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PILEDRIVER

THE OFFICIAL PUBLICATION OF THE PILE DRIVING CONTRACTORS ASSOCIATION | SUMMER 2004 VOL. 1, NO. 3

PROJECT SPOTLIGHT:

PDCA Member Jordan Pile Driving Helps Restore USS Alabama Battleship

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PILEDRIVER

The Official Publication of The Pile Driving Contractors Association | Summer 2004 vol. 1, no. 3

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Restoration of the USS Alabama Battleship, Mobile, AL. Photo: Jordan Pile Driving Inc., Mobile, AL.

Accident Causes Reflection on Deep Foundation Safety and Behavior

By Wayne E. Waters, PDCA President

The recent failure of the large drilled shaft foundation under a pier at an expressway project near Tampa has reverberated throughout the deep foundation industry. I understand that the pier of this elevated structure was supported on a single drilled shaft approximately six feet in diameter. Unfortunately, the failure was fairly rapid as the pier moved downward. As you can see in the photo below, the structure that failed appeared to be completed, and the next span was in the process of being completed.

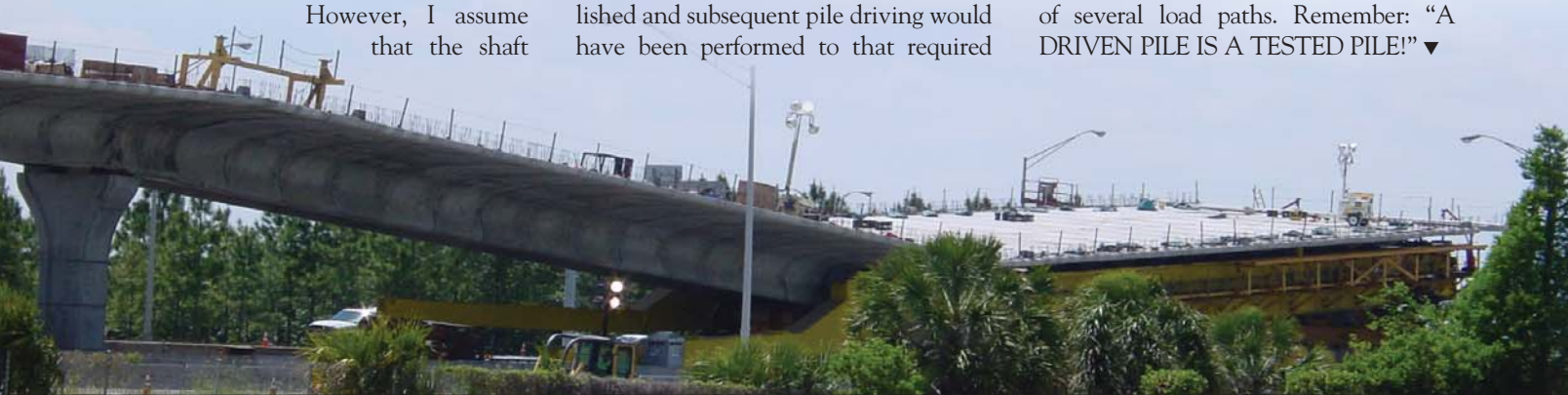
I heard of the failure very early on Tuesday, April 13. Reports stated that the shaft had "plunged" into a sinkhole. Later, I heard that the shaft failed structurally due to a serious defect. These reports were from media sources, rather that factual reports from the job site, but the failure did cause me to reflect on deep foundation safety and behavior. In particular, I wondered, could such a failure have occurred with a driven-pile foundation, assuming the failure was caused by a sinkhole? My conclusion was that it would be virtually impossible.

Admittedly, I do not profess to be an expert in drilled-shaft construction. However, I assume that the shaft was drilled to a specified depth and the drill hole was then filled with concrete. Obviously, the drill hole was not open to the sinkhole since it presumably did not require an unusual amount of concrete, which would cause a red flag to be raised. After the concrete cured, the shaft was loaded by the construction pier and later by the two spans it supports. The foundation failed after an extended period of time had elapsed under the total dead load and possibly by some of the construction load. I assume that the design of the pier carried a safety factor in the neighborhood of 2.0, so I concluded that the ultimate capacity of the existing shaft was much less than that required.

What would happen had a driven-pile foundation been used? A pile-driving criterion would have been selected based on a number of different possibilities. At the beginning of the project, one or more static load tests may have been performed. The test piles would have been driven to some blow count possibly derived from a wave equation analysis. Dynamic testing could have also been used to determine the blow count. After completion of the testing program, the driving criterion would have been established and subsequent pile driving would have been performed to that required blow count. Since the failure occurred under the dead load only, I believe that the blow count at that depth would have been much less than the required value, given the typical factors of safety and dead load/live load ratios. In other words, driving would have continued.

About two years ago, my firm, Ed Waters and Sons Contracting Inc., drove piles for a Florida DOT bridge project in an area of known sinkholes. The majority of piles were driven to depths well below the advanced estimate of 180 feet. Several piles didn't reach criteria even after penetrating over 600 feet! Subsequently, some of those piles were dynamically tested and piles, without the required capacity, were evaluated and in some cases, piles were added. The bridge performs admirably to this date. If a single shaft is inadequate for whatever reason, the structure fails. If it fails at a point where capacity is less than that of the dead load and the construction load, failure could cause injury or possible loss of life.

Driven-pile solutions are the best choice in sinkhole prone areas. Most driven-pile foundations consist of multiple piles, offering a redundancy comprised of several load paths. Remember: "A DRIVEN PILE IS A TESTED PILE!" ▼



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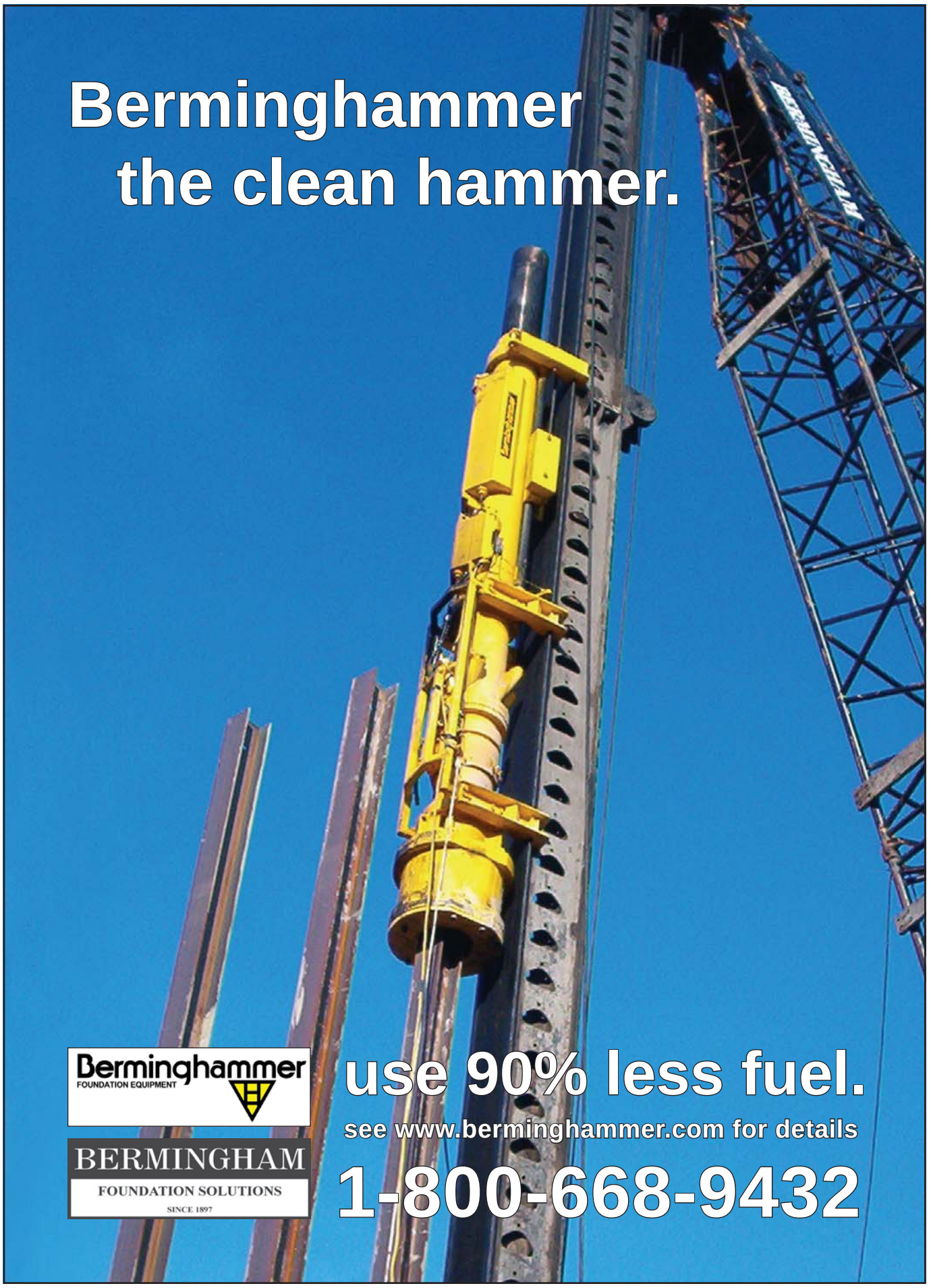
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PDCA Delivers Innovative **Educational Programs**

By Tanya Goble, PDCA Executive Director

A key element in PDCA's mission of promoting the driven pile is developing and delivering cutting-edge education for contractors, engineers, geotechs, university professors and students. These programs are aimed at sharpening the skill set of the engineers that design driven-pile foundations and the contractors that install them. PDCA believes that improved education will result in greater competitiveness for the driven pile through increased reliability, usefulness and cost-effectiveness.

Over the next six to 12 months, PDCA will be sponsoring several educational programs, including a major new initiative. We strongly encourage membership participation in these activities. Here is some more information:

5th Annual Design & Installation of Cost-Efficient Driven Piles Conference

This conference will be held September 16-17, 2004 in Los Angeles. Intended for both for geotechnical and structural engineers and contractors, the one-and-a-half day conference presents the technical basis for understanding, analyzing and controlling pile driving along with the latest methods for improving reliability and reducing costs. We have assembled a stellar line up of speakers. A complete program is included in this edition of Piledriver and is also available on the PDCA Web site at www.piledrivers.org. Attendees will earn 1.0 CEUs or 10 PDHs!

