Jet Grouting

Chesterfield Power Station
Chesterfield, Virginia

Chesterfield is Virginia's largest fossil fueled power station, owned and operated by Dominion Resources, Inc. To lower emissions of sulfur dioxide and nitrogen oxides to regulatory standards, selective Catalytic Reduction (SCR) units were to be installed.

The original design specified large pile cap foundations supported by high-capacity micropiles installed in a congested area. The piles were to be battered and interlaced with piles of adjacent caps at depths of 40-70 ft. Thick pile caps would require excavation support and underpinning of existing foundations. Due to the heavy SCR foundation loads, geology, and tight access, the original design was time consuming, costly and difficult to install.

An innovative, value engineered, design-build alternate soilcrete foundation system was proposed by Hayward Baker to support various combinations of compressive, uplift and lateral loads of the new SCR units. This system required less drilling, excavation support and underpinning.

Preliminary design calculations estimated a cost savings of 33% of the original design, reduced schedule duration, and did not compromise functionality.

Soilcrete column installation began after an extensive field-testing program verified design calculations and assumptions. This program included a full-scale compression test, full-scale uplift test, and in situ coring. The average 28-day UCS result was 1,001 psi for wet-grab samples, and 595 psi for cores. A compression test showed the gross displacement of the column butt at maximum load of 470 kips, was 0.07 inch. Net deformation after unloading was 0.02 inch. A tension load test verified the average design bond stress of the soilcrete/soil interface of 1.0 kips/sf.

Plan view of soilcrete foundation system, top, and cross section of soilcrete foundation system for SCR units, above.

Owner
Dominion Virginia Resources, Inc., Chesterfield, Virginia

Geotechnical Engineer
GZA GeoEnvironmental Inc., Norwood, Massachusetts

Contractor
Alstom Prenco Services Inc., Windsor, Connecticut
Sixteen, 5-ft dia soilcrete columns were installed at each of the five major foundations. The columns provided a stiff, extended foundation by which the bearing loads could be safely and efficiently transferred to suitable bearing soils. Reinforcing bars were installed in the columns and fitted with tension plate assemblies within the pile cap to anchor the foundation to the soilcrete mass. The uplift loads are resisted by the weight of the soilcrete mass and by friction between the soil and the soilcrete mass. Lateral loads are resisted by the passive resistance of the earth on the foundation and the soilcrete mass. In addition to the 5 major footings, 11 small footings were also supported by single soilcrete columns, which required multiple rebars to resist moments created by the shear loads at the foundation.

Soilcrete full and/or half columns were installed under the existing footings. To transfer the load below the base of the new excavation, and to provide excavation support, the columns were extended below proposed excavation depth.

HB was retained as the general contractor responsible for site logistics, demolition and excavation, and construction of temporary support structures. In addition, HB managed the installation of the reinforced concrete foundation, and the relocation of structural steel.

At two installation locations, the new SCR footings required temporary support for existing columns and demolition of the existing smaller footings. Hayward Baker installed new, temporary footings and steel beams to support existing column loads while straddling the new SCR footing locations. Once the new foundations were installed, the base plates of the existing columns were anchored to the new footings.

As a testament to the quality of work, HB was retained by the owner one year later to design and build another soilcrete foundation system for another SCR unit.