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PILEDRIVER

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PROJECT SPOTLIGHT

PDCA 2003 Project of the Year

Awarded to Metro Wastewater Treatment Plant

PDCA
PILE DRIVING CONTRACTORS ASSOCIATION



Pile were delivered from the mill by rail in lengths that had been determined by the pre-production pile-testing program.

PDCA Members AET and L.H. Bolduc Help Save Owner $1 Million in Wastewater Treatment Project

By Lisa Kopochinski, Piledriver Editor

Although construction started three months behind schedule, the foundation team made up much of this time by installing several test piles prior to other site activities, by verifying the design-pile capacity could be achieved at shorter driven lengths, and by eliminating the static load tests.

An ounce of prevention can be worth a pound (or even $1 million) worth of cure.

This old adage applies to the site preparation and foundation phase of the Metro Wastewater Treatment Plant (MWWTP) new solids processing facility in St. Paul, MN.

The 65-year-old MWWTP, one of the largest wastewater treatment facilities in the U.S., is being upgraded with a new solids processing plant. Scheduled to go on-line in 2005, it is a much-needed upgrade. The new $80 million solids processing plant will replace the existing incinerators, thus increasing processing capacity, while reducing air pollution emissions and energy usage. It will be able to handle 400 dry tons of waste daily.

The MWWTP, often referred to as Pigs Eye, is located southeast of downtown St. Paul, just northwest of Pigs Eye Lake (hence the nickname). The facility is located within a relatively flat area along the eastern banks of the Mississippi River.

The site preparation and foundation phase of the project included installing a sheet-pile wall and excavation support system; dewatering to lower the groundwater table; excavating to a depth of up to 24 feet below site grade; installing a driven pipe pile foundation system at the base of the excavation; and constructing the base slab for the facility. The driven pile foundation system consisted of over 1,955 steel pipe piles with an outside diameter of 12 ¾ inches and a wall thickness of 3/8 inch. Design loads of 75 tons in compression and 30 tons in uplift were achieved at driven lengths of 50 feet to 60 feet.

PDCA member and geotechnical engineering firm American Engineering Testing, Inc. (AET) of St. Paul, MN was retained for the project by the general contractor Madsen-Johnson

Photos: AET

Before the site was excavated, test pile were driven to permit more time for soil set up below the excavation bottom.

Corporation, to provide dynamic pile-testing services and observe the originally planned static load testing.

Dynamic pile testing was utilized during the foundation phase of the project to aid in evaluating pile capacities and establish driving criteria. The scope of dynamic pile testing was increased in order to evaluate the potential to achieve the design-pile capacity at reduced driven lengths. The final pile-testing program included dynamic testing of 39 of the more than 1,955 total piles driven for the project. Some of these piles were dynamically monitored during restrike as long as 60 days after initial drive. The results of the dynamic pile-testing program are as follows:

- better coverage for evaluation of subsurface variability
- the elimination of static pile-load testing for the project
- a reduction in time on the project schedule
- the conservation of many tons of foundation materials
- a savings in excess of $1 million in foundation costs

"AET installed a number of piezometers to aid in evaluating ground-water level fluctuations during construction, as well as a number of inclinometers to assist in evaluating sheet-pile wall movements during construction," explains Bill Cody, AET's principal engineer. "We also provided engineering consultation during the construction, and precondition survey and vibration monitoring services."

AET conducted dynamic pile tests on six initial test piles beginning in December 2001, approximately two months before construction began. This was done before the excavation was even made, allowing AET to evaluate the proposed design before beginning production.

"The purpose of the early start was to install some pile and allow time for set-up to occur in order to evaluate potential increases in pile capacity with time. Our work on the piling portion of the project ended in March, 2002," says Cody.

PDCA member L.H. Bolduc of Anoka., MN, the foundation pile-driving contractor on the project, was responsible for driving all test pile and production pile. The company began the project in December 2001 with test piles and completed their work on the project by June 2002. Throughout the project, the company's involvement was aggressive in finding ways to be efficient and cut costs.

The most significant obstacle AET and Bolduc encountered was convincing designers that a modification in the project's specified pile-testing program could have significant benefits to the overall project in terms of cost and time savings. "We overcame this obstacle,"



Photos: AET

Production pile driving went smoothly because the PDA was utilized to quickly check pile capacities and provide a basis for modifications in driving criteria.

elaborates Cody, by effectively presenting the results of the initial tests and extrapolating those results to the overall foundation system; as they affected actual driven pile lengths and associated costs. Obviously, the owner, Metropolitan Council Environmental Services (MCES), was very interested in saving money on the project and, through effective communication with them, we won their trust as a competent engineering firm and pile-driving contractor. MCES was proactive in giving us the support and latitude to conduct additional dynamic pile tests so that we could support our initial findings. We were successful in combining Bolduc's project-specific experience and our pile-testing capabilities to make a strong case that the variable site conditions warranted a different approach than the original specifications envisioned."

Robert Werness, president of L.H. Bolduc, said he found the pipe to pose another challenge. "Since pipe was a mill item, lengths to avoid splicing were a major concern. With an early test pile program using PDA, [to provide answers for capacity across the site], we were able to order the correct lengths," he says.

