Note

Title	Driven Piling Acoustic Assessment		
Project	Rustington Golf Course		
Reference	28C2.NT.1.1	**Author(s)**	AS
Date	23 February 2024	**Reviewer**	RM

1.0 Introduction

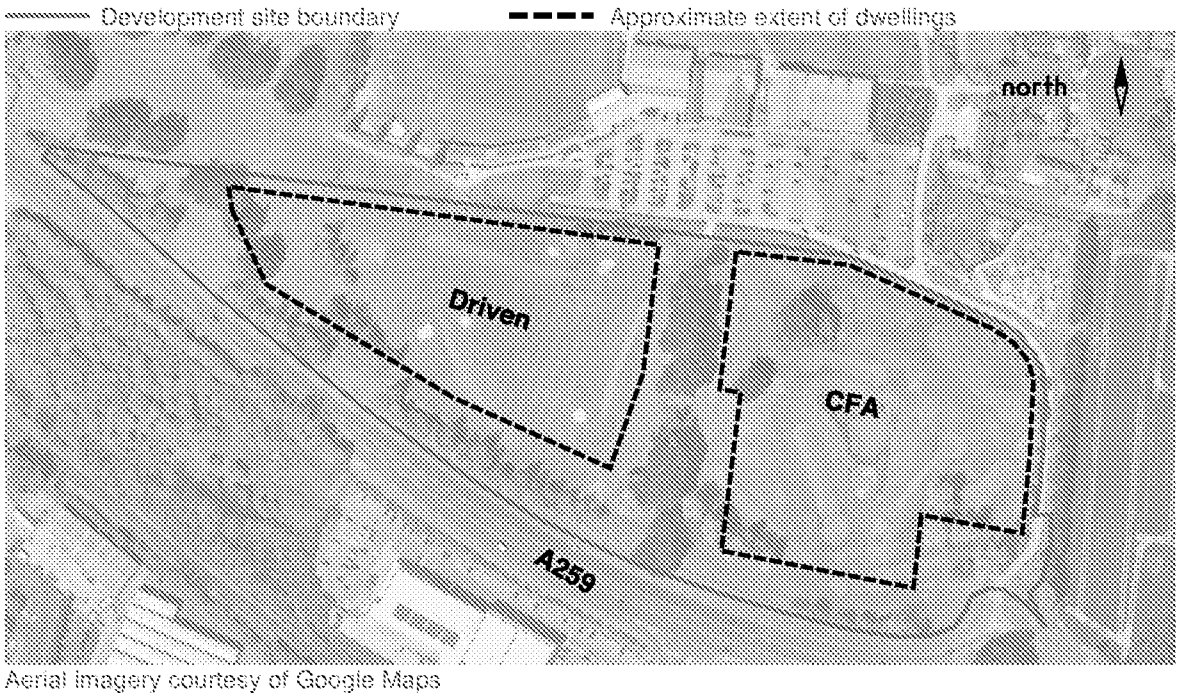
1.1 A residential development on a section of land currently occupied by the Rustington Golf Centre has been granted planning consent. Arun District Council have applied Planning Condition 24 which applies to piling operations at the site; this has been discharged on the basis that continuous flight augured (CFA) piling would be conducted.

1.2 This note sets out details of an assessment of noise emissions and vibration transfer from the use of a driven piling rig to the nearest noise sensitive receptors, to demonstrate adherence with Arun District Council's requirements. It is noteworthy that driven piling is only expected to be necessary to the west of the site, however this note considers the whole site to ensure flexibility should driven piles be needed more widely.

2.0 Site Location and Context

2.1 The proposed development site boundary is outlined in red in the following **Image 1**. The approximate areas in which dwellings are to be situated has also been outlined by a **dashed** black line with the likely required piling methods in each area also shown.