New! Construction of Deep Foundations Teleweb Seminars

PDCA is sponsoring the development of a comprehensive deep-foundations design and installation course, presented to you **in your office**, via electronic means. The course will consist of a series of 90-minute lectures delivered by Dr. George G. Goble, consulting engineer and former professor; and Jerry A. DiMaggio, principal geotechnical engineer with the Federal Highway Administration. This coordinated lecture series is entitled "Construction of Deep Foundations" and will cover all aspects of the **installation** of driven piles, drilled shafts, augercast piles and micropiles. A complete listing of the planned lectures is described on pages 7 and 8. When this series is complete, we expect to present a series of lectures covering deep foundation design. This exciting new program will be available at a low, per-site cost and greatly reduces the personal time and travel expenses associated with continuing education. DVDs of each session will be available for purchase if you miss one. CEUs/PDHs will be awarded for each session attended. More information will be available on the PDCA Web site soon. In the meantime, contact Dr. George Goble at Foundation Courses, Inc. at (303) 494-0702 if you have questions.

2005 PDCA Professor's Piling Institute

The PDCA is pleased to announce that the next PDCA Professor's Institute will be held June 19-24, 2005, at Utah State University in Logan Utah. This key educational program brings together top industry professionals to present the latest concepts in pile driving to an audience of 25 engineering professors. During the five-day program, professors are introduced to all aspects of driven-pile design, installation and quality control and receive the tools to easily incorporate it into their classes. Future engineers, that will be determining the specifications for deep foundation projects, will get much better training on designing constructible and economic pile foundations. The Professor's Institute is a cost- and labor-intensive project. Your association is funding virtually all expenses for the invited professors, including housing, meals, instructor expenses and materials. Please consider sponsoring a professor from your area and making a financial contribution to help us with this important effort. PDCA will be starting a fundraising campaign shortly, so look for more information via e-mail and the PDCA Web site soon.

October 7, 2004

Session 1. Deep Foundation Design and Construction Process - G. Goble

The design and construction process will be reviewed and discussed. The deep foundation design and construction process is quite unusual and there are substantial differences between driven and drilled-foundation elements. The unique and similar aspects of both deep foundation types will be presented.

November 4, 2004

Session 2. Drilled Pile Types – J. DiMaggio

There are several families of drilled piles, including drilled shafts, micropiles and augercast piles. Each drilled pile group will be described and the advantages and limitations of each group will be presented.

Additional Sessions Planned (Schedule TBA)

Session 3. Driven Pile Types – G. Goble

There are a large number of driven-pile types. The most common ones will be described and their particular applications will be discussed. Load magnitudes for the various pile types will be summarized based on typical loads permitted by design codes.

Session 4. Drilled Pile Equipment – J. DiMaggio

Basic construction procedures and typical equipment used for the construction of drilled shafts, augercast piles and micropiles will be discussed.

Session 5. Pile Driving Equipment – G. Goble

The total pile-driving system, including leads, hammers, cushions and helmets will be presented and described. The function of each element will be discussed. The various hammer types will be presented and the important aspects of their operation will be described in detail. Advantages and disadvantages of each hammer type will be discussed.

Session 6. Construction Monitoring of Deep Foundations – DiMaggio

The scope and suggested responsibilities of the construction monitoring phase of a deep foundation project are presented. This seminar topic also addresses the concept of assigning design safety factors based on the reliability and frequency of the testing and monitoring that is used during construction. Static analysis and dynamic formula of capacity predictions are addressed here.

Session 7. Dynamics of Pile Penetration and Wave Equation Field Use – Goble

The penetration of driven piles can be explained best by considerations of wave mechanics. These concepts can be presented in a very simple fashion using one dimensional wave propagation concepts described physically. These concepts will be presented in a manner that can be easily used in understanding and observing pile driving. Wave-equation analysis is usually used to evaluate pile drivability and sometimes used to establish the pile installation criterion. In this presentation, the use of the analysis results will be emphasized.

Session 8. Static Load Testing – J. DiMaggio

This topic addresses the importance and effective use of static load testing in both the design and construction project phases. Conventional tests, as well as O-Cell tests and Statnamic tests are covered. Compression, tension and lateral loading and basic instrumentation and interpretation concepts are presented.

Session 9. Dynamic Testing for Capacity – G. Goble

Dynamic testing under the pile-driving hammer with the Pile Driving Analyzer is now routine on most pile driving jobs. The measurements and equipment will be described and examples of measurements will be presented. The analysis of the measurements to determine hammer performance and pile capacity will be presented and discussed including both Case Method and CAPWAP.

Session 10. Selection of Foundation Type Based on Cost Analysis – J. DiMaggio

Foundation designers often suggest that their designs are based on cost considerations. However, established procedures and methods have not been presented. Cost evaluation will be discussed and methods will be presented. This analysis will include considerations of the cost of construction time.

Teleweb Presenters

The presentations will be made by Jerry A. DiMaggio and George G. Goble. Mr. DiMaggio is principal geotechnical engineer with the Federal Highway Administration in Washington D.C. and a member of the adjunct faculty at the University of Delaware and Johns Hopkins University. With more than 30 years of experience in geotechnical and foundation engineering practice involving the design and construction monitoring of deep foundations and earth retaining structures, he has become well known in this field. He serves on numerous national committees and task forces related to the development of technical guidelines, specifications and testing standards related to geotechnical and foundation practice, and has presented over 250 seminars and workshops for professionals in design and construction of bridges, retaining walls and earthworks.

Dr. Goble is a consulting engineer who specializes in deep foundations with emphasis on driven-pile design and installation. He advises on all aspects of deep-foundation design and installation including value engineering, application of LRFD in foundation design, driven-pile installation problems and structural aspects of deep foundations design. After working as a structural designer for several years, he was on the faculty of civil engineering at Case Western Reserve University and later at the University of Colorado. Currently, he is an adjunct professor at Utah State University. He supervised the research that developed dynamic pile testing, the Pile Driving Analyzer and techniques for the analysis of pile driving. He recently retired from Pile Dynamics, Inc. and GRL Engineers, Inc. (firms that he founded) and now works as an independent consultant. ▼

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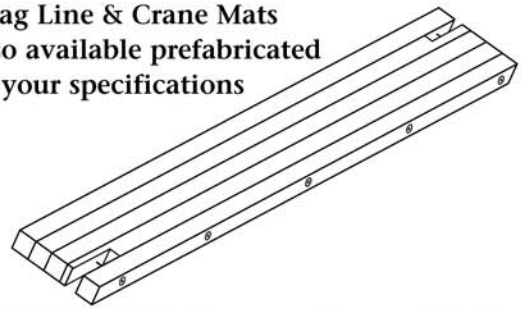

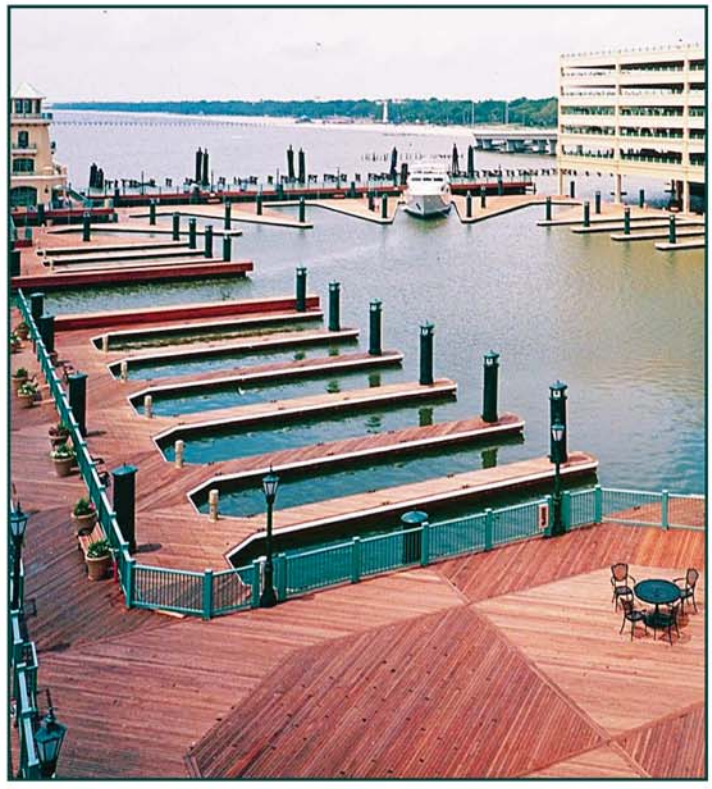

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PDCA PROJECT SPOTLIGHT

From a pile-driving perspective, replacing the deteriorated hull of the 680-foot long battleship, without moving it to dry dock, was no easy feat.

PDCA Member Jordan Pile Driving Inc. Completes USS Alabama Hull Restoration Project Ahead of Schedule

By Lisa Kopochinski, Piledriver Editor

The 70 million lb. WWII battleship has been the centerpiece of the Battleship Memorial Park since 1964.

It's not everyday that a pile-driving contractor gets to work on a project of such historical magnitude. But, such was the case for Mobile, AL-based Jordan Pile Driving Inc. and the USS Alabama, a national historic landmark.

The $4 million restoration of the USS Alabama's hull was completed, not only ahead of schedule, but on budget and without any disruption of the day-to-day operations of the state's largest tourist attraction in Battleship Memorial Park.

The hull of the 62-year old battleship had corroded extensively from resting at the bottom of the Mobile Bay for nearly four decades.

From a pile-driving perspective, replacing the deteriorated hull of the 680-foot long battleship, without moving it to dry dock, was no easy feat.

D.R. Jordan, president of Jordan Pile Driving, Inc., says steel sheet piling was used as shoring to allow excavation alongside the ship's hull to expose deteriorated steel that was then removed and replaced.

While the project, part of $13 million in Battleship Memorial Park's improvements, was expected to be completed last December, construction actually wrapped up late last September.

As reported by George Werneth in the Mobile Register, the project included placing nearly 18,000 square feet of double-plated, half-inch steel on the hull all the way around the WWII vessel (which earned nine battle stars in the Pacific).

"Restoring one of two remaining South Dakota class of battleships is a one-of-a-kind effort."

— Bill Tunnell, executive director,
USS Alabama Battleship Memorial Park

Bill Tunnell, executive director of the Battleship Memorial Park, said that workers cut 10,000 square feet of corroded steel out of the hull and replaced it with three-eighths-inch steel, then covered that over with the double-plated steel.

To properly restore the hull, a cofferdam was constructed around the battleship (by another contractor) at a cost of $4.5 million, so that water around the vessel could be pumped out. Tunnell said the hull was replaced at points extending from above the waterline to below the mud line. The cofferdam will be left in place so that the water level can be raised and lowered as needed.

The hull of the 62-year old battleship had corroded extensively from resting at the bottom of the Mobile Bay for nearly four decades.

