

Balfour Beatty

Ground Engineering



VANCOUVER DELTAPORT, THIRD BERTH

KEY DETAILS

// CLIENT

Vancouver Port Authority

// JOB SPECIFICATION

Marine vibro densification for a new container berth at the Port of Vancouver

// MAIN CONTRACTOR

Deltaport Constructors Ltd

The wet top feed stone column construction technique was employed to provide the required densification.

Seismic loading requirements required the use of two differing granular materials (mattress rock and replacement fill) in a pre-excavated underwater 'dredged trench'.

These materials have a combined average thickness across the site of 13m, with the depth varying beneath caisson foundations and within the seaward apron. Additionally an overbuild of granular 'feed stock' was placed at varying thicknesses of between 4.5m and 6.0m to provide a sufficient supply of material for backfilling columns. In total some 377,000 cubic metres of granular materials were treated within the dredged trench.

Following marine vibro densification trials, BBGE were chosen to be the subcontractor for the seismic mitigation and caisson foundation works.

Due to the project schedule and the volume of material to be densified, a large amount of resources were required. Ten BD400 vibroflots, four HD150 vibroflots and a host of ancillary plant such as hydraulic power packs, water jetting pumps and data acquisition systems were deployed by an experienced Balfour Beatty Ground Engineering (BBGE) team including site superintendents, project managers and engineers. The team worked back to back 10 hour shifts, six days a week to complete the project within the specified quality and time constraints and to minimise downtime in the event of any mechanical faults.

The vibroflot and data acquisition systems were rigged up to conventional duty cycle cranes housed on barges along with the required ancillary equipment.

Each rig was equipped with a Data Logger system to capture depth and hydraulic pressure, with tidal depth inputted into the Logger to give the required tip elevation. This data is processed in a local PVA database that allows QA/QC review for each column constructed. The data provides accurate real time information to the rig operator, allowing column construction procedures to be followed. Submission of this data also provides confirmatory QA/QC checks to ensure the densification process has been carried out to the necessary methodologies, standards and specifications.

Column positioning was achieved using real time marine GPS devices, which allowed the crane operator to accurately position and identify the column to be constructed on an LCD screen in the crane cab, helping to minimise errors and improve quality.

BBGE's ground improvement equipment subsidiary Pennine manufacture the BD400 - one of the largest and most powerful vibroflots available in the world. The BD400 system is designed to maximise reliability and minimise operational costs.

The increased power of this system allows wider column spacings to be used, which in turn helps to minimise client costs and significantly reduce the programme times required. The HD150 vibroflot system has become the standard for stone column construction and it's usage has been proven in varying soil conditions throughout the world. The HD150's penetration capabilities allowed BBGE to penetrate through the replacement rock mattress on occasions where the BD400 system encountered obstructions.

The Pennine manufactured HD225 T3 Power Pack was also used to power both vibroflot systems and provide consistent and reliable power throughout operations.

FOR FURTHER INFORMATION CONTACT:

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