Helical Tiebacks

Project: I-80 Box Culvert Extension

Location: Greenwood, NE

Box culvert extending below I-80

Challenge:

The Interstate 80 (I-80) corridor between Omaha, NE and Lincoln, NE is currently undergoing several phases of reconstruction that include road widening, new bridge overpasses, and new exit and entrance ramps. Several features and obstacles along the interstate prevent typical embankment and road construction. West of Exit 426 (Mahoney State Park exit) there is a 120 feet long, 10 feet wide, and 10 feet high concrete box culvert that extends beneath the entire width of the eastbound and westbound lanes of the interstate. The box culvert was constructed in 1975. One end of the box culvert had to be extended 12 feet to allow for embankment construction to support the proposed road widening and reconstruction of an entrance ramp. A retaining wall was needed at the end of the existing culvert to allow removal of the culvert wing walls and to support the temporarily oversteepened slope of the interstate embankment.

Tieback installation with handheld equipment

Solution:

Soil borings were completed near the culvert to evaluate slope stability and proposed options to retain the soils. The design team recommended a driven sheet pile wall with helical tiebacks and walers to support the slope and provide a safe work zone during construction of the culvert extension. The wall system included a total of 10 tiebacks, five on each side of the culvert in rows of three (top) and two (bottom), with a typical spacing of six feet. The tiebacks were designed for a service load of 15 kips and a factor of safety of at least 1.5. The tieback configuration consisted of 1.5-inch round corner square bar with 8"-10"-12" triple helix lead sections. Standard extensions were used to advance the tiebacks to lengths of 37 to 47 feet, which corresponded to the greater of the design length or the length where the minimum torque criteria of 2,250 ft-lb was achieved. Actual installation torque ranged from 2,700 to 6,100 ft-lb. The tiebacks were installed with portable handheld equipment due to the limited access and working space. Following installation, the tiebacks were proof-tested to 1.3 times the design load with a hollow core hydraulic cylinder. The proof load was removed and the tiebacks were then pre-tensioned to the design load. The 10 tiebacks were installed and pre-tensioned in two days.

Proof-testing helical tieback

Project Summary

Geotechnical Engineer: Thiele Geotech, Inc.

General Contractor: Hawkins Construction

Tieback Installer: Thrasher, Inc.

Products Installed: (10) Supportworks® Model 150 Helical Tiebacks, 8"-10"-12" Lead Section, Installed to lengths of 37 to 47 feet, 15 kip Design Load

Tieback and waler installation complete