Meeting the challenge of a difficult job

An extensive safety analysis was done prior to mobilizing on site. The job had to be built from the water as well as the land. Issues, such as equipment placement and individual work areas, had to be coordinated.

Details, such as equipment maintenance and fueling, had to be addressed too. With dewatering pumps running around the clock, refueling was done during off-peak hours so park visitors would not be inconvenienced.

Cleaning the bunker oil tanks was another challenge. One million gallons of both contaminated and uncontaminated material had to be pumped out of the belly of the battleship into holding tanks, which were then treated and disposed of off site. Each person working in these areas had to wear full toxic material coveralls in the blistering heat of the Mobile summer.

The contract also called for the battleship to be painted after the bunker oil tanks had been emptied and hull repairs had been completed. An extensive scaffolding system was put in place to accommodate the blasting and painting of the severely sloped hull. Marine historians were consulted for recommendations on the exact paint color to be used to match the original color when the USS Alabama was built in 1942.

Excellence in project management

The critical issue on this project was dealing with conditions inside the hull and restoring the ship to its original condition as closely as possible.

Because of the deteriorated condition of the tanks that held contaminated material, very little surveying could be done before this job was bid. The bottom portion of the

While the project, part of $13 million in Battleship Memorial Park's improvements, was expected to be completed last December, construction actually wrapped up late last September.

An extensive safety analysis was done prior to mobilizing on site. The job had to be built from the water as well as the land. Issues, such as equipment placement and individual work areas, had to be coordinated.

hull was essentially "off-limits." Not much information was known as to what was below deck of the battleship.

Jordan Pile Driving Inc. excelled in this aspect of the project. The company was able to make quick assessments of problem areas, consult with marine chemists to determine toxicity levels, and safely dispose of contaminated materials.

D.R. Jordan says what they found most enjoyable about the project was the fact that, "We built the original mooring facilities in 1964. It was very gratifying to go back and work on the same tourist attraction 40 years later."

He adds that the biggest obstacle the company encountered was "keeping the Battleship open to the public, while working 24 hours a day, 7 days a week. The Battleship Park is one of the few tourist attractions that is open 365 days a year."

Innovation in construction techniques

As part of the contract, Jordan kept the inside of the wall, that surrounds the USS Alabama, free of water so work could continue.

"Our experience in the marine construction industry was an advantage here," explains D.R. Jordan. "We relied on our knowledge of large pipes and dewatering techniques. We successfully installed large diameter pipe piling at various locations inside the seawall to aid us. Large pumps were lowered inside these pipes to aid in keeping the water level down."

In the first phase of dewatering, Jordan utilized pumps capable of moving 4,100 gallons of water per minute. After the initial

The USS Alabama is the state of Alabama's most popular tourist attraction, hosting more than 300,000 visitors annually. For 40 years, more than 11 million people have visited the WWII battleship.

water removal process was completed, the company used smaller electric pumps to keep the cofferdam dry.

"We were able to rely on shoring experience to aid muck excavation adjacent to the hull," continues D.R. Jordan. "Short sheet piling was driven in different areas on both sides of the battleship and then dug out to expose the hull below the existing mud line. The damaged hull plating was burned out and replaced with new material."

Sensitivity to environment and surroundings

Because of the USS Alabama's proximity to the water, special precautions were taken to avoid getting hazardous bunker oil into the waters of Mobile Bay. All of the contaminated compartments were pumped out using a large vacuum hose. This hose was pumped directly into holding tanks which were treated and taken to an approved landfill.

Oil soak barriers were strategically placed around areas that were subject to any contaminated material intrusion. All of the contaminated soil was removed from the cofferdam and fresh material brought in to replace it.

Jordan elected to use high efficiency, low emission electric pumps to keep noise levels at a tolerable level.

Also on hand throughout the job were turbidity barriers. These barriers act as screens to filter our dirt particles in the water, keeping the surrounding water color uniform.

Gaining tough approval

The company was not only compelled to complete the job as per the job specifications, but had to meet the satisfaction of the Battleship Commission.

"We were also required to meet the approval of another very interested group," says D.R. Jordan.

This group, and the most important, was the former crew members of the USS Alabama. The group meets regularly at the battleship for reunions and possesses the sharpest eye for change. The crew members lived and breathed on this ship during wartime and know the ship like the back of their hand. To pass inspection by this group is the greatest compliment and achievement. ▼

D.R. Jordan, president of Jordan Pile Driving, Inc., says steel sheet piling was used as shoring to allow excavation alongside the ship's hull to expose deteriorated steel that was then removed and replaced.

Project Name: USS Alabama Hull Restoration Project, Mobile, AL.
Project Description: Replating the deteriorated hull of the 680-foot long battleship without moving the vessel to dry dock.
Pile-driving and general contractor: Jordan Pile Driving, Inc., Mobile, AL.
Owner: USS Alabama Battleship Commission
Engineer: Volkert & Associates, Mobile, AL.

State-of-the-Art Advancement

The 62-year old battleship is far from modern by today's standards. The unique challenge on the project was to upgrade the original structural materials present on the USS Alabama, while keeping the changes hidden.

When built in 1942, the outer tank walls were one-half inch thick. Some 60 years later, they are the thickness of a dime or less in some areas.

New advancements in alloy steel allowed the hull replating to be done with a stronger more corrosion-resistant steel. Jordan Pile Driving Inc. also utilized modern paint mixtures specifically formulated to minimize salt water intrusion. Extensive x-ray testing was performed on every inch of welding to ensure solid 100 percent penetration.

The Pile Driving Contractors Association Presents

Design and Installation of Cost-Efficient Driven Piles Conference

September 16-17, 2004
Los Angeles, California

We have seen dramatic developments in piles and pile-driving equipment in the past 30 years. Quality-control devices have improved the reliability of driven piles so lower factors of safety can be justified. Higher-strength pile materials are available at little or no cost increase. We have a better understanding of pile behavior. The result is a product vastly superior and more cost effective than alternative piling methods.

This seminar is intended for geotechnical engineers, structural engineers, contractors and college professors interested in taking advantage of opportunities in driven-pile design and installation to reduce the cost of their deep foundation designs.

General Information

This one-and-a-half day seminar will present the technical basis for understanding, analyzing and controlling pile driving. Applications of high-design loads will be presented and discussed and the potential for the use of high-design loads and lower factors of safety in the PDCA code will be presented. Other presentations include case studies, testing methods and pile-driving vibrations.

Attendees will receive a certificate verifying 1.0 CEUs or 10 PDHs

Registration & Fees

Fees are $280 if payment is received by **Friday, September 10** and $310 after that date. The registration fee includes: the official Book of Proceedings, session handouts, a copy of the PDCA Code Book, *"Recommended Design Specifications for Driven Bearing Piles, 3rd edition"*, a copy of the PDCA educational CD, *"Driven Piles are Tested Piles,"* lunch and reception on Thursday and coffee breaks. Economical table top exhibits are also available. Registration forms are available on the PDCA Web site at www.piledrivers.org or by contacting PDCA at (303) 517-0421.

Location

The conference will be held at the Sheraton Gateway Los Angeles, 6101 W. Century Blvd., Los Angeles, CA 90045. Reservations can be made by calling (310) 642-1111. A special conference room rate of $109/$119 (deadline is August 25, 2004!) is available by asking for the PDCA DICEP Conference room block. The hotel is located very near Los Angeles International airport and a free shuttle runs continuously between the airport and the hotel. Consider spending the weekend – there's a myriad of fun activities in the area and a shuttle allows for easy access from the hotel to nearby Manhattan Beach. For more info, visit www.sheratonlosangeles.com.

PROGRAM SCHEDULE

Thursday, September 16, 2004

7:30 – 8:30 **Conference registration.**
Exhibit area open, coffee provided.

8:30 – 8:45 **Welcome and Introduction to the Seminar**
Wayne Waters, PDCA President

8:45 – 9:45 **High Capacity Piles**
Peter Osborn, Senior Geotechnical Engineer (Federal Highway Administration)

9:45 – 10:45 **Pile Installation at Soldier Field**
Michael Wysockey, PE (Thatcher Engineering)

10:45 – 11:00 **Break**

11:00 – Noon **Incorporating Setup into the Design and Installation of Driven Piles**
Van Komurka, PE (Wagner Komurka Geotechnical Group)

Noon – 1:00 **Lunch**

1:00 – 2:00 **Support Cost Components of Driven Pile Foundations**
Van Komurka, PE (Wagner Komurka Geotechnical Group)

2:00 – 3:00 **Pile Testing Methods – What Works and What Doesn't**
D. Michael Holloway, Principal (InSituTech, Ltd.)

3:00 – 3:30 **Break**

3:30 – 4:15 **Current Design Codes for Driven Piles**
George Goble, Principal (George Goble Consulting Engineer, LLC)

4:15 – 5:00 **Panel Discussion**
All Presenters

5:00 – 5:30 **Reception**

Friday, September 17, 2004

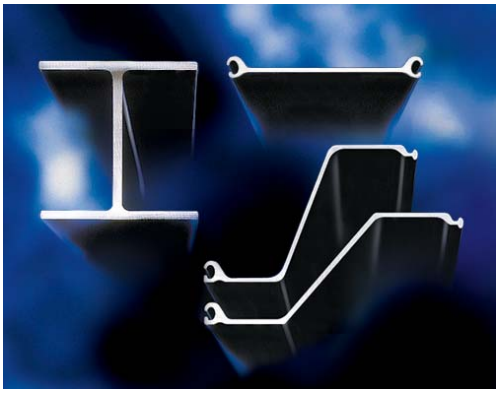
8:30 – 9:30 **Efficient and Economical Driven Pile Solution for Casino Resort: a Case History of the Effective Use of Testing**
Dan Brown, Professor (Auburn University)

9:15 – 9:30 **Break**

9:30 – 10:30 **Vibration Monitoring – Why Bother?**
Barry Roth, Chief Engineer, (Municon Consultants)

10:30 – 11:30 **Batter Piles for Lateral Loads – A Driven Pile Advantage**
Ed Kavazanjian, Associate Professor (Arizona State University)

NUCOR-YAMATO STEEL'S HP8, HP10, HP12 & HP14, PS AND PZ SHEET PILING



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HP8x36		HP10x42	HP10x57

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	in^2	cm^2	in	mm	in	mm	lb/ft	kg/m^2	lb/ft^2	kg/m^2	in^4	cm^4	in^3	cm^3	in^3/ft	cm^3/m	ft^2/ft	m^2/m	ft^2/n	m^2/m
PZ22	11.9	76.6	22.0	559	9.0	228.6	40.3	60.1	22.0	107	151	6301	32.5	532	17.7	952	4.92	1.50	4.48	1.37
PZ27	12.1	78.2	18.0	457	12.0	304.8	40.5	61.3	27.5	134	282	11734	45.3	742	30.2	1622	4.93	1.50	4.48	1.37
PS27.5	13.4	86.6	19.7	500	—	—	45.1	67.9	27.8	136	5.02	209	3.19	52.2	1.94	104	4.58	1.40	3.88	1.18
PS31	15.2	98.2	19.7	500	—	—	50.9	77.0	31.5	154	5.51	229	3.35	55.0	2.04	110	4.58	1.40	3.87	1.18

*Note: Nominal coating area excludes socket interior and ball of interlock.

