

Residential Development, Goulden St., New Cross, Manchester M4

Construction Impact Report

for Mulbury Homes, Great Oak Farm, Mag Lane, Lymm, WA13 0TF

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Executive Summary

Environoise Consulting Limited has been instructed by Mulbury Homes to do a noise and vibration impact assessment associated with enabling and construction works for a proposed 8-storey residential apartment development on Goulden Street, New Cross, Manchester M4.

Predicted Noise Levels

- Predicted construction noise levels exceed the 65dB $L_{Aeq,T}$ target at the nearest residential receptors when assessed to the BS5228-1 'ABC method'.
- Section E2 of BS5228 states that a pragmatic approach should be taken when assessing the effects of any construction project and therefore reference to a 'fixed limit' of 75dB $L_{Aeq,T}$ (for urban environments adjacent to main roads) has also been made. The target is typically met for ground works, but exceeded by up to 6dB for piling works.
- As per BS 5288, noise levels should be acceptable where activities are temporary, relatively short-term with regular liaison with nearby residents and where best practice techniques are adopted.
- Recommendations for noise mitigation are provided in section 4.3.
- Short-term noise monitoring at the site boundary or boundary of receptor is recommended and assessed against appropriate BS 5228-1 criteria.

Predicted Vibration Levels

- The vibration levels due of piling at the nearest point to residential receptors (11 metres) will meet the BS 5228-2 recommended criteria of ≤ 15.0 mm/s to avoid cosmetic damage to residential buildings. The impact on receptors could cause an impact of 'low' amplitude and 'moderate' severity which means that 'vibration might be just perceptible in residential environments'.
- Vibration from the proposed 6T compaction roller will be acceptable at a minimum distance of 15m from the nearest receptors. Use of the roller should be kept to a minimum where distances are below this.
- The assessment of construction ground-borne vibration transmission to receptors is outline only. Short-term vibration monitoring of piling activities at the site boundary or receptor is recommended and compared to appropriate BS 5228-2 criteria.

1 Criteria

1.1 Noise

- 1.1.1 British Standard 5228-1:2009+A1:2014 '*Code of practice for noise and vibration control on construction and open sites. Noise*'ⁱ provides guidance on the prediction and assessment of noise and vibration from development sites.

ABC Method

- 1.1.2 The 'ABC Method' prescribed in the standard requires the ambient noise level at existing noise sensitive properties, rounded to the nearest 5dB integer and compared to the values shown in Table 1.1 to determine the appropriate threshold category value either A, B or C.

Table 1.1 Threshold of significant effect at nearest receptors.

Assessment category and Threshold value period [L _{Aeq} (dB)]	Threshold value (dB)		
	Category A	Category B	Category C
Daytime (07.00 -19.00hrs)	65	70	75
Saturdays (07.00 – 13.00hrs)			

Category A: Threshold values to use when the ambient noise levels (when rounded to the nearest 5dB) are less than this value.

Category B: Threshold values to use when the ambient noise levels (when rounded to the nearest 5dB) are the same as Category A values.

Category C: Threshold values to use when the ambient noise levels (when rounded to the nearest 5dB) are higher than Category A values.

- 1.1.3 It should be noted that the BS 5228 criteria relates to the main long term works i.e. operations that are done on a daily or regular basis. Higher noise levels may be necessary to enable some short-term operations to be undertaken.

Potential significance based on fixed noise limits

- 1.1.4 Section E.2 'Potential significance based on fixed noise limits' of BS 5228 states that a pragmatic approach should be taken when assessing the effects of any construction project. It also offers guidance that 'noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut. Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed.

- 70 decibels (dBA) in rural, suburban and urban areas away from main road traffic and industrial noise;
- 75 decibels (dBA) in urban areas near main roads in heavy industrial areas.

These limits are for daytime working outside living rooms and offices’.

1.2 Vibration

- 1.2.1 BS 5228-2:2009+A1:2014 ‘Code of practice for noise and vibration control on construction and open sites. Vibration’ⁱⁱ provides guidance on construction vibration. The effects of vibration on humans within buildings depending on Peak Particle Velocity (PPV) levels are described in Table B1 of BS 5228-2, reproduced as Table 1.2. A semantic scale for the impact on human receptors in residential buildings is also provided together with a significance of effect descriptor considering the high sensitivity of residential receptors.