Image 1: Site location plan



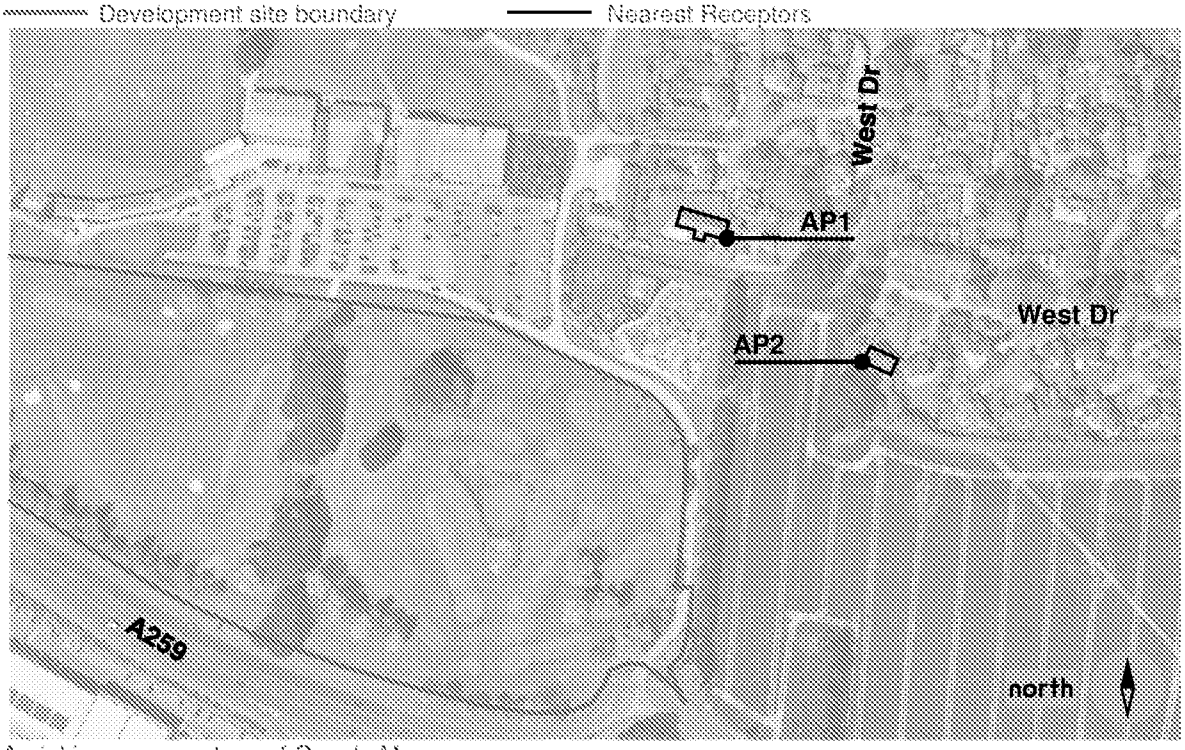
Aerial imagery courtesy of Google Maps

2.2 It is again noted that driven piling is only expected to be required in the west section of the site shown on **Image 1**. Noise from potential driven piling activity has however been assessed across the whole site to allow flexibility in chosen method, should this be required in due course.

2.3 There are a limited number of potentially noise sensitive receptors near to the proposed site, located to the north-east along West Drive and therefore it must be appreciated that due to the physical size of the development, any potential noise impact that may occur would be temporary in nature and limited in extent.

2.4 The locations of the nearest noise sensitive receptors are illustrated in **Image 2**. Whilst there are other sensitive receptors in the vicinity of these, they are at a greater distance to the site than those identified. Therefore, it is reasonable to expect that if noise can be controlled at the identified receptors, it would also be controlled to those at a greater distance.

Image 2: Location of nearest noise sensitive receptors



Aerial imagery courtesy of Google Maps

2.5 Analysis of satellite imagery suggests that position AP1 is the closest noise sensitive receptor to the proposed dwellings within the site footprint. Position AP2 is included for completeness given its proximity to the site. Due to AP2's increased distance to the site in comparison to AP1, it is considered that any potential scheme of mitigation required for AP1 will be sufficient to control noise at AP2 and all other surrounding noise sensitive receptors.

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3.0 Site Operational Hours

3.1 The following hours of construction are permitted by the Local Planning Authority which should be adhered to at all times, subject to the commentary set out later within this report.

Table 1 Site operating hours

Period	Hours
Monday to Friday	0800-1800
Saturdays	0800-1300

3.2 In exceptional circumstances, consent for work outside of these hours may be given after any necessary consultation, with the Environmental Health Officer (EHO). Appropriate noise control methods and assessment criteria would be discussed on a case-by-case basis with the local authority, should such working be sought.

4.0 Noise and Vibration Criteria

Noise Limits

4.1 Guidance provided in Annex E of BS 5228-1:2009+A1:2014[1] has previously been used as a basis for deriving appropriate noise criteria for piling activities on the site. Drawing from the 'ABC' method set out within the document, the following criteria are taken to apply at the nearest receptors.

