

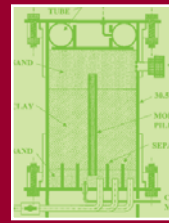
**Double-Acting Air/  
Steam Hammers**

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**Member Profile:  
Dr. George Goble**

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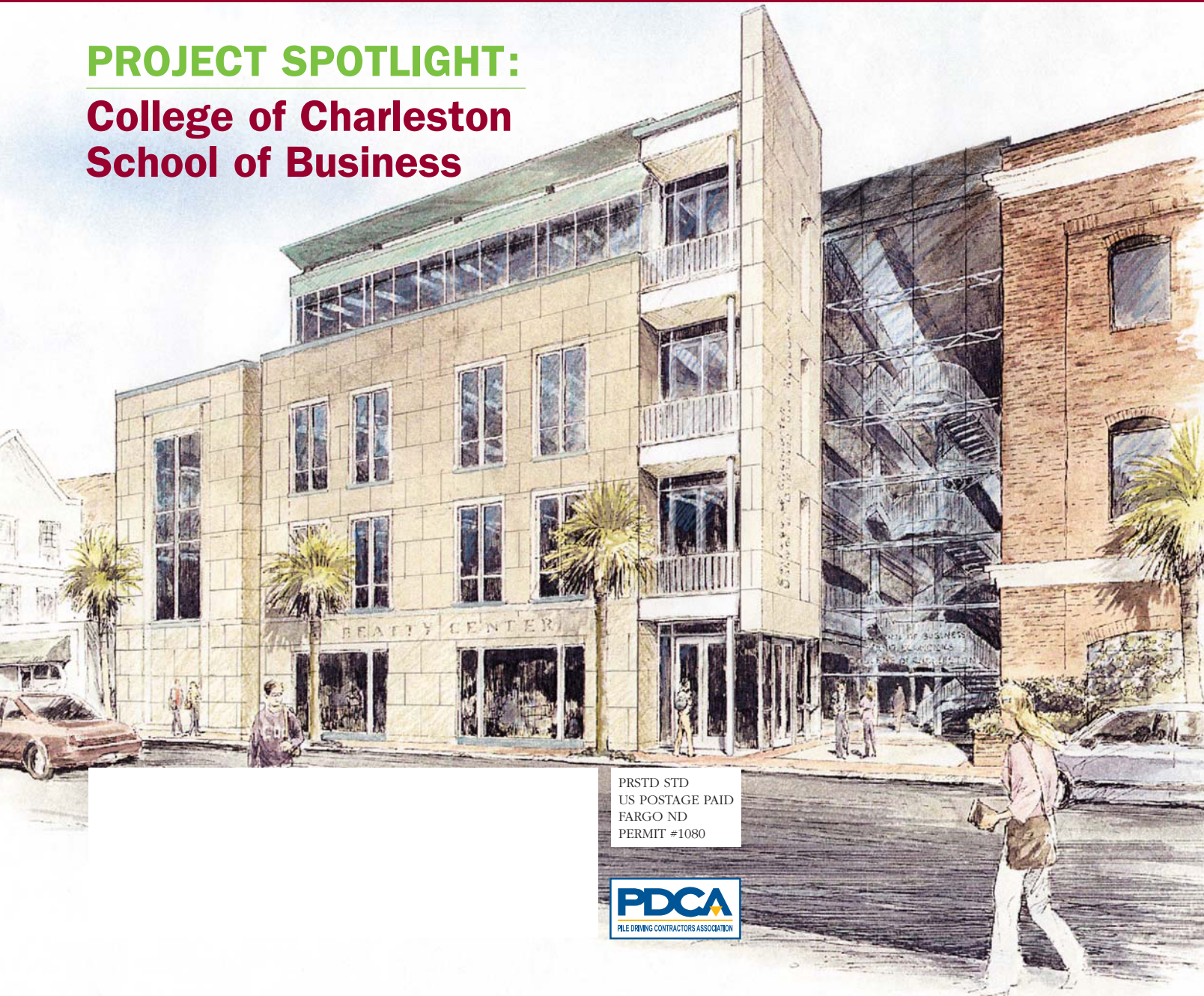
**Pile Foundations:  
An Environmental  
Problem?**

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# PILED RIVER

THE OFFICIAL PUBLICATION OF THE PILE DRIVING CONTRACTORS ASSOCIATION | FALL 2004 VOL. 1, NO. 4

**PROJECT SPOTLIGHT:**  
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THE OFFICIAL PUBLICATION OF THE PILE DRIVING CONTRACTORS ASSOCIATION | FALL 2004 VOL. 1, NO. 4

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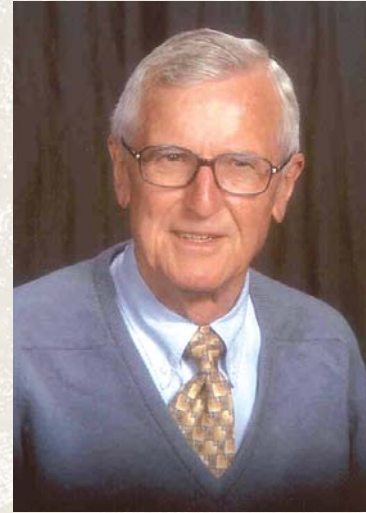
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**COVER:**  
Rendering of Beatty Center for the School of Business at the College of Charleston in Charleston, SC, courtesy of LS3P Associates Ltd. of Charleston, SC.



# How Fast the Year Has Flown!

By Wayne E. Waters, PDCA President

It's hard to believe that the year is almost over and I'm writing this, my final President's Message. This year has been a very productive one for the PDCA. Another DICEP conference and a busy year for the technical and other committees assure our continued growth into the organization of choice for pile driving contractors.

Our first chapter, the PDCA of South Carolina, has been extremely successful.

Local networking provides an opportunity to work closely with the engineering community, state DOTs and, specifically, to address local issues. At the September board meeting, which followed the DICEP conference in Los Angeles, the board reconfirmed its commitment to develop these local chapters, a necessity for future PDCA growth. The plan is to add chapters in the Rocky Mountain area and New Orleans in 2005.

In an effort to attract more members and encourage the establishment of such local chapters, a new membership category was created for 2005. For any contractor with a gross income of \$1 million dollars or less, the dues will be \$350 per year, or half the cost of a regular membership. The regular membership will be increased from \$650 to \$700. We feel there are numerous contractors around the country that can contribute to the success of the PDCA, but simply are not large enough to afford the dues at the current rate. We are hopeful they will take advantage of the reduced rates. Members in this category will receive the same services as those in the regular contractor category.

I once attended a leadership conference where the theme was "Working to Make a Difference." These are five short words, but, if embraced by PDCA members, they would permit us to reach goals that often seem unreachable. Much success can be created when more than a select few participate. In addition to the membership commitment to the PDCA, I ask that you give consideration to get involved by joining one of our many committees. There is considerable opportunity in many different areas of interest. Your input can make a difference.

I would like to thank the board of directors, committee chairmen and their respective members, and Executive Director Tanya Goble, for all the hard work put forth to continue our vast range of services and benefits. These individuals contribute countless hours to assure the continued success of the PDCA. ▼



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# What a Productive Year **IT'S BEEN!**

By Tanya Goble, PDCA Executive Director

**P**DCA has had a very productive year so far. I would like to highlight some of our recent and upcoming activities for our membership.

## **2004 PDCA Design & Installation of Driven Piles Seminar**

The 5<sup>th</sup> annual PDCA Design & Installation of Cost-Efficient Driven Piles Conference was held September 16-17<sup>th</sup> in Los Angeles, California. Attendance was quite good and a range of interesting topics were discussed including:

- High Capacity Piles
- Pile Installation at Soldier Field
- Incorporating Setup in the Design & Installation of Driven Piles
- Support Cost Components of Driven Pile Foundations
- Pile Testing Methods
- Pile Design and Installation Codes
- Pinnacle Casino Resort Case Study
- Vibration Monitoring
- Batter Piles for Lateral Loads

Many thanks go to our excellent speakers that include Dan Brown of Auburn University; George Goble; Michael Holloway of Institutech; Ed Kavazanjian of Arizona State University; Van Komurka of Wagner Komurka Geotechnical; Peter Osborn of the FHWA; Barry Roth from Municon Consultants; and Michael Wysocky of Thatcher Engineering. PDCA has a few remaining copies of the proceedings. PDCA members can request their free copy by calling (303) 517-0421.

## **9<sup>th</sup> Annual PDCA Winter Roundtable Conference**

Please plan on attending the next Winter Roundtable Conference to be held February 17-19, 2005 in beautiful, historic Charleston, South Carolina at the Francis Marion Hotel. The program has been completed and it promises to be our best one yet! Two new short courses will be presented on Thursday, February 17, followed by the main conference on Friday and Saturday morning. PDCA committees and the board of directors will also have meetings. Full program details are presented in this edition of Piledriver. Early hotel reservations are strongly encouraged this year, as there is another major event in Charleston that same weekend.

## **2005 PDCA Professors Piling Institute**

The next College Professors Piling Institute is planned for June 19-24, 2005. This intensive five-day program presents the latest concepts in driven-pile design and the installation of 25 professors that teach foundation engineering courses. Extensive technical material, notes, course outlines and teaching materials will be provided to the attendees. PDCA member Build, Inc. will be providing a pile-driving demonstration during the institute. Many thanks to Build, Inc. for their generous support!

The Piling Institute was extremely well-received in 2002 and 2003 and we are looking to build upon its

tremendous success in 2005. There is simply no more effective way for PDCA to address the current gaps in engineering education that can limit use of driven piles for deep-foundation projects.

We need your help. The Piling Institute is a cost- and labor-intensive project. Your association is funding virtually all expenses for the invited professors and instructors. Please consider sponsoring a professor at this prestigious event. With your help, we can build a solid foundation of enlightened engineers for the future. Complete sponsorship information is available on the PDCA Web site at [www.piledrivers.org](http://www.piledrivers.org).





### PDCA Committees Highlights

Our committees are now meeting regularly via phone conference so it's easier than ever to get involved. If you are interested in joining a committee, please contact PDCA Headquarters at (303) 517-0421. Here are a few key highlights of recent PDCA committee meetings and activities.

### Communications Committee

The committee is working on new membership management software tools to significantly improve our online and printed directories, allow members to easily update their company and contact information, provide better broadcast e-mail capability, support e-commerce for conference registrations and membership renewals and much more.

### Education Committee

The committee has completed the program planning for the 2005 Winter Roundtable. This fall, fundraising for next year's Professors Institute will be conducted and a new pile-driving educational video will be completed.

### Environmental Committee

This new committee is off to a strong start. As its first task, the committee will be tackling the problem of pile-driving vibrations. Look for more information about an important initiative in this area soon.

### Market Development Committee

The Market Development Committee has completed work on a new trade show display for PDCA. PDCA will be exhibiting at upcoming events as a way of increasing our visibility with contractors and geotechnical engineers. Look for the PDCA booth at the GeoInstitute in January and ConExpo in March.

### Technical Committee

The committee has developed a first draft of a new Pile Installation Specification for private sector projects and plans to make it available to our members in time for the Winter Roundtable in February. The new

specifications cover each of the major pile types and capacity determination methods and will be designed to be easy for engineers to incorporate into new designs.

### PDCA Membership Directories

The 2004 edition of the PDCA membership directory is now available. PDCA members have been mailed

their copies along with new hard-hat stickers and the new educational CD, Driven Piles are Tested Piles. A listing of PDCA's 2004 Contractor and Associate (company) members is provided as a special pull-out section in this edition of Piledriver. A complete printable version is also available online at [www.piledrivers.org](http://www.piledrivers.org). ▼

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# College of Charleston Project Gets an A+

By Lisa Kopochinski, Piledriver Editor

The College of Charleston in Charleston, SC will soon be rating even higher marks amongst its faculty and staff once the new Beatty Center for the School of Business Economics is completed later this year.

The \$9 million project consists of constructing a four-story building and renovating 7,000 sq. ft. of existing building space. Complete with a steel pile, concrete cap and grade-beam foundation, the structure has a steel frame with three concrete towers to house stairs and an elevator.

"The interior finish includes painted architectural steel, stone, tile and a carpet floor covering, with glass hand rails at monumental stairs and balconies," explains Billy Boyer, project manager with Charleston-based general contractor Newton Builders. "We are the team with the architect, owner and all subcontractors to construct this new building for the College of Charleston."

Adds architect Ken Harkins of LS3P Associates Ltd. of Charleston, SC: "This facility will provide office space for administration and staff. It is a 48,000-sq.-ft. [building] connected to the existing Tate Center for Entrepreneurship by way of a four-story atrium. The College of Charleston is one of the oldest institutions in America and is located in the old and historic district of the city."

---

**PDCA Member Pile Drivers Inc. drove HP12 X 53 Steel H-piles in 40 ft. sections using a Vulcan 06 Air Hammer.**

---

## Unique and tight site

What makes this project unique is its location.

"We're building it between two existing buildings with a street parking lot on the other," explains Boyer. "The building takes up all the property! We have had to build in the shape of a horseshoe and fill in on the way out."

Harkins says the atrium is unique "with its balconies serving as circulation along one side, similar to many historic Charleston homes with piazzas overlooking their garden. This is [unusual] for a college building."

LS3P began designing the project in 2002. Newton Builders began work on the project in mid September 2003,

the same time as pile-driving contractor and PDCA member Pile Drivers Inc., also of Charleston, SC.

S&ME Inc. of Mt. Pleasant, SC, also a PDCA member, served as geotechnical engineer on the project.

"We provided geotechnical design services and construction quality assurance services," explains Forrest Foshee, S&ME Inc.'s vice president. "We performed [an] initial geotechnical exploration in August 2003. Dynamic pile-testing services were provided [as well as] pre- and post-construction survey. [We also] monitored installation and vibrations, inspected welds and fireproofing and performed strength testing on concrete."