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APRIL 2004

Does Size Really Matter? In Hammer Cushions, Little Things Count!

Someone once made the remark that if you worry about the pennies, the dollars will take care of themselves; meaning that if each of the small items is taken care of along the way, the major items will have been taken care of incrementally many times over. The same can be said of the planning and execution of a piling project. By paying attention to the details the job runs smoother and without unexpected breakdowns and delays, allowing the contractor to work more efficiently and economically.

One item frequently overlooked or misunderstood is pile-driving cushions. Cushions are usually a minor item in the total scheme of the project. If cushions become a problem during the course of the project they can rapidly become a major cost item; not only from the standpoint of the cushion cost but, usually and more especially because of the crew and equipment downtime necessary to change out the cushion — time better spent in driving piles.

Pile-driving cushions are provided primarily to protect the hammer or the pile, and are referred to as Hammer Cushions or Pile Cushions. Although they have a similar purpose, they are two different things. Pile-driving cushions are contradictory items by nature. They are provided to protect the hammer and/or pile by softening (cushioning) the energy of the hammer blow. In doing this, they work at odds with the objective of transmitting maximum available energy to the driving process.

Hammer cushions are the most common cushions encountered on the project and, with a few exceptions, almost all impact pile hammers require the use of a hammer cushion of some sort. Manufacturers design their hammers with the intention of transmitting the most available energy to the pile. However, they recognize that in so doing, and by their design and use, pile hammers are subjected to considerable rebound forces and stresses. Unless managed properly, these forces and stresses can cause major damage to the hammer, increased maintenance, and a threat to the safety of the crew. Damage from these forces that can occur over time can cause fatiguing (crystallization), or fractures of the metal structure, and loosening and eventual dislodging of attached components due to vibration. In order to mitigate the effects of these dangerous forces, the manufacturers have designed a provision for cushion materials into the driving system. The use of the cushion to protect the hammer (and crew) presents a contradictory situation in that by dampening the reflected forces, it also reduces the effective transmission of the full potential energy to the pile. This presents a problem in that while the ideal is to transmit as much energy to the pile as possible, the produced rebound forces must be tempered to protect the hammer.

Regardless of the make, model, and other variables in pile hammer design, the cushion is situated in a receptacle (or cushion pot) located directly under the point of impact of the ram or piston. Often this cushion pot is incorporated into the drive cap or helmet, an accessory that adapts the hammer to the particular size and type of pile being driven. In the case of some hammers, this cushion pot is located in a "universal" head or adaptor that then fits with the drive cap or helmet. The cushion material is situated in this cushion pot and topped with a heavy steel striker plate or anvil. Ideally, what is looked for in a cushion is material that provides adequate protection to the hammer while transmitting the most energy to the pile, provides longest life possible, and requires the least maintenance.

Early mechanical impact hammers, first used to drive timber piles, did not require a cushion as the top of the timber pile provided some cushioning to the hammer. With the advent of other, stiffer pile materials, the industry came to realize that additional protection was required for the hammer, and incidentally to some degree the pile. Many different materials have been used over the years to accomplish this task — blocks and chips of various species of wood, asbestos materials, coiled cable, woven wire mesh encapsulated in plastic, coils of paper and aluminum, phenolic laminate, aluminum, nylon blocks, and many others. Modern hammers most commonly use either a "sandwich" of phenolic laminate material (called by several common trade names), and aluminum, or special alloyed nylon blocks with aluminum layers arranged to achieve the manufacturer's required stack height. Proper cushion stack height is important to adequately protect the hammer and because stack height affects the hammer stroke and/or timing.

Over time, two things occur during driving which affect the efficiency

Hammer cushions are the most common cushions encountered on the project and, with a few exceptions, almost all impact pile hammers require the use of a hammer cushion of some sort.

of the cushion as energy is transmitted through the hammer-cushion drive-cap pile system. First, as driving progresses, the cushion undergoes compression. As the cushion compresses it becomes harder, and will eventually lose its cushioning and ability to protect the hammer. The second thing to occur is the development of a significant amount of heat. Heat is usually most detrimental to cushion life, causing the breakdown of the cushion and loss of cushioning ability. When this happens, the cushion's ability to protect the hammer diminishes, and the energy transmission to the pile drops considerably, causing the pile to require more blows from the hammer for the same amount of penetration — i.e. longer driving time and more cost. Factors affecting the life of a particular cushion are the relationship between the energy of the hammer and size of the cushion, the cushion material, and perhaps most importantly, the driving conditions due to the soil.

It is hard to predict the useful life of a cushion on a given project. Many claims have been made about how long a particular cushion will last or how many piles were driven with it. As mentioned previously, heat is a major factor in the breakdown of cushions. It is useful at this point to recall that the cushion pot used to hold the cushion material is usually a relatively substantial steel structure. This provides a tremendous heat sink, absorbing and retaining large amounts of heat during driving. In situations where there is prolonged hard or heavy driving, tremendous amounts of heat can be generated. This, depending upon the cushion material used, can cause the cushion to smolder or melt. In the event of smoldering, considerable amounts of smoke can be generated. If the cushion gets to this point it is a safe bet that it has been used well beyond its useful life. Likewise, if the cushion begins to melt, it is softening and loses its ability to transmit driving energy. To help alleviate the problem of heat buildup, many contractors have used water cooling of the cushion pot or drive cap. This has proved effective in prolonging the life of the cushion in many cases. However, prolonged immersion in water can cause phenolic materials to delaminate, leading to more rapid deterioration of the cushion.

It is necessary to recognize that hammer cushions are consumable items that get "used up" during the course of use, much like fuel and lubricants on other equipment. Proper selection of hammer cushion is important to maintaining progress in driving, ensuring that the anticipated energy is getting to the pile, and that downtime due to changing cushions is kept to a minimum. An additional consideration is the actual cushion cost. A cheap cushion that lasts only half as long as a little more expensive one recommended or specified by the manufacturer or consultant, is no bargain over the long term. PDCA member hammer manufacturers are sources of information about cushion materials for their particular line of hammers. Additionally, several PDCA associate members specialize in cushion materials and are good sources of information for the available cushion choices for differing applications. For contact information, visit the Member Search section of the PDCA Web site (http://www.piledrivers.org).

Look for a discussion on pile cushions in a future article in Piledriver magazine. ▼

THE CITADEL Breaks Ground with an Outdoor Soils Lab

By Keith Plemmons, PhD, PE, PMP, Assistant Professor
The Citadel, Charleston, SC

Something new and innovative is happening at The Citadel in Charleston, SC. Normally, we think of a college laboratory as a smelly and musty place, where students shuffle about quietly in their lab coats and goggles, watching mold grow or dissecting frogs. This is not the case in The Citadel's Outdoor Soils Lab (OSL). Outdoors, sunshine, fresh air, overlooking the Ashley River, and sometimes very noisy, the students wear sunglasses, hard hats and hearing protection. And, despite the differences, the objective remains the same — students learn the practical application of basic concepts and theories.

The OSL provides senior geotechnical engineering students with something they would not normally receive in an undergraduate classroom or laboratory – field experience. To get this field experience, as their geotechnical professor, I brought the students together with local engineering firms and pile-driving companies to observe and participate in field investigations and pile driving. As one of my students, Jonathan Black, commented, "The outdoor soils lab provided invaluable experience by reinforcing topics that were previously only seen in the classroom."

Andy Feix and Butch Knapp of S&ME describe the operation of the SCPT to a group of Citadel students.

Located on The Citadel campus, the OSL provides an opportunity for the undergraduate civil and environmental engineering students to develop a better understanding of the subjects taught in the classroom. Using hands-on experiences and field demonstrations, the class observed how basic geotechnical concepts apply to everyday practice. Graduating senior Joseph Adams puts it succinctly: "You can learn anything in the classroom, but seeing it in the field makes it real."

Modeled after the engineering and construction process, the field investigation took place last January,

Frank Eaton and his crew from Soil Consultants, Inc. explain the basic operations of a mud rotary soil boring rig.

Citadel students Rhodes Jordan, Josh Roberson and Peter Valiquette (L to R) practice operating a "Speedy" Moisture Tester.

the data analysis and the laboratory tests performed in February and March, and the construction occurred in April. In January, two local engineering and testing companies set up four demonstration stations. At station 1, Soil Consultants Inc. performed a split-spoon sample soil boring with Standard Penetration Tests at five-foot intervals. In addition, several undisturbed Shelby Tube samples were obtained at various depths. At this station, students were instructed on the drilling operations, observed drilling and sampling procedures and obtained soil samples to be tested as part of their soils lab. At stations 2, 3 and 4, S&ME Inc. provided demonstrations of the Seismic Cone Penetration Test (SCPT) rig, a Troxler nuclear density testing device and a "Speedy" moisture tester, respectively.

After progressing through all four stations and to be released from the lab, each student had to walk myself through each station, explaining the procedures, application of theory, materials used and other important facts.

Less than three months after the field investigation, students found themselves back in the OSL watching Pile Drivers Inc. set up and drive an 80-foot HP 10x42 pile and S&ME Inc. perform dynamic pile-testing procedures. This time, they had a personal interest in the outcome. The students had used the soil profile from the January tests to calculate the ultimate bearing capacity of the pile and their results entered into a "contest", with the closest answer winning $10 and a case of soft drinks.

Before pile driving began, the students gathered around the pile-driving rig to learn about its components and operation. Also, they were able to watch Greg Canivan from S&ME install the strain gages and accelerometers on the pile and to learn how they worked.

During the pile driving, two

Greg Canivan of S&ME demonstrates how strain gages and accelerometers are attached to a steel H-pile.

Citadel students record blow counts and gather around Greg Canivan to watch the pile driving and observe his PDA analysis.

Michael McCormick from Pile Drivers Inc. discusses pile-driving fundamentals with two cadets.

of the students, Josh Roberson and Andrew Krisel, volunteered to record blow counts, while the remainder of the class watched Greg analyze the Pile Driving Analyzer (PDA) data. After driving the pile a total of 76 feet and with 30 of those feet driven into the Cooper Marl, a thick, uniform layer of highly plastic clay and the primary deep foundation bearing stratum for the Charleston, SC area, the operation halted for 20 minutes to let the pile gain strength. Restriking the pile and analyzing the data, the students were surprised to learn the pile capacity increased from 35 tons to approximately 85 tons. Though no surprise to the experts, the students thought this gain in capacity was "magic." The open structure and high moisture content (40 to 60 percent) of the Cooper Marl produce driven piles with relatively small driving resistance. Shortly after driving and as pore pressures dissipate, the capacity gain, with respect to time, is substantial and yields an economical foundation design. These characteristics of the Cooper Marl account for most of the "magic."

