TECHNICAL MEMO

Project	**Kingston Wharf – Construction Noise Assessment**
To	PMC Construction and Development Services Ltd
From	Neil Anderson. 7th Wave Acoustics Ltd
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1 INTRODUCTION

7th Wave Acoustics has been commissioned to assess the potential noise impact due to planned construction works at the Kingston Wharf development site located in Shoreham, West Sussex, BN43 6RN.

The purpose of this assessment is to calculate the noise levels from the proposed hammer piling works, which are to be undertaken along the river wall, and determine the potential risk of adverse noise effects which may be caused at the nearest noise sensitive receptors.

The existing site, proposed development and location of the hammer piling construction works are described in the following section of this technical memo, whilst a description of useful acoustic terms, along with the criteria used for the assessment, are included within Section 3 of this report. Details of the attended noise survey are presented in Section 4. The noise calculations and assessment are described in Section 5. The conclusions of this study are summarised in Section 6. A site location plan, including the proposed area of hammer piling, is provided in Appendix A.

2 SITE DESCRIPTION AND OPERATION

Site Description

The site is located in Shoreham-by-Sea, positioned between the A259 Brighton Road to the north and the River Adur to the south.

The site is situated in a predominantly commercial area, with warehouses and builders' merchants to the north and a metal recycling yard to the west of the site. A railway line runs behind the commercial businesses to the north, while beyond the River Adur to the south are existing residential developments.

Development

The proposed development will comprise 255 no. new dwellings in a 4-8 storey building sited at the eastern end of the site, with a two storey commercial building and an A1 retail supermarket and associated parking completing the proposed scheme.

Construction Operation

This assessment only considers the hammer piling construction works along the river wall.

The proposed piling plant comprises a crane suspended Dawson HPH2400 piling hammer with an associated power pack. An indicative sound power level for this equipment has been obtained from BS8233.

It is understood that the proposed hours for the hammer piling operation are:

- Monday to Friday – 08:00 hrs to 16:00 hr. Piling for 3 hours per day

The site location plan, including the proposed area of piling, is provided in Figure A1 of Appendix A.

3 NOISE UNITS, METHODOLOGY & ASSESSMENT CRITERIA

Noise Units

There is a million to one ratio between the threshold of hearing and the highest tolerable sound pressure. Noise is therefore measured using a logarithmic scale, to account for this wide range, called the decibel (dB). Noise is defined as unwanted sound and the range of audible sound varies from around 0 dB to 140 dB.

The human ear is capable of detecting sound over a range of frequencies from around 20 Hz to 20 kHz; however, its response varies depending on the frequency and is most sensitive to sounds in the mid frequency range of 1 kHz to 5 kHz. Instrumentation used to measure noise is, therefore, weighted across the frequency bands to represent the sensitivity of the ear. This is called 'A weighting' and is represented as dB(A).

It is generally accepted that a change in noise level of 1 dB is not perceptible by the normal ear under normal conditions, a 3 dB change is just perceptible, whilst a change of 10 dB is perceived as a doubling or halving of the noise level.

An indication of the range of noise levels commonly found in the environment is given below in Table 1.

Table 1: Typical Noise Levels

Typical Noise Level dB(A)	Example
0	Threshold of hearing
30	Rural area at night
40	Residential area at night
60	Conversation
80	Inside general factory premises
100	Near to pneumatic hammer
120	Near to speaker at rock concert
140	Threshold of pain

A number of different indices are used to describe the fluctuations in noise level over certain time periods. The main indices include:

$L_{A90,T}$ This is the noise level exceeded for 90% of the measurement period and provides a measurement of the quieter 'lull' periods in between noise events. It is often referred to as the background noise level.

$L_{Aeq,T}$ This is the equivalent continuous A-weighted sound pressure level and is the level of a notional steady sound which has the same acoustic energy as the fluctuating sound over a specified time period, T. It is often used for measuring all sources of noise in the environment, which can be referred to as the ambient noise.

$L_{Amax,F}$ This is the maximum sound pressure level measured in a given time period with the sound level meter set to 'fast' response.

