
Project:	Centre for Integrative Semiconductor Materials (CISM), Swansea University	Job No:	60605215
Subject:	Discharge of Planning Condition – Piling Methodology – Revision 1		
Prepared by:	Richard Sambrook	Date:	06/08/2020
Checked / Approved by:	Paul Wewer	Date:	07/08/2020

Planning Application No.:	P2020/0429
Date of Registration:	28 th May 2020

The following technical note has been produced to support the discharge of Planning Condition 6, which required justification of the piling methodology to be used for CISM building at Swansea University's Bay Campus.

Summary

This technical note has been produced to support the discharge of Planning Condition (6) which relates to the piling methodology for the Centre for Integrative Semiconductor Materials (CISM) at Swansea University. The piling types available for the development have been technically assessed in order to develop the most appropriate piling methodology for the project. Due to the sensitivity of the site, the mitigation measures that will be implemented to limit noise and vibration for the proposed piling methodology have been documented.

Introduction

AECOM has been appointed by Swansea University to provide civil and structural engineering advice in relation to the proposed development of the CISM building at their Swansea Bay campus.

CISM will be a 3-storey research facility, approximately 35.0m by 40.0m in plan, located to the north east of the Swansea University Bay Campus. The occupancy of the new build will consist of laboratory space, testing facilities, large plant rooms to service separate clean room classifications and commercial office space at Level 2.

CISM will house vibration sensitive equipment, such as the E-Beam, Nanoprobes, Mask aligners and others. Therefore, the vibration performance of certain areas of the building is a critical consideration for the structural design of CISM. It has been agreed that all vibration sensitive equipment will be located on separated structures isolated from the main building and designed to specific design vibration criteria.

Full planning consent for the development was issued by the Neath Port Talbot County Borough Council on the 28th May 2020, reference P2020/0429.

The following note is presented to support the discharge of Planning Condition (6) of the planning consent. The purpose of this technical note is to assess the piling methods for the development and outline the technical basis for adopting the proposed piling methodology. In addition to the proposed methodology, a mitigation plan for minimising the noise and vibration impact of the piling works is also included.

Planning Condition (6) states the following:

"Prior to any development taking place a scheme setting out the justification and piling methodology to be used for this development shall be submitted to and approved in writing by the Local planning Authority. This shall include details of all mitigation measures to be implemented on site to prevent noise and nuisance to adjoining noise sensitive receptors. The development shall then be undertaken in full compliance with these approved details."

Building Location

The proposed site is located within the Swansea University Bay campus, adjacent to the Energy Safety Research Institute (ESRI), Active Classroom and Active Office.

Site specifics are as follows:

- OS (Eastings & Northings) 270208 & 192877
- National Grid Reference SS 70208 92877 (SS702928)
- Nearest Post Code SA1 8QB

The following are approximate distances of the proposed building to adjacent buildings on the University's campus:

- ISM / SMART 12.6m
- ESRI 10.3m
- Active Office 9.8m
- Active Classroom 12.5m
- Engineering East 15.0m



Figure 1. Proposed Location of the CISM Building.

Piling Methodology

In order to develop the most appropriate piling methodology, the following forms of piling have been considered for the CISM project:

1. Continuous flight auger piles (CFA)
2. Rotary bored piles
3. Precast concrete driven piles
4. Driven steel tubular piles

The piling forms have been assessed based on the following criteria:

- Noise and vibration impact from piling activity
- Noise and vibration impact from activities to support the piling operations (e.g vehicular deliveries, craneage etc)
- Programme duration for the works
- Site specific ground conditions
- Vibration performance of the isolated structures

Piling Solutions

The following piling methodologies are feasible options for the site based upon the known ground conditions:

1. Continuous flight auger (CFA)

The pile is formed by means of a continuous helical auger which can extract the soil as it progresses. Concreting can be achieved by injection under high pressure through a hollow central stem as the auger is removed. Pile reinforcement is dropped down into the wet concrete by a crane / piling rig / attendant machine.