"What began as an idea about moving students from theory and the textbook to give them practical field experience has come to fruition. This is where learning happens. Now we have Outdoor Soils Lab where students can experience important aspects of fieldwork and the process of driving piles. This is a meaningful addition to our program. I want to thank those companies involved for their contribution in helping make this possible," said Dennis Fallon, dean of the School of Engineering.

The OSL experience resulted from collaboration between The Citadel, the South Carolina Chapter of PDCA, engineering and testing firms, pile-driving companies, and material suppliers. Together, we worked to "educate" the next generation of engineers. As Jae Mattox, an engineering senior, states it, "The outdoor soils lab was the capstone for our geotechnical classes as it brought the theories and testing procedures to life." ▼

THE CITADEL SCHOOL OF ENGINEERING AND THE CIVIL AND ENVIRONMENTAL ENGINEERING DEPARTMENT WOULD LIKE TO THANK THE FOLLOWING COMPANIES FOR THEIR CONTRIBUTIONS:		
Company	**Person**	**Contribution**
S&ME Inc.	Billy Camp, Greg Canivan, and field crews	Seismic Cone Penetration Test, field test demonstrations, high strain dynamic testing with the Pile Driving Analyzer (PDA)
Soil Consultants, Inc.	Graham Forsythe, Frank Eaton, and field crew	Soil boring and analysis
Skyline Steel	Richard Gilbert	80 foot, HP 10x42 pile
Pile Drivers, Inc.	John King and Michael McCormick and crew	Field demonstration and pile driving
Palmetto Pile Driving	Harry Robbins	Field set up and coordination of pile driving operations

Author's Note: This was our first year and it was very instructive to put companies and students together in the OSL. In the future, we hope to make additions to our OSL and demonstrate other aspects of field investigation and driven foundations. Being part of a field investigation and discovering what it takes to drive a pile is an experience that each student will long remember. In the future, I hope it helps them make sound engineering decisions regarding various foundation options. I can be reached at keith.plemmons@citadel.edu

President's Note: The author, Keith Plemmons, is a graduate of our 2003 Professors' Piling Institute held in Logan, Utah. The Citadel's Outdoor Soils Lab is a great example of what can happen when PDCA members and educators combine their talents and resources. As new engineers graduate, the benefits of this program will extend far beyond the Charleston area. Get to know the engineering professors in your area. Our next Professors' Institute will be held in June 2005. Please consider sponsoring a professor at this event. It's a great way to promote the driven pile.

South Carolina Chapter of the PDCA Hosts Driven Pile Seminar

The South Carolina Chapter of the PDCA hosted a driven-pile technical seminar on March 25. The day-long event was held at The Citadel in Charleston, South Carolina and attracted over 100 engineers, contractors, architects and others involved with the construction industry.

Dr. Bill Isehnower (Ensoft, Inc.) began the program with a presentation on the lateral analysis of driven piles. He was followed by presentations on the design and use of prestressed concrete piles, steel pipe piles and timber piles, which were made by Mac Nigels (Davis & Floyd), Mark Brumbaugh (Skyline Steel) and Dean Matthews (consultant), respectively. Following a lunch break, Dr. Jim Bay (Utah State University) and Dave Harrison (Walter & Associates) made presentations on construction induced vibrations with Dr. Bay focusing on vibration theory and Mr. Harrison covering measurements and case histories. Dr. George Goble, speaking on driven-pile installation specifications, closed out the technical program in the afternoon. The technical program was followed by a social hour that gave attendees the opportunity to talk with many of the presenters.

The financial support of our sponsors enabled the PDCA to keep the registration fee low. The seminar was considered an overwhelming success and a second "annual" seminar is now tentatively planned for March 2005.

NATIONAL GEOTECHNICAL INSPECTOR QUALIFICATION PROGRAM

Driven Pile Inspection Module

To improve the quality of our constructed highway facilities, FHWA Geotechnical and Hydraulics Technical Service Team Leader Peter W. Osborn is leading an effort to develop a training and certification program for geotechnical field construction inspection and site investigation activities. The program is targeted at those personnel involved in construction inspection, site investigation and field and laboratory testing. The ultimate goal of the program is the development of a nationally accepted certification program that will serve to improve quality, ensure uniformity and establish a minimum standard of construction control for geotechnical work.

The National Geotechnical Inspector Qualification Program developed as a response to the states' Department of Transportation request. The DOT asked for a qualification/certification program that can be adopted by the state DOTs and/or Regional Certification Groups for the qualification/certification of state and consultant inspectors. The effort was endorsed by the AASHTO subcommittees on construction, materials, and bridges and structures. To move the effort forward, the FHWA formed a technical working group (TWG) comprised of state DOT representatives from each of the five Regional Certification Groups, Industry and the FHWA to develop and prioritize the areas in the geotechnical field where qualification/certification is needed. The TWG developed a strategic plan that identified those areas of qualification/certification with the associated costs and time frames for the development of the initial programs. Inspector Certification Modules included in the plan: Driven Piles; Drilled Shaft Foundations; Subsurface Investigation Inspection; Mechanically Stabilized Earth Walls and Reinforced Soil Slopes; Embankments/Cut Slopes; Anchored/Soil-Nail Walls.

The Driven Pile and Drilled Shaft Inspector Certification Modules were completed in January 2003 and have been presented to numerous state DOTs nationwide. The inspection courses are offered through the FHWA's National Highway Institute (NHI) and the Regional Certification Groups and continue to be in great demand. The New England states have adopted the Driven Pile and Drilled Shaft Inspector Qualification Program, which is administered through the New England Transportation Technician Certification Program (NETTCP). Florida, Missouri, Oregon, Kansas and several other states have adopted or are in the process of adopting the program. The development of the Subsurface Investigation Inspection and the Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Modules are currently under development and are expected to be completed in early 2005.

The Driven Pile Inspector Qualification Program was developed under the guidance of a regionally diverse technical working group (TWG) that included state DOT representatives, as well as industry representatives from the PDCA and DFI. The comprehensive reviews from the TWG enabled the development of a set of core training/qualification materials that can be adopted nationwide. The Driven Pile Inspector Qualification Program is specifically targeted at the pile inspector and focuses on what the inspector "needs to know" to properly inspect a driven-pile foundation. The course is two days in length and includes a comprehensive qualification exam. The course follows recommended FHWA and AASHTO specifications and practices and covers all areas of the driven pile construction process from fabrication and delivery to installation and testing. Specific areas include: inspection of the pile materials and accessories; inspection of the hammer/driving system; installation plan; driving criteria; acceptance/rejection criteria; proper documentation; driving logs; the inspector's role in dynamic and static load testing; safety. The program continues to be in high demand among the state DOTs. The program would also be of benefit to construction personnel. ▼

Peter Osborn

For additional information on this program, visit the FHWA's National Highway Institute Web site at www.nhi.fhwa.dot.gov or contact Peter Osborn at peter.osborn@fhwa.dot.gov or (410) 962-0792. Other related Web sites of interest include www.fhwa.dot.gov/bridge; www.fhwa.dot.gov/resourcecenter; www.nhi.fhwa.dot.gov/tccc.

For Course Scheduling contact:

National Highway Institute
NHI, Danielle Mathis-Lee,
(703) 235-0528

Regional Certification Groups

North East: NETTCP,
Chris Bowker, (800) 338-5535
Midwest: M-TRAC,
Chris Anderson, (515) 239-1819
Mid Atlantic: MARTCP,
Woody Hood, (410) 321-4100
West: WAQTC,
Garth Newman, (208) 334-8039
South East: SETFTTQ,
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Operating Principles of Single-Acting Air/Steam Hammer

Single-acting air/steam hammers are very common and have a relatively simple design. In this hammer, compressed air or steam forces a steel ram upward until an exhaust valve opens and the ram falls due to its own weight.

The motive fluid that lifts the ram can be either compressed air or steam. An external power source, such as an air compressor or boiler supplies the pressured motive fluid and a flexible hose carries the motive fluid from the source to a piston attached to the ram. Operation with air or steam is similar. However, a change in motive fluid may change the specifications of the lubricant, lubricator, and hose line.

At the start of the stroke, a valve directs motive fluid from the inlet into a cylinder under the piston (see Figure 1a). The motive fluid, delivered at near constant pressure, forces the piston (and ram) upward. After the ram travels upward a certain distance, a cam attached to a machined slide bar strikes a butterfly valve causing it to rotate from inlet to exhaust positions. Since the ram has an upward velocity at this point it "coasts" on upward under the action of gravity and then begins to fall. The ram may have received an initial velocity from the pile rebound so its velocity can vary depending on the driving conditions. Therefore, the stroke can also vary. In its downward fall, shortly before the ram strikes the hammer cushion another cam on the slide bar rotates the butterfly valve back to the inlet position admitting motive fluid under the piston. This valve timing produces a slight pre-admission of pressurized motive fluid under the downward traveling piston. Motive fluid acting upward on the piston before impact reduces the kinetic energy of the falling ram. However, some pre-admission is a necessary part of the cycle because the slide bar must be moving downward to activate the cam and inlet valve.

Proper operation of a single-acting air/steam hammer requires proper motive fluid pressures, volumes, and correct mechanical timing of the inlet and exhaust valves.