4.2 An unattended noise survey was previously conducted on site by *Cole Jarman* in March 2021, and is set out within their report 20/0278/R01-0. This report was included within the scheme's planning application.

4.3 The *Cole Jarman* survey was undertaken by Adam Sharpe, who is now employed by *Suono* and therefore the survey data and related information set out within is considered suitably accurate and valid. A comprehensive summary of the noise survey methodology and results are set out within the Cole Jarman report referenced above (not replicated here for the sake of brevity) with the results summarised as follows.

4.4 The measured ambient noise levels measured in the site's north-eastern corner are set out within **0**. These have been used as the basis for the noise limits adopted for the assessment of driven piling noise.

Table 2 Measured ambient noise levels measured by Cole Jarman

Location	Ambient Noise Level, $L_{Aeq,T}$ dB	
	Daytime (0700-2300)	Night Time (2300-0700)
MP2: North-eastern site corner	55	51

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

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4.5 Based on the above and using BS 5228-1's 'ABC' method, the Category A thresholds of significance have been adopted for the permitted hours of construction.

Table 3 Construction Noise Limits

Period	Hours	Noise Criteria	
		Construction Noise Level $L_{Aeq,T}$ dB	Period, *T*
Mondays to Fridays	0800-1800	< 65	10 hours
Saturdays	0800-1300		4 hours

Construction noise levels in the schedule relate to free-field conditions, where designated noise sensitive locations are located more than 3.5 m from building façades or other reflective surfaces other than the ground. Where designated noise sensitive locations are located within 1.0 m from building façades, the permitted noise levels can be increased by 3 dB(A).

The construction noise level, $L_{Aeq,T}$ is the total L_{Aeq} from all the noise sources in the vicinity over the specified period, taking into account any periods of inactivity which may occur on the site.

Vibration Limits

4.6 As discussed later in this report, it is expected that there will be no issues with regards to vibration during the period of construction due to the distances between sources and receptors. However, in the unlikely scenario where an issue should arise, this subsection sets out vibration thresholds that can be used to determine the significance of any vibration effects that may arise.

4.7 Criteria for assessing vibration impacts from construction site on people are set out in British Standard BS 5228-2:2009[2]. This is replicated within **Table 4** below with levels up to 1.0 mm/s expected to be acceptable if nearby receptors are kept informed of the works being undertaken (if necessary.

Table 4 Summary of BS 5228 Vibration Criteria

Vibration Level, mm/s	Effect
0.14	Vibration might just be 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.

[2] BS 5228-2:2009: Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration

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5.0 Piling Activity Noise Assessment

Noise Source

5.1 As noted previously, Planning Condition 24 sets requirements for noise mitigation for piling operations at the site, which has been discharged regarding the proposed method of CFA piling. However, it is understood that it is now sought to use driven piles in order to reduce the active duration of piling activities and remove the need for frequent concrete deliveries.

5.2 The following **Table 5** sets out details of the driven piling activity that is proposed to occur on site as part of the development's construction. The list does not take account of wider construction elements that are to take place across the site during construction as this assessment considers only noise from piling activity for the purposes of satisfying the requirements of Planning Condition 24.

Table 5 Driven piling activity

Activity	Example BS 5228 Noise Source	Example Noise Level, $L_{Aeq,T}$ dB at 10 m	Advised 'On-Time' During Permitted Hours of Operation, %
Pre-cast concrete piling: Hydraulic hammer rig	Table C.3 Ref 1	89	70

5.3 Previously, the assessment of CFA piling took account of ancillary noise sources required to undertake the CFA process, such as air compressors in addition to concrete agitators and pumps. It is expected that these are not required in the driven piling process.

5.4 It is assumed that the example noise level set out within **Table 5** accounts for any ancillary plant items required as part of the driven piling process.

Assessment Methodology

5.5 As previously noted, the assessment has been based on noise data for driven piling of pre-cast concrete using a hydraulic hammer rig as set out within BS 5228-1. This reference data pertains to a rig of 16 metres length, using a 5-tonne hammer and plywood dolly. These parameters, in addition to the quoted 145 kW power rating are considered to be representative of that set out within the manufacturer's datasheet for the proposed rig (*Junttan* PM16 Pile Driving Rig), noting that *Junttan* do not publish noise data.

5.6 Noise emissions from the proposed rig have been considered to the nearest noise sensitive receivers as illustrated previously on **Image 2**, and described below.