Table 1.2: Construction vibration levels and magnitude impact criteria.

Vibration Level [PPV (mm/s)]	Effect Description	Magnitude of Impact	Significance Effect Level
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.	Negligible	Not Significant
0.3	Vibration might be just perceptible in residential environments.	Low	Moderate
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.	Medium	Major / Moderate
10	Vibration is likely to be intolerable for any more than a very brief exposure to this level.	High	Major

- 1.2.2 Cosmetic damage (not structural damage) is most likely to occur to properties that are within the first 20 metres (m) of piling activities. Table B.2 of BS 5228-2 gives vibration limits for transient excitation for different types of buildings and are reproduced in Table 1.3. Vibration levels at considered distances can be estimated from existing piling vibration data provided in BS 5228-2.

Table 1.3: Guidance on transient vibration levels for cosmetic damage.

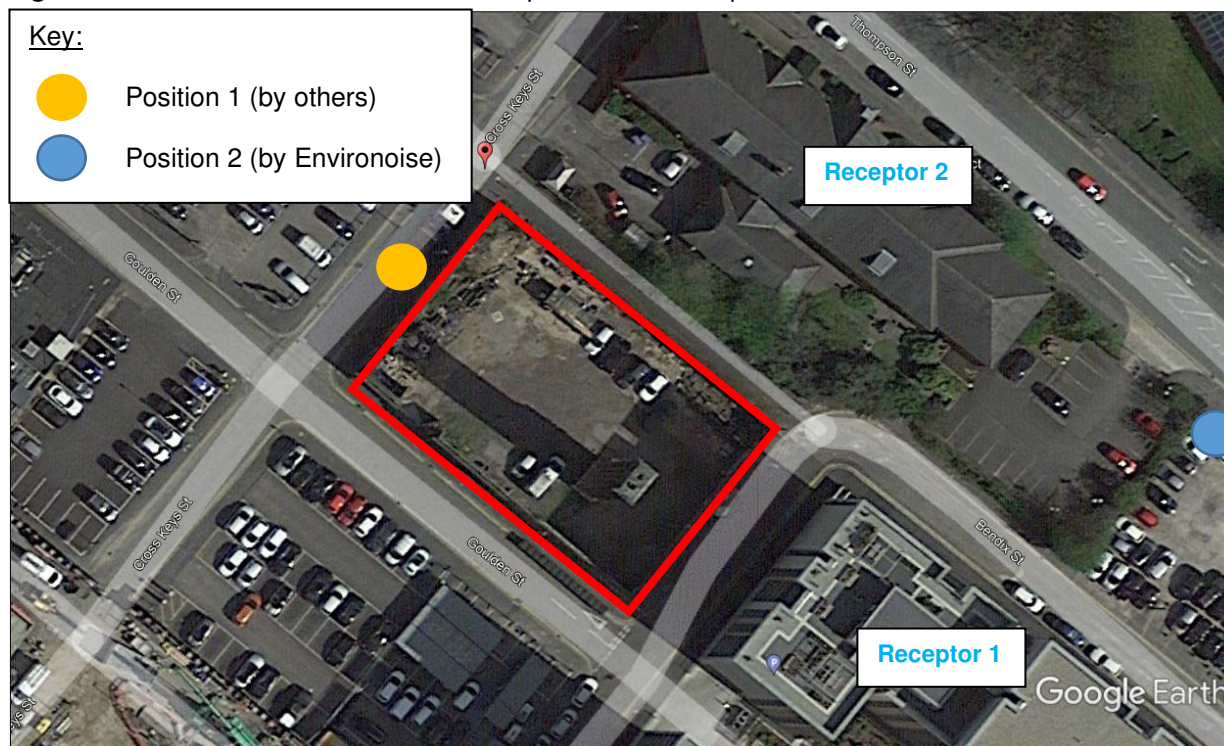
Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse ¹	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures (industrial and heavy commercial buildings)	50 mm/s at 4 Hz and above	
Unreinforced or light framed structures. (residential or light commercial buildings)	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz ²	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

2 Noise Surveys

2.1 Overview

- 2.1.1 Daytime noise surveys have been done at the site by others¹ on 29.10.2019 and 30.10.2019 to inform the planning application for the proposed development. A survey was done by Environoise on Thursday 13th October 2020 (on behalf of the Contractor) to inform a construction noise and vibration impact assessment for the Mulbury build of two other residential apartment blocks at Newcross. The results reported for appropriate survey positions (see Figure 2.1) have been cross referenced to determine an ambient noise level representative of that experienced by the nearest residential receptors.