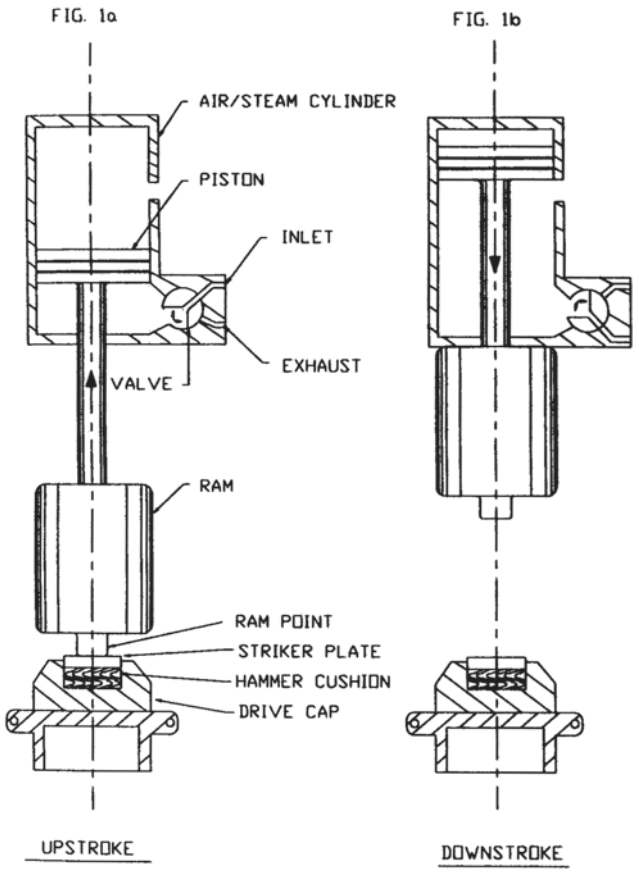

Figure 1: Single-acting Air/Steam Hammer

Hammer designs usually compensate for the effect of pre-admission by increasing the downward forces on the ram. A common single-acting air/steam hammer design uses the effects of air pressure at the top of the stroke. In this design, the piston travels above the exhaust port into an upper chamber. At full stroke a small volume of air, trapped above the piston, acts as a pneumatic stopper between the piston and the top of the cylinder. The force of the trapped air accelerates the ram downward until the relief port re-opens. These extra downward forces at the start of the ram's descent help compensate for the effects of pre-admission.

Proper operation of a single-acting air/steam hammer requires proper motive fluid pressures, volumes, and

correct mechanical timing of the inlet and exhaust valves. The cycle described above is common to many of these hammer designs. However, variations of timing and pressure cycle details do occur among some models of this type of hammer. For details of individual hammers consult the manufacturer.

The rated energy of a single-acting air/steam hammers is determined by taking the product of the ram weight and the specified stroke. The ram weight is commonly defined as the total weight of all striking parts, including the ram body, piston rod, keys, slide bar, etc. Manufacturers provide information on the appropriate ram weights, stroke lengths, and rated energies for their products. Commercially available single-acting air/steam hammers are available with ram weights from 3,000 lbs. (1300 kilograms) to over 300,000 lbs. (130,000 kilograms) and energy ratings of less than 10,000 ft-lbs (13 kilojoules) to 1.8 million ft-lbs (2500 kilojoules). The larger single-acting air/steam hammers are used in offshore construction with long, large diameter piles.

Single-acting air/steam hammers usually have a hammer cushion between the ram and the drive cap. In most cases, the mechanical timing of the inlet valves will be correct only if the combined thickness of the hammer cushion and striker plate is correct. Moreover, a properly functioning hammer cushion protects the hammer and the pile by slightly reducing the shock of the ram's impact. Occasionally, the hammer manufacturer's design may not call for a hammer cushion. Consult the manufacturer or supplier if there is a question about hammer cushion details.

Some single-acting air/steam hammers are adaptable to operation submerged under water. Also, some of the hammers can operate with more than one, or a continuously variable, user selectable, stroke length. Several methods of changing the stroke are in use; refer to the manufacturer for detailed information.

Single-Acting Air/Steam Hammers Inspection Guide

1. Obtain the correct manufacturer's specifications for the hammer model in use.

2. Check the air or steam supply. Confirm that this supply is adequate to meet the hammer specifications. Also verify that the length and diameter of the hose(s) are adequate to provide the required pressure and flow volume at the hammer inlet. Hammer manufacturers provide guidelines for proper compressors and supply hoses.

3. Make a visual inspection of the hammer cushion if the hammer has one and note the cushion material type, condition, total thickness, and cross section dimensions. A simple sketch with dimensions is useful to record observations. Compare the collected information with the manufacturer's hammer cushion specifications. In most cases, the total thickness of the cushion and striker plate must match the manufacturer's specifications for proper hammer operation, and should be maintained.

4. On the hammer assembly, (hammer framework) measure and mark a reference point for use in observing the stroke length. Measure from a convenient point on the ram while supporting the ram by the drive cap and hammer cushion. When making more than one mark, consider color-coding. During driving, observe and record the stroke for comparison with the specified stroke. Proper hammer performance requires a proper stroke length.

5. Initial inspection of hammer operation often occurs on piles that will become part of the project foundation. Occasionally, separate test piles are used to test the hammer and to establish driving procedures. Attempt to inspect hammer operation in circumstances that match routine driving at the final pile penetration. A single-acting air/steam hammer may perform differently during hard driving (high blow counts) than during easy driving (low blow counts).

6. Have the pile crew start the hammer. When starting a cold hammer in cold ambient temperatures, the crew may want to short stroke the hammer for 5 to 10 minutes to warm up the metal parts before subjecting them to full ram stroke and stress.

7. During continuous hammer operation near the end of driving count the number of times the hammer strikes in one minute. Record this number as the hammer speed, or blow rate. Compare the observed hammer speed with the manufacturer's specifications. A hammer speed that is less than the specified value may indicate a single-acting air/steam hammer deficiency. Such deficiencies include short strokes and improperly timed pre-admission.

8. During easy driving (low blow counts), the hammer speed and stroke is often less than during hard driving. This behavior is normal. When recording the hammer speed and stroke, also include the approximate pile penetration. These data are most useful if the pile penetration and blow count are close to their final values.

9. As the pile's driving resistance (blow count) increases, the ram stroke may increase slightly. At very high driving resistances the ram stroke may increase and the upward traveling ram may strike the hammer assembly (framework), causing it to bounce upward. This behavior is called racking, and is readily detected by sight and sound. If racking occurs, the motive fluid flow may be reduced gradually or slightly until racking stops. After proper adjustment to control racking, the ram stroke and potential energy will normally continue to equal the specified stroke and energy rating.

10. During driving the hammer hoist line should be slack, with the hammer's weight carried by the pile. Excessive tension in the hammer hoist line is hazardous and will reduce the energy delivered to the pile. Leads should always be used.

11. During the driving of a pile, changes should not be made in the pile cushion. If it is necessary to insert a fresh cushion, it can be expected that the blow count will change, possibly substantially. The complete driving record should show where the new cushion was added in order to show the effect of the new cushion on the driving resistance.

12. Some manufacturers of single-acting air/steam hammers will void their equipment warranties if the penetration resistance consistently exceeds 10 blows per inch (10 blows per 25 millimeters). This limit is sometimes exceeded for short periods, such as when piles are driven to end bearing on hard material. Nevertheless, the limit should be given due consideration in cases where hard driving occurs.

Hammer Trouble Shooting

Provision and maintenance of a properly functioning hammer is normally the responsibility of the contractor. However, the following information may be helpful when the hammer malfunctions:

1. Inability to attain the specified hammer speed (blows per minute) can result from inadequate motive fluid flow or pressure, a restricted or undersized hose, inadequate lubrication, poor valve timing, and worn hammer parts. Refer to the manufacturer for specifications and recommendations. Note: The motive fluid pressure at the hammer is best checked with a pneumatic needle gage installed as close to the hammer inlet as is safely possible.

2. Erratic hammer operation, such as skipping blows, can result from an improper hammer cushion thickness, inadequate lubrication, rubber hose lining or other foreign material in a valve, a faulty valve/cam system, or loose hammer fasteners (keys, nuts, etc). In cold or humid weather, ice may build up in the hammer and near the exhaust and may cause irregular operation. If the motive fluid is steam, a cold hose or hammer may produce large amounts of condensate. Until such condensate exhausts or bleeds off, the ram's motion may be very irregular. ▼

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Founding PDCA Member and Build Inc. President Dick Stromness is Still Going Strong at 86

By a Marino

Richard Stromness

Dick finds it extremely beneficial to be part of an organization that allows his company to promote its services, network and associate with others who share the same challenges and accomplishments.

At 86 years young, Richard J. Stromness is still putting his heart and soul into making his business bigger and better. As founder and president of Build Inc., a family-owned general contracting business, based in Bountiful, Utah, "Dick" reports to work seven days a week. While his son, Fred, actively manages the company, Dick is still very much involved in everyday decisions.

"Dick loves his work and finds great satisfaction in the daily operations," says other son Richy. "He has a strong positive influence on the projects he is involved with."

A long history

Dick and another gentleman, Dick Van de Merwe, founded Build Inc. in 1953 with a half-horsepower, electric cement mixer that delivered a wheelbarrow full of concrete. The company's first job was a simple shelter that took two days to construct at a cost of $40. (Dick later bought out Van de Merwe's share of the company). The company gradually progressed from constructing dwellings, apartment buildings and commercial buildings to heavy and industrial construction. Today, Build Inc. owns and operates a fleet of cranes, pile drivers and earth-moving equipment and serves as general contractor and subcontractor on a wide array of projects.

One of Build Inc.'s more impressive projects is a $5 million, 10-million gallon concrete reservoir in Vernal, Utah. Currently under construction, but slated for completion by November, the reservoir will hold culinary water for the local population.

Another project the company is excited about is the renovation of the Union Pacific Railroad in Lakeside, Utah. The railroad is replacing a wooden train bridge with a new concrete bridge that will be set atop a pile foundation. Build Inc. is installing the piles, casting the pile caps and setting the pre-cast concrete girders.

Other projects the company is involved in include the Olmstead Flow Line, a multi-million dollar, soil-nailing project to protect a replacement of a 96-inch flow line along a steep mountainside of the Provo canyon; and the renovation of the Great Salt Lake Marina, which includes the rehabilitation and replacement of many boat slips (the slips are then anchored using wooden piles).

Sheer determination

The secret to Build Inc.'s longevity can be summed up by Dick's willpower and ability to say there is nothing too difficult to be accomplished. Diversity and responsiveness have enabled the company to weather the ups and downs of the past half century.

"Show Dick a seemingly impossible job and he says, 'This is how it can be done'," says Richy. "To him, construction is an exciting and challenging art."

When asked what drives him, Dick simply responds, "an abject fear of poverty."

Through this fear (having grown up during the Depression) and due to his vision, creativity, high quality work and integrity, Build Inc. has carved a solid niche in the construction industry in both Utah and the surrounding states. The company also began making a positive impression on the industry as a founding member of the Pile Driving Contractors Association. Dick says he became involved in PDCA to promote the driven pile as a comparable deep foundations system, but has found much more than that in the association. Dick appreciates the education that comes from the PDCA roundtables as well as the industry benefits derived from promoting the driven pile. He says it is extremely beneficial to be part of an organization that allows his company to promote its services, network and associate with others who share the same challenges and accomplishments.

Because of its ability to cater to customers needs, Build Inc. has won customer satisfaction and industry recognition awards from the American Concrete Association and the American Public Works Association.

Along with being professionally successful, Dick has fostered a wonderful family life. He and his wife Mary have raised six children – two sons and four daughters. In his spare time, Richy says Dick likes to "eat ice cream, watch *60 Minutes* and spend time at our family cabin. He also enjoys learning about travel destinations and frequents the symphony." ▼

Dick and Mary Stromness.

