



Vibro Replacement Stone Columns

Tacoma, Washington Lincoln Avenue Grade Improvements

Improvement Overview

Stone columns are a ground improvement method which involves replacing in-situ material with an aggregate such as 1-1/2 inch to 3/4 inch crushed rock. This replacement process not only densifies the surrounding material through displacement, but also through settlement due to vibration. During an earthquake, seismic loading is resisted by the combination of stone reinforcement and densified soils. Additionally, the dynamically induced increase in pore water pressure dissipates through the permeable stone columns thus preventing liquefaction.

Ground Conditions

This Port of Tacoma project raises Lincoln Avenue over key railroad tracks in the Port area, removing the at-grade conflict between rail activities and heavy vehicular traffic. The bridge design incorporated large earthen embankments founded on reclaimed lands composed of highly variable fill soils and landfill.



Construction

Malcolm Drilling utilized a dry, bottom-feed B-27 Vibroflot featuring state-of-the-art technology to construct the stone columns on this project. Powered by a 180-hp electric motor, the B-27 Vibroflot generates in excess of 25-tons of eccentric force. The Vibroflot is suspended from a crawler crane and is modular in nature enabling construction at depths from near surface to greater than 100 feet and diameters ranging from 30 to 48 inches. A robust automatic data acquisition package is mated to the system to compliment quality control measures. Offering an economical and convenient package to the General Contractor, Malcolm also installed drilled shafts to support each bridge pier along the eight bents.

Owner

Port of Tacoma

Construction Manager

BergerABAM

General Contractor

Scarsella Brothers, Inc.

Geotechnical Engineer

GeoEngineers, Inc.



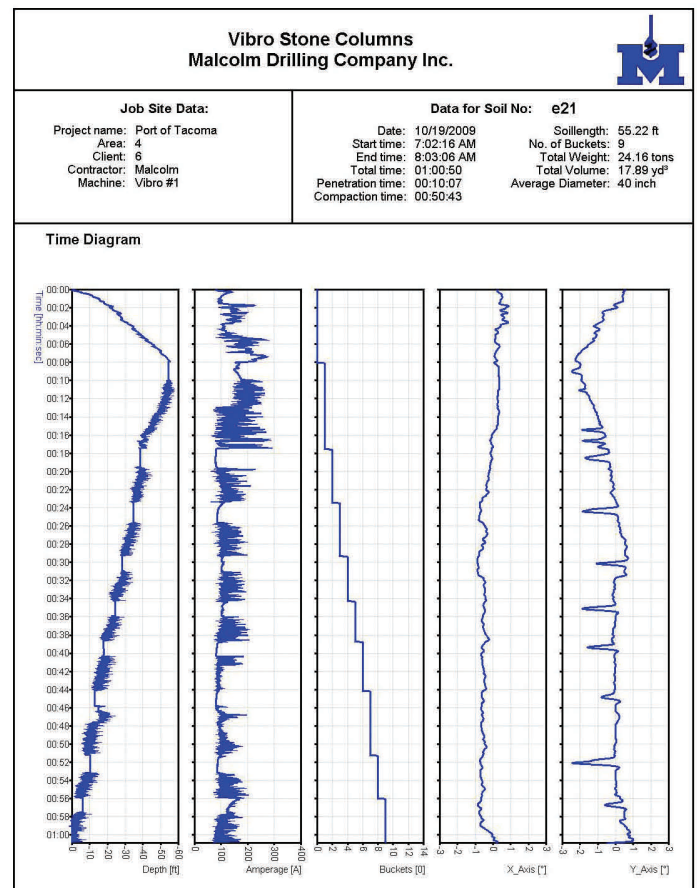
Vibro Replacement Stone Columns

Tacoma, Washington Lincoln Avenue Grade Improvements



Quality Assurance

Unique to this project was the requirement for an automated data acquisition system to record and display the numerous construction parameters for each stone column installed. The data gathered by the onboard computer was transferred to a PC, where special software automatically generated an electronic record for each stone column installed.



Design

Malcolm Drilling installed approximately 120 dry, bottom-feed stone columns to a 55 foot depth at the planned locations of bridge abutments. The purpose of the stone column ground improvement was to reduce the liquefaction-induced settlements of bridge abutments and embankments during a seismic event.

Ground Improvement Division 3524 Breakwater Avenue, Suite 108 Hayward, California 94545 Tel: (510) 780-1167	San Francisco 3503 Breakwater Court Hayward, CA 94545 Tel: (510) 780-9181	Seattle 8701 South 192nd Street Kent, WA 98031 Tel: (253) 395-3300	San Diego 16885 West Bernardo Drive, Suite 100 San Diego, CA 92127 Tel: (858) 753-0707
Corporate Office 92 Natoma Street, Suite 400 San Francisco, CA 94105 Tel: (415) 901-4400	Los Angeles 4926 North Azusa Canyon Road Irwindale, CA 91706 Tel: (626) 338-0035	Salt Lake City 10 West 100 South, Suite 703 Salt Lake City, UT 84101 Tel: (801) 359- 2757	Las Vegas 2365B Renaissance Drive Las Vegas, NV 89119 Tel: (702) 650-2922