

To the Crux of the matter

Challenging geotechnical conditions and access constraints led to the recent installation of speciality micropile foundations within a New Jersey wetland in the north-eastern US



Micropile drill delivered to site by helicopter

The Susquehanna-Roseland Electric Reliability Project is a 500kV transmission line from the Berwick, Pennsylvania, area to Roseland, New Jersey.

Public Service Electric and Gas Company is responsible for building the New Jersey portion of the alignment, including a 1.5-mile (2.4km) segment traversing Troy Meadows, a priority wetland located in Morris County. The structures located in this habitat required a deep-foundation alternative to mitigate environmental impact, maintain the project schedule and meet the long-term reliability needs of the line.

Standing water and other

permitting restrictions in the Troy Meadows area eliminated the possibility of conventional access for construction activities.

Additional challenges included limited geotechnical data, environmental sensitivity affecting fluid containment and concrete placement, and installing heavily loaded structures in deep, soft soils. Structure loads were approximately 20,000 kip-ft (27 million Nm) OTM (overturning moment) with 160 kips shear, and geotechnical reports suggested rock at depths ranging from 80 to 120ft (24-37m).

MICROPILE DESIGN

Micropiles provided a foundation solution for all seven structures located within the wetland. The lightweight materials and equipment necessary for installation are transportable by light- and medium-lift helicopter, and pile quantities and lengths can be adjusted during installation to accommodate site-specific geotechnical conditions.

The ambiguity in depth to rock

and rock quality prior to installation necessitated that both Type A (placed under gravity head only) and Type B (pressure-grouted as drill casing is removed) micropile designs be developed. Foundation contractor Crux Subsurface employed a patent-pending field-characterisation method to adapt the micropile design to actual geotechnical conditions at the time of installation.

Geological characterisation was completed during the drilling of the first pile at each foundation location, effectively determining the pile type, quantity and depth for that structure. The ability to characterise on-site removed much of the risk associated with limited geotechnical data.

COFFERDAM SET-UP

Matting was permitted to one structure close to existing roadways; the remaining six required helicopter support for all materials and equipment. In order to minimise impacts to the wetland, Crux employed a unique ▶

Helicopter view of the micropile foundation site





Left to right: ► closed-cell cofferdam set-up at each site. This set-up provided a stable platform for equipment in soft soils and groundwater, contained drill spoils from contaminating the wetland and acted as a form for concrete placement during pile cap construction. A speciality fabricated drill and rotating



carriage were set on the cofferdam, and micropiles were installed in a battered array. Proof testing was then completed to confirm capacity. The micropile drill and drill carriage were removed from the site to allow for rebar installation and concrete form construction. A pre-constructed anchor bolt



cage was flown to the site and placed within the cofferdam, and concrete was poured utilising helicopter support. Once the concrete had cured, concrete forms were stripped and tubular steel pole structures were set on foundations.

DEEP FOUNDATIONS

Prior to foundation construction, Crux completed two rounds of value engineering, effectively decreasing the number of micropiles and total disturbance area of the concrete caps.

Reducing the required number of piles and amount of concrete significantly benefited the project schedule. The allowed outage for all work to be completed within the wetland area was 90 days, with just 60 days allotted to foundation-construction activities. Six drills were operated simultaneously to complete all foundation-construction activities ahead of the scheduled deadline.

The use of micropiles as a deep-foundation alternative played a major role in the timely completion of this segment. The small, lightweight components allowed the owner to overcome access challenges, and efficient adaptability on-site allowed for designs to be finalised during installation. Portions of the Susquehanna to Roseland line are still under construction and the full alignment is expected to be in-service by June 2015. ♥

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