Cementation

SKANSKA

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Bevis Marks

Award winning foundation re-use project

Client
Core

Main contractor
Skanska UK

Engineer
Waterman

Scope of works
37nr 1050/1200mm up to 29m using large diameter rotary pile technique

66nr 300mm diameter rotary minipiles to 37m

Fibre optic cable instrumentation in existing piles to monitor foundation performance as existing building demolished

Value
£1.2m

Duration
16 weeks

Overview

The 6 Bevis Marks building, built to a BREEAM Excellent rating, contains 160,000 sq ft of office space comprising 16 storeys and 3 stepped roof terraces. It is 80% more efficient than the building it replaced.

The unique aspect of the new construction is the re-use of the existing basement retaining walls and foundations (piles, caps and slab),which accounted for 50% of the mass of the original building. The existing under ream piles were installed some 20 years ago by Cementation Skanska.

Project development

The project originally started life as part removal and rebuild in 2008, but moved on to consider the re-use of the existing foundations. Key to this decision, was the balancing act in the considering the bulk and mass of the building with the existing foundation capacity and assessing the sufficiency of these foundations. This foundation assessment was made from examination of as built Cementation records, a building analysis and in situ investigations, which involved coring some existing walls and under-ream piles. In an innovative approach, real time fibre optic instrumentation was added to some of the under ream piles to assess pile response during unloading due to demolition.

Cementation Skanska, under a separated design consultancy package, were appointed to the project team which assessed varying combinations of live load with the number of floors to optimise the foundation capacity and minimise any additional foundations. This exercise was vital to assess the viability of the overall development and to outline and manage potential risks arising from a re-use strategy.

Scope

37nr 1050/1200mm diameter piles were used to supplement the existing 67nr under ream

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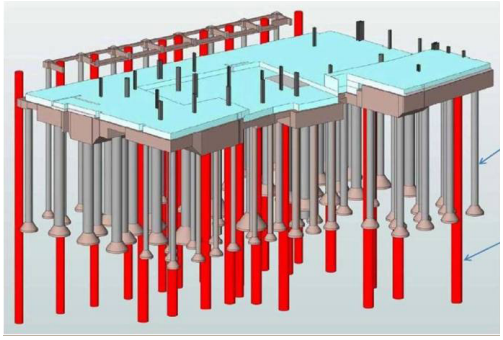
03/06/13 Rev 0

piles of 750-1050 mm diameter belled out to 1800-4500 mm (see diagram). The new piles were constructed using a Soilmec 312 base machine and a conventional rotary technique. The rig was lifted into the basement (a more sustainable option to operating a ramp).



66nr 300mm diameter rotary minipiles were constructed at pavement level using 2 Klemm rigs 709. A down the hole hammer was used to pile through mass concrete foundations (a more sustainable option to coring).

The installed instrumentation comprised prefabricated fibre optic cables arrays into two under ream piles and one into a geotechnical borehole.

These underream installations were installed while the building was still under full load. Cambridge University were used to analyse and interpret the data on ground heave and monitor potential pile cracking once clay uplift forces came into play on demolition.

Benefits of Re-use

Adopting a re-use approach saved several construction activities and programme time, which led to project savings:

- Demolition.
- Pile removal or coring through existing pile.
- Debris and waste disposal
- Temporary works to uphold the retained ground.
- Installation of new piles.
- Installation of new retaining walls, caps, beams and slabs.
- Associated groundworks.

These activities would also contribute significantly to the carbon footprint of the building, which is now reduced, along with the embodied carbon:

- 67 piles were re-used. The calculated savings for avoiding this installation are 1000t $C0_2$, cost £1,000,000 and 8 weeks programme time.
- The entire Basement box – walls, slab and pile caps were all re-used with significant savings on $C0_2$, cost and programme time.

As a result there was a considerable return on the design package investment and the risks with a re-use strategy were quantified and managed.

Drivers

- The client's aspiration to re-use the structure, to upgrade an existing building to improve its efficiency, modern letting requirements and obtain a BREEAM Excellent standard.
- The sustainable approach to the project had to be financially viable.
- The integration of the new supplementary piled solution, threaded in between the existing piles, reduced the potential for substructure clashes leading the client to a low risk construction solution.
- To future proofing of the building. In order to obtain a good load transfer from the structure to the ground, a thick transfer slab was introduced not only to alleviate the degree of reliability on any individual pile, but to have the added benefit to future. redevelopment in having an adaptable foundation.
- A re-use strategy is sympathetic environmentally and socially. Several thousands of truck loads of waste material off site are avoided as well as importing similar volumes of replacement materials. The resulting shorter construction period reduced the exposure of the local business community to noise and congestion – a main concern in a busy city centre environment .

Summary

A re-use strategy has a variety of benefits to client, community and the environment. Cementation Skanska are actively working with clients, developers and contractors to invest in this sustainable strategy.

We have undertaken similar re-use projects at Coventry and Bridgwater and have several more under consideration.

In 2013, the re-use approach at Bevis Marks was awarded the GE Award for Sustainable project of the Year.