Figure 2.1: Location of noise measurement position and receptors.



¹ Noise Impact Assessment (ref: 18070) dated 11.11.2019 by dBX Acoustics

2.2 Ambient Noise Levels

- 2.2.1 The daytime ambient noise level determined at Positions 1 and 2 are presented in Table 2.1. Please note, we cannot be held responsible for the accuracy of noise data obtained by others.

Table 2.1: Measured noise data summary.

Position	L _{Aeq,T} (dB)
1	60
2	67

- 2.2.2 We have used the lower ambient noise level determined at Position 1 for our assessment. Based on this, the BS 5228-1 'ABC Method' target of 65dB L_{Aeq,T} is applicable.

3 Noise Impact Assessment

3.1 Proposed Works

3.1.1 The following construction working hours are proposed:

- Monday to Friday: 08.00 to 16.30hrs, Monday to Friday.

Works Overview

3.1.2 Table 3.1 gives the schedule² for high-noise level works and corresponding machinery and noise data.

Table 3.1: Proposed activities and machinery.

Activity	Date of works	Machinery	Example Model	Sound level
Piling	26/05/21 – 23/06/22	Piling rig	Soilmec SR-35	110dB L _{WA}
		Concrete pump and 9m ³ concrete agitator drum	Putzmeister PM55	80dB L _{pA} at 10 metres
		Excavator	Hitachi ZX135US-6	99dB L _{WA}
		Compressor	Compair C38	98dB L _{WA}
		6T Compaction roller	BS5228 – Ref. table D3-115	102dB L _{WA}
		3T Dump truck	Wacker Neuson 3001	101dB L _{WA}
Groundworks	25/10/22 – 30/01/23	6T Compaction roller	BS5228 – Ref. table D3-115	102dB L _{WA}
		Generator	Honda GX-160	65dB at 10 metres ³
		Excavator	Hitachi ZX135US-6	99dB L _{WA}
		Compressor	Compair C38	98dB L _{WA}
		3T Dump truck	Wacker Neuson 3001	101dB L _{WA}

² As informed by Peter Leonard, Mulbury in an e-mail to Miles Woolley, Environoise Consulting dated 30.11.2021 and the Mulbury Goulden Street Programme.