John King, of Pile Drivers, Inc., noted that the largest obstacle his team encountered was the designer's preference for auger cast piles. King says driven piles were selected over auger cast for several reasons.

The project was designed to utilize auger cast piles.

However, the specifications provided for an alternate deep-foundation design consisting

of HP14x73 piles and HP12x63

piles. Prior to the bid, the

South Carolina Chapter of the PDCA got

involved. PDCA mem-

bers were able to con-

vince the project engi-

neer that HP12x53

piles would be adequate

for use in the project

which helped to make

driven piles more com-

petitive with auger

cast piles.

Harry Robbins,

president of the South

Carolina PDCA Chap-

ter, also addressed the

auger cast pile reinfor-

cement issue. "Auger cast

piles typically require steel

cages for reinforcement.

These rein-

forcement cages are pushed

into position after the

grout has been placed in the

augered hole. It is difficult

to get these cages into the

proper position within the

pile, particularly in long

piles, and there is no way



**“We gave the owner a better foundation with the driven pile instead of the auger cast piles. The driven piles are all tested piles, so the owner can see what they get before it goes into the ground.”**

— JOHN KING, PILE DRIVERS INC.

The \$9 million project consists of constructing a four-story building and renovating 7,000 sq. ft. of existing building space.



**THE MAJOR PLAYERS INVOLVED**

**OWNER:** College of Charleston, Charleston, SC  
**GENERAL CONTRACTOR:** Newton Builders, Charleston, SC  
**PILE-DRIVING CONTRACTOR:** Pile Drivers Inc., Charleston, SC  
**SUBCONTRACTOR/SUPPLIER:** Skyline Steel, Norcross, GA

**ARCHITECT:** LS3P Associates. Ltd., Charleston, SC  
**GEOTECHNICAL ENGINEER:** S&ME, Inc., Mt. Pleasant, SC  
**STRUCTURAL ENGINEER:** ADC Engineering, Inc. Hanahan, SC  
**PDCA SOUTH CAROLINA CHAPTER:** Charleston, SC

This proved to be another advantage for the driven pile. King enjoyed the fact “that driven piles are better than auger cast in many ways. “You can see what you have from tip to butt before piles are driven. There is no guesswork on the reinforcement in the finished product in driven piles as there is in auger cast piles.”

He continues: “Test piles were driven on September 15, 2003 and we finished production piles in October 2003. The five test piles were 90 ft. below grade and production piles were 85 ft. below grade. Piles were driven with a Vulcan 06 Air Hammer 19,500 ft. lbs. We furnished and drove the 12-inch x 53# steel H-piles, supplied by PDCA member Skyline Steel. Richard Gilbert of Skyline Steel was a tremendous help.” A total of 154 piles 85 ft. below grade were driven.

**Project has share of challenges**

S&ME’s Foshee says: “The subsurface conditions generally consisted of very soft clay interbedded with loose to dense sands, to a depth of about 28 ft., underlain by soft to firm

clays and silts to about 55 ft. Medium dense to very dense sands were encountered from 55 ft. to 75 ft. where the cone penetration test (CPT) soundings encountered the Cooper Group Marl.” (The Cooper Group Marl is a thick stratum of over-consolidated, calcareous sand silt, and is the typical bearing stratum for deep foundations in the Charleston area).

Foshee adds that what he found unique and challenging about the project was “working in an historically sensitive area with many very old unreinforced masonry structures in the immediate vicinity.”

The project involved driving piles in an historic area where building owners can be “sensitive” to vibrations.

“In Charleston,” King explains, “with our historic buildings, all driven piles are unique in the perception that damage could be caused. There have been hundreds of driven-pile projects and no damage done to any structures from piles being driven.”


King continues: “The piles were driven as all piles are driven in Charleston. First, we pre-auger around 40 ft. to make sure there are no obstructions in the ground to set the first section of piles.

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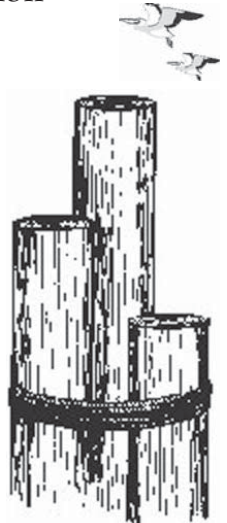
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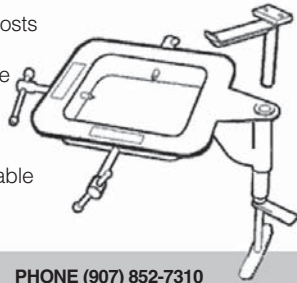
The project involved driving piles in an historic area where building owners can be “sensitive” to vibrations.



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We place a 100-percent butt weld on to the top section and drive the piles to grade. The only precaution we take is a pre- and post-construction survey, as well as vibration monitoring that is done during all pile driving.”

The limited working room on the urban site posed another challenge. King says the corner of the new building required piles to be driven 18 inches off an old building next door. The tight site also affected pile deliveries. “Steel piles were used because of access. I don’t believe we could have shipped 90 ft. of concrete test piles to the site.” The use of steel H-piles allowed piles to be installed in shorter lengths and King used this to his advantage.

LS3P’s Harkins says the largest obstacle his team faced and overcame was the fact that “all new construction in the old and historic district must meet the approval of the city’s board of architectural review. Meeting the programmed space requirements of the school, while working within the existing streetscape’s height and scale was a challenge. We overcame this by stepping the fourth floor back from the three floors below, along the front of the building, and breaking the scale down into three smaller components – the main four-story element, flanked on one side by the atrium, which provides the indoor-to-outdoor connections to the campus; and a three-story element on the other.”

**Enjoyable and rewarding project**

Still, obstacles or not, many of the team members have found this project to be immensely rewarding.

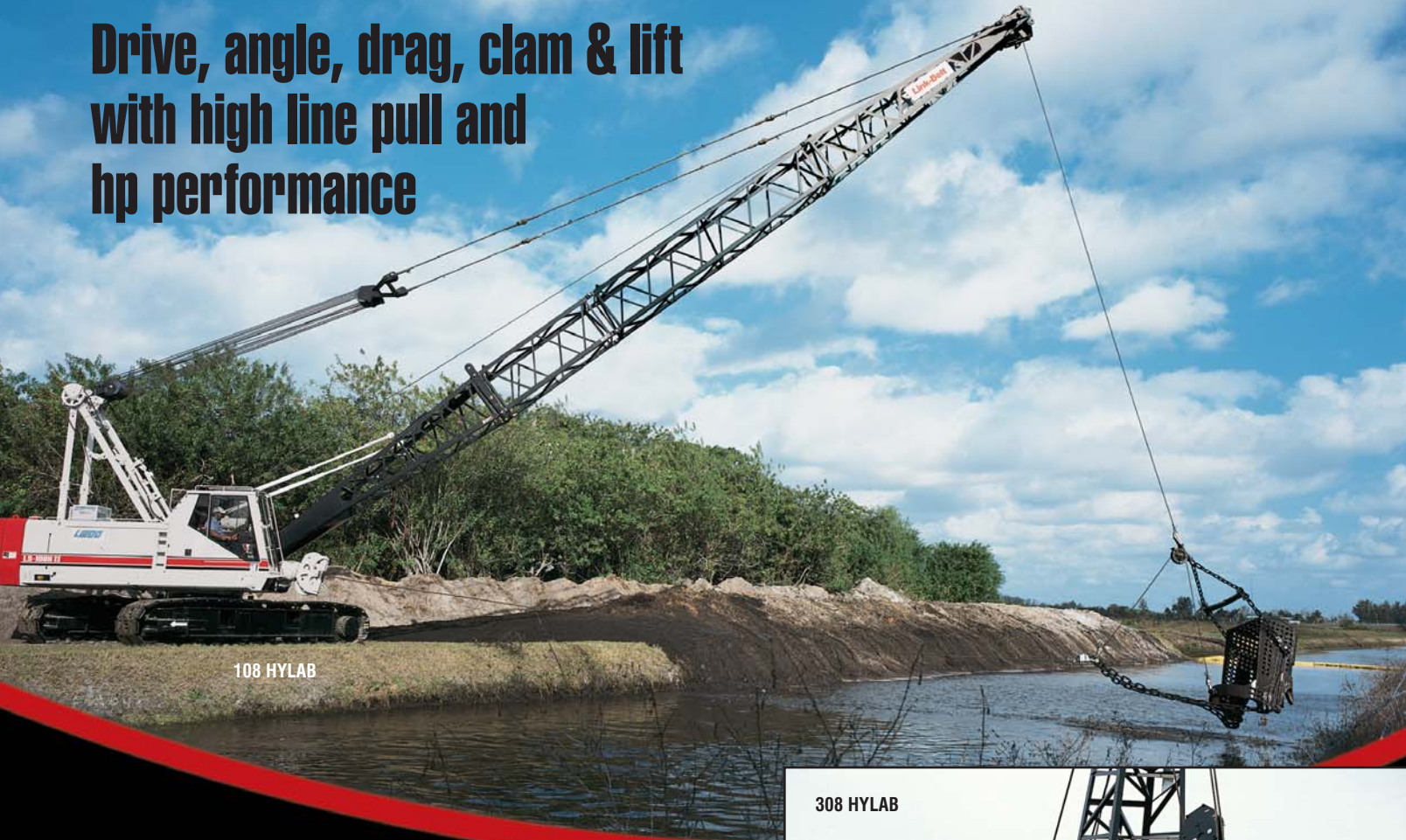
For Boyer, he says he loves starting with a vacant piece of property and then taking a team of contractors and “someone with a need for a building and [making it happen]. I love the saying, ‘if it was easy, anybody would be doing it.’”

Foshee concurs: “[What I enjoyed most was] just being part of the continuous development of a beautiful and historical city that is Charleston.”

Adds Harkins: “Creating a handsome and exciting new addition to what has been called one of the most beautiful campuses in the U.S. has been both satisfying and rewarding.”

As for King, he is proud of the fact that he was able to install the best product for the project owner.” We gave the owner a better foundation with the driven pile instead of the auger cast piles. The driven piles are all tested piles, so the owner can see what they get before it goes into the ground.” ▼

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# 2005 PDCA Winter Roundtable Set for Historic Charleston, South Carolina



Architecture of Charleston

The 2005 PDCA Winter Roundtable will be held February 17– 19, 2005 at the Francis Marion Hotel in beautiful Charleston, South Carolina.

The Roundtable is the premier event of the Pile Driving Contractors Association and is for contractors, geotechnical and structural engineers, owners, developers, suppliers, academics and anyone else who deals with and supports the pile-driving industry. An outstanding line up of speakers has been assembled to cover a variety of topics related to the driven pile.

The Winter Roundtable provides an opportunity for you to meet with your peers and industry leaders from around the country to discuss what is new in the industry, the needs of the industry, common problems and solutions. A wide range of exhibitors will be on-hand with information on a variety of products and services.

This year's conference will be held at the Francis Marion Hotel, located in the heart of the historic downtown area. Many of the attractions of Charleston, including old homes and buildings, the harbor and other sites of historical significance are within walking distance from the hotel.

More information on the hotel can be found at [www.francismarionhotel.com](http://www.francismarionhotel.com). Charleston information can be found at [www.charlestoncvb.com](http://www.charlestoncvb.com). Room reservations can be made by calling (843) 722-0600. Ask for the PDCA Winter Roundtable Conference room block. The deadline for the guaranteed conference rate of \$169 is January 26, 2005. Please make your room reservations early this year as hotel space is expected to be tight in Charleston that week due to other events in town. For help with your travel arrangements, contact PDCA's travel coordinator Lorraine Engleman of Blue Ribbon Travel at (718) 767-0088.

Please plan to attend the PDCA Winter Roundtable. For more information and registration forms, visit the PDCA Web site at [www.piledrivers.org](http://www.piledrivers.org). Don't forget your spouse – PDCA has put together a program for them as well. ▼



Sunset Sail Waterways

## PRE-CONFERENCE SHORT COURSES - THURSDAY, FEBRUARY 17, 2005

**9:00 – 5:00 PM**

### **FHWA Driven Pile Inspectors Short Course**

Peter Osborn and Jerry DiMaggio of the Federal Highway Administration teach a condensed one-day version of this course which will soon become a requirement in many states. Contractors and their personnel as well as engineers should consider attending. 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.

**9:00 – 5:00 PM**

### **Deep Foundation Design, Construction, Testing & Quality Control Short Course**

Mohamad Hussein, vice president of GRL Engineers and Jerry DiMaggio of the FHWA team up to teach a condensed one-day version of this course. This course will be of interest to design engineers and contractors wishing to increase their knowledge of the design process. Learn the fundamental principles and modern technologies aiding in the design, installation, testing and quality control of driven piles and cast-in-place shafts deep foundations. Emphasis will be placed on actual problem solving tools.



# PDCA 2005 WINTER ROUNDTABLE PROGRAM

February 17-19, 2005 Francis Marion Hotel, Charleston, South Carolina

## THURSDAY, FEBRUARY 17, 2005

8:00 – 9:00 AM Short Course Registration

9:00 AM – 5:00 PM **Pile Inspectors Short Course.**  
Peter Osborn & Jerry DiMaggio, FHWA.

9:00 AM – 5:00 PM  
**Deep Foundation Design, Construction, Testing & Quality Control Short Course.**  
Mohamad Hussein, GRL Engineers & Jerry DiMaggio, FHWA.

Noon – 2:30 PM **PDCA Committee Meetings:**  
Technical, Environmental, Communications

2:30 – 5:00 PM **PDCA Committee Meetings:**  
Education, Market Development, Finance.

