

ROGER BULLIVANT

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Erection of a raw materials bunker (an extension to existing facilities) and associated works

PILING METHOD RISK ASSESSMENT



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Executive Summary

This document aims to explain the installation process and benefits of bottom driven piles for the proposed erection of raw materials bunker (an extension to existing facilities) and associated works at Tata Steel Port Talbot

Indicative noise and vibration levels are also enclosed.

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1. Pile Installation process

Bottom driven steel piles are installed using hydraulically operated piling hammers of 0.3-1.5 tonne weight, with the stroke energy being determined by the pile loading requirements and ground conditions encountered.

Pile casings are supplied in 1-3m length and are joined to ensure the design length is reached with minimal wastage (see figures 1 and 2).

The lead section is fabricated with a swaged and welded point to prevent material being 'plugged' inside the steel tube

No spoil is generated during installation and groundwater does not affect the installation or performance of the piles.

The piling hammer is lowered inside the casing and allowed to free fall against an internal concrete plug driving the tube into the ground

The hammer stroke is variable to allow control of pile driving stresses during installation.



Figure 1 : Driven pile installation process

Subsequent sections of steel tube are added and driven into the ground until the design length is achieved

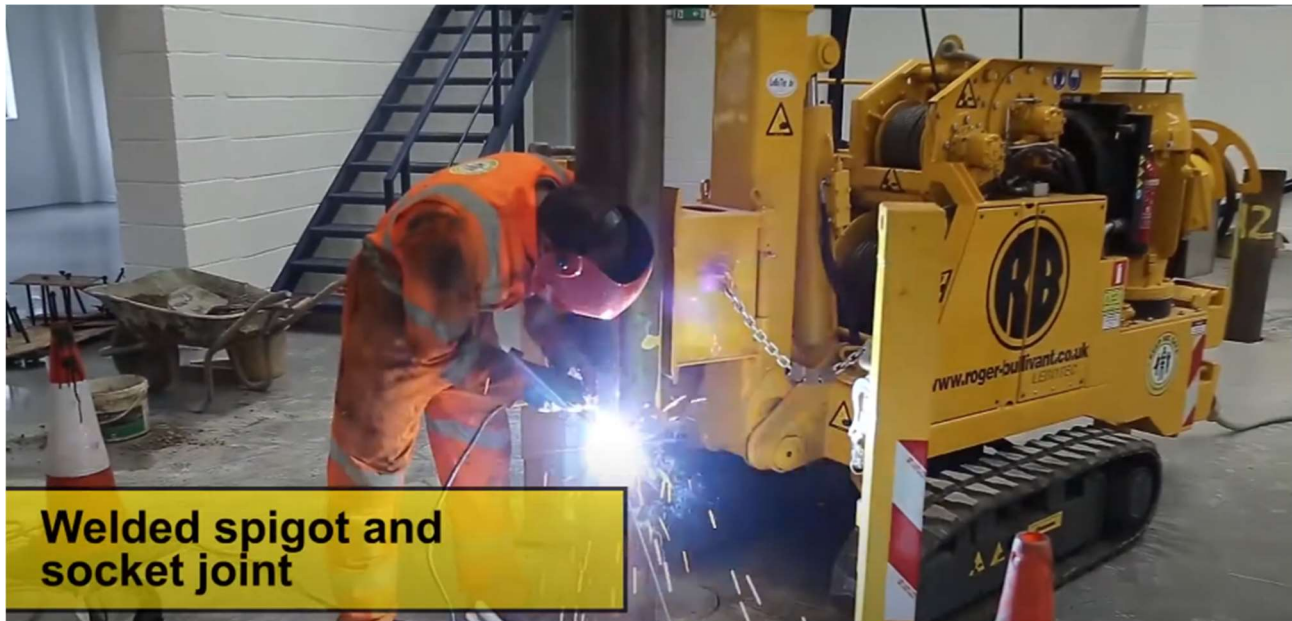


Figure 2 : Segmental pile sections reduce waste

The pile casing is then filled with reinforced concrete in accordance with the design

At the 200T bunker project because of site restrictions the piles will be driven in 2m lengths to achieve and anticipated design length of 25m . The piles will derive bearing capacity in both end bearing skin friction from the underlying dense glacial gravels.

2. Advantages of the bottom driven steel piling technique

The bottom steel tubular piling technique offers a multitude of benefits over other piling and ground improvement techniques, some benefits include;

- ☐ Pile installation is quick and clean
- ☐ Large free fall drop heights enables efficient energy transfer producing significant design capacities from small plant.
- ☐ Piles can transfer high driving forces required to penetrate the deep made ground and socket into the dense bearing strata
- ☐ Piles are fabricated in factory controlled conditions to BS EN ISO 9001:2008
- ☐ Piling can operate in restricted headroom and electric or diesel powered machinery
- ☐ Ground water does not affect the installation or performance of the piles
- ☐ Less plant and equipment required than other techniques
- ☐ As such less deliveries are required
- ☐ No spoil to remove off site

3. Piling in Contaminated Ground

We have noted from the site investigation report provided the 'made ground' is described as potentially contaminated and there is concern regarding pollution of the under lying groundwater.

