EFFECT OF SUBSURFACE CONDITIONS ON DIAPHRAGM WALL CONSTRUCTION

During construction of an emergency tunnel ventilation and evacuation structure in Jersey City, New Jersey for the Port Authority of New York and New Jersey, delays were encountered by a specialty foundation contractor resulting from unanticipated difficulties encountered in advancing excavations for slurry diaphragm walls. The 3-foot-thick, reinforced-concrete diaphragm walls were designed as part of the braced excavation support for construction of the approximately 60- by 63- by 80-foot-deep shaft structure. Excavation difficulty was encountered at isolated locations in a glacial till between 40 and 60 feet due to the presence of boulders and in more extensive areas in underlying arkose and sandstone rock of varying characteristics (hardness, grain size and cementation) extending to the shaft bottom.

D'Appolonia was retained by the specialty foundation contractor, Franki Northwest Corporation, to document the geologic conditions encountered in the excavation along with the effort required to excavate the varied materials, to collect and test representative samples of the excavated materials, and to provide a professional opinion of the subsurface conditions observed vis-à-vis the conditions anticipated based on pre-construction exploration. Field documentation performed by D'Appolonia included video recording of excavation work, performing in-place nuclear density tests, collection of bulk soil samples and coring of in-situ rock.

The glacial till in the excavated shaft was exposed at an approximate depth of 40 feet and extended to depths in the range of 53 to 60 feet across the excavation. Six large samples weighing between 700 to 900 pounds were collected by D'Appolonia for particle-size analysis. The composite gradation was found to be 2 percent boulders (>12 inches), 12 percent cobbles (3- to 12-inch size), 23 percent gravel, 46 percent sand and 17 percent silt- and clay-size material. Large-size boulders (>2.5 feet in one dimension) were measured and their locations recorded. The largest boulder encountered was approximately 4 feet by 4 feet by 9 feet. The dry unit weight of the till ranged from about 126 to 137 pounds per cubic foot (pcf) at an average moisture content of about 9 percent.

Top of shaft showing perimeter diaphragm wall and internal bracing.

Excavation of rock inside 60- by 63- by 80-foot-deep shaft.

A thickness of approximately 15 feet of friable arkose was encountered below the till. Cementation of this stratum was very inconsistent and resulted in the rock being soft to very soft. Coring of the friable arkose was not possible because of its weak condition. The unit weight of this stratum ranged from 125 to 142 pounds per cubic foot (pcf) and moisture contents ranged from 5 to 10 percent.

Competent arkose was encountered below the friable arkose at depths between 68 and 72 feet. The color, size of grains, hardness and cementation of this unit changed rapidly and randomly. Twenty-five 24-inch-long rock core samples were obtained using an electric drill mounted on a drill guide platform. The samples were used for detailed geologic classification to determine the variability of the competent arkose based on grain size.