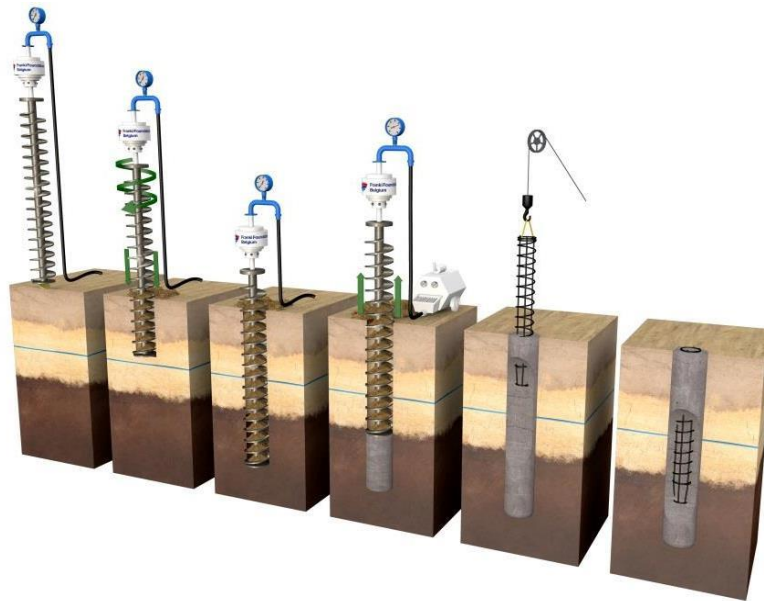


Image courtesy of Franki Foundations

Advantages	Disadvantages
+ Minimal levels of vibration + Lower noise levels generated by piling rig. + More suitable for tension loads at stability elements dependant on ability to install cage prior to concrete drying out	- Collapse of pile bore in sands below water table. Requires driven steel casings to be installed, generating noise and vibration. - Longer piles required than driven (not driven to a predetermined set). Longer continuous noise exposure than driven piles. - Removal and disposal of potentially contaminated soil arisings is required - Potentially more costly with longer installation and curing time. Estimated installation programme 8 weeks. - Obstacle drilling cannot be implemented (rotary chiselling would be required – refer Rotary Bored Piles) - More construction traffic – delivery of steel and concrete and removal of arisings - Craneage required to install pile reinforcement. - Risk of insitu concrete drying out due to sand leaching may cause issues with cage installation

2. Rotary Bored Piles

This is a cast in place cylindrical concrete pile. The pile is a non-displacement pile, bored with a temporary recoverable steel casing for stabilising the adjacent soil.

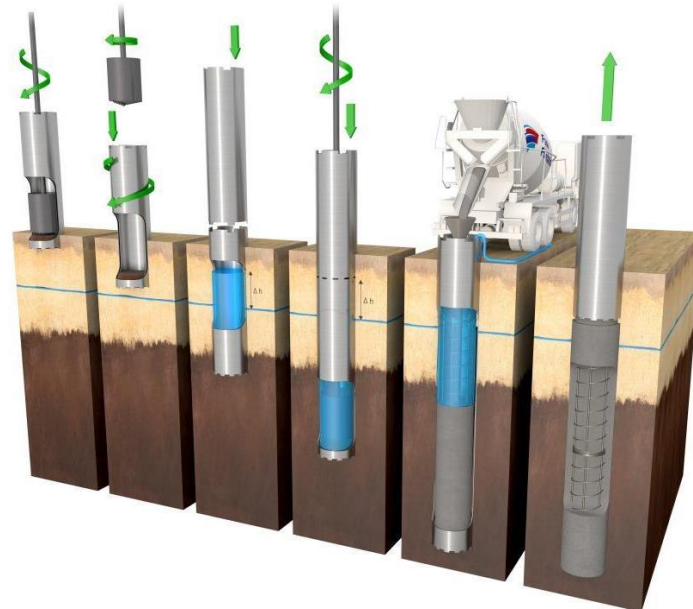


Image courtesy of Franki Foundations

Advantages	Disadvantages
+ Minimal levels of vibration. + Lower piling rig noise levels generated than precast. + Obstacle drilling is possible + More suitable for tension loads at stability elements dependant on ability to install cage prior to concrete drying out	- Removal of potentially contaminated soil arisings is required - Chiselling may be required through buried obstructions and would cause significant noise and vibration - Potentially most expensive/slowest of the methodologies presented (estimated programme 8 weeks). - Driven steel casings required in sandy/granular site soils below water table leading to additional noise and vibration. - Drilling liquid may be used and may require disposal - More construction traffic – delivery of steel and concrete and removal of arisings - Longer piles required than driven (not driven to a predetermined set) – longer continuous noise exposure. - Longer continuous noise exposure. - Craneage to install reinforcement cages. - Risk of insitu concrete drying out due to sand leaching may cause issues with cage installation

3. Driven Precast Piles

A precast concrete pile is a prefabricated, high strength concrete column, delivered to site and impact driven into the soil by means of a hydraulic or diesel hammer.



Image courtesy of Franki Foundations

Advantages	Disadvantages
+ Quick installation – reduced programme (estimated 3 weeks) + Cost effective/efficient based on existing site soil conditions + Less construction traffic – pile delivery only + No soil removal – reduces potential contamination issues + Good level of quality control achievable + Flexibility to remove and re-pile at buried obstructions	- Higher levels of intermittent percussive noise pollution - Higher levels of intermittent vibration - Cannot drive through buried obstruction - Not suitable for high tension loads at stability elements

4. Driven Steel Tubular Piles

This is a low energy driven full-displacement pile with a lost steel tube. The pile is formed using an internal free fall hammer striking a dry concrete plug locked at the bottom of the casing. Concrete or rubble is then poured into the driven tube before installing starter reinforcement and a concrete cap.

Please note the following:

- The steel tubular driven piles will top driven and not bottom driven (as shown below). Bottom driven methodology is not suitable for the site as the capacity of the hammer is limited and due to the strength of the underlying granular material will not be suitable. In addition, the top driven method will utilise the same rig as the precast concrete driven piles.

