

Model 288 Retrofit Helical Piers and Grouted Tiebacks

Project: Southwest Bible Church Addition

Location: Beaverton, OR

Challenge:

A 31,000-square-foot nursery school and daycare addition was planned for the Southwest Bible Church located in Beaverton, Oregon. The addition was planned as a three-story structure with a basement. Construction of the addition would first require underpinning of one corner of the existing church to allow excavation to a depth of about 12 feet below the existing footings. A soil boring advanced in the area generally showed soft to medium stiff clay and silt to depths of about 30 feet where it transitioned into stiff to very stiff clay and silt to the termination of boring at 51.5 feet. Groundwater was not observed during drilling operations due to the use of mud-rotary drilling techniques. It was also understood that the existing building slab and footings were constructed on a pad of compacted gravel fill. With the anticipated presence of the very dense gravel layer, a drilled and grouted micropile and tieback system was considered for underpinning and excavation support. However, during the first installations of the micropiles, artesian groundwater conditions were encountered at a depth of about 30 feet, which limited the ability to inject grout effectively. The grouted tiebacks and shotcrete wall were above the artesian zone and were still a valid method for shoring; however, an alternate underpinning pier method was desired to keep the project on time and reduce any additional costs.

Solution:

The gravel layer was found not to extend beyond the footprint of the existing structure. The alternate underpinning and shoring design then included 11 helical piers and 22 grouted tiebacks. The geotechnical engineer determined that the shotcrete wall could be constructed in two excavation stages of 6 feet for the total wall height of 12 feet. The helical pier design consisted of the Model 288 (2.875-inch OD by 0.276-inch wall) hollow round shaft with a 10"-12" helix plate configuration and the FS288BL bracket, to support a design working load of 23.2 kips at a 4-foot spacing. The piers were installed to depths ranging from 40 to 50 feet below the footings after achieving at least 5,200 ft-lb of torque and torque-correlated ultimate capacities of at least twice the design working load. During installation, the helical piers were fitted with additional lengths of external sleeving (3.5-inch O.D. by 0.216-inch wall) for a total sleeve length of 15 feet below each bracket. The sleeve material provided additional lateral support for the piers during excavation for the shotcrete wall. The tieback detail consisted of 32-millimeter diameter, hollow-core bars grouted into 4-inch diameter augured holes for 15-foot total lengths. Six tiebacks were proof tested to 1.4 times the design load of 6 kips to confirm capacity and deflection, then unloaded. All tiebacks were placed into service by applying 75 ft-lb of torque to the tightening nut against the wall plates for a correlated lock-off at 6 kips.

Project Summary

Architect:	William Wilson Architects, PC
Structural Engineer:	TM Rippey Consulting Engineers
Geotechnical Engineer:	GeoDesign, Inc.
General Contractor:	Centrex Construction
Pier and Tieback Installer:	TerraFirma Foundation Systems
Products Installed:	(11) Supportworks® Model 288 Helical Piers, 10"-12" Plate Configuration, Design Working Load of 23.2 kips, Installed Depths of 40 to 50 feet; (22) Grouted Tiebacks, Design Working Load of 6 kips, Installed Length of 15 feet



Installing retrofit helical piers



Underpinning piers and grouted tiebacks in place after first stage of excavation



First stage shotcrete wall reinforcement installed



First stage shotcrete placed



Wall completed and grouted tiebacks locked off