5:00 – 6:30 PM **Conference Registration**

6:00 – 7:30 PM **Opening Reception**

## FRIDAY, FEBRUARY 18, 2005

7:30 – 8:30 AM **Continental Breakfast**

8:30 – 9:15 AM **Annual Membership Meeting.**  
PDCA President Randy Dietel and the Executive Committee will discuss results for 2004 along with plans for 2005 and beyond.

9:15 – 10:00 AM  
**How Pile Setup Saved \$7M: A Case History of a Power Plant.**  
Billy Camp, S&ME.

10:00 – 10:30 AM **Break in Exhibit Hall**

10:30 – 11:15 AM  
**Effective Use and Interpretation of the Wave Equation Program and Dynamic Pile Monitoring.**  
Jerry DiMaggio, Principal Geotechnical Engineer, FHWA. This presentation provides practical guidance on the application of these important engineering tools so as to avoid communication problems and contract disputes on small, large and extremely complex driven pile projects.

11:15 – 12:00 PM  
**Roundtable Discussion: Value Engineering Opportunities.**  
Numerous cases exist where a driven-pile design would be more cost-effective than the existing cast-in-place design. A procedure for the development of value engineering proposals via partnerships of piling contractors and engineers will be discussed.

12:00 – 1:30 PM  
**PDCA Project of the Year Award Presentation and Luncheon.**

1:30 – 2:15 PM  
**Driven Piles in Historic Charleston: A Case History.**  
Ed Hajduk, WPC. Over 530 H-piles and 17 open-ended pipe piles were driven in and around an old building in Charleston, which experienced no structural damage from the vibrations. The test pile program, pre-condition survey and vibration and installation monitoring will be discussed.

2:15 – 2:30 PM **PDCA Noise & Vibration Database.**  
PDCA's Environmental Committee discusses a new program for helping contractors and engineers understand, predict and model the effects of pile driving noise and vibrations.

2:30 - 3:00 PM **Break in Exhibit Hall**

3:00 – 5:00 PM **What's New in Piling Materials?**  
Industry representatives discuss what's new, cost and supply trends and present other information on various pile types including steel h-piles, pipe piles, sheet piles, concrete and timber piling and more.

5:30 – 7:00 PM **President's Reception**

## SATURDAY, FEBRUARY 19, 2005

7:30 – 8:30 AM **Continental Breakfast**

8:30 – 9:15 AM  
**Installation of Driven Piles in Brownfield Sites.**  
Dr. Gordon Boutwell, Soil Testing Engineers. The environmental challenges of pile installation in industrial sites are discussed and best practices are recommended.

9:15 – 10:00 AM  
**Pile driving for the Dundalk Marine Terminal.**  
Mike Hart, Cianbro Bros.

10:00 – 10:30 AM **Break**

10:30 – 11:15 AM  
**Guide Specification for Driven Pile Installation,**  
George Goble, Goble Consulting. To address the many problems that pile-driving contractors see with pile-installation specifications for

private sector work, PDCA has developed its own set of recommended specifications. This session discusses the new specs and how to use them to improve communications with design engineers.

11:15 – Noon  
**Roundtable Discussion: Tiebacks for Excavation Support Systems.**  
This important part of the overall foundation project offers significant business opportunities for piling contractors. The discussion will be led by contractors with experience in this area. Come prepared to share your own experiences and tips for success.

12:00 PM **Adjourn**

1:00 – 5:00 PM **Board of Directors Meeting**

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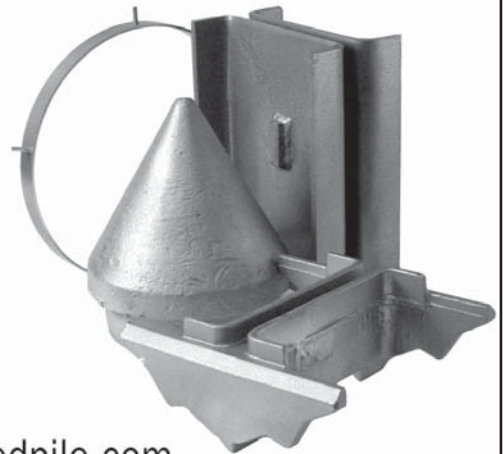
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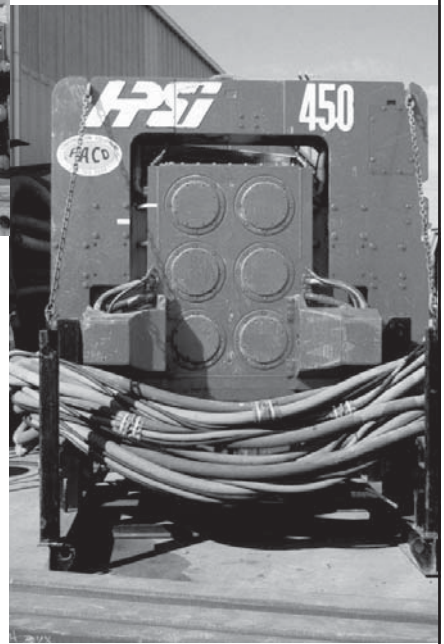
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# Double-Acting Air/Steam Hammers

Double-acting air/steam hammers use compressed air or steam as the motive fluid to power the upward and downward ram stroke. Because power is applied on the down stroke these hammers typically operate at a higher number of blows per minute than a single-acting air/steam hammer and can provide a favorable amount of rated energy when compared to total hammer weight. However, they can lift off when motive fluid pressure is excessive; they rely on proper motive fluid pressure to reach rated energy, and they require closer attention and inspection during operation.

An external power source, such as an air compressor or a boiler supplies the pressurized motive fluid. A flexible hose carries the motive fluid from the source to the hammer. Operation with air or steam is similar. However, a change in motive fluid may change the specifications of the lubricant, lubricator, and hose line.

Figures 2a and 2b show the principal components of a double-acting air/steam hammer. In this hammer, when the ram nears the bottom of the stroke the lower valve opens to the motive fluid inlet and the upper valve opens to the exhaust. The motive fluid, delivered to the cylinder at near constant pressure, forces the piston and ram upward (Figure 2a). At some point during the upstroke the lower valve closes to the inlet and opens to the exhaust. At the same time, the upper valve opens to the inlet and closes to the exhaust (Figure 2b). The ram coasts upward against the pressure on top of the piston and then falls due to the effect of gravity and the force of the motive fluid above the piston. The ram moves downward and impacts the striker plate. Near the bottom of the stroke both valves return to their

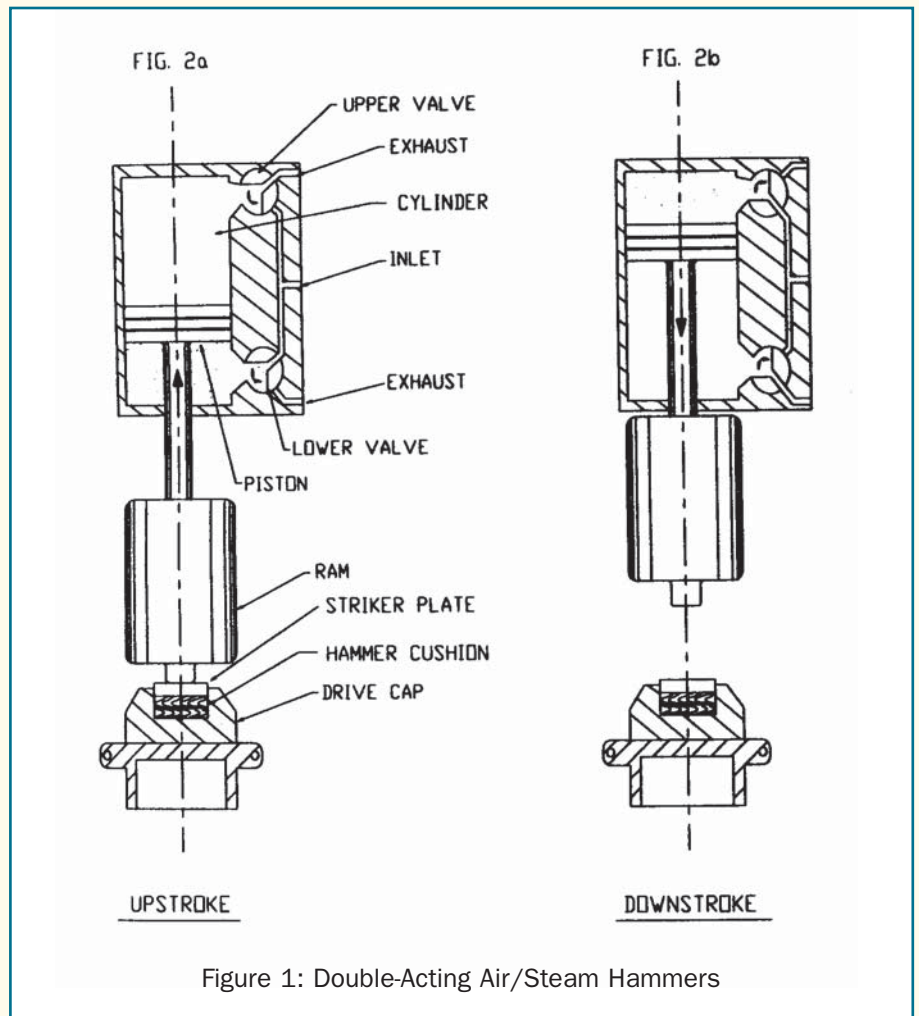


Figure 1: Double-Acting Air/Steam Hammers

original positions (Figure 2a) and the cycle repeats. The position of the upper and lower valves is controlled by cams and their movement depends, in turn, on the position of the ram within the hammer assembly.

The energy rating of a double-acting air/steam hammer is an indication of the nominal kinetic energy of the ram just before impact. This kinetic energy depends on the weight of the ram, the stroke length, the upper area of the piston head, and the pressure time history above the piston head.

The average effective pressure above the piston is not the gage pressure at the inlet, and cannot practically be determined in the field. Thus, the inspector cannot readily know the nominal kinetic energy of the ram based on observation or other simple inspection.

To assist the inspector, hammer manufacturers provide tables relating the rated energy to the hammer speed. The hammer speed is defined as the number of blows per minute, and can be measured by counting hammer blows during a suitable length of time.

The rated energy of the hammer at a specific blow rate is obtained by using the observed hammer speed and the manufacturer's tables.

Double acting air/steam hammers for pile driving are available with ram weights between 3,000 and 60,000 lbs. (1,300 and 27,000 kilograms). Maximum energy ratings typically range from 7000 to 180,000 ft-lbs (10 and 250 kilojoules). Because the ram of some double-acting air/steam hammers is enclosed, they can be operated submerged under water. For information on specific hammers refer to the manufacturer.

Some double-acting air/steam hammers are used without a hammer cushion between the striker plate and the drive cap. Thus, the ram may strike directly, steel to steel, on the striker plate anvil block which sits in the helmet. Other double-acting air/steam hammers have cushions of the same type as the single acting air/steam hammers and in this case the cushion has the same function in both hammer types.

## Double-Acting Air/Steam Hammer 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 meets the hammer specification. 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 anvil and 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, if the ram is visible. 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, a separate test pile is 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 double-acting air/steam hammer may have different impact velocity during hard driving (high blow counts) than during easy driving (low blow counts).
6. After the contractor has the hammer operating continuously, measure the hammer speed by counting the number of hammer blows in one minute. Compare the speed observed to the manufacturer's specifications. Repeat the hammer speed measurement several times to verify consistent hammer operation. If hammer speed measurement is required it should be determined at the end of driving for each pile.
7. Refer to the manufacturer's tables or charts to estimate the energy rating for the observed hammer speed. The energy rating estimated in this way may be compared with the specifications or requirements of the project. Do not use the tables or charts to estimate energy if the hammer speed is outside the range of the table or chart. Such extrapolations may not be valid.
8. During easy driving (low blow counts) the hammer speed is often less than it is during hard driving. This behavior is normal. When recording the hammer speed and stroke 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 or piston 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 should be reduced until racking stops. After proper adjustment to control racking, continue



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to monitor the hammer speed and use the manufacturer's data to estimate the energy rating.

10. During the driving of a pile, changes should not be made in the cushion. If it is necessary to insert a fresh pile cushion, it can be expected that the blow count will change, possibly substantially. The driving record should show where the new cushion was added and should contain a complete blow count record in order to show the effect of the new cushion on the driving resistance.
11. 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 may be hazardous and will reduce the energy delivered to the pile. Leads should always be used.
12. Some manufacturers of double-acting air/steam hammers will void their equipment warranties if the penetration resistance consistently exceeds 10 blows per inch. 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. It may be more desirable to use a larger hammer or a stiffer pile. Drivability should be investigated to try to avoid extremely high blow counts.

### Hammer Trouble Shooting

Provision and maintenance of a properly functioning hammer is 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, improper valve timing, or loose hammer fasteners (keys, nuts, etc). In cold or humid weather, ice may build up in the hammer 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.

The above information has been reprinted by permission from the Pile Inspector's Guide to Hammers, copyright 1995, published first by the Deep Foundation Institute (DFI). Equipment availability may vary due to market conditions. ▼



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Fax: (843) 884-0516  
Email: bobm@caperomaincontractors.com  
Will drive piles in: FL, GA, NC, SC.

### Cianbro

Tom Ruksznis  
P.O. Box 1000  
Pittsfield, ME 04967  
Ph: (207) 679-2522  
Fax: (207) 679-2354  
Email: truksznis@cianbro.com  
Will drive piles in: CT, FL, MA, MD, ME, NH, NY, PA, RI, VA.

### Ciport S.A.

Rafael C. Miranda  
C.E. Las Camaras, Office 702  
P.O. Box 09-01-1282  
Guayaquil, Ecuador  
Ph: (593) 426-80485  
Fax: (593) 426-80502  
Email: rmiranda@ciport.com  
Internet: www.ciport.com  
Will drive piles in: Ecuador.