We have reviewed the site investigation report by Apex Geotechnical and the boreholes indicate the following soil profile: -

0 – 3m Made Ground

3 – 21m Alluvial sands, gravel, clay and peat

21m+ Medium dense to dense glacial gravel

The soils report has noted that the made ground is dominated by gravelly CLAY with some man made material namely slag and brick

The most appropriate pile type from a geotechnical perspective, taking into account the site constraints is a bottom driven steel tubular pile however consideration should also be given to the environmental considerations in particular the environmental risks of piling into the contaminated made ground.

In order to verify that the most appropriate pile type has been selected and that it will have a minimal adverse environmental impact the site has been assessed against the six pollution scenarios detailed in the National Groundwater and Contaminated Land Centre report 'Piling into contaminated sites' (ISBN 1857058038)

Scenario 1 – *Creation of pathways to allow contamination of the groundwater*

Groundwater was noted within the trial pits as stationary at around 3m which rose slightly under artesian pressure. As the groundwater was within the depth of the potentially contaminated made ground therefore piling through the material will not increase the risk of further contamination. It is also noted in Environmental Agency report Piling in Layered Ground: Risks to Ground water and Archaeology (SC020074/SR) that Creation of pathways are likely to be temporary and reformation of the soils around the pile shaft through cohesive material will aid in the prevention of water penetrating to depth.

Scenario 2 – *Creation of a pathway for sealed landfill gas*

The made ground is not encapsulated by an impermeable layer of soil and does not contain organic material therefore the risk is not present.

Scenario 3 – *Human contact with contaminated arisings*

The tubular steel pile is a displacement pile and as such does not create arisings

Scenario 4 – *Contaminated material degrading the pile materials*

Having assessed the level and nature of the contamination we can confirm that it will not detrimentally affect the design life of the piled system

Scenario 5 – *Pushing solid contaminants down into the groundwater*

Top driven steel tubular piles have open toes allowing material to 'plug' and be taken down from near surface to depth. The pile sections on this project have been specified swaged to a point and welded to prevent plugging and will deflect contaminants aside rather than dragging material down to depth.

Scenario 6 – *Contamination of the groundwater by concrete, cement paste or grout*

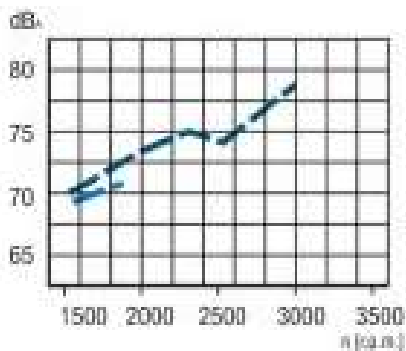
The steel tubular pile acts as a protective sleeve preventing the infill material being in contact with the soil or groundwater.

Having considered all of the potential pollution scenarios on the site we are satisfied that the potential hazards have been assessed and environmental risks mitigated.

4. Indicative Noise & Vibration levels

Noise

Roger Bullivant's fleet of bottom driven piling rigs are designed to work in close proximity to the general public e.g., schools, hospitals and railway stations and the process of winching and driving the pile is almost silent compared to 'average' construction noise levels. The only area of potential concern would be from the diesel engine which itself is a four cylinder silenced unit. The chart below illustrates that under normal operating conditions at 1750 rpm, the average noise level LpA at 7m radial distance would be 72dB



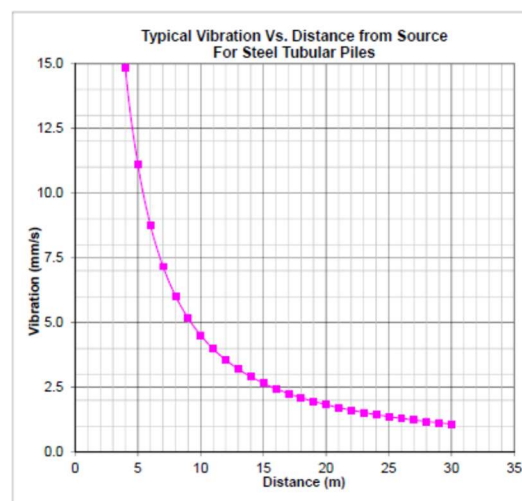
3 Cylinder Hatz L series Silent-Pack Engine (3L41C)

Vibration

BS5228 quoted limiting criteria for the onset of minor cosmetic damage to light framed structures of 15mm/s for transient, short duration vibration, and 7.5mm/s for continuous vibration.

The below table details typical vibration levels for a D1000 piling rig taken at 5m, 10m, 20m and 30m increments.

Although these are actual field measurements small variations may occur particularly when driving through layered soils.



5. Conclusion

In conclusion based on the above RB consider bottom driven steel tubular piles will provide the best environmental and technical solution to the project.

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17.12.20