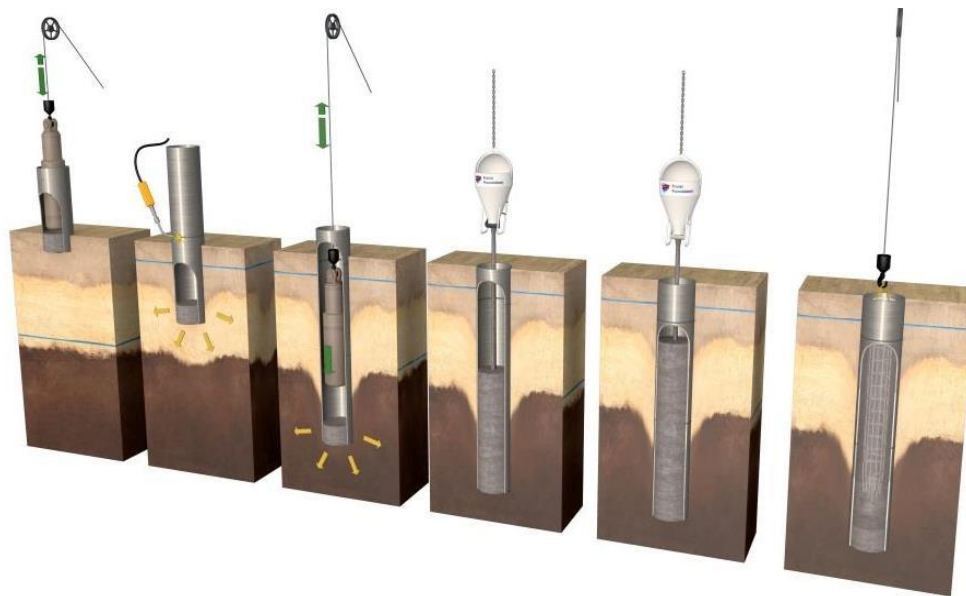


Image courtesy of Franki Foundations

Advantages	Disadvantages
+ Suitable for aggressive soil conditions and contaminated soils + Suitable for very soft or unstable layers of soil which may leach and dry out insitu concrete + Reduced vibration and noise pollution compared to precast as driving performed inside tube + No soil removal – reduces potential contamination issues + Flexibility to remove and re-pile at buried obstructions	- Potentially slower and more costly than precast driven piles - Cannot drive through buried obstructions - Not suitable for high tension loads at stability elements - Piles are driven to deeper depths therefore potentially longer percussive noise exposure than precast.

Selected Piling Methodology – Main Building

After a detailed assessment, the proposed piling methodology for the main building is for a combination of **(i) driven precast concrete piles** and **(ii) driven steel tubular piles infilled with concrete**.

To minimise vibration during the driving process, all piles are to be installed into pre-bored holes to a depth of approximately 3-6 metres (dependent upon ground conditions and to be determined by the piling contractor), using the methods described previously. This is in accordance with the piling methodology for the site as approved under Planning Permission P2013/0256.

Note: The piles are to be pre-bored to a depth of approximately 6 metres. However, the material is not removed but merely disturbed to reduce the resistance from the underlying ground during driving. This process significantly reduces vibration during installation due to the reduced resistance from the soil during driving. Pre-boring introduces an additional stage to the contractor's programme, however, the precast and tubular piles can be installed at higher rates due to the reduced driving resistance.

It is proposed that piling starts adjacent to the neighbouring buildings (ESRI & SMART), beginning with the pre-bored tubular steel piles. Precast piles will then be used after reaching a distance from the adjacent buildings, such that the monitored vibration reaches a reduced and acceptable level.

Justification

The combined method for pre-bored steel and precast concrete driven piles has been chosen for the CISM building for the following reasons:

Precast concrete piles

- Precast piles require a significantly shorter installation programme with less disruption on site.
- Reduced potential for environmental hazards due to elimination of arisings/soil removal.
- Less associated construction traffic and craneage – pile delivery only.
- Most cost effective/efficient solution based on existing site soil conditions.
- Flexibility to remove and re-install at buried obstructions
- Good level of quality control achievable due to off-site manufacture
- Noise and vibration can be significantly reduced by implementing mitigation measures.

Tubular Steel Piles

- Reduced potential for environmental hazards due to elimination of arisings/soil removal.
- Less associated construction traffic and craneage – pile delivery only.
- Flexibility to remove and re-install at buried obstructions
- Good level of quality control achievable due to off-site manufacture
- Reduced vibration compared to precast piles without additional mitigation measures.
- Noise during piling is at a higher frequency than precast piling, however, noise can be mitigated by considering the orientation of the piling rig with respect to the nearby properties.

Selected Piling Methodology – Isolated Structures

After a detailed assessment, the proposed piling methodology for the isolated structures is to be bored (CFA or rotary bored). It should be noted that the diameter of the pile and size of the rig will be sufficient to mitigate the risk of refusal on a below ground obstruction.

The CISM building will house vibration sensitive equipment, such as the E-Beam, Nanoprobes, Mask aligners and others critical equipment. It has been agreed that all vibration sensitive equipment will be located on separated structures isolated from the main building and designed to specific design vibration criteria. Therefore, the vibration performance of these isolated areas of the building is a critical consideration for the structural design of the CISM building.

The predicted performance of the isolated structures at the CISM facility when founded on bored piles complies with the user requirement to meet or exceed the predicted vibration performance of the isolated structures at the existing CNH facility, where the equipment is currently located. Whereas, the predicted performance of the isolated structures when founded on precast piles does not.

The proposed foundation solution for the isolated structures will deliver 17 No. 450mm diameter bored/CFA piles which are approximately 22m long and socketed into the bedrock.

Key Considerations of Adopting CFA or Bored Piles

A small CFA rig is likely to refuse on sub-surface obstructions (sandstone boulders) and rotary boring may then be required to reach the proposed pile lengths. Therefore, the size of rig and diameter of auger must be suitable to the ground conditions, to ensure that encountered boulders do not halt progress. The torque must be sufficient to core through encountered obstructions.

Rotary pile chiselling and coring through obstructions will generate significant noise and vibration. This is a significant risk given the variable depths that the boulders were encountered during the investigation. There would be increased costs associated with mobilisation and re-drill.