### Continental Construction Co.

Rodney Waits  
5646 Shelby Oaks Drive  
Memphis, TN 38134  
Ph: (901) 382-4070  
Fax: (901) 388-2534  
Email: rwaits@continentalconst.com  
Will drive piles in: AL, AR, FL, GA, IA, IL, IN, KS, KY, LA, MO, MS, NC, NE, OH, OK, SC, TN, TX, VA, WV, and Puerto Rico.

### Cooper Crane & Rigging

Russ Barnes  
P.O. Box 2540  
Novato, CA 94948  
Ph: (415) 892-2778  
Fax: (415) 892-9229  
Email: russ@coopercrane.com  
Internet: www.coopercrane.com  
Will drive piles in: CA, WA.

### CS Marine Constructors

Casey Stockon  
P.O. Box 2195  
Vallejo, CA 94592  
Ph: (707) 562-4100  
Fax: (707) 562-4106  
Email: casey@csmarine.com  
Internet: www.csmarine.com  
Will drive piles in: CA.

### DeWitt Construction Inc.

Wayne DeWitt  
13909 N.E. 10th Ave.  
Vancouver, WA 98685  
Ph: (360) 576-8754  
Fax: (360) 574-8599  
Email: dewittcons@aol.com  
Will drive piles in: CA, WA, OR, AK, ID, MT, UT, OR.

### E. C. Korneffel Company

C. G. Korneffel  
2691 Veterans Parkway  
Trenton, MI 48183  
Ph: (734) 676-2131  
Fax: (734) 676-0788  
Email: info@korneffel.com  
Internet: www.korneffel.com  
Will drive piles in: PA, OH, IN, IL, MI, WI.

### E.S. Wagner

Edward W. Kitzman  
840 Patchen Rd.  
Oregon, OH 43816  
Ph: (419) 691-8651  
Fax: (419) 691-0429  
Email: ekitzman@eswagner.com  
Will drive piles in: IN, KY, MI, OH, PA, SC, NC, TN, WV.

### East Bay Construction Corp.

Joseph Burket  
512 W. Farmington Rd.  
Virginia Beach, VA 23454  
Ph: 757-463-1735  
Fax: 757-463-1736  
Email: T\_Tug@hotmail.com  
Will drive piles in: VA.

### Ed Waters & Sons Contracting Co. Inc.

Wayne E. Waters  
6467 Greenland Road  
Jacksonville, FL 32258  
Ph: (904) 268-4419  
Fax: (904) 260-9379  
Email: wew2150@aol.com  
Will drive piles in: GA, FL, SC.

### Edward E. Gillen Co.

Thomas Miller  
218 W. Becher St.  
Milwaukee, WI 53207  
Ph: (414) 769-3120  
Fax: (414) 769-3135  
Email: inform@gillenco.com  
Internet: www.gillenco.com  
Will drive piles in: IL, MI, WI.

### ETI Corporation

George Eliason  
P.O. Box 280  
Lebanon, ME 4027  
Ph: (207) 457-1895  
Fax: (207) 457-1030  
Email: stillwaters@metrocast.net  
Will drive piles in: ME, MA, NH, VT.

### F&W Construction Co. Inc.

Nigel E. Wells  
P.O. Box 1549  
Ozark, AL 36361  
Ph: (334) 299-3502  
Fax: (334) 299-6616  
Email: nwells@fandwconst.com  
Will drive piles in: AL, FL, GA, MS, NC, SC, TN.

## **Fenton Rigging & Contracting Inc.**

Robert J. Witte, Jr.  
2150 Langdon Farm Rd.  
Cincinnati, OH 45237  
Ph: (513) 631-5500  
Fax: 513-631-4361  
Email: bwitte@fentonrigging.com  
Internet: www.fentonrigging.com  
Will drive piles in: AL, AR, FL, GA, IA, IL, IN, KS, KY, LA, MI, MO, MS, NC, ND, NE, NJ, OH, OK, PA, SC, SD, TN, TX, VA.

## **Ford Pile Foundations Inc.**

Trey Ford  
4985 Euclid Road  
Virginia Beach, VA 23462  
Ph: (757) 497-3593  
Fax: (757) 497-0031  
Email: piledrvr@yahoo.com  
Will drive piles in: AL, DC, DE, FL, GA, KY, MD, MS, NC, NY, NJ, TN, VA, WV, SC.

## **Giken America Corp.**

John Santos  
5802 Hoffner Ave. Suite 707  
Orlando, FL 32822  
Ph: (407) 380-3232  
Fax: (407) 380-9411  
Email: gbears@gikenamerica.com  
Internet: www.gikenamerica.com  
Will drive piles in: Global.

## **Great Lakes Construction Company**

H. James Hoessle  
2608 Great Lakes Way  
Hinckley, OH 44233  
Ph: (216) 210-0569  
Fax: (330) 220-7670  
Email: jhoessle@tglcc.com  
Internet: www.tglcc.com  
Will drive piles in: OH, PA.

## **Gulf South Piling & Construction Inc.**

J.L. "Butch" Casey  
P.O. Box 10073  
Jefferson, LA 70181  
Ph: (504) 834-7791  
Fax: (504) 834-7792  
Email: butch@gsp.gs.net  
Will drive piles in: Continental U.S., Global, AL, LA, MS, TX.

## **H.B. Fleming**

John S. Linscott  
89 Pleasant Ave.  
South Portland, ME 4106  
Ph: (207) 799-8514  
Fax: (207) 799-8538  
Email: john.linscott@hbfleming.com  
Internet: hbfleming.com  
Will drive piles in: CT, MA, ME, NH, VT.

## **Hal Jones Contractor Inc.**

Paul C. Kirkland  
770 Talleyrand Ave.  
Jacksonville, FL 32202  
Ph: (904) 355-5885  
Fax: (904) 355-7648  
Email: pkirkland@wwgmc.com  
Will drive piles in: FL, GA.

## **Halverson Construction Co. Inc.**

Larry Antonacci  
P.O. Box 6039  
Springfield, IL 62708  
Ph: (217) 753-0027  
Fax: (217) 753-1904  
Email: larrya@halversonconstruction.com  
Internet: www.halversonconstruction.com  
Will drive piles in: IA, IN, IL, KY, MO.

## **Harper Structures Inc.**

Chuck Kethel  
1613 S. Defiance St. / P.O. Box 70  
Archbold, OH 43502  
Ph: (419) 445-8110  
Fax: (419) 445-8212  
Email: johnisola@mbcholdings.com  
Internet: www.millerbroconst.com/hsi.html  
Will drive piles in: IN, MI, OH.

## **Hawaiian Dredging Construction Company**

Mel Miyamoto  
614 Kapahulu Avenue  
Honolulu, HI 96815  
Ph: (808) 735-3211  
Fax: (808) 735-7413  
Internet: www.hawaiianredging.com  
Will drive piles in: HI.

## **Herbert F. Darling Inc.**

Herbert F. "Buck" Darling, III  
131 California Drive  
Williamsville, NY 14221  
Ph: (716) 632-1125  
Fax: (716) 632-0705  
Email: piling@hfdarling.com  
Will drive piles in: NY-except NYC area, OH-Northeast, PA-northern and western.

## **J.A. Walder Inc.**

J.A. Walder, Jr.  
P.O. Box 2047  
Ashland, VA 23005  
Ph: (804) 798-3605  
Fax: (804) 798-5032  
Email: email@walder.com  
Internet: www.walder.com  
Will drive piles in: MD, VA, NC, SC.

## **Johnson Bros. Corp.**

Derek Fogt  
2617 A Edenborn Avenue, #A  
Metairie, LA 70002  
Ph: (504) 779-5686  
Fax: (504) 779-5692  
Email: dfogt@johnson-bros.com  
Internet: www.johnson-bros.com  
Will drive piles in: AL, FL, IA, LA, MN, MS, MT, ND, SD, TX, WI.

## **Jordan Pile Driving Inc.**

D. R. Jordan  
P.O. Drawer 3004  
Mobile, AL 36652  
Ph: (251) 432-5000  
Fax: (251) 438-4666  
Email: drjordan@jordangroup.com  
Internet: http://www.jordangroup.com  
Will drive piles in: AL, FL, GA, LA, MS, TN.

## **Key Constructors Inc.**

Charles Webster  
P.O. Box 590  
Madison, MS 39130  
Ph: (601) 898-9892  
Fax: (601) 898-9896  
Email: pmcpmail@keyconstructors.com  
Will drive piles in: MS.

## **Kiewit Pacific Co.**

David A. Jack  
5000 Marsh Drive  
Concord, CA 94520  
Ph: (925) 686-3030  
Fax: (925) 687-5143  
Email: david.jack@norcal.kiewit.com  
Internet: www.kiewit.com  
Will drive piles in: CA, WA, OR, AK, NV, HI, AZ, ID, MT, UT.

## **L.H. Bolduc Co. Inc.**

Robert Werness  
649 W. Garfield St. / P.O. Box 815  
Anoka, MN 55303  
Ph: (763) 427-4330  
Fax: (763) 427-4012  
Email: lhbolduc@uswest.net  
Will drive piles in: IA, IL, MN, ND, NE, SD, WI.

## **Lawrence Construction Company**

Jim Frazier  
9002 North Moore Road  
Littleton, CO 80125  
Ph: (303) 791-5642  
Fax: (303) 791-5647  
Email: jim@wedrivepile.com  
Internet: www.wedrivepile.com  
Will drive piles in: NE, KS, TX, NM, AZ, OK, CO, UT, WY, ID.

## **Lorig Construction**

David Lorig  
250 East Touhy  
Des Plaines, IL 60018  
Ph: (847) 298-0360  
Fax: (847) 298-2689  
Email: dlorig@flash.net  
Will drive piles in: IL.  
Skyline Steel Corporation

## **M.J. Lee Construction Company**

Danny Lee  
5601 S. 122nd Ave.  
Tulsa, OK 74146  
Ph: (918) 437-9560  
Fax: (918) 437-9563  
Email: djlee@mccmail.com  
Will drive piles in: AR, OK, TX.

## **Marine Construction Inc.**

Ken Hanjes  
208 Michigan Ave.  
Folly Beach, SC 29439  
Ph: (843) 588-2882  
Fax: (843) 588-2012  
Will drive piles in: SC.

## **Max J. Kunej Company**

Karsten Olson  
P.O. Box 4008  
Spokane, WA 99220  
Ph: (509) 535-0651  
Fax: (509) 534-6828  
Email: karsten@maxkunej.com  
Internet: www.maxkunej.com  
Will drive piles in: ID, MT, OR, WA.

## **MB Western Industrial Contracting Co.**

James S. Bosley  
P.O. Box 5399  
Pasadena, TX 77508  
Ph: (281) 487-5757  
Fax: (281) 487-5726  
Email: steveb@mbwestern.com  
Internet: www.mbwestern.com  
Will drive piles in: TX.

## **MCM Construction Inc.**

James A. Carter  
6413 32nd Street  
North Highlands, CA 95660  
Ph: (916) 334-1221  
Fax: (916) 334-0562  
Email: jcarter@mcmconstructioninc.com  
Internet: www.mcmconstructioninc.com  
Will drive piles in: AZ, NV, OR.



## **McMullen & Pitz Construction Co.**

Erich Pitz  
17 Maritime Drive  
Manitowoc, WI 54221  
Ph: (920) 682-0131  
Fax: (920) 682-1099  
Email: pitz@lakefield.net  
Will drive piles in: WI.

## **MidAtlantic Piling**

William J. Lytle  
386 Industrial Road  
Glen Rock, PA 17327  
Ph: (717) 227-2492  
Fax: (717) 227-2393  
Email: blytle1965@aol.com  
Internet: midatlanticpiling.com  
Will drive piles in: DC, MD, PA, VA.

## **Misener Marine Construction Inc.**

Mark LaFon  
5600 West Commerce St.  
Tampa, FL 33616  
Ph: (813) 839-8441  
Fax: (813) 831-7498  
Email: mlafon@misenermarine.com  
Internet:  
<http://www.misenermarine.com>  
Will drive piles in: AL, CA, CT, DE, FL, GA, HI, LA, MA, MD, ME, MS, NC, NH, NJ, PA, RI, SC, TX, VA, Mexico, Central America, Caribbean.

## **Mobley Contractors Inc.**

Ronald F. Mobley  
P.O. Box 150  
Morrilton, AR 72110  
Ph: (501) 354-2510  
Fax: (501) 354-1862  
Will drive piles in: AR.

## **Murphree Bridge Corporation**

Tom Murphree  
P.O. Drawer 547  
Troy, AL 36081  
Ph: (334) 566-0756  
Fax: (334) 566-0757  
Email: mubridge@bellsouth.net  
Will drive piles in: GA, AL, FL.

## **O'Quinn Marine Construction**

Robert O'Quinn  
95 Sheppard Rd.  
Beaufort, SC 29907  
Ph: (843) 522-3313  
Fax: (843) 522-3138  
Will drive piles in: SC.

## **P+H Construction Corp.**

Pat Hensley  
80 St. Michael St., Suite 203  
Mobile, AL 36602  
Ph: (251) 433-6716  
Fax: (251) 433-6719  
Email: phconst1@aol.com  
Will drive piles in: AL.

## **Palmetto Pile Driving Inc.**

J. Harry Robbins, Jr.  
P.O. Box 70986  
Charleston, SC 29415  
Ph: (843) 577-0545  
Fax: (843) 577-0547  
Email: PalmettoPile@aol.com  
Will drive piles in: GA, NC, SC.

