monitoring is required, the following location has been identified as relevant:

- On-site: At the boundary closest to the nearest residential receptor (NSR 01), located to the rear of Damask Way.



7.0 Conclusion

Backhouse Housing Limited has appointed SLR Consulting Limited (SLR) to undertake a construction noise assessment for the construction on Land at Damask Way, Warminster.

To assess the noise impact of the proposals this Report includes:

- An assessment to determine the impact of noise and vibration arising from construction activities upon the nearest noise sensitive receptors to the Site. This assessment has been completed with reference to BS 5228:2009+A1:2014 '*Code of practice for noise*' and '*Vibration control on construction and open sites – Part 1: Noise and Part 2: Vibration*'.

The assessment has found that:

- that the noise limit for construction noise will largely be met at the nearest NSR's assessed during the various subphases of construction assuming a 2.5 m high hoarding has been installed around the perimeter of the site.
- With the implementation of a Construction Environmental Management Plan (CEMP), noise levels from construction may be reduced by up to 5 dB(A).
- Additional measures for consideration have been highlighted in relation to selection of specific plant items to minimise any remaining exceedances of the assessed thresholds.
- Examples measure that may be included in the CEMP are included in **Section 5.8**.

The construction vibration assessment has established standoff distances for various work types in respect to building damage, and human perceptibility thresholds.

Suitable types of compactions and piling activity have been identified in respect to the site context.

In addition to the above, a complaint's procedure has been drafted which outlined the actions required if a noise or vibration complaint is received from any of the residents to the construction site including a subsequent schedule of monitoring which could be undertaken for both construction noise and/or vibration at the most sensitive receptors if complaints should arise.

In view of the above the results of the construction noise and vibration assessments support the development construction methodology when considered in the context of implementation of best practicable means mitigation and activity.



8.0 Closure

The assessment has required a suitable level of technical ability and has been undertaken by a Suitably Qualified Person (SQP). An individual with all the following credentials has been considered a SQP for this assessment:

- Has a minimum of three years' verifiable experience (within the last five years) of providing noise impact assessments in planning. Such experience has clearly demonstrated a practical understanding of factors affecting acoustics in relation to the proposed development use and in the built environment in general, including acting in an advisory capacity to provide recommendations and design advice in planning, and;
- Holds a recognised acoustic qualification and membership of an appropriate professional body. The primary professional body for acoustics in the UK is the Institute of Acoustics.

This assessment has been led and managed by a SQP as defined above.

Where some elements of the assessment (e.g. measurements) have been carried out by an acoustician who does not meet the requirements above, this has been undertaken with the direct guidance and supervision of a SQP who has reviewed, agreed and overseen the measurement methodology and any results obtained.

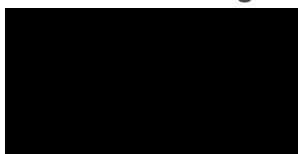
The SQP confirms that the relevant measurements and calculations:

- Represent good industry practice in accordance with available guidance.
- Are appropriate given the development being assessed and scope of works proposed.
- Avoid invalid, biased and exaggerated claims.

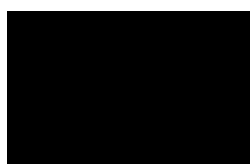
The checker and author of this document confirm that they both comply with the definition of a SQP defined in this Section.

Regards,

SLR Consulting Limited



Zoe Richardson, MIOA
Senior Acoustic Consultant



Vince Taylor, BSc. (Hons) MSc. MIOA
Technical Director





Appendix A Technical Glossary

Damask Way, Warminster

Damask Way, Warminster

Backhouse Housing Limited

SLR Project No.: 425.066850.00001

26 March 2026

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0dB (the threshold of hearing) to over 120 dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

Table 01-1 Sound Levels Commonly Found in the Environment

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

A.1 Acoustic Terminology

dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2×10^{-5} Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
L_{Aeq}	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.
L_{10} & L_{90}	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L_{10} index to describe traffic noise.
L_{Amax}	L_{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.