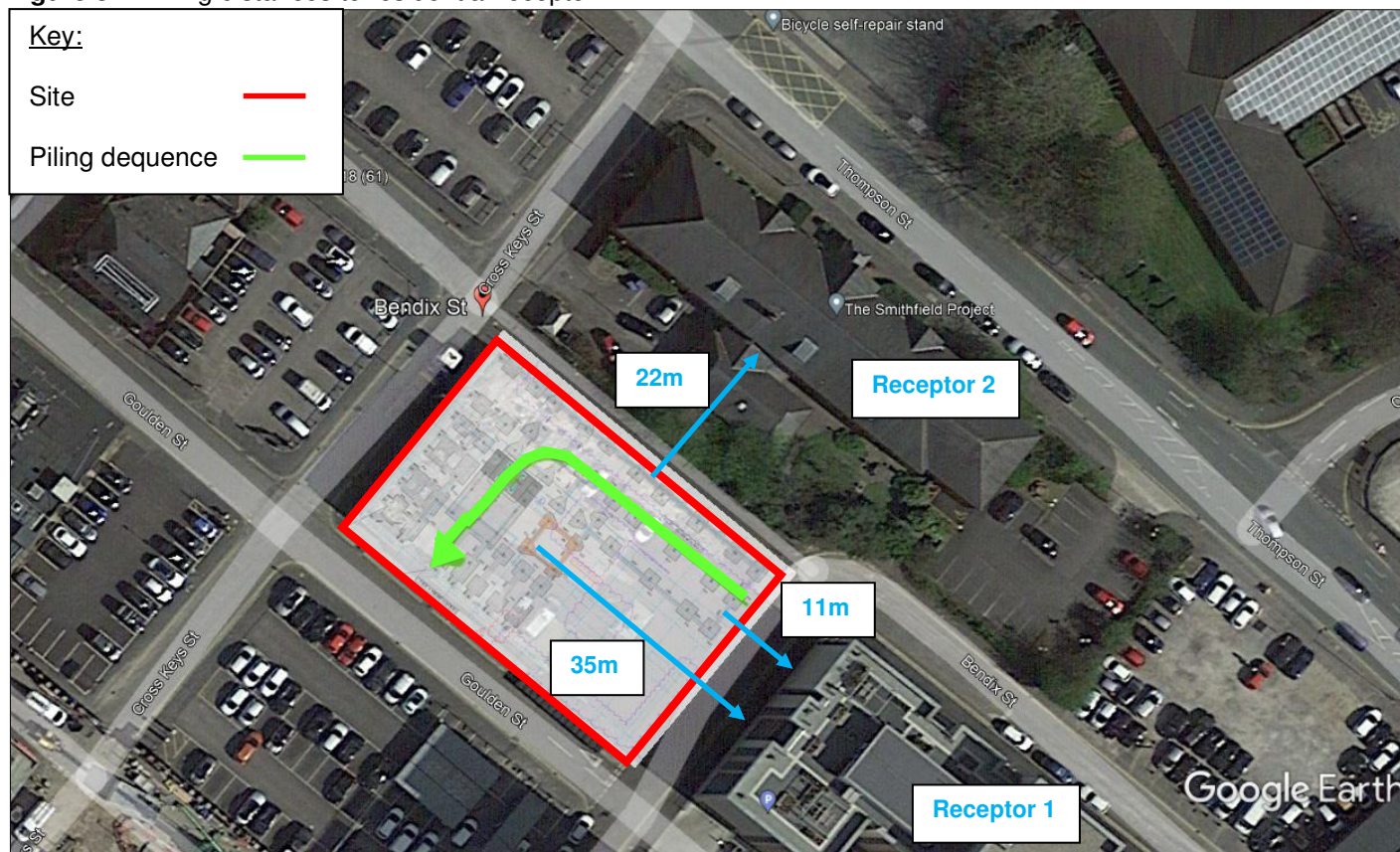
³ Noise data does not state distance the level (65dB) applies to. It is considered to be an A-weighted value at 10-metres which would correspond to a typical generator noise level.

3.2 Piling

3.2.1 450mm diameter CFA piles are to be installed to a depth of up to 25m (TBC) and will consist of drilling, drill withdrawal and concreting and finally, steel reinforcement cage installation. The piling will start at the east of the site (adjacent to Bendix Street), progress to the north-west and then finish at the west of the site (adjacent to Goulden Street), see Figure 3.1. The distance from the centre-point of site / central pile and nearest point of site / nearest pile is also shown. The piling will occur at a minimum distance of 1m from the existing site boundary wall.

3.2.2 An assumed piling 'on-time' of 50% has been considered. The on-times for other equipment are shown in Appendix A.

Figure 3.1: Piling distances to residential receptor.



3.3 Groundworks

- 3.3.1 The on-times for ground works machinery is shown in Appendix A. The centre-point of site and nearest point to the receptors (as given in Figure 3.1) have been considered within our calculations.

4 Noise Impact Results

4.1 Noise Level at Receptor 1

- 4.1.1 Table 4.1 shows the predicted overall typical noise levels at the Receptor 1 for piling and for groundworks (full calculations in Appendix A provide levels for individual machinery) and a comparison with the 'fixed limit' criterion (as per section 1.1.3). Table 4.2 provides a calculation for each phase where activity is at the closest point to Receptor 1. Screening noise mitigation offered by the existing brick wall will be negligible due to the height of the receptor 8-storey building.

Table 4.1: Typical noise impact to receptors.

Construction Phase	BS 5228 'fixed limit' [$L_{Aeq,T}$ (dB)]	Noise at nearest receptors [$L_{Aeq,T}$ (dB)]	Excess over target (dB)
Piling	75	77	+2
Groundworks		70	0

Table 4.2: Highest calculated noise impact to receptors.