## **Parker Marine Contracting Corp.**

John T. Parker  
68 Braswell St. / P.O. Box 30651  
Charleston, SC 29405  
Ph: (843) 853-7615  
Fax: (843) 853-6263  
Email: johnp@parkermarine.net  
Will drive piles in: GA, NC, SC.

## **Phoenix Marine Co.**

John A. Keeley  
46 Highway 36  
Keyport, NJ 7735  
Ph: (732) 888-9336  
Fax: (732) 888-5544  
Email: phoenix@netlabs.net  
Will drive piles in: NY, NJ.

## **Pile Drivers Inc.**

John King  
4530 Hwy. 162  
Charleston, SC 29449  
Ph: (843) 763-7736  
Fax: (843) 763-7974  
Email: kingpiledrive@aol.com  
Will drive piles in: GA, NC, SC.

## **Piling Inc.**

Randy Dietel  
P.O. Box 1847  
Texas City, TX 77592  
Ph: (409) 945-3459  
Fax: (409) 945-4318  
Email: randy@pilinginc.com  
Internet: www.pilinginc.com  
Will drive piles in: Gulf Coast of Texas, TX, LA.

## **Purdy Construction Co. Inc.**

Brad Preston  
P.O. Box 668  
Mansfield, OH 44901  
Ph: (419) 524-2491  
Fax: (419) 525-4112  
Will drive piles in: OH.

## **R&C Welding & Fabrication Inc.**

Craig L. Carlson  
880 E. Country Club Rd.  
Gering, NE 69341  
Ph: (308) 635-0081  
Fax: (308) 635-7177  
Email: rcweldingfab@yahoo.com  
Internet: www.rcwelding.com  
Will drive piles in: CO, KS, NE, SD, WY.

## **R.L. Morrison & Sons Inc.**

Michael H. Morrison  
623 Morrison Street  
McClellanville, SC 29458  
Ph: (843) 887-3261  
Fax: (843) 887-3208  
Email: rlms@tds.net  
Will drive piles in: GA, NC, SC.

## **Reiman Corp.**

Tom Reiman  
P.O. Box 1007  
Cheyenne, WY 82003  
Ph: (307) 632-8971  
Fax: (307) 632-8972  
Email: trr@reimancorp.com  
Internet: reimancorp.com  
Will drive piles in: NM, CO, MT, WY, NE, SD.

## **Richard E. Pierson Construction Co. Inc.**

Douglas G. Penoyer  
P.O. Box 430  
Woodstown, NJ 8098  
Ph: (856) 769-8244  
Fax: (856) 769-5630  
Email: dpenoyer@repdemo.com  
Internet: www.repdemo.com  
Will drive piles in: DE, MD, NJ, PA.

## **Richard Goettle Inc.**

Larry Rayburn  
12071 Hamilton Ave.  
Cincinnati, OH 45231  
Ph: (513) 825-8100  
Fax: (513) 828-8107  
Email: lrayburn@goettle.com  
Internet: goettle.com  
Will drive piles in: All States.

## **River Pile & Foundation Co. Inc.**

Simeon Beer  
6 Executive Plaza  
Yonkers, NY 10701  
Ph: (914) 969-2424  
Fax: (914) 969-3088  
Will drive piles in: CT, NY, NJ.

## **Shoreline Foundation Inc.**

S. Michael Betancourt  
2781 S.W. 56th Ave.  
Pembroke Park, FL 33023  
Ph: (954) 985-0460  
Fax: (954) 985-0462  
Email:  
[info@shorelinefoundation.com](mailto:info@shorelinefoundation.com)  
Internet:  
[www.shorelinefoundation.com](http://www.shorelinefoundation.com)  
Will drive piles in: FL, Caribbean.

## **Signor Enterprises**

Rusty Signor  
8800 Madrone Ranch Trail  
Austin, TX 78734  
Ph: (512) 264-8300  
Fax: (512) 264-8301  
Email: rustysignor@hotmail.com  
Will drive piles in: TX.

## **Simpson & Brown Inc.**

Bob Anttonen  
119 North Ave. West  
Cranford, NJ 7016  
Ph: (908) 276-2776  
Fax: (908) 272-2627  
Email:  
[rantttonen@simpsonandbrown.com](mailto:rantttonen@simpsonandbrown.com)  
Will drive piles in: NJ, PA, NY, CT.

## **Spark Contractors**

Samuel Ruga  
1307 14th Avenue  
Dorothy, NJ 8317  
Ph: (609) 476-2175  
Fax: (609) 476-2702  
Will drive piles in: NJ.

## **Spearin, Preston and Burrows Inc.**

Gerard A. Neumann, Jr.  
3365 Richmond Terrace  
Staten Island, NJ 10303  
Ph: (718) 720-8029  
Fax: (718) 273-9326  
Email: ganeumann@spearin.com  
Will drive piles in: NY, NJ, DE, MD, VA, PA, CT.

## **Stroer & Graff Inc.**

Dave Graff  
1830 Phillips Lane  
Antioch, CA 94509  
Ph: (925) 778-0200  
Fax: (925) 778-6766  
Will drive piles in: CA, WA, OR, NV.

## **Subsurface Constructors Inc.**

John B. Morgan  
110 Angelica Street  
St. Louis, MO 63147  
Ph: (314) 421-2460  
Fax: (314) 421-2479  
Email:  
[jeff.morgan@subsurfaceconstructors.com](mailto:jeff.morgan@subsurfaceconstructors.com)  
Internet:  
[www.subsurfaceconstructors.com](http://www.subsurfaceconstructors.com)  
Will drive piles in: KY, GA, AL, MS, FL, NC, SC, TN, ND, SD, NE, MO, MN, IA, KS.

## Susquehanna Valley Construction

Wayne M. Schug  
175 Lamont Road  
New Cumberland, PA 17070  
Ph: (717) 774-7461  
Fax: (717) 774-1844  
Email: svccorp@aol.com  
Will drive piles in: PA.

## Swalling Construction Co.,

Mike Swalling  
P.O. Box 101039  
Anchorage, AK 99510  
Ph: (907) 272-3461  
Fax: (907) 274-6002  
Email: mswalling@swalling.com  
Will drive piles in: AK.

## T.L. Wallace Construction Inc.

Michael Walpert  
P.O. Box 523  
Columbia, MS 39429  
Ph: (601) 736-4525  
Fax: (601) 736-3401  
Email: mike@tlwallace.com  
Internet: www.tlwallace.com  
Will drive piles in: AL, FL, LA, MS.

## Texas Gulf Construction Co. Inc.

John Kelso  
P.O. Box 2110  
Galveston, TX 77553  
Ph: (409) 740-0266  
Fax: (409) 740-0268  
Will drive piles in: TX.

## Tioga Construction Co.

John T. Dillon  
333 Gros Blvd.  
Herkimer, NY 13350  
Ph: (315) 866-3199  
Fax: (315) 866-3533  
Email: jdillon421@aol.com  
Will drive piles in: NY, PA, VT.

## Veit & Company Inc.

Greg Boelke  
14000 Veit Place  
Rogers, MN 55374  
Ph: (763) 428-2242  
Fax: (763) 428-8348  
Email: gboelke@veitcompanies.com  
Internet: www.veitcompanies.com  
Will drive piles in: MN, WI, IA, ND, SD.

## W. M. Brode Company

Robert W. Brode  
820 Hill St.  
Coshocton, OH 43812  
Ph: (330) 340-9310  
Fax: (740) 622-5104  
Email: bobbrode@tusco.net  
Internet: www.wmbrode.com  
Will drive piles in: AL, DC, DE, GA, IL, IN, KY, MD, MI, MO, NC, NY, OH, PA, SC, TN, VA, WI, WV.

## W.R. Fairchild, Construction, LLC

Mark A. Fairchild  
P.O. Box 15909  
Hattiesburg, MS 39404  
Ph: (601) 544-1151  
Fax: (601) 583-4200  
Will drive piles in: GA, AL, AR, LA, MS, FL, TN.

## Whatcom Construction Inc.

Don Robinson  
1951 Division Street  
Bellingham, WA 98226  
Ph: (360) 671-7858  
Fax: (360) 734-8373  
Email: whatcompiles@aol.com  
Will drive piles in: CA, WA, OR, AK, NV, HI.

## Williams Bros

James D. Pitcock  
P.O. Box 66428  
Houston, TX 77266  
Ph: (713) 522-9821  
Fax: (713) 520-5247  
Internet: dpitcock@wbctx.com  
Will drive piles in: TX.

## ASSOCIATE MEMBERS

### AB Chance / Hubbell Power Systems

Rich Zinser  
210 N. Allen St.  
Centralia, MO 65240  
Ph: (573) 682-8367  
Fax: (573) 682-8660  
Email: rlzinser@hpshubbell.com  
Internet: www.abchance.com

### Products & Services Offered:

Composite piles, helical steel piers, steel pipe piles, drill equipment, drive caps & inserts, leads & spotters, marine equipment, specialized rigs & equipment.

### American Piledriving Equipment Inc.

John L. White  
7032 South 196th Street  
Kent, WA 98032  
Ph: (253) 872-0141  
Fax: (253) 872-8710  
Email: johnw@apevibro.com  
Internet: www.apevibro.com

### Products & Services Offered:

Sales, rental and manufacturer of pile driving equipment.

### Associated Pile & Fitting Corp.

Matthew Scerbak  
262 Rutherford Blvd. /  
P.O. Box 1048  
Clifton, NJ 07014  
Ph: (800) 526-9047  
Fax: (973) 773-8442  
Email: apf@associatedpile.com  
Internet: www.associatedpile.com

### Products & Services Offered:

Suppliers of accessories for driven piles. H-Pile: Hard-bite points, champion splicers. Pipe pile: drive-on splicers, conical points, cutting shoes, drive-tite boots. Sheet pile: sheet pile protectors, sheet pile splicers. Timber pile: timber pile points.

### Atlantic Wood Industries Inc

William L. Crossman  
P.O. Box 1608  
Savannah, GA 31402  
Ph: (912) 964-1234  
Fax: (912) 964-2633  
Email: wcrossman@atlanticwood.com  
Internet: www.atlanticwood.com

### Products & Services Offered:

Timber piles, prestressed concrete piles, vinyl sheet piles, AASHTO beams.

## Bay Machinery Corp.

Jim Arkin  
P.O. Box 70430  
Richmond, CA 94807  
Ph: (510) 236-9000  
Fax: (510) 236-7212  
Email: jim@baymachinery.com  
Internet: www.baymachinery.com

### Products & Services Offered:

Rental and sales of vibratory equipment, pile leads, top drive drills, diesel hammers, hydraulic impact hammers, air hammers, and crane rental and track drills and tie-back machines.

## Bayshore Concrete Products

Chad A. Saunders  
P.O. Box 230  
Cape Charles, VA 23310  
Ph: (757) 331-2300  
Fax: (757) 331-2501  
Email: csaunders@bcpcorp.com  
Internet: www.bcpcorp.com

### Products & Services Offered:

Manufacturer of prestressed concrete piles.

## Birmingham Foundation Solutions

Patrick Bermingham  
600 Ferguson Ave. North  
Hamilton, ON L8L4Z9  
Ph: (800) 668-9432  
Fax: (905) 528-6187  
Email: pbermingham@berminghammer.com  
Internet: www.berminghammer.com

## Brittix International Inc.

Balor Moore  
5505 Alameda Genoa Road  
Houston, TX 77048  
Ph: (713) 991-6107  
Fax: (713) 991-3128  
Email: balor@brittixpipe.com

### Products & Services Offered:

Paint and fabricate steel pipe piles to length; steel line pipe to 48 inches and roll and weld to 96 inches. Supplier of steel pipe, new & used; welded to length, sandblasting, painting, fabrication.

## **CDS Manufacturing**

Clayton Sembler  
441 South Virginia Street  
Quincy, FL 32351  
Ph: (850) 875-4651  
Fax: (850) 875-4660  
Email: cdsmfg@earthlink.net  
Internet:  
www.cdsmanufacturing.com

### Products & Services Offered:

Concrete piles, trucking.

## **CMRM**

John Hammill  
950 Industrial Rd.  
Cambridge Ontario CANADA  
N3H4W1  
Ph: (519) 650-2222  
Fax: (519) 650-2223  
Email: jhammill@rollformgroup.com

### Products & Services Offered:

Cold formed steel sheet piling, hot rolled steel sheet piling, Waterloo barrier, sealable sheet piling, high modulus sheet piling, "H" bearing piling, pipe pile, structurals, tie rods and hardware, highway guardrail.

## **Cox Utility / Carolina Poles**

Andrea Edwards  
P.O. Box 70  
Eutawville, SC 29048  
Ph: (803) 492-7728  
Fax: (803) 492-7942  
Email: andreaecpi@aol.com

### Products & Services Offered:

Vinyl sheet piles, timber piles & treated lumber.

## **D.P. Nicoli Inc.**

David P. Nicoli  
19600 Cipole Road  
Tulatin, OR 97062  
Ph: (503) 612-8200  
Fax: (503) 692-1700  
Email: dnicoli@dpnicoli.com

### Products & Services Offered:

Steel, H-piles, pipe piles, sheet piles, piling accessories and beams.

## **Drive-Con Inc.**

Terry Lee  
8225 Washington Blvd.  
Jessup, MD 20794  
Ph: (410) 799-8963  
Fax: (410) 799-5264  
Email: drvcon@aol.com  
Internet: www.drive-con.com

### Products & Services Offered:

Rental, sales and service of pile driving equipment.

## **Durabond Steel Corp.**

Brad Norris  
P.O. Box 518  
Export, PA 15632  
Ph: (724) 327-0280  
Fax: 724-327-0113  
Internet: dura-bond.com

### Products & Services Offered:

Steel sheet piles.