Local Authority Requirements

Local Authorities in Sussex, including Adur & Worthing Councils, have produced a planning guidance document 'Planning Noise Advice Document – Sussex[1] which sets out the required approach for undertaking a noise assessment, for certain types of development.

For construction sites, the guidance states that BS 5228-1:2009+A1:2014[1] is the relevant standard to use for the assessment noise from construction sites. The guidance also refers to Annex E of BS 5228-1:2009+A1:2014 for setting appropriate noise thresholds.

BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part: Noise'

Part 1 of the Code of Practice for Noise and Vibration Control on Construction and Open Sites provides guidance on the methods that can be used to predict and measure noise from construction activities and how to assess the impact on those exposed to it. In particular, Annex F sets out the methods of estimating noise from construction sites which take into account distance, ground effects, reflections from surfaces, and screening by obstacles.

Annexes C and D of Part 1 of the Code of Practice provide generic source noise data for various items of plant used on open sites which can be used in the absence of measured data.

Part 1, Annex E 'Significance of noise effects' of BS5228 presents various methods of determining the significance of noise effects due to construction works.

For residential receptors, the 'ABC method' published in BS 5228:2009 + A1:2014 Part 1 can be applied to determine the potential for significant effects.

Table 2 overleaf shows an example of the threshold values of potential significant effect at dwellings. If the calculated site noise level exceeds the adopted category value, then a significance effect is deemed to occur. Notes on how the threshold category is determined are provided below Table 2.

Table 2: BS 5228 Example Threshold of Potential Significant Effect at Dwellings

Assessment category and threshold value period ($L_{Aeq,T}$)	Threshold value, in decibels (dB)		
	Category A	Category B	Category C
Night-time (11.00pm to 7.00am)	45	50	55
Evenings (7.00pm to 11.00pm weekdays). Weekends (1.00pm to 11.00pm Saturdays and 7.00am to 11.00pm Sundays)	55	60	65
Daytime (7.00am to 7.00pm) and Saturdays (7.00am to 1.00pm)	65	70	75

Notes:
A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level;
If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise;
Applied to residential receptors only;
Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values;
Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values; and
Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

4 ATTENDED BASELINE NOISE MONITORING

Attended Baseline Ambient Noise Survey

Attended short-term noise measurements, prior to construction works, were obtained at monitoring locations ST1, ST2 and ST3, as shown overleaf in Figure 1, to determine the typical ambient noise levels during daytime working hours and to identify the dominant sources of noise, at the nearest noise sensitive receptors to the worksite.

The attended measurements were obtained between 11:18 - 13:16 on Wednesday 21st July 2021.

The sound level meter was configured to measure A-weighted noise indices, which included $L_{Amax,F}$, $L_{A10,15min}$, $L_{Aeq,15min}$ and $L_{A90,15min}$ levels. Two sets of 15-minute measurements were obtained at each attended noise monitoring location.

Measurements were undertaken at the following locations:

- Location ST1 (free-field) – 5m from façade of Quay Court;
- Location ST2 (free-field) – 5m from façade of 190 Harbour Way; and
- Location ST3 (free-field) – 5m from façade of Garland Point Flats.

The measurement locations were selected as these are considered to be representative of the closest residential properties to the proposed hammer piling works.

Figure 1: Plan Showing Attended Noise Monitoring Locations



The measurements were made using a Norsonic Class 1 sound level meter (s/n 1403236). The sound level meter was mounted on tripod at a height of approximately 1.5 m above local ground and fitted with a windshield. The equipment was calibrated before and after the surveys to generate a calibration level of 114.0dB at 1kHz, with the noted drift falling within acceptable tolerances. Relevant calibration certificates can be obtained on request.

The weather during the baseline survey was noted to be dry with scattered clouds. Air temperatures were around 24°C with a relative humidity of 64%. Average wind speeds remained below 0.5m/s.

Baseline Ambient Noise Results

The results of the attended baseline measurements undertaken on Tuesday 21st July 2021 are presented overleaf in Table 3.