The rotary bored rig will pass through sub-surface obstructions (sandstone boulders), but given the granular nature of the underlying ground conditions and shallow groundwater leading to instability, the holes may have to be cased leading to additional costs/noise associated with the driven installation of steel casings.

The piling rig, a tracked crane, may be required for the reinforcement cage (additional noise/ vibration). Wet concrete will require delivery from heavy concrete trucks leading to additional noise/vibration. Alternatively, concrete may be batched on site however there would also be additional noise associated with this.

In addition, there is a risk that bored piles may create contaminated arisings, which will need to be stored and disposed of safely offsite. CISM is located in the north-east corner of the former BP Transit Site, which was previously used for storage of petroleum hydrocarbons and chemical products. It is understood that the Fabian Way site has undergone decommissioning, environmental assessments and remedial works since 2002. Therefore, it is understood that Swansea University's Bay campus has been previously sufficiently remediated. However, there remains a risk that contaminated arisings may still be present where remedial works were insufficient or not complete. Therefore, arisings from the bored piles will be monitored closely on site.

Please refer to the Construction Methodology Plan (issued in response to planning condition 4), for further information on the proposed strategy for encountering and managing unexpected contamination.

In addition, CFA/rotary piles can present a leachate risk to groundwater.

Selected Piling Methodology – Crane base

The following section has been completed by Kier Construction and relates to the piling methodology for the tower crane base.

When designing tower crane base piles, it is generally prudent to design and install these to a higher factor of safety. CFA piles will offer the highest factor of safety and the least vibration. We have avoided use of CFA to limit risk of displacement of materials, but CFA piles are required to provide the stiffness criteria for the specialist equipment (see page 9). Therefore to ensure a higher factor of safety we have been advised by Kier Professional Services' specialist engineering team that CFA's are recommended. Due to site constraints, the substructure design for the tower crane will need to be utilised for the sprinkler tank in this location, therefore CFA piles are proposed locally in this area. The location is sited within 3m of the Active Classroom and within 2m of live services, there is therefore the added benefit of using CFA in this area.

Kier Construction Ltd, Western & Wales (10.08.2020)

Piling Vibration

The site is adjacent to the SMART building and ESRI, which house vibration sensitive equipment and activities. For this reason, the vibration generated by piling and site activities, needs to be carefully considered.

Whilst each of the above piling methods will generate noise and vibration, previous discussions with Neath Port Talbot County Borough Council have raised concerns that the installation of driven piles (precast piles or steel tubular piles) will generate more vibration than that of CFA or rotary bored piles. Therefore, as part of the justification, the following assessment of vibration and noise levels has been carried out and the findings are provided below.

Anticipated vibration levels

BBGE undertook noise and vibration monitoring during the driving of the precast piles at the adjacent Computational Foundry building. These results have been made available for the CISM building and are summarised in Figure (2).

Please note that the Computational Foundry piles were not pre bored therefore the expected vibration levels for the CISM Building are lower than the values detailed. BBGE provided indicative levels of vibration for pre-bored, precast concrete piles based on the prevailing ground conditions and previous site experience in their email dated 24th October 2017. These indicative vibration levels can be found in Figure (2).

In the absence of vibration monitoring data for pre-bored steel tubular piles, BBGE have produced calculations stating predicted values of the peak particle velocity for this method, which are outlined in Figure (3). For further details refer to the attached BBGE calculations in Appendix B. Figures (2) and (3) show that the anticipated peak particle velocity (PPV) due to piling at the Computational Foundry and the adjacent buildings will have dissipated to levels significantly below the thresholds recommended in BS 5228: 2009 for cosmetic damage to buildings. According to the CIRIA guidance document C142, the residual vibration levels at the Foundry and the SMART building are comparable to the peak particle velocities generated by traffic or humans jumping.

For illustrative purposes, the following PPV measurements are provided in CIRIA TN142:

- | | | |
|---|---|----------|
| • Threshold for prevention of structural issues | = | 8 mm/s |
| • Traffic (typical – non-specific) | = | 6 mm/s |
| • Footfalls across a wooden floor | = | 3 mm/s |
| • Stamping on a computer room floor | = | 2 mm/s |
| • Footsteps a few metres from a home | = | 0.5 mm/s |

The contractor is to allow for monitoring during piling and ground works for assessment against the agreed benchmarks/thresholds. Reference is to be made to the CIRIA 142 document - 'Ground Borne Vibrations Arising from Piling'.

It is proposed to undertake further background vibration monitoring at the SMART and Engineering Central buildings to ascertain vibration levels from normal campus activities. This data can then be used as a benchmark for monitoring site activities.

Results from previous BBGE investigation into piling vibration

The following results, provided by BBGE, detail the record peak particle velocity (PPV) levels for precast concrete driven piles including pre-boring, as measured on the Swansea Bay Campus.

Table 1 – Indicative PPV Levels for precast concrete driven piles (as provided by BBGE)

Precast Concrete Driven Piles (including pre-boring)		
	Distance from the CISM building	Peak Particle Velocity (PPV)
	5m	20mm/s
	10m	8mm/s
	15m	6mm/s
	20m	4mm/s
	25-30m	3mm/s
	35-40m	0.5mm/s

Table 2 – Indicative PPV Levels for steel tubular driven piles (as provided by BBGE)

Steel Tubular Driven Piles (including pre-boring)		
	Distance from the CISM building	Peak Particle Velocity (PPV)
	5m	10mm/s
	10m	6mm/s
	15m	4mm/s
	20m	3mm/s
	25-30m	2mm/s
	35-40m	1mm/s

Refer to **Appendix A** for a graphical representation of the zones around the proposed building detailing the estimated peak particle velocity.