## **Ellis & Associates**

Greg A. Edmonds  
7064 Davis Creek Rd.  
Jacksonville, FL 32256  
Ph: (904) 880-0960  
Fax: (904) 880-0970  
Email: ellis@ellisassoc.com

### Products & Services Offered:

Analysis, design, testing, vibration monitoring, surveys, consulting, geotechnical engineers, pile monitoring, pile driving analyzer (PDA) testing.

## **Equipment Corp. of America**

Roy Kern  
P.O. Box 306  
Coraopolis, PA 15108  
Ph: (412) 264-4480  
Fax: (412) 264-1158  
Email: arkern@ecanet.com  
Internet: ecanet.com

### Products & Services Offered:

Rental, sales, vibratory drivers/extractors, fixed/swing leads, jet pumps, drills, cushion materials, pile driving leads, cutter head, drill bits, drive caps, off shore leader system, drilling supplies, pile hammers-vibratory, diesel, hydraulic, air/stea.

## **Flexicore of Texas**

Joe Phillips  
P.O. Box 450049  
Houston, TX 77245  
Ph: (888) 359-4267  
Fax: (281) 437-8913  
Email: joephillips@flexicoretex.com

### Products & Services Offered:

Concrete sheet piles.

## **Florida Pipe & Steel**

Vince Bianco  
6685 Forest Hill Blvd. Suite 207  
W. Palm Beach, FL 33413  
Ph: (561) 642-1811  
Fax: (561) 642-7478  
Email: sales@floridapipe.com  
Internet: www.steel4sale.com

### Products & Services Offered:

Steel beams, pipe pile, steel fabrication.

## **Frank Black Pipe & Supply**

Jerry Johnson  
1375 17th Ave.  
McPherson, KS 67460  
Ph: (620) 241-2582  
Fax: (620) 241-8080

### Products & Services Offered:

Pipe pile.

## **Gate Concrete Products Co.**

Earl Shimp  
402 Heckscher Dr.  
Jacksonville, FL 32226  
Ph: (904) 757-0860  
Fax: (904) 751-5435  
Email: eshimp@gatepetro.com

### Products & Services Offered:

Concrete piles, sheet piles (concrete).

## **Geokon Inc.**

Michael McDonough  
48 Spencer Street  
Lebanon, NH 03766  
Ph: (603) 448-1562  
Fax: (603) 448-3216  
Email: tony@geokon.com  
Internet: www.geokon.com

### Products & Services Offered:

Pile monitoring.

## **Geotechnics**

Larry Wetzel  
544 Braddock Ave.  
East Pittsburg, PA 15112  
Ph: (412) 823-7600  
Fax: (412) 823-8999  
Email: lwetzel@geotechnics.net  
Internet: www.geotechnics.net

### Products & Services Offered:

Deep foundation testing services.

## **GRL Engineers Inc.**

Frank Rausche  
4535 Renaissance Pkwy.  
Cleveland, OH 44128  
Ph: (216) 831-6131  
Fax: (216) 831-0916  
Email: frank@pile.com  
Internet: www.pile.com

### Products & Services Offered:

Dynamic pile testing, wave equation analysis, sonic and ultrasonic integrity testing.

## **Gulf Coast Pre-Stress Inc.**

Max J. Williams  
P.O. Box 825  
Pass Christian, MS 39571  
Ph: (228) 452-9486  
Fax: (228) 452-9495  
Email: mwilliams@gcpstress.com  
Internet: http://www.gcpstress.com

### Products & Services Offered:

Precast prestressed concrete piles 10 inches square to 42 inches square, to 36-inch, 54-inch, and 66-inch cylinder pile, precast prestressed concrete sheet piles.

## **GZA GeoEnvironmental, Inc**

Bradford W. Roberts  
One Edgewater Dr.  
Norwood, MA 02062  
Ph: (781) 278-3840  
Fax: (781) 278-5701  
Email: broberts@gza.com

### Products & Services Offered:

Dynamic pile testing, instrumentation, vibration monitoring, testing, geotechnical, design, consulting.

## **Hartman Engineering**

Richard Hartman  
4910 Ranson Rd  
Clarence, NY 14031  
Ph: (716) 759-2900  
Fax: (716) 759-2668  
Email:  
rhartman@hartmanengineering.com  
Internet: hartmanengineering.com

### Products & Services Offered:

Consulting, cofferdam design.

## **ICE-International Construction Equipment Inc.**

Kurt Seufurt  
301 Warehouse Drive  
Matthews, NC 28104  
Ph: (800) 438-9281  
Fax: (704) 821-8201  
Internet: www.iceusa.com

### Products & Services Offered:

Vibratory pile hammers, diesel impact hammers, hydraulic impact hammers, top drive augers, bored pile drill rigs, tie-back drill rigs, pile driving leads, drive caps, pile driving accessories, drilling accessories, sales and rentals.

## IHC Hydrohammer B.V.

Geert Jonker  
6, Smitweg, 2961 AW, Box 26  
Kinderdijk The Netherlands,  
2960AA  
Ph: 31-78-69-10302  
Fax: 31-78-69-10304  
Email: g.jonker@ihcfe.com  
Internet: www.ihcfe.com

### Products & Services Offered:

Manufacturer of hydraulic pile driving hammers (Hydrohammer), hydraulic piling rigs, (Fundex), auger drives, vibratory hammers, leads, air/steam operated hammers (Vulcan).

## International Construction Services Inc.

Brian Land  
P.O. Box 15598  
Pittsburgh, PA 15244  
Ph: (412) 788-6430  
Fax: (412) 788-9180  
Email: icsi@nb.net

### Products & Services Offered:

Coatings & chemicals, steel pipe piles, steel sheet piles.

## J.D. Fields & Co. Inc.

Stan Fisher  
P.O. Box 218424  
Houston, TX 77218  
Ph: (281) 558-7199  
Fax: (281) 870-9918  
Email: sfisher@jdfields.com  
Internet: jdfields.com

### Products & Services Offered:

Rental of sheet piling, sales of H-pile, sheet pile, and steel pipe.

## Junttan OY

Pentti Heimonen  
P.O. Box 1702  
Kuopio FIN-70701 FINLAND,  
Ph: 358-017-2874400  
Fax: 358-017-2874411  
Email: pentti.heinonen@junttan.com  
Internet: www.junttan.com

### Products & Services Offered:

Manufacturer of hydraulic hammers and piling and drilling rigs.

## Kentucky State District Council of Carpenters

Steve Barger  
632 Comanche Trail  
Frankfort, KY 40601  
Ph: (502) 875-7474  
Fax: (502) 875-3409  
Email: sbarger@ksdcc.org

### Products & Services Offered:

Labor organization.

## Koppers Inc.

Donald R. Surrency  
200 N.W. 23rd Ave.  
Gainesville, FL 32609  
Ph: (352) 376-5144  
Fax: (352) 371-4657  
Email: surrencydr@koppers.com  
Internet: www.koppers.com

### Products & Services Offered:

Timber piles.

## L.B. Foster Company

Don Vukmanic  
415 Holiday Drive  
Pittsburgh, PA 15220  
Ph: (412) 928-3487  
Fax: 412-928-3427  
Email: dvukmanic@lbfosterco.com  
Internet: www.foster-piling.com

### Products & Services Offered:

Sell and rent sheet piling, H beams and foundation pile, and fender systems.

## Liebherr Nenzing Crane Co.

Wolfgang Herzog  
1400 E. North Belt, Suite 160  
Houston, TX 77032  
Ph: (281) 219-7131  
Fax: (281) 219-7134  
Email: wolfgang.herzog@inc.liebherr.com  
Internet: www.liebherr.com

### Products & Services Offered:

Sales, cranes, fixed/swing leads, steel sheet piling, H bearing piling, sheet piles, drills, composite pile, pile driving leads, off shore leader system, drilling supplies, dynamic compactor.

## Liedtka Trucking Inc.

Phillip Liedtka  
110 Patterson Ave.  
Trenton, NJ 08650  
Ph: (609) 586-2080  
Fax: (609) 890-9333

### Products & Services Offered:

Trucking services.

## Link-Belt Construction Equip. Co.

Pat Collins  
2651 Palumbo Dr. / P.O. Box 13600  
Lexington, KY 40509  
Ph: (859) 263-5200  
Fax: (859) 264-6351  
Email: pcollins@linkbelt.com  
Internet: www.linkbelt.com

### Products & Services Offered:

Cranes.

## Mandal Pipe Co.

Bill Buckland  
P.O. Box 2566  
Lilburn, GA 30048  
Ph: (770) 925-8885  
Fax: (770) 925-8803  
Email: BillBuckland@mandalpipe.com  
Internet: www.mandalpipe.com

### Products & Services Offered:

Large diameter steel pipe, H-Piles, pipe piling, cutting, welding, plate attachment, sandblasting, and painting. Mill direct shipments.

## Menck GmbH

Dr. Bernhard Bruggaier  
P.O. Box 1461  
24562 Kaltenkirchen GERMANY,  
Ph: [49] 49-041919110  
Fax: [49] 490419191100  
Internet: www.menck.com

### Products & Services Offered:

Design, manufacture and sell off-shore pile driving hammers and on-land pile driving hammers.

## MG&B

Mark Greenberg  
P.O. Box 664  
Mandeville, LA 70470  
Ph: (800) 256-2185  
Fax: (985) 893-5222  
Email: mg7b@aol.com

### Products & Services Offered:

Trucking Services

## Mississippi River Equipment Company

John Waguespack  
P.O. Box 249  
Norco, LA 70079  
Ph: (985) 764-1194  
Fax: (985) 764-1196  
Email: jj@pem-usa.com  
Internet: www.mreco.com

### Products & Services Offered:

MKT-Vulcan-Hamortex dealer rental-sales of PDE & accessories. Dawson dealer.

## Mississippi Valley Equipment Co.

Mike Whisler  
1198 Pershall Road  
St. Louis, MO 63137  
Ph: (314) 869-8600  
Fax: (314) 869-6862  
Email: mwhisler@mve-stl.com  
Internet: www.mve-stl.com

### Products & Services Offered:

Rentals, sales, parts and service of MKT pile driving equipment and hydraulic augers. Distributor for IHC Hydrohammers, Vulcan air hammers, and Mait hydraulic drill rigs. Custom fabrication, hydraulic repair work, repair on all pile driving equipment.

## Monotube Pile Corp.

Samuel Kosa  
P.O. Box 7339  
Canton, OH 44705  
Ph: (330) 454-6111  
Fax: (330) 454-1572  
Email: monotube@raex.com  
Internet: www.monotube.com

## Municon Consultants

Barry C. Roth  
1300 22nd Street, Suite A  
San Francisco, CA 94107  
Ph: (415) 641-2570  
Fax: (415) 282-4097  
Email: municon@municon.net

### Products & Services Offered:

Vibration monitoring of pile driving; also inclinometer, piezometer, tilt meter monitoring; pre construction photo/video surveys.

## National Ventures Inc.

Glenn Lockie  
264 Cazneau Ave.  
Sausalito, CA 94965  
Ph: (415) 331-7260  
Fax: (415) 331-7261  
Email: glockie@pilesplices.com  
Internet: www.pilesplices.com

### Products & Services Offered:

Sure-lock splice for prestressed concrete piles. All sizes and shapes of piles. Fast, easy and reliable. Used for 30 years.

## **NationWide Utility Poles & Supply Inc.**

Phil S. Myers  
P.O. Box 130  
Brierfield, AL 35035  
Ph: (205) 926-1887  
Fax: (205) 926-7495  
Email: pmyers@nwpoles.com  
Internet: www.nwpoles.com

### Products & Services Offered:

Timber piling.

## **Naylor Pipe Co.**

Mike Griffin  
1230 - 92nd St.  
Chicago, IL 60619  
Ph: (773) 721-9400  
Fax: (773) 721-9494  
Email: sales@naylorpipe.com  
Internet: www.naylorpipe.com

### Products & Services Offered:

Manufacturers of spiralweld pipe and piling and caissons 6" I.D through 102" O.D. in wall thickness from .134" to .500"

## **Northwest Pipe Company**

James T. Rollandi  
200 S.W. Market Street, Ste. 1800  
Portland, OR 97201  
Ph: (800) 989-9631  
Fax: (503) 978-2561  
Email: jrollandi@nwpipe.com  
Internet: www.nwpipe.com

### Products & Services Offered:

Manufacturer of steel pipe ranging from 18" through 154" located in six production facilities with complete fabrication and coating systems.

## **Nucor-Yamato Steel Company**

Michael F. Engstrom  
P.O. Box 1228  
Blytheville, AR 72316  
Ph: (954) 384-4545  
Fax: (954) 337-0831  
Email: MEngstrom@aol.com  
Internet: www.nucoryamato.com

### Products & Services Offered:

Supplier of steel H-Piles and hot rolled steel sheet piling.

## **Pacific American Commercial Company**

Ted Obermeit  
P.O. Box 3742  
Seattle, WA 98124  
Ph: (800) 678-6379  
Fax: (206) 763-4232  
Email: info@pacoequip.com  
Internet: www.pacoequip.com

### Products & Services Offered:

Sales, rental and service of all pile driving equipment.

## **Pacific Coast Council of Pile Drivers**

Lonnie Wangen  
412 S. 13th St.  
Tacoma, WA 98402  
Ph: (206) 728-2396  
Fax: (253) 627-5121  
Email: lu2396@worldnet.att.net

## **Penn State Fabricators**

Herbert J. Engler  
124 Newton Street  
Brooklyn, NY 11222  
Ph: (718) 388-1890  
Fax: (718) 388-4741  
Email: pennstate.fab@verizon.net  
Internet:  
www.pennstatefabricators.com

### Products & Services Offered:

Manufacturer of CONBEST/ CONBEST II hammer cushion blocks. Secondary market supplier, SLIDE BARS for Vulcan/Conmaco hammers. Pile (plywood) cushion blocks. General machine/fabrication. Manufacturer of GEARS.