- AP1: Southern facing windows of Ham Manor Barn to the north of site;
- AP2: Western facing windows of the cottage west of the site's north-eastern corner.

5.7 In reality, the piling rig would be expected to move around the proposed development site and as such is highly unlikely that it would be located at the same point for the whole example day. As such, it is expected that any potential noise contribution would be reduced. This has been partially taken account of through implementation of an on-time correction.

5.8 The size of the site and location of the nearest noise sensitive receptors means that the receptors would rarely be affected by piling activity in close proximity and as previously noted, any local noise effects would be limited to relatively short durations or be temporary.

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5.9 During the previous assessment of CFA piling, it was advised that an on-time of 70% (i.e. piling activity would take place across 70% of a working day) was forecasted. This has therefore also been adopted as the assessment basis for the driven impact piling.

5.10 Levels of construction activity noise have been calculated at the assessment positions by correcting for distance, on-time and screening losses where appropriate.

Results

5.11 **Table 6** sets out calculations of the nearest possible driven piling activity to assessment positions AP1 with the default on-time of 70% and no screening corrections applied. It is considered that noise levels at all other noise sensitive receptors will be lower than this due to their increased distance to site in comparison to that of AP1.

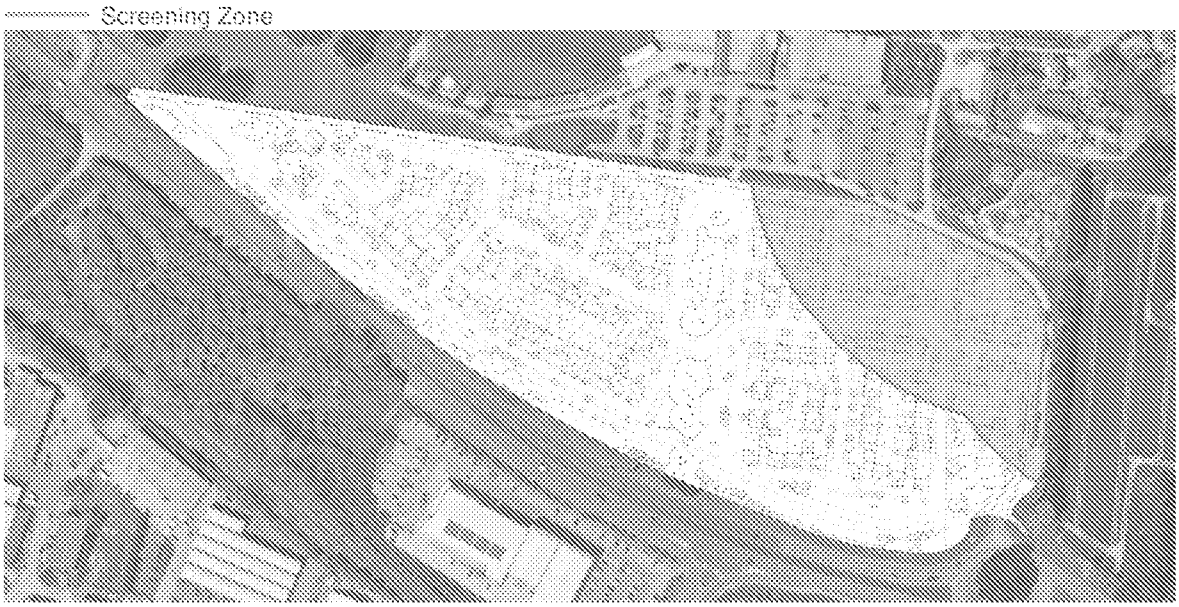
Table 6 Driven piling activity noise levels at nearest residential receptor (no screening)

Plant Item	Sound Pressure level, L_p dB @ 10 m	On Time, %	No. Units	Distance, m	Sound Pressure Level, L_p dB at Position AP1
Pre-cast concrete piling: Hydraulic hammer rig	89	70	1	86	71

5.12 It can be seen from **Table 6** above that it will be necessary to introduce localised screening to the driven piling activity should this method be used in the site's northeastern corner. We note that driven piling is not current expect to take place in this eastern region of the site where mitigation would be required.