Piling Noise

The noise measurements taken by BBGE during the recent similar piling operations at the student residences on campus, indicated noise levels in the order of 92 dB $L_{Aeq,1hr}$ at a 3 m distance, and 86 dB $L_{Aeq,1hr}$ at a 5 m distance from source. This equates to approximately 81 – 82 dB when measured at 10 m, lower than the 89 dB L_{Aeq} threshold quoted in BS 5228:1-2009.

For the proposed CISM site, the nearest noise sensitive receivers are the student residences approximately 15 m to the west of the easternmost proposed piles. Piling operations are likely to be anywhere from 15 m to 70 m from nearby buildings, equating to a predicted noise level of between 78 and 65 dB $L_{Aeq,1hr}$. In the context of the area, average noise levels are already relatively high due to road traffic from Fabian Way, and the roads associated with the campus, including bus routes directly outside of the student residences.



Figure 2. BBGE Noise and Vibration Monitoring Locations (January-April 2016)

At two monitoring noise receptors in the residential area to the north of Fabian Way (NR06 and NR07), typical L_{Aeq} of 60.2 to 63dB and L_{Amax} of 69.6-70.1 were recorded during the recent precast driven piling works during the construction of the student accommodation blocks.

The impact of driven piling noise can be mitigated where required, by consideration of working hours, utilising rig noise suppression and considering the orientation of the rig. The figures (3) and (4) show the comparative continuous noise emission from the rotary bored piling rig and the intermittent peak noise from the precast driven piling rig. It can be seen that the orientation of the driven piling rig is important when considering the impact of noise emissions and location of noise receptors.

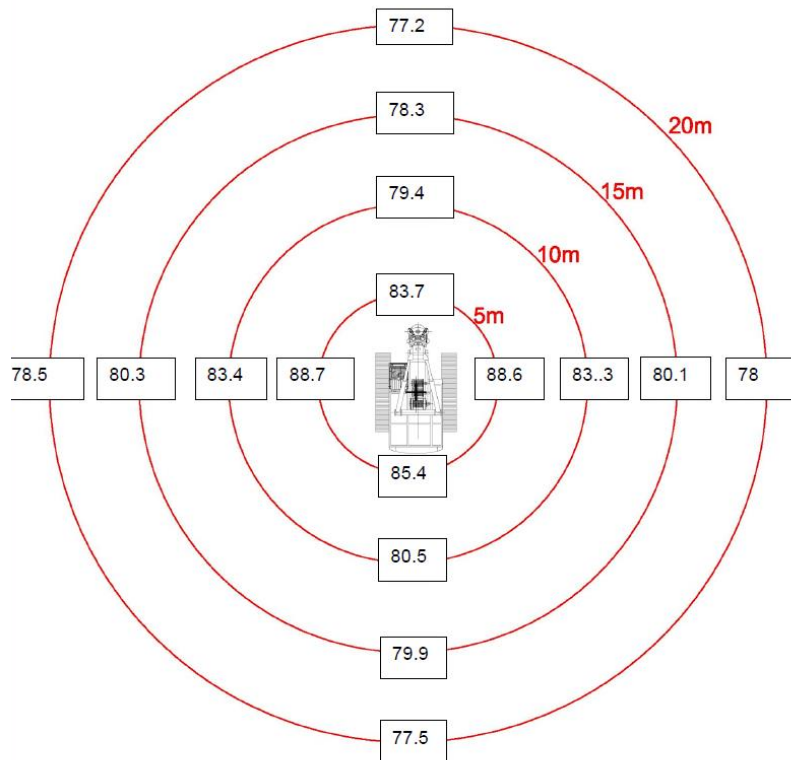


Figure 3. Rotary Bored Soilmec Piling Rig Noise Emissions (data provided by BBGE)

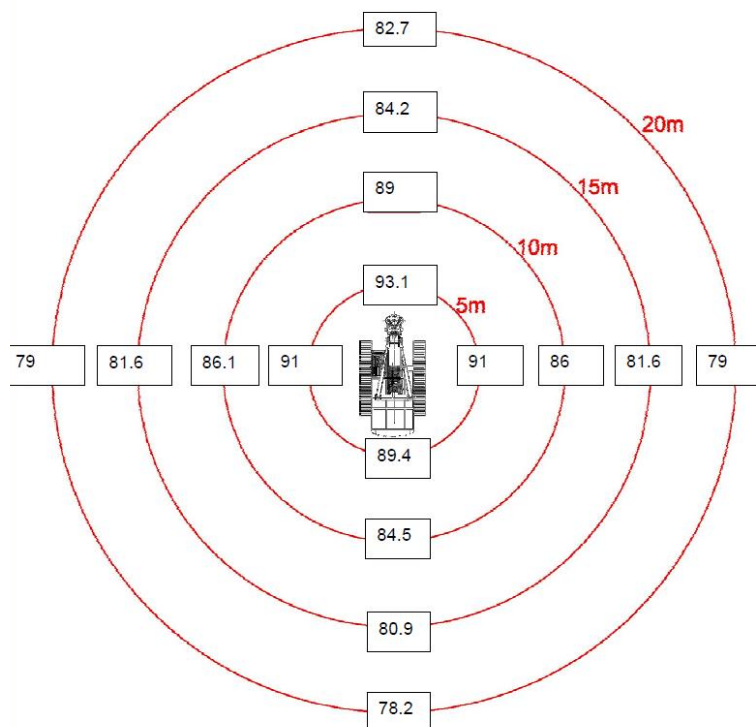


Figure 4. Typical Junttan Precast Driven Piling Rig Noise Emissions (data provided by BBGE)