Design consideration for use of driven piles

"I think on this particular project, the contractor, L.H. Bolduc deserves most of the credit for having the insight to develop a test pile-driving scheme that would optimize the potential capacity of the pile," says Cody. "It's common knowledge that the longer a pile is in the ground, the more capacity it gains from soil set up. On most projects, time just isn't available to allow the set up to fully mobilize and pile-capacity predictions are often conservative. The Pile-Driving Analyzer was also a useful tool because of its mobility and efficiency in predicting pile capacities. It was used to confirm capacities of a number of production pile driven during the course of construction that would have otherwise gone untested had the original specifications been enforced. The PDA was an extremely valuable tool in allowing us to "dial in" the required pile penetrations needed to develop the design capacities with a reasonable safety factor."

Recipients of the PDCA 2003 Project of the Year Award (left to right): William Cody, PE, American Engineering Testing; Megan Lee, American Engineering Testing; Robert Werness, L.H. Bolduc Company.

Photos: AET

Proactive approach part of project's uniqueness

At a site where driven-pile foundation support is the norm, the unique part of this project involved the proactive approach of the pile-driving contractor. Bolduc elected to drive several test piles prior to the start of other site work activities to determine pile capacities at various pile toe elevations and to evaluate the potential for long-term pile set-up. This allowed them to order the optimum pile lengths, thus reducing time and costs involved for materials, for diving, and for splicing. Innovation also included an expanded dynamic testing program (resulting in better coverage for the evaluation of subsurface variability) and the elimination of the specified static load tests (resulting in the savings of time, materials, and money associated with these tests).

"[Along with us], MCES, AET, and Madsen-Johnson were involved in the early testing program, while the excavation sheeting and dewatering of the football field-size area by a depth of 24 feet was prepared," explains Werness.

Adds Cody. "I think it was unique and helpful that MCES entrusted the pile-driving contractor and pile-driving consultant to call many of the shots as the project progressed. I think they thought we were most qualified to make some of the decisions, given our level of expertise and previous history of successful projects."

Significant savings

Cody feels he found the project rewarding because of the significant savings in foundation costs and time to install the foundations.

In the pursuit of a value-engineering opportunity, the dynamic pile-testing program for this project was expanded. The results of the program, coupled with the efforts and cooperation of the foundation team, resulted in saving more than seven miles of steel pipe pile, as well as tons of concrete in-fill.

"With 2,000+/- piles required, we saved 30 percent in footage, which translated into a $1 million savings to the owner and eight weeks in schedule time," says Werness.

Once it was determined that there may be significant savings in foundation costs and time to install the foundations, it seemed as though the designers, owner, contractor, and consultants worked as a team to achieve the best end result," Werness continues. "We had a high level of communication with all parties involved during the project and, at no time, did any one of the project team members assume an adversarial role. Unlike many government projects, a high level of common sense ruled the decision-making that occurred on this project. Probably the most rewarding was the owner's gratitude after everything was said and done. They had a good foundation that saved approximately $1 million and, because approximately two months had been shaved off the production pile-driving schedule, the overall project schedule got back on track."

Adds Harold Voth, manager of plant engineering for MCES: "In a case where we had a tough site, with regard to variable subsurface conditions, we invested more than usual in the initial pile testing, and it paid off many times over. We are very satisfied with the teamwork exhibited by all parties involved." ▼

PROJECT PLAYERS

Owner: Metropolitan Council Environmental Services (MCES), St. Paul, MN.
Geotechnical engineer: American Engineering Testing, Inc. (AET), St. Paul, MN.
Pile driving contractor: L.H. Bolduc Co. Inc., Anoka, MN
General contractor: Madsen Johnson Corp., Hudson, WI.
Structural engineer: CH2M Hill, Eagan, MN

L.H. Bolduc Co. mobilized multiple rigs to increase production.

PDCA Chooses Wastewater Treatment Plant as 2003 Project of the Year

The Metro Wastewater Treatment Plant, Solids Processing Improvements, Site Preparation and Foundation Phase project in St. Paul, Minnesota earned the PDCA 2003 Project of the Year Award for several reasons.

It utilized driven piles in an innovative manner. The design build team demonstrated that dynamic testing could prove a more economic foundation design to provide value for the owner. Through a combination of experience, initiative, and cooperation, the contractor and design team were able to meet the project's foundation requirements, while eliminating more than seven miles of steel pipe and over 1,000 cubic yards of related concrete fill. By dynamically testing less than two percent of the overall number of piles, the contractor was able to prove that piles were capable of providing the required pile capacity at shallower tip elevations than those originally specified. The resulting shorter pile lengths also allowed the contractor to order material in optimum lengths, thus eliminating a large number of splices. The reduced quantities allowed the contractor to make up substantial time in the project schedule. The resulting savings in cost, time, and materials, through the use of driven piles, made this project a winner. It proves once again that a driven pile is a tested pile.

In addition, through the proactive use of the pile contractor, the cooperation of the foundation team, and the extensive use of dynamic pile testing, driving pile lengths at the site were reduced and the need for static load tests were eliminated. The owner (MCES) realized a savings in excess of $1 million in foundation costs. Of equal importance, significant time was shaved from the construction schedule and many tons of foundation materials were eliminated.

Photos: AET

Delmag D19-32 hammers were used from start to finish.