Construction Phase	BS 5228 'fixed limit' [$L_{Aeq,T}$ (dB)]	Noise at nearest receptors [$L_{Aeq,T}$ (dB)]	Excess over target (dB)
Piling	75	87	+12
Groundworks		79	+4

Discussion of Results

- 4.1.2 As shown in Table 4.1, typical piling and groundworks noise levels may exceed the 'ABC Method' criterion of 65dB $L_{Aeq,T}$. However, the 'fixed limit' is only exceeded by 2dB for piling and is met for ground works. This is likely to be acceptable where works are temporary and resident liaison and best practice techniques are adopted, see sections 4.3 and 6.
- 4.1.3 As shown in Table 4.2, 'worst case' piling and groundworks noise levels may exceed the 'ABC Method' criterion of 65dB $L_{Aeq,T}$. The 'fixed limit' is exceeded by 12dB for piling, but only 4dB for ground works. Piling adjacent to Receptor 1 will be in the short-term as operations start and move away from Receptor 1 (as shown in Figure 3.1). Therefore, noise is likely to be acceptable where works are temporary, resident liaison and best practice techniques are adopted and recommendations in section 4.3 are considered.

4.2 Noise Level at Receptor 2

- 4.2.1 Table 4.3 shows the predicted noise levels at the closest point to Receptor 2 for piling and for groundworks (full calculations in Appendix A provide levels for individual machinery) and a comparison with the 'fixed limit' criterion (as per section 1.1.3).

Table 4.3: Highest calculated noise impact to Receptor 2.

Construction Phase	BS 5228 'fixed limit' [$L_{Aeq,T}$ (dB)]	Noise at nearest receptors [$L_{Aeq,T}$ (dB)]	Excess over target (dB)
Piling	75	81	+6
Groundworks		73	0

Discussion of Results

- 4.2.2 As shown in Table 4.3, 'worst case' piling and groundworks noise levels may exceed the 'ABC Method' criterion of 65dB $L_{Aeq,T}$. The 'fixed limit' is exceeded by 6dB for piling but is met for ground works. Noise is likely to be acceptable where works are temporary, resident liaison and best practice techniques are adopted and recommendations in section 4.3 are considered.

4.3 Recommendations

Piling Method

- 4.3.1 The excess over the BS 5288 noise target during piling is largely due to the high sound power level associated with the use of the auger piling rig. An alternative, quieter method such as press piling, if practicable, would reduce operational noise levels at the receptors.

Screening

- 4.3.2 If press piling is not practicable, a portable / retractable construction noise barrier could be considered when operating within 22m of Receptor 1. The barrier material should have a surface mass of $\geq 7\text{kg/m}^2$. The width of a vertical barrier should generally encompass the noise source and have a minimum height so that the main source of noise is not visible from the 8-storey Receptor 1 building. An overall reduction of between 5 to 10 dB(A) can be achieved.
- 4.3.3 A sound reduction of 8dB(A) is predicted at the 2-storey Receptor 2 building where 2.4m high homogenous hoarding is installed along the north-east boundary of the site, see calculation in Figure A7, Appendix A. This will sufficiently reduce piling and ground works at Receptor 2.

Resident Liaison

- 4.3.4 Section 6.3 'Issues associated with noise effects and community reaction' of BS 5228 Part 1 part b (existing ambient noise levels) seems most appropriate where the duration of the works is relatively short, and states:

'Experience of complaints associated with industrial noise sources indicates that the likelihood of complaint increases as the difference between the industrial noise and the existing background noise increases. Some types of open sites, such as quarries and landfill sites, are usually assessed in this manner. For some large infrastructure projects that require an environmental statement to be prepared, construction noise is sometimes assessed by comparing the predicted construction noise (plus ambient noise) with the pre-construction ambient noise. However, it is generally assumed that a greater difference might be tolerated, than for an industrial source, when it is known that the operations are of short or limited duration, and the critical issues are likely to include interference with speech communication and/or sleep disturbance.'

- 4.3.5 Section C 'Duration of site operations' of the same section also states:

'...Local residents might be willing to accept higher levels of noise if they know that such levels will only last for a short time. It is then important that construction activities are carried out in accordance with the stated schedule and that the community is informed of their likely durations.'

- 4.3.6 Considering the above, we recommend that a construction schedule is issued to local residents and that open communication is established and retained thereafter.

