WATERFRONT FACILITY INSPECTION PART II – PLANNING FOR INSPECTION

PUBLISHED 6 TIMES A YEAR

EST. 1984

PILE BUCK

THE INTERNATIONAL DEEP FOUNDATIONS AND MARINE CONSTRUCTION MAGAZINE

JUL/AUG 2022
VOLUME 38, ISSUE 4

KEEP CALM AND DRILL ON!

ROC'S HUNT FOR THE ELUSIVE OAK ISLAND TREASURE

PLUS

MONITORING PILE STRESSES
During Dynamic Testing

MANUFACTURING STEEL SHEET PILE
Thoughts from Lee Wilczynski

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CONTENTS

VOL.38 NO.4 2022 | THE INTERNATIONAL DEEP FOUNDATIONS AND MARINE CONSTRUCTION MAGAZINE

COVER STORY

JOB STORY

PILE BUCK SPOTLIGHT

PRODUCT SPOTLIGHT

FEATURE

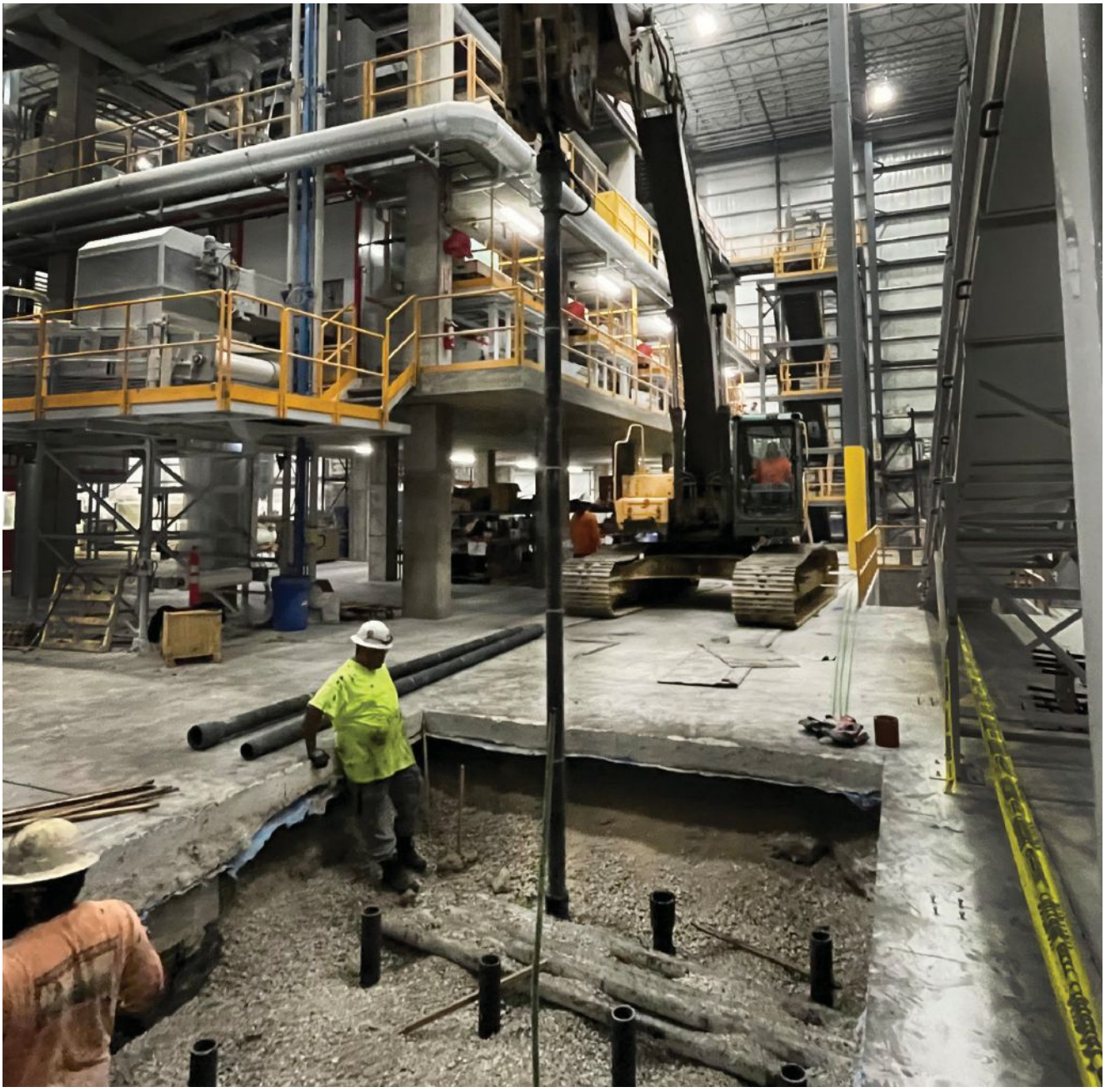
INDUSTRY NEWS

IN EVERY ISSUE

By Craig Christenbury, Matt Caskey

DUCTILE IRON PILES DEVELOP A LARGE CAPACITY IN A SMALL SPACE

Dickson, TN



THE DUCTILE IRON PILE ADVANTAGE:

FAST. SIMPLE. SAFE.™

DuroTerra supplies Ductile Iron Piles to geotechnical contractors for proven, cost effective solutions for challenging sites.

