

# Ground Improvement

## Vibro Stone Columns

GLASGOW, SCOTLAND



### Dry Top Feed Vibro Stone Columns

#### Introduction

As part of the ongoing regeneration of the Gorbals area of Glasgow a library is being constructed at Crown Street.

#### Ground Conditions

The site consisted of a loose fill material comprising of clays, sands, brick and concrete rubble overlying more competent strata at approximately 3m depth. Groundwater was not anticipated allowing the use of a dry top feed stone column system.

#### Design

The development posed several problems, as the fill materials would not support the loads generated by the foundation or floor slabs and both total and differential settlements would be excessive. Ground improvement was selected due to the variable nature of the fill materials. Vibro Foundation Limited's team of specialist Geotechnical Designers proposed a solution utilising dry top feed stone columns beneath foundation and floor slabs to provide the required bearing capacity as well as controlling settlement.



V23 System mounted on a 21 Tonne excavator

CLIENT:

MAIN CONTRACTOR:

Nielstra

CONSULTING ENGINEER:

rja Consulting

DURATION OF WORKS:

September 2002

#### WORKS QUANTITIES

Vibro Replacement

500 Stone Columns

7 Plate Load Tests

2 Dummy Foundation Tests



A Dry Top Feed system was chosen as being the most cost and time effective to enhance both the bearing capacity and settlement characteristics of the fill materials.

As a service diversion required a second visit to site, the use of standard excavators offered significant benefits over more traditional stone column construction techniques.

### Plant & Construction

The system chosen utilised the powerful V23 vibro-flot that has been developed to use standard civil engineering plant, such as the Komatsu PC210LC excavator pictured opposite.

The construction cycle is as follows:

Penetration The vibro-probe penetrates to the required depth by vibration with the aid of compressed air.

Construction the vibro probe is then withdrawn completely from the ground

and gravel is added in small increments. The vibro-probe is reinserted after every addition of gravel to form a compacted stone column. This operation is repeated until ground level is reached.

Completion The ground surface is levelled and compacted by the main contractor.

### Verification Testing

In addition to the rigorous monitoring of individual stone column construction using the in-cab readout unit and the measurement of stone consumption additional verification testing was carried out in the form of:

- 8<sup>no</sup> 600mm diameter Plate Bearing Tests
- 2<sup>no</sup> Dummy Foundation Tests

The results of these tests confirmed both the anticipated bearing capacity and settlement performance of the constructed columns and treated ground.



Plate Load Test being carried out

### Summary

In conclusion the use of a major specialist foundation engineering contractor allowed a flexible and value engineered strategy to be provided. Ground Treatment offered significant benefits not only in the speed of construction, but also in terms of the associated cost where conventional foundations were adopted, rather than a more costly piled and fully spanning foundation and floor slab solution.



V23 excavator mounted system