5.13 Screening should take the form of localised barriers around the piling activity, as close to the equipment as practicable (noting that it will be necessary to move screens as the piling activity moves). The results of our assessment show that this will be necessary for all piles within 180 metres of assessment positions AP1 and AP2, as per **Image 3**. Beyond the region identified in orange, no noise mitigation measures are deemed to be necessary:

Image 3: Required piling screening zone



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5.14 Any noise generating equipment associated within the driven piling activity, operated within the orange boundary, should be fully screened from positions AP1 and AP2 using appropriate height, fully imperforate barriers (minimum mass 10 kg/m^2) that feature no gaps between panels, or between ground level and the bottom of the screening panels. These should be installed as close to the equipment as possible. Alternatively, any manufacturer's proprietary screening system, such as special drive caps, guide tubes or insulation jackets can also be used, provided they mitigate noise levels by at least 7 dBA.

5.15 With the screening measures in place, the assessment concludes that the following worst case noise levels are to be expected at the nearest noise sensitive receptor.

Table 7 Driven piling activity noise levels at nearest residential receptors (with screening)

Plant Item	Sound Pressure level, L_p dB @ 10 m	On Time, %	No. Units	Distance, m	Screening Loss, dB	Sound Pressure Level, L_p dB at Position AP1
Pre-cast concrete piling: Hydraulic hammer rig	89	70	1	86	-10[3]	61

5.16 It has been demonstrated therefore that the use driven pre-cast piles would be acceptable on any part of the proposed development site, subject to the implementation of suitable mitigation measures in the eastern region, if driving pilling is deemed necessary in that area.

5.17 Further to the above, and in lieu of specific manufacturer's piling rig noise data, it can also be concluded that a driven piling not exceeding a limiting sound power level of **109 dB L_w** would meet the noise limits at position AP1 and all other receptors without need for any mitigation/screening.

5.18 The assessment has been conducted on the basis that all other construction activities to take place on the site remain unchanged from the developer's original proposals. It has also been assumed that the delivery of piling materials will be included as part of normal deliveries to site in order to avoid the generation of a significant number of additional deliveries.

6.0 Vibration

6.1 Based publicly available data from the British Geological survey[4], the ground makeup across the proposed development is expected to comprise a chalk bedroom with sand/silt/clay/gravel deposits above.

6.2 Vibration data relating to driven pre-cast piles (with reference M7 as set out in Table D.2 from BS 5228-2:2009+A1:2014[5]) is replicated below; this data shows measured levels of vibration at varying distances from the example piling rig. While the ground conditions vary somewhat, the data is deemed to be broadly representative.

[3] At least 6dBA of attenuation is required however 10 dBA is based on what would typically be expected when full screening is achieved.

[4] https://geologyviewer.bgs.ac.uk/?_ga=2.144626165.191254481.1708690446-776543462.1708690446

[5] BS 5228-2:2009+A1:2014 - Code of practice for noise and vibration control on construction and open sites - Vibration

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Image 4: BS5228-2 Vibration Data (irrelevant data omitted)

Table D.11 Summary of miscellaneous historic case history data on vibration levels measured during piling and kindred operations *(continued)*

Ref. no.	Year and location	Soil conditions	Pile dimensions	Mode	Measured peak particle velocity (PPV) at various plan distances							Remarks
					Theoretical energy per blow	Plan distance	PPV	Plan distance	PPV	Plan distance	PPV	
					kJ	m	mm/s^{-1}	m	mm/s^{-1}	m	mm/s^{-1}	
M9	1982 Ukeby (Humberside)	1.5 m crushed and rolled limestone over cohesive soils over limestone or chalk	Driven precast concrete piles 18 m depth	Drop hammer driving piles	26.5 to 44.1	8	18.6	16	6.6	32	1.3	Ground surface measurements

6.3 Extrapolating the reduction in vibration levels beyond the distances set out above suggests that beyond circa 35 metres from the piling rig, levels of vibration are likely to fall below 1.0 mm/s. As all potential receptors are at a distance well in excess of this distance, vibration from piling is not expected to be a significant consideration.

7.0 Summary

7.1 As driven piles are only currently expected to be required in the western region of the site identified earlier in this report (**Image 1**), no noise mitigation measures are expected to be necessary to suitably control potential adverse effects.

7.2 However, it has also been determined that with either the previously described localised screening in place, or with data from *Juntann* (or equivalent alternative) demonstrating that noise emissions do not exceed 109 dB L_w, noise from driven piling activities on any part of the proposed development can be sufficiently controlled to meet the relevant noise limits at the nearest residential receptors land.

7.3 Vibration from driven pilling activity is not predicted to give rise to any significant impacts at nearby receptors.

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