

## Foundation Improvement with Micropiles In San Francisco

### The Challenge

The owners of an older 3 story building in San Francisco's financial district wanted to add an additional story on for their growing practice as well as earthquake-proof the building.

The existing inadequate foundation consisted of shallow spread footings sitting on up to 35ft. of artificial fill and marsh deposits.

The site presented a very difficult challenge besides the overburden: there was no access to the basement for the 20,000lb. micropile drill rig that needed to be used.



1050cfm high pressure compressor  
in front of job site



Drill rig being jacked down from mezzanine level to basement



## Action:

To gain access, the front of the building was opened up at the street level and the floor was shored underneath from the basement. The drill rig was then tracked inside and onto a cribbed platform that went from the basement up through an opening in and level with the first floor. The rig was then slowly and carefully jacked down to the basement level.

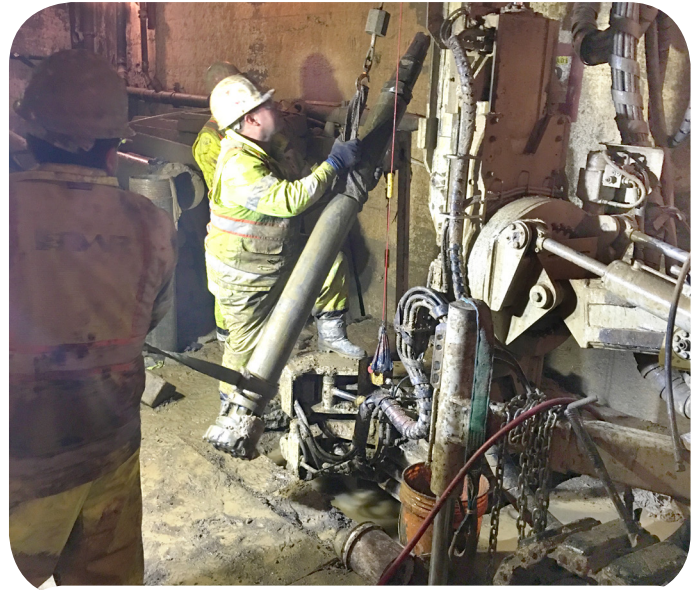
After reviewing the soils data, RWR decided to use a rotary percussion drilling technique to install 8" diameter micropiles reinforced with a solid 1 3/8" diameter 150KSI bar.

The drilling proceeded by advancing a retractable casing through the overburden until the tip was seated into the top the bedrock. A Down-The-Hole hammer was then advanced through the casing using 1050cfm of 350psi (high pressure) air to power the hammer and clear the cuttings. The DTH hammer continued to advance through the bedrock until the desired bond length was achieved.



**Retractable casing being installed through the overburden**

The bedrock consisted of layered shale and sandstone but the sandstone layers were much weaker than expected, which necessitated a recalculation of the overall shear strength and the bond lengths being deepened. This caused pile lengths to be increased to up to 60ft.



**DTH hammer being pulled out of hole after drilling to 60ft**



**Lowering reinforcing rod with 2 postgrout tubes into hole**

As an added precaution, all piles were post grouted 24 hours after installation. Tension testing was performed on 20% of the piles to 133% of the design load of 75 kips and all passed.

**Results:** Successful installation of the piles allowed construction of the additional story on top the of the building and provided greatly enhanced safety against seismic uplift, settlement and lateral movement