Conclusions and Recommendations

The levels of vibration and noise associated with precast piling have been estimated to be within the reasonable thresholds provided in BS 5228: 2009 and CIRIA guidance document C142 based on the monitoring carried out by BBGE during driven piling activities elsewhere on the Campus.

However, the following noise and vibration mitigation techniques will be implemented on the project to minimise the impact of the works as far as is practical.

Piling Noise and Vibration Mitigation

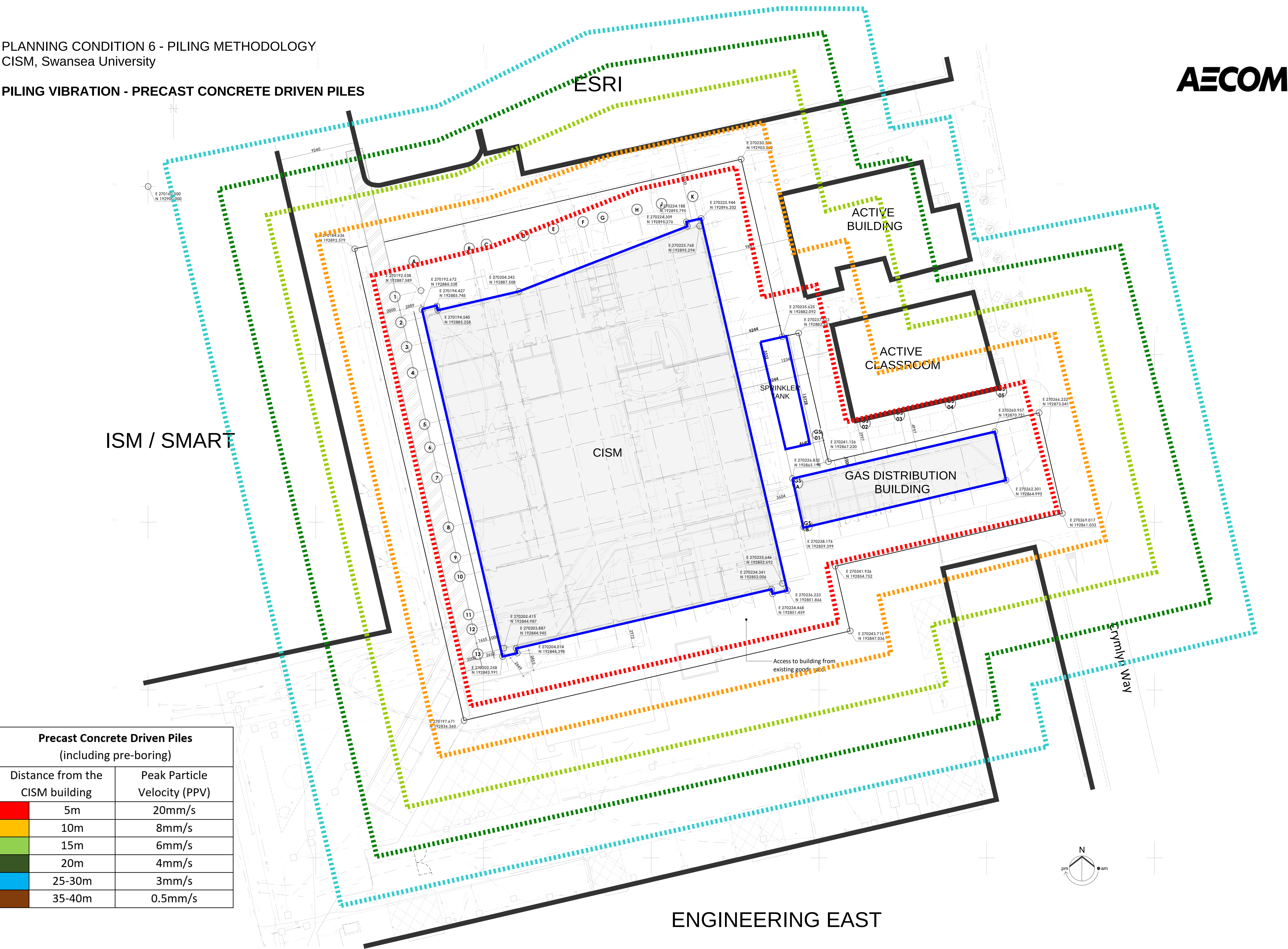
The following piling noise and vibration mitigation measures will be implemented on the CISM project to minimise the noise and vibration impact of the precast driven piling works.