Noise Monitoring

- 4.3.7 Short-term monitoring of noise levels should be done at the site boundary or the boundary of the receptors during piling and groundworks to assess the levels of noise against appropriate BS 5228-1 criteria.

5 Vibration Impact Assessment

5.1 Overview

- 5.1.1 In this section, the level of vibration (peak particle velocity [mm/s]) due to compaction and piling works has been predicted at the closest proposed location that the works will be carried out to the nearest receptors.

5.2 Piling

- 5.2.1 Vibration levels of the Soilmec SR-35 piling rig have not been made available. Therefore, vibration levels have been taken from historic case data⁴ given in Appendix D of 5228-2:2009+A1:2014 for auger piling systems which states a peak particle velocity of level of 0.4mm/s at 10 metres.
- 5.2.2 The vibration levels due to piling at the nearest point to residential receptors (11 metres) will meet the BS 5228-2 recommended criteria of ≤ 15.0 mm/s to avoid cosmetic damage to residential buildings. An impact of 'low' amplitude and 'moderate' severity for human receptors is likely which means that 'vibration might be just perceptible in residential environments'. Most piling will occur at a distance further than 11 metres and therefore may not be perceptible to residents.

5.3 Groundworks

- 5.3.1 Vibration levels for the considered 6T compaction roller are not known. However, Table 5.1 indicates that a minimum safe working distance of 15m would be acceptable. The use of the compaction roller less than 15m from the Receptor 1 should be kept to a minimum.

5.4 Other Groundworks

- 5.4.1 Resultant ground borne vibration levels from other groundwork construction techniques to receptors vary significantly as the level is dependent on ground type relative to both the building under construction and the receptor, construction technique and distance. Therefore, the transmission of ground-borne vibration to receptors during construction cannot be accurately predicted. However, for guidance, Table 5.1 provides estimates of the minimum distances to receivers and equipment that is most likely to be vibration intensive. This allows for a comparison for safe working distances when determining the likely vibration impacts of the construction scenarios as well as 'human response'.

⁴ BS 5228 case reference numbers 103 (1983 Romford) and 104 (1985 London W1).

Table 5.1: Recommended safe working distances for vibration intensive plant.

Plant item	Description	Safe working distance (metres)	
		Cosmetic damage*	Human response
Vibratory roller	<50 kN – typically 7 – 13t	15	100
	<50 kN – typically 13 – 18t	20	
	<50 kN – > 18t	25	
Small hydraulic hammer	300kg 18t to 34t excavator	2	7
Medium hydraulic	1600kg 5 to 12t excavator	7	23
Large hydraulic hammer	1600kg 12 to 18t excavator	22	73

*From BS 7385 Part 2 1993 Evaluation and measurement for vibration in buildings Part 2.

5.5 Recommendations

Piling Method

- 5.5.1 Similar to section 4.3.1 of this report, press piling would be expected to have lower resultant vibration levels, if a practicable method for this site.

Vibration Monitoring

- 5.5.2 Short-term monitoring of vibration levels should be done at the site boundary or boundary of the receptors during piling activity and compared against appropriate BS 5228-2 criteria.

6 Best Practice Techniques

6.1 Noise

6.1.1 The contractor should be committed to following best practice construction techniques to minimise their noise impact on receptors; such measures are likely to include:

- Plant should be shut down when not in use or for long periods of inactivity between uses. Similarly, delivery vehicles should not leave engines running idle whilst stationary.
- Regular maintenance of construction plant.
- All vehicles and mechanical plant should be fitted with effective exhaust silencers and should be maintained in good, efficient working order.
- Stationary plant (e.g. generators, compressors and pumps) should be positioned so as to cause minimum noise disturbance through distance and shielding to receptors. Additionally, localised screens/enclosures should be used to reduce noise from static sources.
- All ancillary pneumatic percussive tools should be fitted with mufflers or silencers as recommended by the respective manufacturers.
- Handled materials should be placed rather than dropped. Care should be taken when unloading vehicles to minimise noise.
- Compressors should be fitted with and sealed acoustic covers and lined with a suitable sound-absorbent material. Attention should be given to selecting the quietest available and appropriate plant.
- Delivery routes to the site should be marked so that the noise impact on local residents is reduced; deliveries should be made during the daytime period only.
- The impact of noise on local residents can be ameliorated by establishing and maintaining a line of communication with affected residents. This should include the informing of them of any periods of construction which are likely to produce atypically high noise levels.
- Works should not generally be undertaken outside of the agreed hours of operation. However, if works outside of normal working hours is required, then the residents should be notified.
- Short-term noise monitoring at the boundary of the nearest receptors during activities of expected high levels of noise should be considered.