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  Engine: Liebherr V8 Diesel engine, D 9408 TI-E, 544 HP at 1900 rpm. No additional power packs are required as attachments, can be powered with the machine's engine.

- Liebherr LRB 125
  Max. Operating weight: 43 US ton
  Leader Length: 42 ft.
  Max. Torque: 87,000 ft.lbs.
  Max. Push/Pull (crowd force): 44,100 lbs.
  Engine: Liebherr V8 Diesel engine, D 9408 TI-E, 544 HP at 1900 rpm. No additional power packs are required as attachments, can be powered with the machine's engine.

- Liebherr LRB 255
  Max. Operating weight: 88 US ton
  Leader Length: 80 ft./90 ft./100 ft.
  Max. Torque: 217,000 ft.lbs.
  Max. Push/Pull (crowd force): 99,200 lbs.
  Engine: Liebherr V8 Diesel engine, D 9408 TI-E, 544 HP at 1900 rpm. No additional power packs are required as attachments, can be powered with the machine's engine. Optional Mercedes Benz engine.

- Liebherr LRB 400
  Max. Operating weight: 154 US ton
  Leader Length: 100 ft./120 ft./140 ft.
  Max. Torque: 289,300 ft.lbs.
  Max. Push/Pull (crowd force): 132,000 lbs.
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Calendar of Events

September 16-17, 2004

5th Annual DICEP Conference
Sheraton Gateway Hotel
Los Angeles, California

February 17-19, 2005

9th Annual Winter Roundtable Conference
Francis Marion Hotel
Charleston, South Carolina

June 19-24, 2005

3rd Professors Piling Institute
Utah State University
Logan, Utah

REQUEST FOR PHOTOS

Attention PDCA members
Piledriver magazine is on the lookout for any interesting photos you may have. We're looking for fairly generic pile-driving images that we can print in upcoming issues. If they are digital, they need to be saved in either a TIF, JPG or EPS format at 300 dpi and should be at least 4 x 5 inches in dimension. If they are actual hard copy photos, please mail them to:

Editor
Lisa Kopochinski
3231 Strevel Way, Sacramento, CA 95825.
Email: lisa@lesterpublications.com
(800) 481-0265
We will be sure to return them to you.

PDCA MEMBERSHIP APPLICATION

PDCA
PILE DRIVING CONTRACTORS ASSOCIATION

Step 1: Select Membership Type

I wish to apply for the following membership status (check one):

❑ **Contractor ($650/year)**
A Contractor Member is defined as a specialty subcontractor or general contractor who commonly installs driven piles for foundations and earth retention systems. Includes one primary membership. Secondary memberships are $75 each.

❑ **Associate ($650/year)**
Associate Members of the Association shall consist of firms or corporations engaged in the manufacture and/or supply of equipment, materials, testing or other services to the pile driving industry. Secondary memberships are $75 each.

❑ **Technical Affiliate ($95/year)**
Technical Affiliate Members of the Association shall consist of individuals who are involved with the design and installation of driven piles or in teaching the art and science of pile design and installation. They may be employed engineers, architects, government agencies, or universities. Employees of contractors are not eligible to become Technical Affiliate Members. Note: Technical Affiliate Membership category is for individuals only. For a company listing in the directory and on the Web site, you must join as an Associate Member.

❑ **Retired Industry Member ($50/year)**
A Retired Member shall be defined as any individual who has reached retirement age as defined by U.S. law, who has left active employment and who wishes to remain a member.
I am retiring as a: ❑ Contractor ❑ Associate ❑ Technical Affiliate

Step 2: Demographic Information

Company Name _____ Phone _____

Your Name _____ Fax _____

Address _____ Email _____

_____ Home Page _____

City/State/Zip _____

Step 3. Company Description (complete only the category for which you are applying)

A. Contractor Only Company Description (check all that apply):

❑ Bridge Building ❑ Docks &Wharves ❑ Marine
❑ Bulkheads ❑ Earth Retention ❑ Pile Driving
❑ Deep Dynamic Compaction ❑ General ❑ Other _____
❑ Deep Excavation ❑ Highway & Heavy Civil

B. Associate Company Only Company Description (check all that apply):

Accessories

❑ Cutter Heads & Drill Bits ❑ Lubricants & Greases ❑ Safety Equipment
❑ Dock & Marine Supplies ❑ Pile Cushions ❑ Other _____
❑ Hammer Cushions ❑ Pile Points & Splicers
❑ Hoses & Fittings ❑ Rigging Supplies

Applications Systems

❑ Aluminum Sheet Piles
❑ Coatings & Chemicals
❑ Structural Steel
❑ Synthetic Material Piles
❑ Other_____
❑ Steel Pipe Piles
❑ Steel Sheet Piles
❑ Vinyl Sheet Piles
❑ Other Structural Materials
❑ Timber Piles/Treated Lumber & Timbers
❑ Concrete Piles
❑ Composite Piles
❑ H-Piles

Equipment

❑ Air Compressors
❑ Cranes
❑ Drill Equipment
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❑ Hammers
❑ Hydraulic Power Packs
❑ Leads & Spotters
❑ Pumps
❑ Specialized Rigs & Equipment
❑ Other

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❑ Design
❑ Freight Brokerage
❑ Geotechnical
❑ Marine Drayage
❑ Surveying
❑ Testing
❑ Trucking
❑ Vibration Monitoring _____
❑ Other _____

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❑ Rental ❑ Sales ❑ Other _____ ❑ Other _____

C. Technical Affiliate Only (check all that apply)

❑ Analysis
❑ Geotechnical
❑ Surveying
❑ Civil & Design
❑ Materials Testing
❑ Vibration Monitoring
❑ Consulting
❑ Pile Driving Monitoring
❑ Other
❑ Educational/Association

Step 4. Geographic Areas Where Contracting, Products and Services Available

(All applicants check all that apply)

❑ All States	❑ CT	❑ ID	❑ MD	❑ NC	❑ OH	❑ TN	❑ WV
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❑ AR	❑ FL	❑ KS	❑ MN	❑ NJ	❑ PA	❑ VA	❑ Mexico
❑ AZ	❑ GA	❑ KY	❑ MO	❑ NM	❑ RI	❑ VT	❑ Europe
❑ CA	❑ H	❑ LA	❑ MS	❑ NV	❑ SC	❑ WA	❑ Global
❑ CO	❑ IA	❑ MA	❑ MT	❑ NY	❑ SD	❑ WI	

Step 5. Sponsorship: Who told you about PDCA?

Member Name_____

Step 6. Method of Payment

Attached is my payment of $_____ for annual dues.

❑ I understand that dues are due annually on December 31 and, that if I joined PDCA after March 31, I may be entitled to a prorated dues amount for the subsequent year only.

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Please send this completed application to: PDCA

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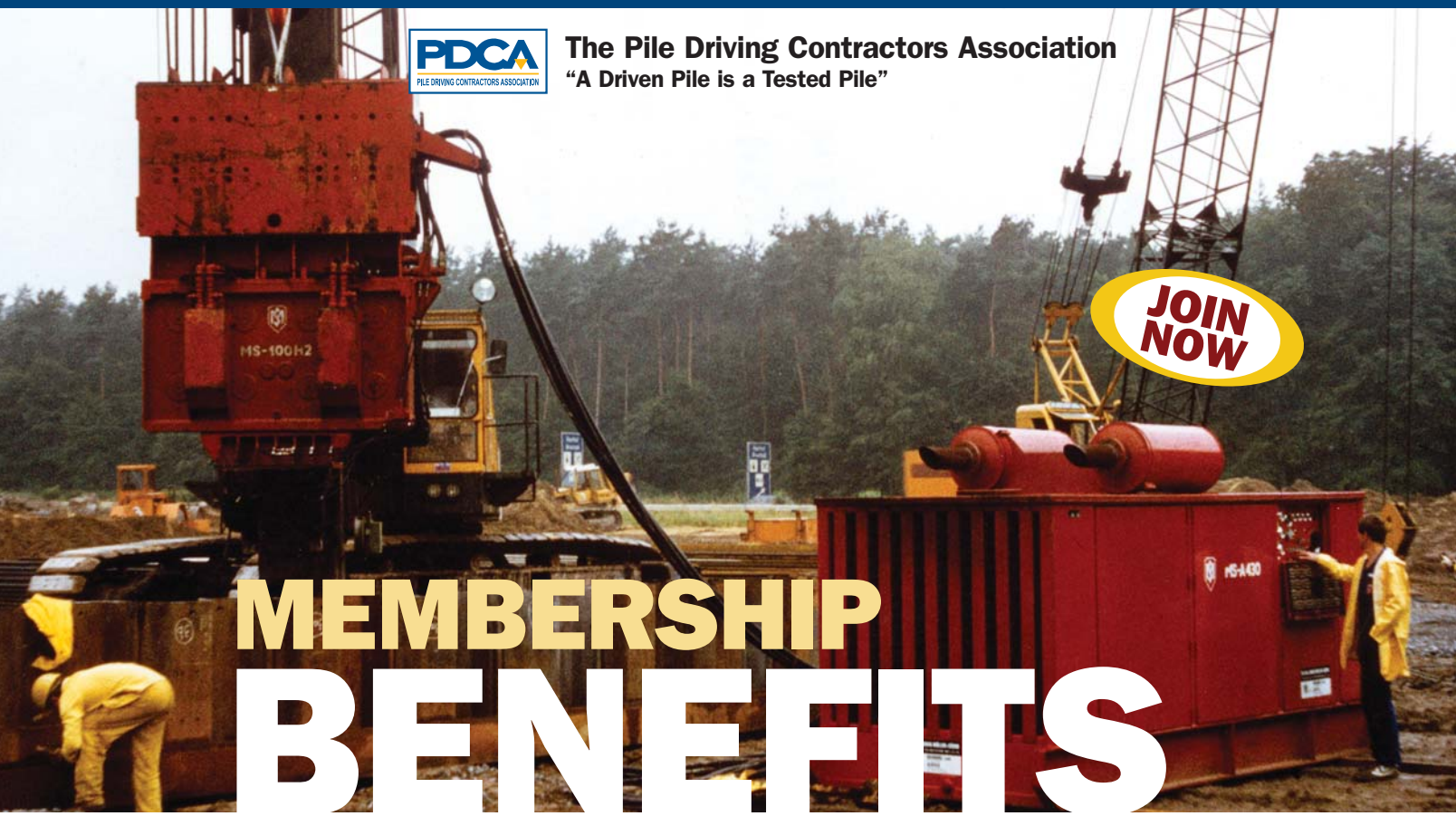

PDCA
PILE DRIVING CONTRACTORS ASSOCIATION

The Pile Driving Contractors Association
"A Driven Pile is a Tested Pile"

MEMBERSHIP BENEFITS

General Membership Information

We are the premier association for pile-driving contractors

The PDCA was founded in 1996 to promote use of driven-pile solutions in all cases where they are effective. We strive to build and maintain working relationships among end users, manufacturers, government agencies, educational institutions, engineers and others involved in the design, installation and quality control of the driven pile.

