



**HELICAL PIER
SYSTEMS**

Building Foundation Reinforcement

Project:

High Pressure Grouted Screw Piles Load Testing
Marvell Campus, Building 4, Santa Clara, CA USA

Installation Contractor:

RWR Construction Ltd.
Engineering Consultant:
Almita Manufacturing Ltd.
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ASCE

Acknowledgements:

Behavior of High Pressure grouted Screw Piles in Santa Clara, CA; authored by Mamdouh Nasr, M.Eng. P.Eng. ASCE
Date: Sept. 2004

Description:

Several column foundations in the building had to be reinforced to sustain the earthquake forces that will be exerted on the foundations. A solution using screw piles with high-pressure grout in loose sand was proposed. The engineer and owner accepted to carry out preliminary pile load tests on site to verify the design and assure that the behavior of the pile meets the acceptable criteria.

Design:

The reinforcement of the original foundations was proposed to sustain major earthquake forces. Due to existence of loose sand layer at a depth between 8-11.0 m, high pressure grouted screw piles were proposed instead of mini piles. The requirements of the piles were to carry a working load of 375 kN (84 Kips) and to be tested to 150% working load (560 kN, 125 Kips).

The Screw Piles installed measured 89 mm shaft diameter (3 1/2"), 17.6m deep (55') with five helices [.25m * .30m *.36m *.36m *.36m] i.e.(10" * 12" *14" * 14" * 14"). After installation, grout was pushed into the loose sand layer through grout ports in the pile utilizing a high pressure-grouting pump. Volume and pressure of grout at each pile location was monitored and recorded. Preliminary Pile Load tests were to be completed before the commencement of the project. As well, 16 working pile load tests were to be carried out during construction.

Two un-grouted screw pile tests were to be performed on site to compare the pile behavior.

Construction and Testing:

Based on the assumption that the grouted sand will behave as dense - very dense, the top clayey soil is soft (Undrained shear strength = 50 kPa) and the layer below the sand is firm to stiff Clay (Undrained shear strength = 75 kPa). Using the Cylindrical shear method for load transfer analysis, the pile ultimate load = 570 kN. Using the same analysis with loose sand (not grouted), the pile ultimate load = 450 kN.

The high-pressure grout increases the pile ultimate capacity by 40%. The actual test results proved that for a specific pile deflection the grouted piles achieved almost 40% higher load than the un-grouted for the same uplift deflection. i.e. for 15 mm total deflection, 250 kN required for the Un-grouted piles compared to 350 KN for the grouted ones. The test results also showed for a specific load, the total deflection of the pile is much less for the grouted piles in comparison to the Un-grouted piles. i.e. at 400 kN the Un-grouted pile deflected 27.0mm compared to 17.0mm for the grouted pile.

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