Table 3: Summary of Attended Monitoring Results – Tuesday 21st July 2021

Monitoring Location	Start Time	Duration (mins)	Measured Free-field Noise Levels, dB			
			$L_{Amax,F}$	$L_{A10,T}$	$L_{Aeq,T}$	$L_{A90,T}$
ST1	11:18:01	15	69.7	54.3	51.6	44.5
ST1	12:27:03	15	77.4	59.4	55.9	42.9
	Cumulative		***77.4***	***56.8***	***54.3***	***43.7***
ST2	11:50:55	15	63.9	55.5	51.4	43.9
ST2	12:43:26	15	76.5	60.0	55.9	43.4
	Cumulative		***76.5***	***57.8***	***54.2***	***43.7***
ST3	12:09:29	15	69.7	56.1	53.3	45.7
ST3	13:00:43	15	75.0	52.7	51.9	44.2
	Cumulative		***75.0***	***54.4***	***52.7***	***45.0***

Observations

Observations made during the site visit identified that the main source of noise outside of the residential properties was road traffic in the surrounding area and directly to the front of the properties at ST1 and ST2, noise from overhead light aircrafts, pedestrian noise, and industrial noise from the metal recycling yard.

Determination of Noise Thresholds

The noise levels ($L_{Aeq,T}$) measured during the daytime period at ST1 ranged between 52 and 56 dB with an average noise level of 54 $L_{Aeq,T}$.

The noise levels ($L_{Aeq,T}$) measured during the daytime period at ST2 ranged between 51 and 56 dB with an average noise level of 54 $L_{Aeq,T}$.

The noise levels ($L_{Aeq,T}$) measured during the daytime period at ST3 ranged between 52 and 53 dB with an average noise level of 53 $L_{Aeq,T}$.

Based on the ABC criteria, the threshold for significant effects at the nearest residential receptors are summarised in Table 4 below.

Table 4: ABC Impact Criterion

Monitoring Location	Representative Receptor Name	Receptor Type	Measured Daytime Ambient Noise Level, dB $L_{Aeq,T}$ [1]	ABC Impact Criterion Threshold Level (potential significance for residential), dB $L_{Aeq,T}$
			Day	Day
ST1	Quay Court	Residential	57	A (65)
ST2	190 Harbour Way	Residential	57	A (65)
ST3	Garland Point Flats	Residential	56	A (65)

Note: A +3dB façade correction has been added to the calculated free-field noise levels at building receptor locations.

According to the 'ABC method' adopted for this assessment, an exceedance of the ABC noise impact threshold indicates an adverse impact with the potential to cause a significant effect. According to BS5228, the significance of the effect is assessed using 'other project-specific factors, such as the number of receptors affected and the duration and character of the impact'.

5 NOISE IMPACT ASSESSMENT

Construction Activity Calculations

The calculation method of BS 5228 takes account of the duration of an activity per hour, the "on-time" and the attenuation of sound due to the effects of distance, ground attenuation and barrier effects.

At the present time a detailed construction programme for the piling works or plant information is not available.

In the absence of detailed information, the assessment has been based on the assumed plant item and on-times based on the information provided within BS 5228-1:2009.

The plant assumption and derived sound power level for the Hammer Piling activity is shown below in Table 5.

Table 5: Hammer Piling Assumptions

Plant/Activity	Reference	Sound Power Level dB(A)	% On-Time	Corrected Sound Power Level dB(A)
Hydraulic hammer rig	BS5228-1:2009 Table C.3:2	115	40%	111

The derived sound power level was then used to predict the activity noise level at the closest noise sensitive receptors. Corrections were made for distance, ground type and screening. Following the methodology prescribed in BS5228, a correction of -10dB, -5dB or 0dB was applied where there is no line of site, partial line of sight or full line of sight to the activity from the receptor locations. The predicted activity noise levels are presented in Table 6 below.

