Ground Improvement

H&R Johnson

STAFFORDSHIRE, UK

Installation of Vibro Stone Columns

Introduction

As part of an ongoing development programme involving several sites at Tunstall in Stoke-on-Trent, Bachy Soletanche Limited was commissioned to provide foundation support to the redevelopment of an operating ceramics factory for H&R Johnson Limited.

Ground Conditions

The site consisted of a loose to medium dense clayey ash fill with tile and pottery fragments, overlying firm to stiff clays, with cola measures at depth.

Design

The development of the existing factory posed several problems, the main issue being that the client wished to maintain production while work progressed. This required the adoption of four ground engineering techniques:

- CFA Piling
- Vibro Stone Columns
- Mini-piling
- Jet Grouting

Dry top feed stone columns being constructed at the Tunstall site

CLIENT:	H&R Johnson
MAIN CONTRACTOR:	Eric Wright Construction Limited
CONSULTING ENGINEER:	Jubb & Partners
DURATION OF WORKS:	3 months

WORKS QUANTITIES

CFA Piling	766 no
Vibro Replacement	800 stone columns to 3.75m depth
Mini Piling	33 no, 240mm diameter piles
Jet Grouting	39 no, 1.8m diameter columns

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Construction

CFA Piling was used to support the majority of main structural loads. This involved the construction of 766 no CFA piles with diameters between 350mm and 450mm with capacities of between 300kN and 1200kN.

Mini piling was utilised where conventional CFA plant could not access due to height and space restrictions. This allowed essential areas of the factory to remain in production whilst the facilities were redeveloped.

Mini Piling in restricted access areas

A Hutte HBR 202 TF mini rig was used to form 240mm diameter cased augured and DTH hammer mini piles with a depth up to 17m and capacities between 300kN and 450kN.

Ground treatment was carried out to ground floor slabs using a dry 'top feed' Vibro Stone Columns system. This technique was used to value engineer floor slab support where engineering assessment had indicated that total and differential settlements of the fill materials would exceed acceptable limits, but where a fully piled solution was not required.

Ground treatment offered significant benefits not only in the speed of construction, but also in terms of the associated cost where a ground bearing floor slab was adopted rather than the more costly fully spanning solution.

Compaction of Stone into Column

Jet grouting using the 'double tube' method was employed to provide excavation support and underpinning for foundations within the existing structure, where deep excavations were required and conventional piling plant could not access.

Jet Grouted Wall showing bricks encased in the cement grout matrix

The area jet grouted was historically a waste pit for the tile-making process and contained a mixture of highly unstable tile and brick fill, coupled with high groundwater flows near the surface which meant that a retaining wall had to be provided prior to excavation being commenced. Utilising jet grouting gave both a high degree of confidence in the temporary works design as well as providing a gravity retaining structure that did not require propping.

Summary

In conclusion, the benefits offered by a single multi-disciplinary contractor allowed a flexible and value engineered strategy to be provided. The provision of several specialist solutions integrated into one ground engineering package allowed a fully flexible approach to be adopted, with several major design changes being accommodated as site works progressed.

Exploded View of North, East and West Faces of Jet Grouted Wall After Excavation Providing Gravity Excavation Support Without