## **Pile Buck**

Chris Smoot  
P.O. Box 64-3929  
Vero Beach, FL 32964  
Ph: (772) 231-5200  
Fax: (772) 231-8400  
Email: pilebuck@pilebuck.com  
Internet: www.pilebuck.com

### Products & Services Offered:

Monthly newspaper for pile driving.

## **Pile Dynamics Inc.**

Garland E. Likins, Jr.  
4535 Renaissance Parkway  
Cleveland, OH 44128  
Ph: (216) 831-6131  
Fax: (216) 831-0916  
Email: garland@pile.com  
Internet: www.pile.com

### Products & Services Offered:

Dynamic pile testing equipment, dynamic pile testing service. pile driving analyzer, pile integrity tester, pile installation recorder for driven piles. hammer performance analyzer, saximeter, GRLWEAP wave equation.

## **Pile Equipment Inc.**

Mike Elliott  
1058 Roland Avenue  
Green Cove Springs, FL 32043  
Ph: (904) 284-1779  
Fax: (904) 284-2588  
Email: info@pile-eqp.net  
Internet: pile-eqp.net

### Products & Services Offered:

Sales, rental, parts, service of pile driving equipment: Delmag, HPSI, Vulcan, Dawson, Hamortex, ABI, Multipiler.

## **Pileco Inc.**

Warren Waite  
P.O. Box 16099  
Houston, TX 77222  
Ph: (800) 474-5326  
Fax: (713) 691-0089  
Email: wwaite@pileco.com  
Internet: http://www.pileco.com

### Products & Services Offered:

Sales-rental-service, Delmag diesel hammers, IHC Hydrohammers, Vibrohammers & drills, piledriving leads, helmets, jet pumps, saximeter, and other accessories.

## **Pilemac Inc.**

George W. Smith  
91 Greenville Rd.  
Livermore, CA 94650  
Ph: (800) 745-3622  
Fax: (925) 449-6034  
Email: gsmith@pilemac.com  
Internet: http://www.pilemac.com

### Products & Services Offered:

Rental, sales, vibratory drivers/ extractors, cranes, fixed/swinging leads, jet pumps, inserts, drills, de-watering pumps, cushion materials, pile driving leads, cutter head, drill bits, drive caps, off shore leader system, pile hammers-vibratory, diesel.

## **Piling Products Inc.**

Sandra R. Koslow  
945 Center Street  
Green Cove Springs, FL 32043  
Ph: (904) 287-8000  
Fax: (904) 529-7757  
Email: sandypipi@bellsouth.net  
Internet: ppisteel@bellsouth.net

### Products & Services Offered:

Dock & marine supplies, pile points & splicers, steel sheet piles, vinyl sheet piles, H-piles.

## **Pipe & Piling Supplies**

Kevin Brady  
P.O. Box 44178, 1658 Bedford Hwy.  
Bedford, NS B4A 3Z8  
Ph: (902) 835-6158  
Fax: (902) 835-6079  
Email: kbrady@pipe-piling.com

### Products & Services Offered:

Rollong mill, spiral weld pipe, pipe 6 5/8 to 120" o.d., lengths up to 128 ft. long.

## **Pipe & Tube Supplies Inc.**

Jeff Searce  
4201 West Orange Street  
Pearland, TX 77581  
Ph: (800) 883-7473  
Fax: (281) 485-0149  
Email: jsearce@pts-us.com  
Internet:  
www.pipeandtubesupplies.com

### Products & Services Offered:

Provider of steel pipe piles with submerged arc-welding capabilities to length.

## **Pittsburgh Coatings**

Alex Lowery  
8105 Perry Highway  
Pittsburgh, PA 15237  
Ph: (412) 366-5159  
Fax: (412) 366-6019  
Email: awl@pittcoat.com  
Internet: www.pittcoat.com

### Products & Services Offered:

Steel beams, pipe pile, steel sheet piling, H bearing piling, steel fabrication, sheet piles, H-beam, coating.

## **Pittsburgh Intermodal Terminals**

Mark A. Devimney  
P.O. Box 29  
Butler, PA 16003  
Ph: (724) 287-7733  
Fax: (724) 287-5708  
Email: mdevinney@nicholasinc.com

### Products & Services Offered:

River terminal.

## **Precast/Prestressed Concrete Institute**

John S. Dick  
209 West Jackson Blvd., Ste. 500  
Chicago, IL 60606  
Ph: (312) 786-0300  
Fax: (312) 786-0353  
Email: jdick@pci.org  
Internet: www.pci.org

### Products & Services Offered:

A dynamic international trade association devoted to research, development, education, and promotion concerning pre-cast concrete products including pipes.

## **Raymond Piling Products Inc.**

Ray Johnson  
391 W. Water St.  
Taunton, MA 02780  
Ph: (508) 821-4700

## **Robishaw Engineering Inc.**

Dixon McNair  
P.O. Box 79246  
Houston, TX 77279  
Ph: (800) 877-1706  
Fax: (713) 468-5822  
Email: info@flexifloat.com  
Internet: www.flexifloat.com

### Products & Services Offered:

Manufacturer of flexifloat construction systems. Rental and sales of truck-portable sectional barges and attachments for marine pile driving and construction.

## **S&ME**

Billy Camp  
840 Low Country Blvd.  
Mount Pleasant, SC 29464  
Ph: (843) 884-0005  
Fax: (843) 881-6149  
Email: bcamp@smeinc.com

### Products & Services Offered:

Consulting, design, geotechnical, testing, vibration monitoring.

## **Shoreline Steel Inc.**

Tom M. Willey  
P.O. Box 480519  
New Haven, MI 48048  
Ph: (586) 749-9650  
Fax: (586) 749-6653  
Internet: www.shorelinesteel.com

### Products & Services Offered:

Manufacturer of cold-formed, interlocking steel sheet piling.

## **Skyline Steel Corporation**

Rory Kelly  
5610-B Sandy Lewis Dr.  
Fairfax, VA 22032  
Ph: (703) 978-2500  
Fax: (703) 978-2908  
Email: rkelly@skylinesteel.com  
Internet: www.skylinesteel.com

### Products & Services Offered:

Rental, sales, steel beams, pipe piling, steel sheet piles, H bearing piles, pile point and splicers, steel fabrication, environmental barrier walls.

## **Soil Consultants Inc.**

Kenneth Johnson, Jr.  
P.O. Drawer 698  
Charleston, SC 29402  
Ph: (843) 723-4539  
Fax: (843) 723-3648  
Email: kennyj@soilconsultantsinc.com  
Internet: www.soilconsultantsinc.com

### Products & Services Offered:

Consulting, geotechnical, testing, vibration monitoring.

## **Specialty Piling Systems Inc.**

Stephen K. Whitty, Jr.  
P.O. Box 1607  
Slidell, LA 70459  
Ph: (985) 643-0690  
Fax: (985) 643-0690  
Email: SWhittySPS@earthlink.net

### Products & Services Offered:

Sales and brokerage of pile driving and marine equipment; accessories (pile points and connectors, recoil dampener rings); Vulcan slide bars & parts; supplies (hammer & pile cushions (incl. Bongossi); hardwood mats. consulting services (varied).

## **Steel Dynamics Sales N.A. Inc.**

Paul J. Kotsenas  
295 Cottingham Place  
Cranberry TWSP, PA 16066  
Ph: (724) 452-3991  
Fax: (724) 452-3992  
Email: paul.kotsenas@stld-cci.com  
Internet: www.steeldynamics.com

### Products & Services Offered:

Steel beams, H bearing pile.

## **Sunbelt Rental Piledriving Equipment**

Samuel Glova  
8 Bryant Court  
Sterling, VA 20120  
Ph: (800) 223-8427  
Fax: (703) 435-4530  
Email: sglova@sunbeltrentals.com

### Products & Services Offered:

Rental, service and sales of foundation equipment; diesel/air/hydraulic hammers, drills and attachments; fixed and swinging leads; hydraulic vibratory driver/extractors with complete accessories, hydraulic concrete pile cutters.

## **T+R Pipeline Services**

Warren Cross III  
15110 Hooper Rd.  
Houston, TX 77047  
Ph: (713) 412-9120  
Fax: (713) 413-9112  
Email: tcross@trpipe.com

### Products & Services Offered:

Steel pipe piles, steel sheet piles.

## **Timber Piling Council**

Dean Matthews  
2405 61st Ave. SE  
Mercer Island, WA 98040  
Ph: (800) 410-2070  
Fax: (206) 275-4755  
Email: dean@matthewsassociates.com  
Internet: www.timberpilingcouncil.org

### Products & Services Offered:

Provide current, accurate technical information about pressure-treated wood piling.

## **Trimble Navigation**

Gretchen Hartley  
11412 Timberwild St.  
The Woodlands, TX 77380  
Ph: (713) 201-7658  
Fax: (281) 292-8876  
Email: gretchen\_hartley@trimble.com  
Internet: www.trimble.com

### Products & Services Offered:

Sales, GPS & construction software.

## **TXI Chaparral Steel**

Stan Baucum  
300 Ward Rd.  
Midlothian, TX 76065  
Ph: (800) 527-7979  
Fax: (972) 988-7502  
Email: sbaucum@TXI.com  
Internet: www.chaparralsteel.com

### Products & Services Offered:

Sales, steel beams, steel sheet piling, H bearing piling, sheet piles, H-Beam.

## **United Wood Preservers**

Wayne R. Comtois  
P.O. Box 248  
Whitmire, SC 29178  
Ph: (803) 694-3668  
Fax: (803) 694-3976  
Email: www.unitedwood.com  
Internet: wcomtois@unitedwood.com

### Products & Services Offered:

Wood treating.

## **Versabite Piling Accessories**

Ernie Taylor  
1704 Tower Industrial Dr  
Monroe, NC 28110  
Ph: (800) 280-9950  
Fax: (704) 225-1567  
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# PILE FOUNDATIONS - An Environmental Problem?

By Dr. Gordon P. Boutwell, P.E.<sup>(1)</sup>, M. S. Nataraj, P.E.<sup>(2)</sup>, and Kenneth L. McManis, P.E.<sup>(3)</sup>

## SUMMARY

We civil engineers frequently work on expansions of existing industrial plants, which may have near-surface zones containing some contaminants. Pile support of such expansions is often needed, but regulatory agencies are concerned with the potential environmental effects of puncturing a clay aquitard which overlies a sand aquifer. Expensive countermeasures have been required for this situation.

We investigated the problem using the literature (scarce), analytical calculations, and tests on model piles simulating the situation. The results indicate that proper selection of the pile type, pile material, and pile tip design prevents contaminant transfer. Use of a displacement-type pile, made of impervious material, and (possibly) with a pointed tip is recommended for this situation.

## INTRODUCTION

It's hard to drive through much of Louisiana without being in sight of some chemical plant, especially in the Baton Rouge-New Orleans corridor and around Lake Charles. We civil engineers often design expansions for these existing plants. Those of us who do are well aware of the Louisiana Department of Environmental Quality (LDEQ), and how some of their policies affect even our foundation designs. One particular LDEQ policy is the "Groundwater Certification" you must make to receive — get this — your Air Quality permit!

This requirement arose during Paul Templet's term as LDEQ Secretary, because so many older plants had real or suspected groundwater impacts from spills, pipe or tank leaks, etc. You have to cleanup or at least monitor any underground pollution. Where this LDEQ policy meets your foundation design is when you need pile support but there is some underground contamination in the area. Of course, you

want to drive the piles to a sand to get high capacity. However, most of our sands are "aquifers": potential sources of drinking water. The regulatory agency is concerned that pile foundations may cause or accelerate transfer of pentachlorinated chicken fat or other chemicals from the contaminated upper zone to a lower aquifer. LDEQ's design requirements to block any such transfer are quite complicated and expensive, as we will see.

The senior author has encountered this problem on several industrial expansions, and found almost no guidance or information in the literature. The University of New Orleans (UNO) received a USEPA grant to study piles as a mechanism for contaminant transfer. This article describes our findings to date; these were also published in *Boutwell, et al., (2000)*.

## POTENTIAL FOR CONTAMINATION BY PILES

We identified four mechanisms for potential contaminant transfer. The first is from the pile material itself, such as a creosoted timber pile. This mechanism is limited in today's real-world construction, and was not studied. The mechanisms that would apply to all piles are:



Dr. Gordon Boutwell

- **Direct Transfer.** This potential mechanism is illustrated in Figure 1. Soil bearing capacity theory indicates that there is a roughly conical "dead zone" or plug of soil just below the pile tip. Under the right (wrong for us) conditions, the plug could be created in the contaminated zone (Stage 1) and carried along with the pile tip (Stage 2) all the way down to the aquifer. This would result in a one-time slug of contaminants reaching the aquifer (Stage 3). Groundwater flow in the aquifer then moves a plume of the contamination away from the pile tip.