Table 6: Estimated Hammer Piling Activity Noise Levels at The Nearest Noise Sensitive Receptors

Monitoring Location / Receptor	Activity Sound Power Level	Ground Type	Distance to Receptor, (m)[1]	Distance Attenuation, dB(A)	Screening Attenuation, dB(A)	Façade Correction	Total Attenuation, dB(A)	Predicted Activity Noise Level, dB $L_{Aeq,T}$
ST1		H	160	-52	+0	+3	-49	62
ST2	111	H	163	-52	+0	+3	-49	62
ST3		H	119	-50	+0	+3	-47	64

Note: [1] Measurement distance taken to the closest point of piling works to provide a worse case assessment.

The above hammer piling activity noise levels at the receptors are presented alongside the adopted BS 5228 impact criterion threshold noise levels overleaf in Table 7.

Table 7: Comparison of Hammer Piling Activity Noise Levels with the ABC Impact Criterion Threshold Levels

Monitoring Location / Receptor	Representative Receptor Name	Predicted Hammer Piling Activity Noise Level, dB $L_{Aeq,T}$	ABC Impact Criterion Threshold Level, dB $L_{Aeq,T}$	Excess Above Criterion dB $L_{Aeq,T}$
ST1	Quay Court	62	A (65)	-3
ST2	190 Harbour Way	62	A (65)	-3
ST3	Garland Point Flats	64	A (65)	-1

The results indicate that the threshold levels are not exceeded at the nearest receptors ST1, ST2 and ST3.

It should also be noted that the assessment has been based on a worse case, whereby the predicted hammer piling activity noise level is calculated based on the closest point between the hammer piling works and the receptor. As the piling works progress along the river wall, the distance will increase between the works and receptor, resulting in a reduction in noise levels.

Notwithstanding the above findings noise mitigation measures are discussed in the following section.

Vibration

The large distance (>100m) between the hammer piling works and closest residential receptors are such that the risk of vibration transmission is considered negligible and a requirement for further vibration assessment has been scoped out at this stage.

Noise Mitigation

The noise impact of the hammer piling activity can be further minimised by use of the noise control measures, as suggested in Section 8 of BS 5228-1:2009+A1:2014.

General principles for the control of noise during the hammer piling works are presented below:

- Use of best practicable means and best practice methods;
- When the piling rig is in intermittent use, it shall be shut down in intervening periods of non-use or, where this is impracticable, they shall be throttled down to a minimum;
- Although it may not be practicable due to the location of the hammer piling works, local hoarding, screens or barriers could be considered to shield the hammer piling activities from the noise sensitive receptors;
- The use of alternative piling methods;
- Regular plant maintenance to keep plant in good working condition and reduce noise from machinery;
- Ensure that all staff and operatives are briefed on the requirement to minimise nuisance from site activities.

6 CONCLUSIONS

7th Wave Acoustics has been commissioned to assess the potential noise impacts from the hammer piling activity associated with the construction phase of the Kingston Wharf development located in Shoreham, West Sussex, BN43 6RN.

An attended noise survey was carried out to establish the existing ambient noise levels at the closest noise sensitive receptors.

The results of the attended noise monitoring have been used to determine noise thresholds for assessing the significance of effects at the nearest residential receptors located beyond the River Adur to the south of the development site, using the methods described in BS5228-1+A1:2014.

Calculations of the hammer piling activity, using the methodology within BS5228-1+A1:2014, have shown that the adopted noise thresholds should not be exceeded at the nearest residential properties.

It is noted that the assessment has been based on a worse case scenario, whereby the predicted hammer piling activity noise level is calculated from the closest point between the hammer piling works and the receptor . As the piling works progress along the river wall, the distance will increase between the works and receptor, resulting in a reduction in noise levels.

Measures to further control the noise during the hammer piling works along with best practicable means methods have been suggested.

7 REFERENCES

1. The Planning Noise Advice Document: Sussex. 2021

2. BS 5228-1:2009+A1:2014 ‘Code of practice for noise and vibration control on construction and open sites – Part: Noise’

3. PMC Construction. Kingston Wharf: Construction Environmental Management Plan.

Appendix A – Figures

Figure A1: Site Location Plan

