



PINDERFIELDS HOSPITAL, WAKEFIELD

KEY DETAILS

// CLIENT

Balfour Beatty PPHJV

// JOB SPECIFICATION

The installation of Monopiles for a new hospital

// STRUCTURAL ENGINEERS

White Young Green

The redevelopment of Pinderfields Hospital in West Yorkshire is central to the reconfiguration of health services in the area. The new construction involved 90,000m² of Acute Hospital on a footprint of 22,000m², all on a brown field site. The layout has two separate buildings connected by a central atrium which includes public services. The eastern building, the adult in-patient block, generally contains wards and is designed with a steel frame while the western building contains the acute hospital departments and is designed with a concrete frame.

The original foundation concept was to support both buildings on concrete pads at a standard depth with mass concrete making up the level between the allowable bearing depth and the underside of the pad. The site investigation report

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recommended that a ground bearing pressure of 300kN/m² could be adopted below a pad foundation. However, the excavation depth required to reach this recommended bearing pressure level varied across the site by up to 5m due to the contour of the mudstone bedrock dipping steadily across the building footprint. Above the mudstone was mostly made ground which was unsuitable as a bearing material. The boreholes also identified a water table falling in the same direction as the rockhead below slab level.

The pad foundation approach therefore required extensive excavation, management and disposal of ground water, removal of unsuitable material and the import and compaction of suitable fill. To avoid these difficulties alternative designs were considered using piles.

Balfour Beatty Ground Engineering worked with the project design team to design, develop and propose a large diameter monopile solution. The monopiling scheme was engineered so that the holding down bolts for the steel frame columns could be installed directly into the wet concrete at the head of the piles. Similarly for the concrete frame a reinforcement starter cage could be plunged into the concrete. The introduction of insitu concrete column starter bars in this way, as part of the pile construction process, marks a significant step forward.

Piles were installed using rotary boring techniques to ensure they could be socketed sufficiently into the mudstone bedrock to carry vertical loads of up to 4,500kN. Preliminary pile tests were also performed to check actual settlement performance against calculated design values. A total of 544 piles of 1050mm and 1200mm diameter were installed using 2 rigs in a 10 week programme. Each pile had a specific design and for each a reinforcement cage was numbered to correspond with that pile. In total there were 122 different combinations of pile diameters and lengths required.

One of the major challenges was to achieve a “right first time” construction. The large number of combinations of pile lengths, reinforcement cages, holding down bolt details, and starter bar details required careful management, scheduling and sequencing. Purpose made guide frames were manufactured to ensure the tolerance of the finished pile heads were equal in line and level to that used by the steel and concrete frame contractors. In most cases this was up to 8 times tighter than normal piling tolerances. Rigorous checking and signing off procedures were adopted to ensure compliance and successful handover.

Using the monopile solution both buildings could be constructed directly off the piles, making pile trimming and pile caps unnecessary. Savings were generated in excavation, concrete and reinforcement when compared to the original concept. A shorter overall construction programme was also achieved as there was no intervening trade package between piling and frame contractors. Consequential benefits also included a reduction in the project carbon dioxide footprint and a safer working environment without deep excavations. Technically the piles eliminated the risk of differential settlement that would have been associated with pads founding at different levels.

FOR FURTHER INFORMATION CONTACT:

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