We are dedicated to advancing the driven pile

As the only organization solely dedicated to pile-driving contractors, we know that you understand the superiority of the driven pile in most applications. We are the only association addressing the intrusion of non-driven solutions that take away business from the driven-pile contractor. The PDCA understands that to survive in today's competitive marketplace, a pile-driving contractor must strive to stay abreast of the latest trends and technologies in the industry. That is why we maintain close ties with the world's leading suppliers to the industry. It's why we provide a broad range of educational programs for university professors, practicing engineers and contractors. And, it's why more and more contractors, engineers and suppliers are realizing that the PDCA significantly increases their value in the marketplace.

We are a direct link to decision makers

Major manufacturers take an active role supporting the PDCA. At our conferences, we bring together the world's leading design manufacturers and technical application experts to assist you in advancing the driven pile as a superior product.

The PDCA works closely with the technical community to format design codes and installation practices. We offer seminars throughout the country for engineers and educators on the capabilities and advantages of the driven pile. We also work with agencies, such as the Federal Highway Administration and state DOTs, which develop specifications for highway building and other infrastructure project that use driven piles.

We offer timely, valuable services

The PDCA improves your company's bottom line, as well as your stature in the construction industry, through a variety of programs and services:

Job Referrals

We are the only organization that provides contractor referrals to end users of driven piles. You tell us where you will drive piles and we will refer you to end-users. We also provide referrals to our supplier and technical members.

Peer-to-Peer Opportunities

With more than 100 contractor members, networking opportunities abound at the PDCA. Whether at our Winter Roundtable, our regional seminars or by just picking up the phone, you'll develop long-lasting professional relationships and friendships in the industry.

Annual Membership Directory

As a member, you'll receive PDCA's annual membership directory of our contractor, supplier and technical members. Your company is listed along with the piling solutions you employ and states in which you work. This directory is provided throughout the year to construction users on a complimentary basis.

Educational Conferences and Meetings

The PDCA offers cutting-edge education for contractors, engineers, geotechs and anyone else interested in the driven pile and its applications at two major conferences annually. Members receive discounts on exhibit and registration fees.

- The Winter Roundtable, held each February since 1997, is a nationally recognized conference that brings together leading technical experts, suppliers to the piling industry and contractors. This conference focuses on the key issues faced by pile-driving contractors and features discussions and presentations as well as an extensive exhibit area.

- The Design and Installation of Cost-Efficient Driven Piles Conference (DICEP), held each September since 2000, is a nationally recognized two-day conference that brings together geotechnical and design engineers, college professors and contractors to discuss the latest trends in understanding, analyzing and controlling piling costs.

Industry Development

The PDCA continually strives to expand market share for the driven pile. The PDCA sponsors the College Professors Piling Institute, held at Utah State University in Logan, Utah. Up to 25 professors, from major engineering schools, are invited to participate in an intensive, week-long program that presents them with the latest concepts in driven-pile design, installation and quality control. Some of the leading faculty in the deep foundation field has attended the institute to date. The program supplies the educators with the tools and knowledge to be able to teach their students about the advantages of the driven pile. It promises to have a long-term impact on market share for the driven pile.

Publications and Reference Materials

As a PDCA member, you will receive our quarterly publication, "*Piledriver*," which presents articles on issues and trends of interest to our industry. As a member, you'll receive discounts on advertising in the magazine.

All PDCA members receive a complimentary copy of the PDCA's codebook, "*Recommended Design Specifications for Driven Bearing Piles*," now in its third edition. This book covers all required guidelines for driven piles and includes a suggested bid and payment schedule.

The PDCA also sells "*The Pile Design Manual*," an FHWA manual on the design and construction of driven piles. Order forms are available on the PDCA Web site.

"Through its programs and services, PDCA has presented our company with numerous opportunities to continue our business success. It is certainly a cornerstone for growth in a very competitive business."

D.R. Jordan, President and CEO, Jordan Pile Driving, Inc.

Connect Worldwide at www.piledrivers.org

The PDCA's newly redesigned Web site at www.piledrivers.org lets you research the latest trends in the industry and find direct links to manufacturers, suppliers, engineers and others. PDCA members receive a free listing in our member search area, which is being used by an increasing number of end users to find pile driving contractors and services. Our forums area makes it easy for you to connect with others to discuss issues and problems.

Leadership Opportunities

Membership in the PDCA provides opportunities for recognition and leadership. Positions are available on the PDCA board of directors and various committees that impact the industry. The PDCA recognizes noteworthy contributions to the industry with our "Driven Pile Project of the Year" award, giving opportunities for high profile recognition.

Membership is available to you

There is strength in numbers and we, at the PDCA, need to count your company when telling government agencies, engineers and suppliers that we are interesting in keeping your business viable and in growing market share for the driven pile. We need your ideas and efforts in working together toward a common goal: the use of driven-pile solutions. You can contribute your expertise and assist the Association in developing:

- A greater focus on safety
- The quality of driven pile products
- The formatting of codes and specifications for the driven pile
- Support for a program to help educate students in the use of driven piles

Join today. Be part of a growing and vibrant organization the will play a key role in the future of deep foundations. Support your industry by completing the membership application in this issue. You will immediately begin to enjoy benefits of membership. ▼

PDCA New Member List

We would like to welcome the following companies as new members. Please visit the PDCA Web site at www.piledrivers.org and click on "Member Search" for complete contact information on all PDCA members.

NEW CONTRACTOR MEMBERS

All American Underpinning and Shoring
Roselle, Illinois
Contact: Michelle Lusader
Services Provided: Bridge Building, Bulkheads, Docks and Wharves, Earth Retention, Highway and Heavy Civil, Pile Driving.

Cianbro
Pittsfield, Maine
Contact: Tom Ruksznis
Services Provided: Bridge Building, Bulkheads, Docks and Wharves, Earth Retention, General Contracting, Marine, Pile Driving.

East Bay Construction
Virginia Beach, Virginia
Contact: Joseph Burket
Services Provided: Bulkheads, Docks and Wharves, Marine, Pile Driving.

ETI
Lebanon, Maine
Contact: George Eliason
Services Provided: Bridge Building, Earth Retention, Highway and Heavy Civil, Pile Driving.

Hal Jones Contractor, Inc.
Jacksonville, Florida
Contact: Paul C. Kirkland
Services Provided: Bridge Building, Bulkheads, Docks and Wharves, Pile Driving, Marine.

Williams Brothers Construction Co.
Houston, Texas
Contact: James Pitcock
Services Provided: Bridge Building.

NEW ASSOCIATE MEMBERS

Geotechnics
East Pittsburg, Pennsylvania
Contact: Larry Wetzel
Services Provided: Deep Foundation Testing.

Hartman Engineering
Clarence, New York
Contact: Richard Hartman
Services Provided: Consulting, Cofferdam Design.

International Construction Services, Inc.
Pittsburg, Pennsylvania
Contact: Brian Land
Services Provided: Coatings and Chemicals, Steel Pipe Piles, Steel Sheet Piles, H-Piles.

Nationwide Utility Poles and Supply, Inc.
Brierfield, Alabama
Contact: Phil S. Myers
Services Provided: Timber Piling.

T+R Pipeline Services
Houston, Texas
Contact: Warren Cross
Services Provided: Steel Pipe Piles, Steel Sheet Piles, Pipe.

United Wood Preservers
Whitmire, South Carolina
Contact: Wayne R. Comtois
Services Provided: Timber Piles, Treated Lumber and Timbers, Wood Treating.

NEW TECHNICAL MEMBERS

Chuck Blakeman
BECC Co, Inc.
Yarmouth, Maine
Services Provided: Construction Vibrations Specialist.

Edward Hajduk
WPC
Charleston, South Carolina
Services Provided: Analysis, Geotechnical, Materials Testing, Vibration Monitoring, Consulting, Pile Driving Monitoring.

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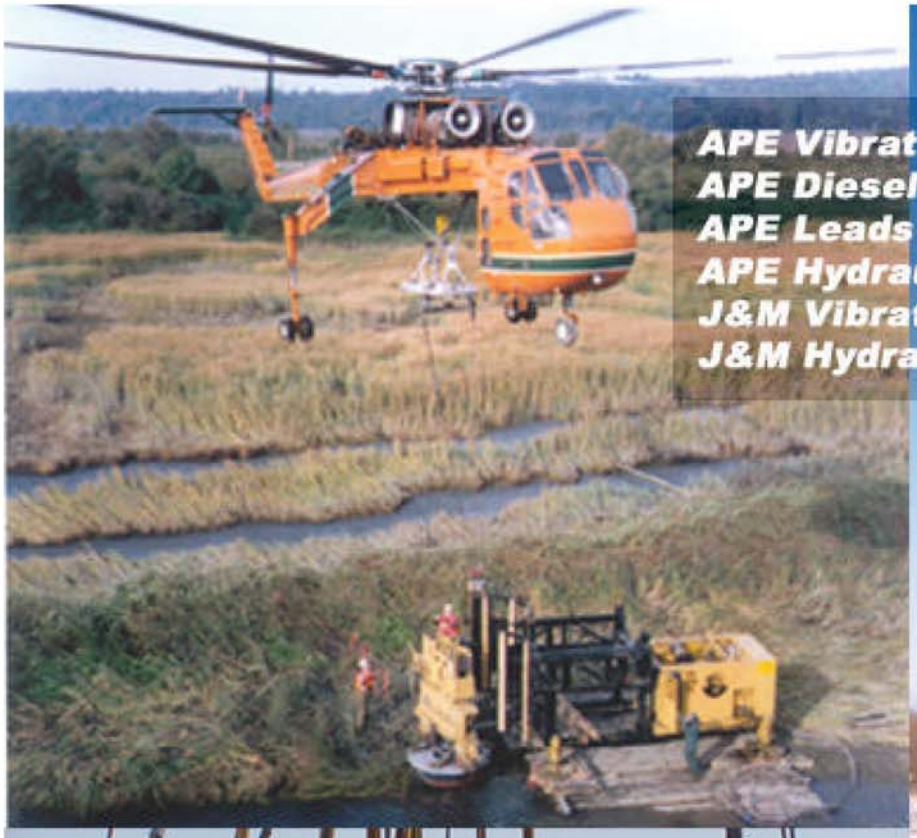

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