An alternative to drilled micropiles, helical piles and other deep foundations.

THE IDEAL SOLUTION FOR PROJECTS WITH:

- Limited overhead clearance
- Constrained work sites
- Low vibration requirements
- Challenging ground conditions
- Variable rock depths

DUROTERRA™

DUCTILE IRON PILES

PROJECT TYPE:

INDUSTRIAL

LOCATION:

DICKSON, TN

CHALLENGES:

- Rapid turn-key operation
- Simple, low-vibration installation
- Interior installation near existing structures

GEOTECHNICAL CONTRACTOR:

CHRIS-HILL CONSTRUCTION

STRUCTURAL ENGINEER:

JASON PIRTLE STRUCTURAL ENGINEERING

GEOTECHNICAL ENGINEER:

CONSTRUCTION MATERIALS LABORATORIES

FOR MORE INFORMATION OR PROJECT FEASIBILITY:

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JOB STORY

Additions to a tile manufacturing facility in Dickson, Tennessee included a new raw-product storage silo to add materials capacity. The new silo needed to be close to the existing silos, located inside the building. The subgrade conditions explored by the geotechnical team at Construction Materials Laboratories (Jackson, TN) consist of soft to very stiff sandy gravelly clay extending to nearly 60 feet below grade. Sandstone bedrock was encountered at the maximum explored depth of 60-ft. Standard penetrometer testing (SPT) in the bedrock resulted in an N-value of 50/6″. Groundwater was interpreted at about 50-feet below grade. The new silo is supported on four legs with loads of 215 kips (compression) and 50 kips (uplift) on each leg. The legs are supported on a mat foundation with a bearing area of 161 square feet. With total axial loads in excess of 800 kips and 200 kips of net uplift, a deep foundation system was deemed necessary by the project team.

PROJECT CHALLENGES

The location of the new silo mat foundation sits immediately adjacent to an existing equipment pit that is 13-ft below the existing floor. The project team was concerned that new foundation loads would impart lateral loads on the pit walls unless deep foundations were used to transfer the loads below the bottom of the equipment pit foundation. Additionally, access to the new silo location was constrained by existing mezzanine structures, stairs, and conveyors. With overhead clearance of less than 40 feet in the high-bay facility and narrow aisle widths (~12-ft), the use of traditional deep foundation equipment was restricted.

DESIGN SOLUTION

The project structural engineer, Jason Pirtle Structural Engineers (Jackson, TN) and the plant manager chose DuroTerra's Ductile Iron Pile system due to the benefit of using a modular pile system that could be installed with nimble, small-footprint equipment. The project was designed for non-grouted (exterior) Series 118/9.0 Ductile Iron Piles (118 mm diameter & wall thicknesses of 9.0 mm) with 118mm HD drive shoes. The DIPs were designed to achieve a maximum working capacity of up to 80-kips in end-bearing by "setting" the pile on the sandstone bedrock. Ductile Iron Pile "set" capacity is typically defined as a penetration rate equal to or less than 1″ penetration in 50-seconds of driving. The tensile design capacity was calculated to be 28 kips for the non-grouted pile and soil interface. The final design required a 16-pile group connecting to a 14′-1″ x 11′-6″ x 3′-3″ reinforced concrete mat foundation to support the new silo.

JOB STORY

CONSTRUCTION CHALLENGES

Chris-Hill Construction (Memphis, TN) was chosen by the project team to install the Ductile Iron Piles. To install DIP's, Chris-Hill used a Volvo EC290 excavator equipped with an Okada TOP270 Hydraulic Demolition hammer. The suspended weight of the hammer with adapter bracket was 9000 lbs. The hammer is rated at 5550 ft-lbs of impact energy. Access through the facility was narrow and concrete floors had to be protected from damage by the excavator's steel tracks. Plywood and rubber belting provided protection of the flooring. Once the excavator was positioned at the pile driving location, radial swinging of the boom was limited due to lateral obstructions. Each 5 meter piling section was individually dragged to the hammer and driven into the ground. Installation was accomplished using the dry-method, with no exterior grout. All DIPs were driven to the specified "set" criteria at depths ranging from 52 to 58 feet below grade. The interiors of all piles were grouted post-installation using a 4,000 psi lean cement grout. A #8 (Grade 75) all-thread bar was wet-set in 12 of the pile locations requiring tension load resistance. Limited access working conditions slowed production, however, Chris-Hill Construction averaged 120 ft/hour working in the very constrained conditions and completed almost 1,000 LF of installation in less than two days. Pile load testing verified the design capacities of the Ductile Iron Pile system. ■

CHRIS-HILL CONSTRUCTION (MEMPHIS, TN) WAS CHOSEN BY THE PROJECT TEAM TO INSTALL THE DUCTILE IRON PILES. TO INSTALL DIP'S, CHRIS-HILL USED A VOLVO EC290 EXCAVATOR EQUIPPED WITH AN OKADA TOP270 HYDRAULIC DEMOLITION HAMMER. THE SUSPENDED WEIGHT OF THE HAMMER WITH ADAPTER BRACKET WAS 9000 LBS. THE HAMMER IS RATED AT 5550 FT-LBS OF IMPACT ENERGY.