

Model 349 Helical Piles

Project: Ben Bikin' Bridge

Location: Sparta, WI

Challenge:

Sparta, Wisconsin is the self-proclaimed Bicycling Capital of America located at the center of 101 miles of connected state bike trails and at the end of the Elroy-Sparta State Bike Trail. The City planned the construction of a new pedestrian/snowmobile bridge. The bridge would be located at the intersection of Highway 16 and Water Street near a 32-foot tall fiberglass structure of Ben Bikin', a fictional character developed for marketing purposes. The original bridge design included two concrete abutments supported on driven steel "H" piles. Two H piles were planned per abutment with each pile driven to an ultimate capacity of 140 kips. The design working load per pile was on the order of 50 kips. With the project site located near a major intersection, city officials were concerned about large pile driving equipment blocking traffic and causing excessive disturbance to the site. Soil information for the project was also limited. Bedrock was estimated at a depth of approximately 35 feet below grade based upon pile driving logs from a highway bridge located 100 to 150 feet from the project site.

Solution:

The design team chose a helical foundation system to support the bridge. Installation of helical piles with a skid steer or mini-excavator would eliminate the concern of blocking traffic and also minimize disturbance to the site. Two helical piles were planned for each of the original H piles. The pile design considered buckling since it was also assumed that soft soils existed in the upper part of the profile. The foundation design included eight Model 349 (3.5-inch OD by 0.300-inch wall) round shaft helical piles with 10"-12"-14" triple-helix lead sections to support the design working load of 25 kips per pile. The piles would be installed to an ultimate capacity of at least 70 kips for a factor of safety (FOS) ≥ 2.8 . Foundation Supportworks of Wisconsin worked with the general contractor to locate and mark the pile locations. Each helical pile was battered at five degrees from vertical away from the adjacent pile. Battering the piles provided proper spacing at the helix plate depths yet still allowed the tops of the piles to be within one foot of each other within the abutments. The bottom elevation of the east abutment was approximately one foot below the elevation of the water in the river. Pumps and temporary shoring were required to keep the excavation dry to install the piles. The helical piles were advanced to the weathered bedrock and installed to torque values of at least 11,000 ft-lbs, correlating to ultimate capacities of at least 77 kips. The tops of the piles were cut off to the design elevation and new construction brackets were tack-welded in place. Three feet of pile length was left exposed above the bottoms of the excavations to allow the pile caps to be embedded mid-height within the concrete abutments. Foundation Supportworks of Wisconsin installed the eight piles in one day to an average depth of 32 feet below the bottoms of the excavations.

Project Summary

Structural Engineer: Duffy Engineering & Associates

General Contractor: MTNT Energy, Inc.

Pile Installer: Foundation Supportworks[®] of Wisconsin

Products Installed: (8) Supportworks[®] Model 349 Helical Piles, 10"-12"-14" Lead Section, Installed to an Average Depth of 32 feet, 70 kip Design Ultimate Load



32-foot Ben Bikin'



Locating the lead section



Piles installed at five degree batter



Helical piles complete



Bridge set on new abutments