6.2 Vibration

6.2.1 The contractor should be committed to following best practice construction techniques to minimise vibration impact to receptors; such measures are likely to include:

- Noise caused by vibrating machinery having rotating parts can be reduced by attention to proper balancing.
- Wherever possible, the use of hydraulic attachments is preferred to pneumatic breakers. Where the use of impact hammers is necessary, their attachment to larger and heavier excavators often can reduce the level of vibration.

Short-term monitoring of vibration levels at the boundary of the nearest receptors during activities of expected high levels of vibrations should be considered.

Appendix A: Calculations

Figure A1: Predicted noise level from nearest pile to Receptor 1.

Nearest pile to receptor	Piling rig	Excavator	Compressor	Dump Truck	Compaction Roller	Concrete pump and 9m3 concrete agitator drum	Combined Noise level [L _{Aeq,T} (dB)]	Distance to Residential receptor (m)	Noise level at Residential receptor (m)
Sound power level	110	99	98	101	102	80			
% on time	50	20	50	30	30	20			
Attenuation (dB)	0	0	0	0	0	0			
On-time' corrected sound power level [L _{WA} (dB)]	107	92	95	96	97	73			
						On-time' corrected sound pressure level at 10m [L _{Aeq,T} (dB)]	72	108	11
						On-time' corrected sound pressure level at receptor (11m) [L _{Aeq,T} (dB)]			87

Figure A2: Predicted noise level from central pile to Receptor 1.

Central pile to receptor	Piling rig	Excavator	Compressor	Dump Truck	Compaction Roller	Concrete pump and 9m3 concrete agitator drum	Combined Noise level [L _{Aeq,T} (dB)]	Distance to Residential receptor (m)	Noise level at Residential receptor (m)
Sound power level	110	99	98	101	102	80			
% on time	50	20	50	30	30	20			
Attenuation (dB)	0	0	0	0	0	0			
On-time' corrected sound power level [L _{WA} (dB)]	107	92	95	96	97	73			
						On-time' corrected sound pressure level at 10m [L _{Aeq,T} (dB)]			

Figure A3: Predicted noise level from nearest point of groundworks to Receptor 1.

Nearest point to receptor	Compaction Roller	Excavator	Compressor	Dump Truck	Generator	Combined Noise level [L _{Aeq,T} (dB)]	Distance to Residential receptor (m)	Noise level at Residential receptor (m)
Sound power level	102	99	98	101	65			
% on time	30	40	30	30	100			
Attenuation (dB)	0	0	0	0	0			
On-time' corrected sound power level [L _{WA} (dB)]	97	95	93	96	65			
					On-time' corrected sound pressure level at 10m [L _{Aeq,T} (dB)]	63	100	11
					On-time' corrected sound pressure level at receptor (11m) [L _{Aeq,T} (dB)]			79

Figure A4: Predicted noise level from central point of groundworks to Receptor 1.

Centre point to receptor	Compaction Roller	Excavator	Compressor	Dump Truck	Generator	Combined Noise level [L _{Aeq,T} (dB)]	Distance to Residential receptor (m)	Noise level at Residential receptor (m)
Sound power level	102	99	98	101	65			
% on time	30	40	30	30	100			
Attenuation (dB)	0	0	0	0	0			
On-time' corrected sound power level [L _{WA} (dB)]	97	95	93	96	65			
					On-time' corrected sound pressure level at 10m [L _{Aeq,T} (dB)]	63	100	35
					On-time' corrected sound pressure level at receptor (35m) [L _{Aeq,T} (dB)]			70

