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INSIDE

HELICAL PIERS, POROUS PAVEMENT, PROTECT WETLANDS

Pathway connecting two schools in Norwell, Mass., is built using environmentally sensitive technology

By Paul Fournier

A bike and pedestrian path linking two schools in southeastern Massachusetts was successfully constructed through wetlands using environmentally sensitive technology.

I.W. Harding Construction Co. Inc. of West Bridgewater, Mass., had a contract with the Town to build a 3,200-foot path consisting of sections of elevated boardwalk and porous asphalt pavement through a wetlands area between a Middle School and Norwell High School.

Consultants Horsley Witten Group Inc. of Sandwich, Mass., designed the pathway, which comprised approximately 1,500 feet of 8-foot-wide elevated boardwalk in three separate sections, and about 1,700 feet of 8-foot-wide asphalt pavement, also in several separate sections.

The consultants called for the boardwalks to be built of pressure treated southern yellow pine framework supported by helical piers, and the paved path to consist of 4-inch-thick porous asphalt pavement mix constructed on a 16-inch-thick engineered base.

Providing Safety, Minimizing Impact

Both technologies provide safety for students and others while minimizing impact on the sensitive natural resource.

Located in the wetlands portion of the pathway, the sections of boardwalk are designed as pedestrian bridges capable of supporting a minimum live load of 100 pounds per square foot. They also meet H5 vehicle loading requirements of the American Association of State Highway and Transportation Officials (AASHTO), i.e., for a vehicle with a 2,000-pound front axle and 8,000-pound rear axle, should it be necessary for an emergency vehicle to access the site. Furthermore, helical piers are designed as deep foundations to achieve necessary load-bearing capacity in existing soils, do not require vibration or impact methods of installation, and preclude having to excavate soils and remove spoils from the site.

Continued on page 5 »

Solid Earth Technologies uses a Bobcat 335 Excavator to install Chance helical piles for boardwalk being built by I.W. Harding Construction in Norwell, Mass.

Welcome the New Congress and Administration With…

When you read this you will know who won the elections – Obama or Romney; which party has control of the House; the Senate. The pre-election phone calls pushing you to vote for such and such a candidate have ended as have the endless string of commercials. The tone of the news has changed. It is no longer focused on Who and Why. It's now focused on How, What and When. That's what the last couple of years have been all about, finding the answers to Who, Why, How, What and When.

Continued on page 3 »

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Helical Piers, Porous Pavement, Protect Wetlands

Owner: **Town of Norwell, Mass.**

General Contractor: **I.W. Harding Construction Co., Inc.**

Left: Don Martin Corporation's Cat AP655D Paver installs porous asphalt pavement mix supplied by Aggregate Industries for 8-foot bike/pedestrian path between Norwell schools.

Continued from cover »

Porous pavement was installed in pathway sections that do not traverse wetlands.

Situated between boardwalks, these paved sections, like helical piers, minimize impact to the wetlands, according to Justin Lamoureaux, civil engineer for Horsley Witten.

"Since water passes right through this pavement, and underlying soil percolates really well, there are no increases in storm runoff to impact the sensitive wetlands," said Lamoureaux.

Soils Studied To Pick Foundation

Protecting the sensitive nature of the area was a prime reason designers and town officials agreed to use helical piers for the boardwalk, Lamoureaux noted.

"Helical piers offered the least environmental disturbance of the several foundation options we looked at," he said. He added that a soil survey conducted by Lahlaf Geotechnical Consulting Inc. (LGCI) supported the use of helical piles based on the results of several borings.

LGCI engaged New Hampshire Boring, Inc. of Brockton, Mass., to advance three borings at the site using a truck-mounted rig. Borings were advanced by cased wash boring techniques using a 3-inch casing to depths between 16 and 22 feet beneath the ground surface. The drillers performed Standard Penetration Tests (SPT) with a 140-pound safety hammer dropping 30 inches continuously or at 5-foot intervals.

Beneath topsoil and/or fill the drillers found a layer of glacial till comprising dense to very dense soil. Foundation piles would have to penetrate into this layer to provide the required bearing capacity.

Stacks of Chance helical piles are ready for Danbro Distributors to ship to jobsite.