1. **Piling Rig Noise Emissions** – the precast driven piling will be undertaken using the latest hydraulic rig. Acoustic measures will be implemented within the rig. The Junttan rig will also be fitted with the latest Shark hammer, which offers exceptional noise suppression. In addition, the shark hammer is contained within a localised enclosure which will also improve noise suppression.
2. **Piling Rig Orientation** – the piling rig noise emissions are greatest from the hammer facing end of the rig. The piling platform will therefore be extended to allow the rig to be orientated to face away from the residential properties during piling operations, a noise reduction which may be up to 5dB.
3. **Site Hoarding** – a solid perimeter site hoarding will now be installed to provide low level shielding to absorb and deflect noise from the piling operations. The hoarding will be most effective when the piles are driven to their founding depth where the noise emissions are generally greatest.
4. **Site Noise and Vibration Monitoring** – site noise and vibration monitoring will be implemented on site and from the nearest noise sensitive properties (i.e residential dwellings). Trigger values will be set and telemetry can be provided to allow real time feedback to the site team and University if threshold values are exceeded, allowing the contractor to take immediate action. The piling noise and vibration monitoring to be undertaken during the piling works will be implemented in accordance with the BBGE monitoring plan included in appendix B of this report.
5. **Communications with Residents** – the project will be registered with the Considerate Contractor's scheme. Therefore, there will be a requirement to undertake leaflet drops to communicate planned construction activities with the local residents and students. A specific leaflet drop to inform residents of the planned piling activities will be undertaken ahead of the works. Site contact details will also be provided in the event of any issues arising. An example leaflet from another project is appended to this document.
6. **University liaison** – Swansea University will provide Neath Port Talbot Planning Authority with a direct point of contact to address and action any noise or vibration related issues prior to any development taking place.
7. **Restricted Working Hours** – the hours of work will be restricted to 8.30am to 5.30pm, Monday to Friday. Piling works will also be planned to avoid specific noise sensitive University events, such as exams.
8. **Pile Cutting** – the piles will be cropped using specialist pile cropping machinery. Jack hammers or similar will not be used in order to reduce noise emissions.

Appendix A

Site plans with expected peak particle velocity levels (PPV)

PILING VIBRATION - PRECAST CONCRETE DRIVEN PILES



ENGINEERING EAST

PILING VIBRATION - STEEL DRIVEN TUBULAR PILES



Steel Tubular Driven Piles (including pre-boring)		
Distance from the CISM building	Peak Particle Velocity (PPV)	
5m	10mm/s	
10m	6mm/s	
15m	4mm/s	
20m	3mm/s	
25-30m	2mm/s	
35-40m	1mm/s	

Appendix B

Example Leaflet Drop

Kier Construction Western & Wales

Swansea University Impact Building



ISSUE 01

Welcome to issue 1 of the Swansea University Bay Campus IMPACT Building update from Kier Construction Western and Wales. We welcome your feedback.



Gavin Thomas

Project Manager

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We at Kier Construction are happy to announce that we have been awarded the contract for the new Innovative Materials, Processing and Numerical Technologies (IMPACT) building situated on the Swansea University Bay Campus.

This exciting new development will provide future proof, highly specialised laboratories for fundamental research and a dynamic environment for significant research finding.

Construction proposals...

Hi from the Kier Site team, our enabling works will start on 6th November 2017. This is the period where we set up our site arrangements to protect the public and local environment from the Construction activities.

We will be hoarding our site, placing our site accommodation, providing services to our accommodation and excavating our site to create a piling matt to commence piling operations on 27th November for circa 3 weeks.

Jargon Buster

Piling Mat

A Piling mat is the hardcore base on which the piling rig will travel. The design of the piling mat is required to resist the forces from the piling rig during travelling and piling. A piling mat should be constructed of suitable inert material

Piling

This process will involve a piling rig which is a machine that 'drives' piles into the ground. We are using driven precast concrete and steel tube piles as previously used on the bay campus.

We will provide as previously used on the new campus further mitigation measures to avoid noise/vibration disruption during the piling operation by:

Preboring pile locations/rigs will have acoustic shrouds/orientation of rig/solid hoardings/monitoring stations/good communication with our neighbours/ 8.30am-17.30pm weekday working hours only.

After Christmas we will be starting the construction of the Foundations in preparation of the steel frame late February 2018.



Meet the team



Gavin Thomas
Project Manager
07710 051253



Amy Griffiths
Site Manager
07974267480



Amanda Swoboda
Community Engagement Co-ordinator
07864977056

Community Engagement

Future Engagements will include:

- School Engagement
- Community Engagement
- Regular Development Updates

If you would like us to consider an engagement opportunity with you, please contact Amanda Swoboda on amanda.swoboda@kier.co.uk



Health and Safety

Construction sites can be dangerous places. "At Kier Construction we endeavour to undertake all our activities with particular regard to health and safety. This not only relates to our own people working on our sites, but also to the public and users around our site. For this reason, please ensure that unauthorized persons do not enter the site itself."

"We operate an open door policy"

Gavin Thomas - Project Manager



Kier Construction Cymru a'r Gorllewin

Adeilad IMPACT Prifysgol Abertawe



Rhif 01

Croeso i rifyn 1 o'r diweddariadau ar Adeilad IMPACT Campws Prifysgol Abertawe yn y Bae gan Kier Construction Cymru a'r Gorllewin. Rydyn ni'n



Gavin Thomas

Rheolwr y Prosiect

07710 051253

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Mae Kier Construction yn hapus i gyhoeddi ein bod ni wedi ennill y contract i adeiladu'r adeilad Technolegau Deunyddiau Prosesu, Technolegau a Rhifiadol Arloesol (IMPACT) newydd ar Gampws Prifysgol Abertawe yn y Bae. Bydd y datblygiad newydd cyffrous yma'n darparu labordai newydd arbenigol iawn sy'n ddiogel rhag y dyfodol er mwyn cyflawni gwaith ymchwil hanfodol, a chreu amgylchedd deinamig ar gyfer gwneud canfyddiadau pwysig trwy waith ymchwil.