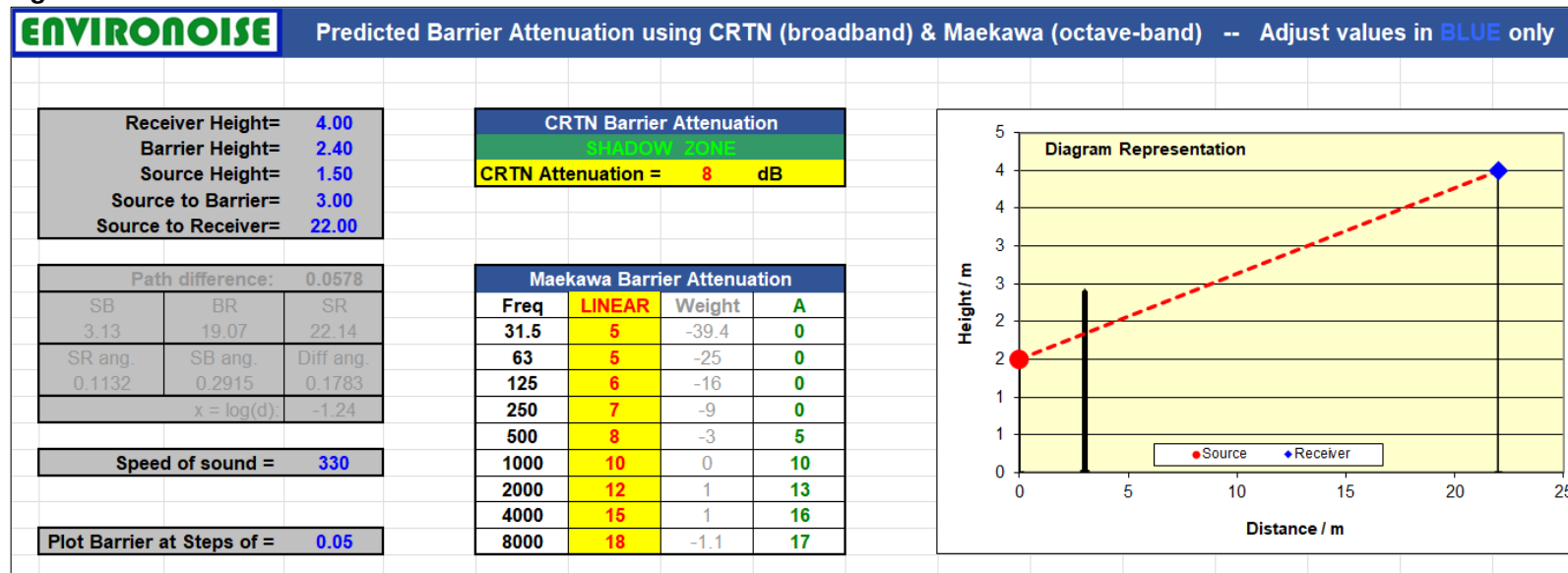
Figure A5: Predicted noise level from nearest pile to Receptor 2.

Nearest pile to receptor	Piling rig	Excavator	Compressor	Dump Truck	Compaction Roller	Concrete pump and 9m ³ concrete agitator drum	Combined Noise level [L _{Aeq,T} (dB)]	Distance to Residential receptor (m)	Noise level at Residential receptor (m)
Sound power level	110	99	98	101	102	80			
% on time	50	20	50	30	30	20			
Attenuation (dB)	0	0	0	0	0	0			
On-time' corrected sound power level [L _{WA} (dB)]	107	92	95	96	97	73			
						On-time' corrected sound pressure level at 10m [L _{Aeq,T} (dB)]	66	108	22
									81

Figure A6: Predicted noise level from nearest point of groundworks to Receptor 2.

Nearest point to receptor	Compaction Roller	Excavator	Compressor	Dump Truck	Generator	Combined Noise level [L _{Aeq,T} (dB)]	Distance to Residential receptor (m)	Noise level at Residential receptor (m)
Sound power level	102	99	98	101	65			
% on time	30	40	30	30	100			
Attenuation (dB)	0	0	0	0	0			
On-time' corrected sound power level [L _{WA} (dB)]	97	95	93	96	65			
					On-time' corrected sound pressure level at 10m [L _{Aeq,T} (dB)]	58	100	22
								73

Figure A7: North-east barrier calculation



References

- ⁱ BS 5228-1:2009+A1:2014 '*Code of practice for noise and vibration control on construction and open sites. Noise*'
- ⁱⁱ BS 5228-2:2009+A1:2014 '*Code of practice for noise and vibration control on construction and open sites. Vibration*'