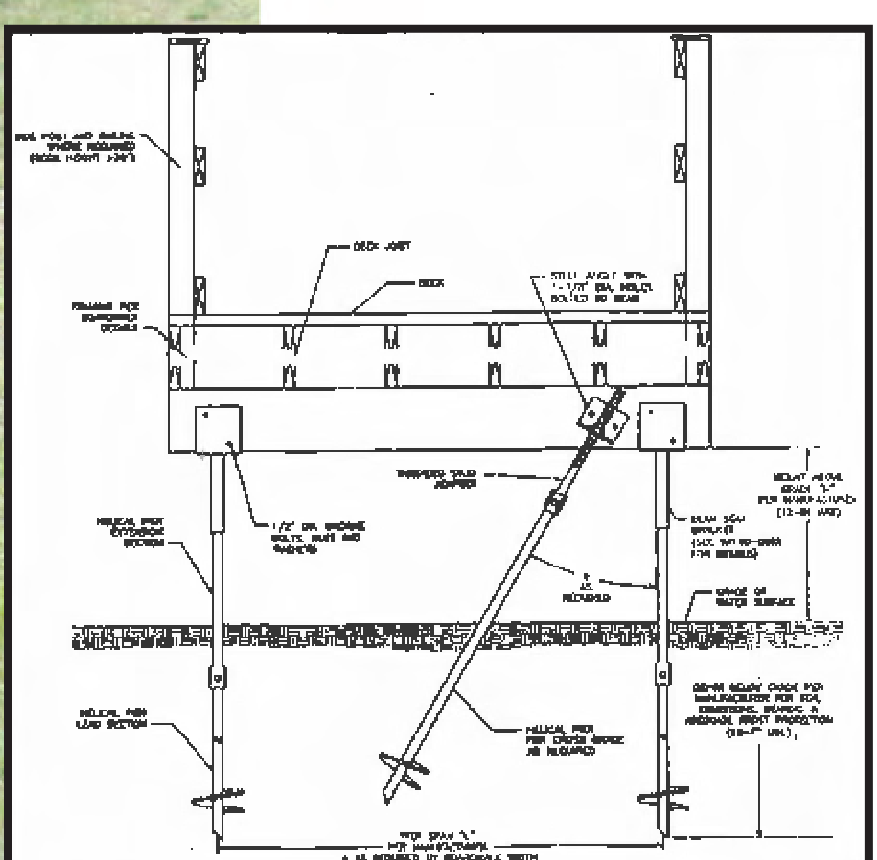
In its survey report, LGCI pointed out that due to the sensitivity of the site to disturbance and the presence of shallow groundwater, they believed that other foundation options such as conventional footings would be disruptive and require significant dewatering. In their opinion, helical piles were a good option to support the proposed boardwalk, especially in wet areas.

Helical Pile Installation

Helical piles, also known as screwpiles, screw piers, helical piers, helical anchors, screw anchors and screw foundations, have been around in some form since the 1800s, and are manufactured by many companies worldwide. For the Norwell project, town officials chose Chance Helical Piles, made by A.B. Chance Company and distributed by DANBRO Distributors' New England area representative Jill Bramblett.

According to A.B. Chance Company, a helical pile functions similar to a wood screw except that it has a discontinuous thread. A simple helix pile consists of a central shaft and a welded bearing plate forming one helical revolution around the shaft. As the screw is wound into the soil, it functions as an axially loaded end-bearing deep foundation. For maximum efficiency, the helix bearing plate is shaped as a true ramped spiral to slice through the soil rather than disturb it. The helical plate serves as the means to install the pile and also is the bearing element that transfers the load to the soil.

As a helical pile is screwed into increasingly denser soil, the required torque to do so increases proportionally. Knowing the bearing capacity of the soil layer penetrated by the pile, the area of the helical plate and the applied torque to turn the pile, allows designers to determine the bearing capacity of that particular pile from charts based on empirical data.



Typical helical pile installation for boardwalk. Norwell project did not require battered piles.

Readings of torque indicator in line with helical pile and rotary drive motor are correlated with empirical charts to determine load-bearing capacity of pile.

Piles can be single-helix or multi-helix. To determine the bearing capacity of a multi-helix pile, designers sum up the bearing capacities of the individual helix plates.

Helix piles were installed for the Norwell boardwalk by subcontractor Solid Earth Technologies of Amherst, N.H. According to Solid Earth representative Mike Cole, they installed approximately 340 Chance SS-5 1-1/2-inch square shaft single helix piles using a hydraulic motor attached to a Bobcat 335 Mini-Excavator. Crews installed the piles in pairs about 5 feet on center, with a 10-foot span between these pile bents.

Similar to a mechanic using a torque wrench, the Bobcat operator can read the applied torque on a pile. For example, a torque reading of 1,000 foot-pounds in a particular type of soil might indicate the bearing capacity of that pile at that depth is 10,000 pounds.

When narrow ROW and other conditions prevented large equipment access, workers used handcarts to bring in building materials for the boardwalk.