Y cynigion adeiladu...

Helo 'na gan dîm safle Kier! Bydd ein gwaith paratoi yn cychwyn ar 6 Tachwedd 2017. Bryd hynny, byddwn ni'n dechrau paratoi'r safle er mwyn amddiffyn y cyhoedd a'r amgylchedd lleol rhag y gwaith adeiladu.

Byddwn ni'n gosod byrddau o amgylch ffiniau'r safle, yn paratoi cyfleusterau'r gweithwyr, yn darparu gwasanaethau ar gyfer ein cyfleusterau ac yn cloddio'r safle er mwyn creu mat pyst fel y gallwn ddechrau'r gwaith o osod y pyst ar 27 Tachwedd. Bydd y gwaith o osod y pyst yn cymryd tua 3 wythnos.

Chwalu'r Jargon

Mat Pyst

Mat pyst yw'r sylfaen caled y bydd y peiriant cludo pyst yn teithio arno. Mae angen dylunio'r mat pyst mewn ffordd sy'n gwrthsefyll grymoedd yr offer gosod pyst wrth deithio ac wrth osod y pyst eu hunain. Caiff y mat pyst ei adeiladu o ddeunyddiau segur addas.

Gosod Pyst

Bydd y broses yma'n defnyddio peiriant gosod pyst i 'yrru' pyst i mewn i'r ddaear. Byddwn ni'n defnyddio pyst o goncrit parod a thiwbiau dur.

Yn yr un modd ag o'r blaen ar safle'r campws newydd, byddwn ni'n rhoi mesurau lliniaru ar waith er mwyn atal y sŵn/dirgryniant rhag tarfu ar y gymuned leol yn ystod y gwaith o osod y pyst. Byddwn ni'n gwneud hyn trwy:

Dorri tyllau cyn gosod y pyst/gosod gorchuddion acwstig ar yr offer/lleoli'r peiriannau'n ofalus/codi byrddau ffin solet/gosod gorsafoedd monitro/cyfathrebu â'n cymdogion/ gweithio rhwng 8.30am-17.30pm yn ystod yr wythnos yn unig.

Ar ôl y Nadolig, byddwn ni'n dechrau adeiladu'r sylfeini er mwyn paratoi ar gyfer gosod y ffrâm ddur ddiwedd Chwefror 2018.



Cwrdd â'r tîm ...



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Ymgysylltu â'r Gymuned ...

Bydd ein gwaith ymgysylltu yn y dyfodol yn cynnwys:

- Ymgysylltu ag Ysgolion
- Ymgysylltu â'r Gymuned
- Diweddariadau Cyson ar y Datblygiad

Os ydych chi am i ni ystyried cyfle ymgysylltu, cysylltwch ag Amanda Swoboda ar amanda.swoboda@kier.co.uk



Iechyd a Diogelwch

Mae safleoedd adeiladu'n gallu bod yn beryglus. "Yn Kier Construction, rydyn ni'n gwneud ein gorau glas i gyflawni ein holl weithgareddau â ffocws arbennig ar iechyd a diogelwch. Nid dim ond mater o'n pobl ein hunain sy'n gweithio ar ein safleoedd yw hyn, ond y cyhoedd a defnyddwyr eraill hefyd. Am y rheswm hwn, cofiwch sicrhau nad oes neb yn mynd i'r safle gwaith ei hun heb awdurdod."

"Mae gennym bolisi drws agored."
Gavin Thomas - Rheolwr y Prosiect



Appendix C

BBGE Piling Vibration Calculation Report

Appendix B – BBGE Piling Vibration Calculation Report

Note: BBGE cannot confirm what the vibration levels will be during the installation of the steel tubular piles; therefore calculations have been completed to indicative levels. The actual level produced will be measured on site and then reviewing in order to determine benchmark/threshold levels.

Prediction of vibration levels due to impact driving of piles.

Source: - TRL Report 429 entitled "Groundborne vibration caused by mechanised construction work"

The expression recommended in the above document is as follows: -

$$v_{res} \leq \frac{k_p (W)^{1/2}}{r^{1.3}} \quad (\text{expression 19 on page 52})$$

This expression will be incorporated into the 2008 revision of BS 5228

where v_{res} = resultant peak particle velocity in mm/second

W = hammer energy in joules

r = distance in metres **from pile toe** to the point of concern

k_p = an empirical scaling factor related to soil conditions, choose from range of loose/soft through medium dense/stiff and dense/very stiff to refusal

Piling hammer details

Hammer weight **4** tonnes
Fall height **300** mm
Efficiency **80** %

Soil conditions

medium dense or stiff soil

At the site in question, the following values of the above parameters apply: -

W	=	9418	joules							
R	=	5	10	15	20	25	30	35	40	radial distance in metres
d	=	6	6	6	6	6	6	6	6	depth to pile toe in metres
r	=	8	12	16	21	26	31	36	40	metres
k_p	=	1.5								for a pile being driven through medium dense or stiff soil

Consequently the peak particle velocity can be calculated as: -

$v_{res} \leq$	10	6	4	3	2	2	1	1	mm/second
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Variation of peak particle velocity (ppv) with radial distance from source (TRL 429)