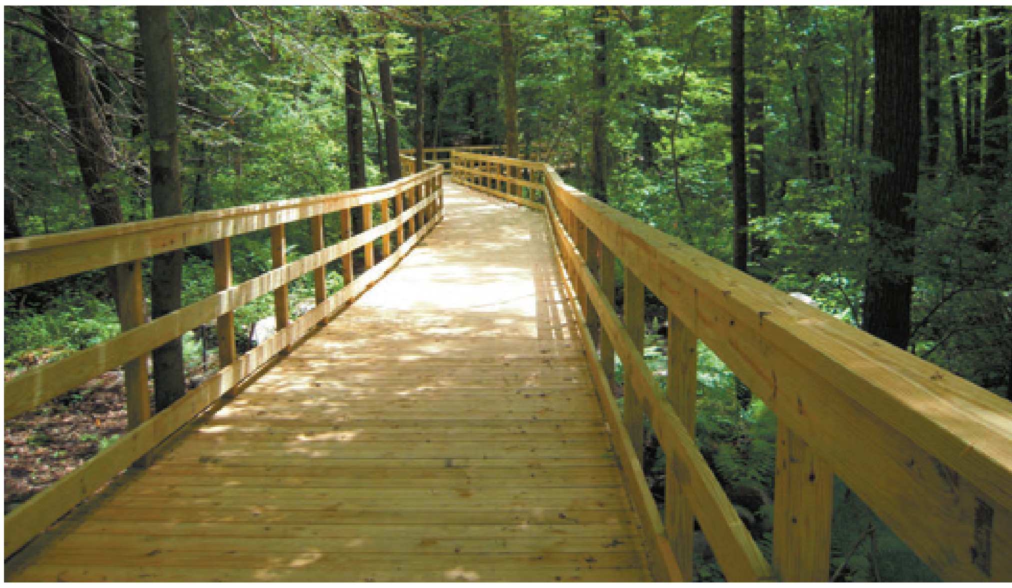
Demanding Work

Under the direction of project manager Dave Stahley and project superintendent Jim Shalek, I.W. Harding crews began work at the site in April 2012.The work was demanding due to the extremely narrow, 12-foot working right-of-way. And in much of the boardwalk sites the soil was soft and wet. Since these conditions precluded the access of large construction and material handling equipment, crews had to deliver a substantial amount of building materials to work areas using small backhoe/loaders, mini-excavators, or even hand trucks in some cases. Material included a large quantity of shredded wood mulch that workers spread over the right-of-way to create a firm, dry base for driving piles and building boardwalks. Some timber mud mats and 1-inch-thick steel road plates were also brought in to bridge particularly wet areas.

Concrete slabs measuring roughly 8 feet by 10 feet were constructed to serve as approach slabs between boardwalks and porous pavement. F.C. Construction of Westport, Mass., built the 8-inch slabs on grade.

Porous Pavement To Reduce Runoff

The 1,700 feet of 8-foot porous asphalt pavement was installed by Don Martin Corp. of Marshfield, Mass., using hot mix asphalt supplied by the Wrentham, Mass., plant of Aggregate Industries. The job mix contained 6 percent asphalt binder and had an aggregate gradation ranging between 100 percent passing a ¾-inch sieve and 10 percent passing a #8 sieve, with only 2 percent of minus #200 fines. The PG64-28 binder was modified with 3 percent SBR latex polymer.



Completed boardwalk, designed for 100 pounds per square foot live load, also meets AASHTO H5 load requirements to accommodate emergency vehicles.

Martin used a Cat AP655D Paver to install the mix and a small DYNAPAC roller to compact the material, producing a porous asphalt pavement with approximately 18 percent air voids.

As described by the National Asphalt Pavement Association (NAPA), porous asphalt pavements allow water to drain through the pavement surface into a stone recharge bed and infiltrate into soils below the pavement. Porous asphalt pavements provide the water with a place to go, usually in the form of an underlying, open-graded stone bed. As the water drains through the porous asphalt into the stone bed, it slowly infiltrates the soil. The stone bed size and depth are designed so that the water level never rises into the asphalt, the Association notes.

For the Norwell project, the engineers called for 4 inches of porous asphalt pavement supported by a 4-inch choker course of ¾-inch stone, an underlying filter course comprising poorly graded sand, and a non-woven filter fabric placed on the subgrade.

Martin Corporation's DYNAPAC roller compacts porous pavement, which allows water to pass through to an underlying stone recharge bed and into the soil.

Service For Years To Come

I.W. Harding completed the bike and pedestrian path last month. The new boardwalk and porous pavement path are expected to serve the community for many years, providing a safe passage for students between schools and protecting Norwell's valuable natural resource.