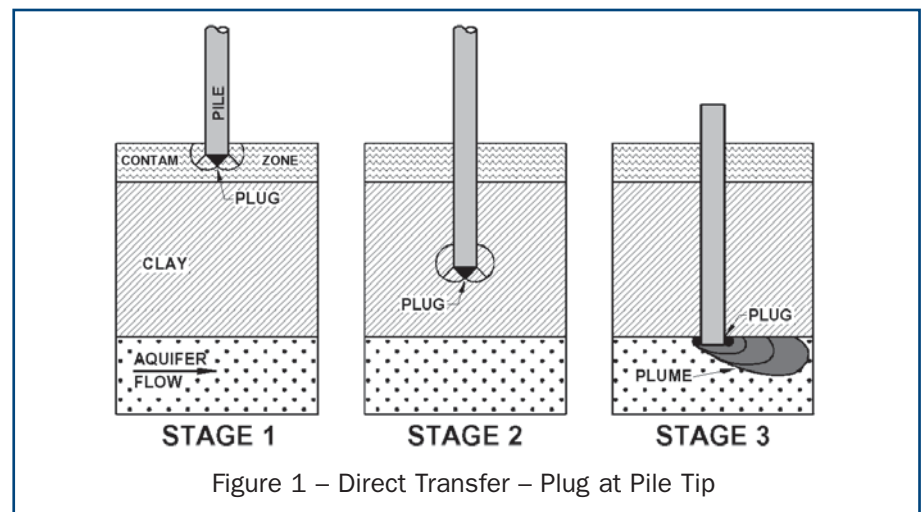


Figure 1 – Direct Transfer – Plug at Pile Tip

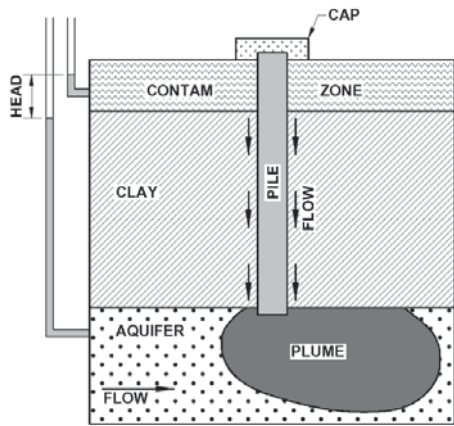


Figure 2 – Flow at Pile / Soil Interface

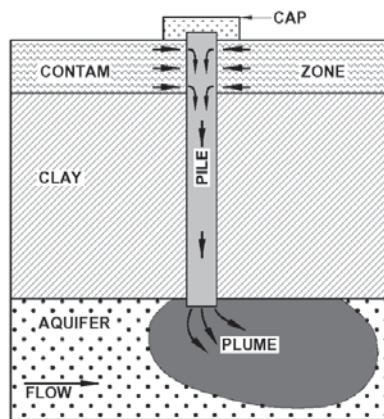


Figure 3 – Flow Through Pile Material

The regulatory response to these potentials is to require that the piles be hydraulically isolated from the contaminated zone. A typical such requirement is illustrated in Figure 4. First, you drill out the contaminated soils. Then, you grout a casing (steel or plastic) into place, extending below the contaminated soils to prevent the contaminants from having access to the “disturbed” zone or pile. This is shown as steps 1, 2, and 3 of Figure 4. Finally, you can drive your pile through the casing (Step 4). Then, you have to grout up the casing (Step 5). The cost for this procedure can be as much as the cost of the pile!

What are your options? You could stop the piles in the clay, leaving a clay barrier beneath the pile tips. However, this means reduced pile capacity, and thus many more piles: another extra expense. Of course, industries don’t want to spend extra money on casing or more piles, *especially* if it’s not necessary.

- Conduit Formation. This would be continuous (long-term) flow along the pile, as illustrated in Figure 2. It occurs in the soil zone disturbed by pile-driving, especially along the pile-soil interface. It requires:

(1) that the pile create an annular void, or at least a zone of higher permeability, and

(2) a downwards hydraulic gradient to cause flow, i.e., the groundwater head in the contaminated zone must be higher than that in the aquifer.

- Wicking. This would be flow through the pile itself, as shown on Figure 3. It could occur if the pile is made of a material more permeable than the soil (usually clay) which lies between the contaminated upper zone and the lower aquifer. Wood and

some concrete are more permeable than most of our Louisiana clays. Of course, you must still have a downwards gradient to cause flow. Where wicking exists, it would be a long-term problem.

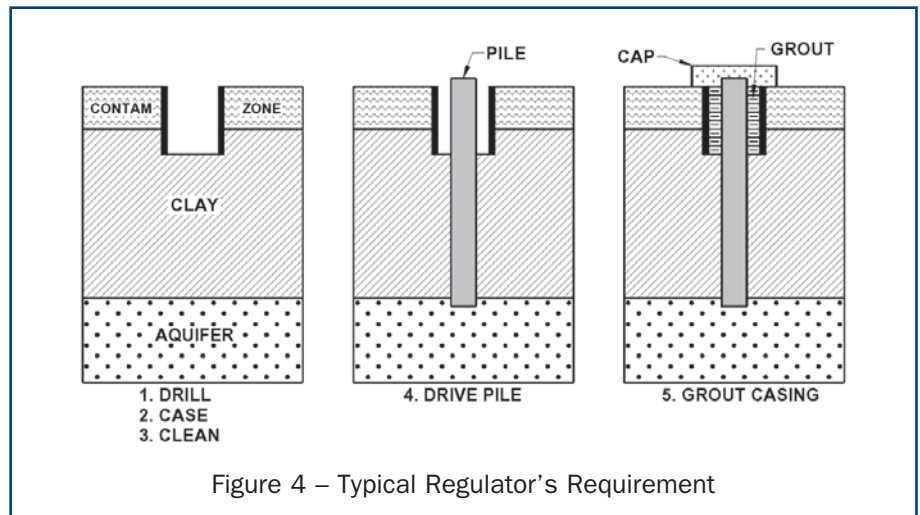


Figure 4 – Typical Regulator’s Requirement

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## OVERVIEW OF STUDY

A literature review indicated only two references to this situation. The first involved groundwater contamination at the old Ethyl plant in Baton Rouge [Campbell, et.al., (1984)]. However, while they showed unsealed water wells to have been a major factor, there was no proof or even strong indication that piles contributed to the problem. The second was a model pile study by Hayman, et.al., (1993), where they caused flow of chlorinated solvents through their pile/soil system. They found a small effect due to Direct Transfer, some due to Wicking, but none due to Conduit Formation.

So, we developed a program at UNO to look into this problem. We were fortunate enough to get U.S. EPA funding for the program. Basically, we studied Direct Transfer by analytical means, using contaminant transport equations. We looked at Conduit Formation and Wicking by model pile tests.

## DIRECT TRANSFER STUDY

As mentioned before, this could occur if a plug of contaminated soil were carried driven to the aquifer by the pile tip. The volume of the soil plug ( $V$ ) for a flat-tipped pile driven through clay is about  $0.15D^3$ , where  $D$  is the pile width/diameter. Initially, the contaminant concentration in the pore water of the plug is the same as that in the contaminated upper stratum ( $c_0$ ). The volume of actual contaminant in the plug is its pore water volume times the chemical concentration in the pore water. It can be calculated as plug volume ( $V$ ) times the soil porosity ( $n$ ) multiplied by  $c_0$ . Some of the contaminated initial plug is lost by friction during driving, especially when the pile tip passes through stronger materials between the contaminated zone and the aquifer. Hayman, et.al., (1993) used piles with conical tips, which resulted in smaller plugs. Therefore, the volume of soil transferred in their tests was far less than the above theoretical maximum. Their results indicated contaminant transfer via this mechanism of the order of 0.3% (in the case of their steel pile) to 7% (in the case of their wooden pile) of the theoretical maximum for flat-tipped piles.

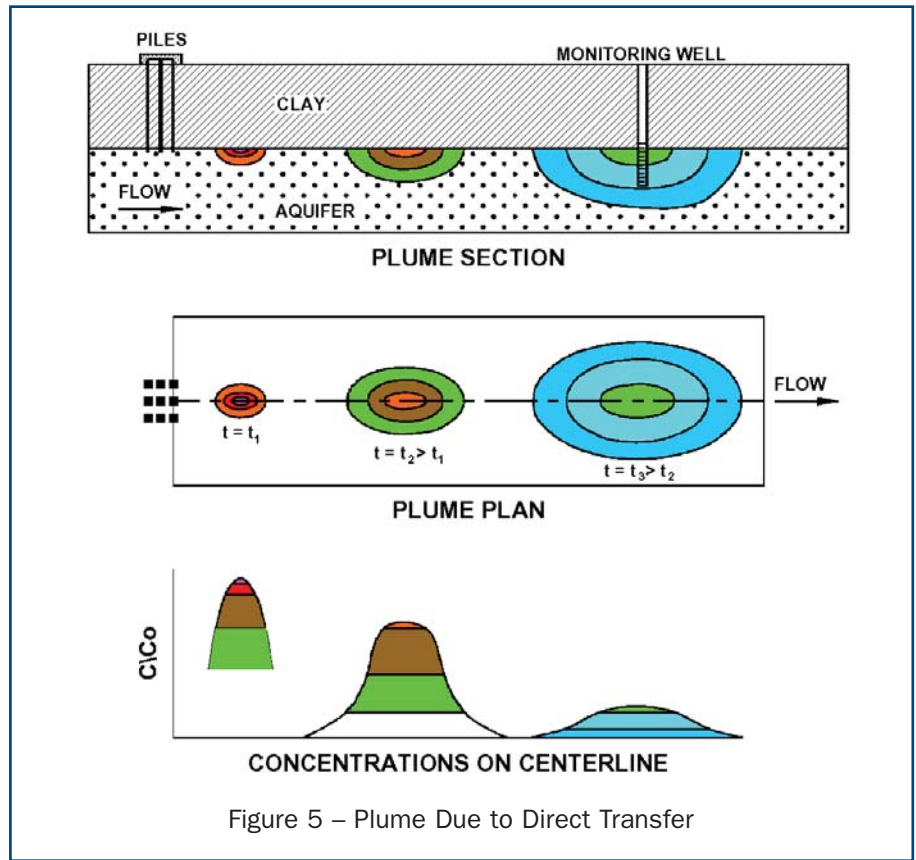


Figure 5 – Plume Due to Direct Transfer

Hayman, et.al., (1993) also calculated the average concentration ( $c_a$ ) in static groundwater under a hypothetical industrial process area with an average pile spacing of 40 feet. The resulting dilution factor ( $c_a/c_0$ ) was about  $6 \times 10^{-9}$ . In other words, an original concentration of, say, 1000 mg/L (ppm), would be reduced to less than 0.01 ug/L (ppb). However, regulatory concerns would be more appropriately addressed by examining the *maximum* concentrations downgradient of a pile group in a flowing aquifer. As illustrated in Figure 5, the concentrations caused by the slug of contaminated soil decrease as the plume moves away from the pile.

This effect can be calculated using the three-dimensional advection—dispersion model developed by Baetsle, (1969). Diffusion can normally be disregarded at the relatively high groundwater velocities in an aquifer. In this case, the Baetsle equation reduces to :

$$\frac{c}{c_0} = \frac{V_e \sqrt{pq} e^{-F}}{8 (\pi \alpha X)^{3/2}}$$

(Eq. 1)

Where

$$F = \frac{1}{4\alpha X} [(x-X)^2 + py^2 + qz^2]$$

$V_e$  = Effective pore volume of plug

$\alpha_i$  = Characteristic length, direction (i)

$p = \alpha_x/\alpha_y$

$q = \alpha_x/\alpha_z$

$k$  = Horizontal hydraulic conductivity

$i$  = Hydraulic gradient in aquifer

$X$  = Location of plume center along flow axis =  $v^1 t$

$x$  = Location of ( $c/c_0$ ) along flow axis

$y$  = Location of ( $c/c_0$ ), horizontally from  $x$  axis

$z$  = Location of ( $c/c_0$ ), vertically from  $x$  axis

$v^1 = v/n_s$  where  $n_s$  = porosity of aquifer,

$v$  = gross water velocity =  $ki$

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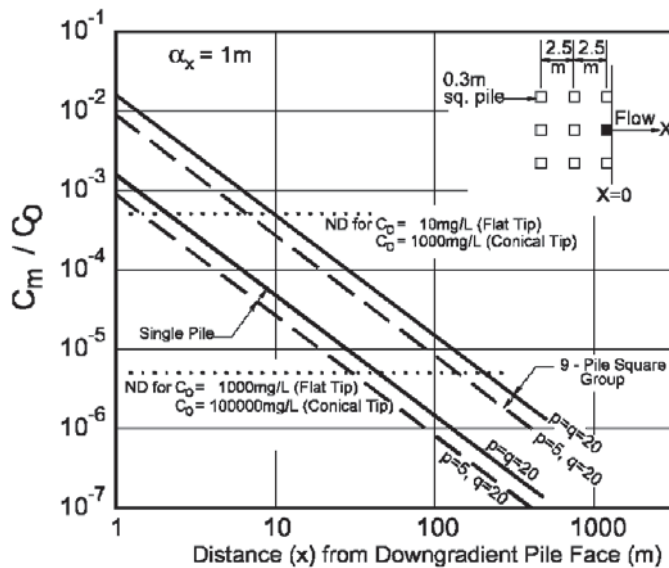


Figure 6 – Dilution of Direct Transfer Contaminants

where  $c_m$  is the maximum concentration in the plume at a distance  $X^1$  from the pile group center and  $N$  is the number of piles in the group.

In most cases, pile driving terminates a short distance into the aquifer because of high tip bearing. Upwards flow is barred by the overlying clay, so virtually all flow is in the aquifer. Mathematically, you can account for this by doubling the contaminant volume, that is, by using ( $V_c$ ) as  $2nV$ . Multiple pile groups can be analyzed using Eq. 1 with superposition, or by Eq. 2 for large relative distances “X”. We calculated the maximum ( $c/c_o$ ) values along the x-axis ( $c_m/c_o$ ). The assumed flow/transport parameters are presented in Figure 6, which also illustrates the results in terms of ( $c_m/c_o$ ) for various distances from the downgradient pile face, both for a single pile and for a group of 9 piles.

A useful interpretation of Figure 6 is to evaluate the distance ( $XC_c$ ) from the pile group at which concentrations of

For large relative distances (“X > 20) the contaminant plume is fairly uniform in concentration near its center, and Eq. 1 can be approximated closely by:

$$\frac{c_m}{c_o} = \frac{NV_e \sqrt{pq}}{8(\pi\alpha X^1)^{3/2}} \quad (\text{Eq. 2})$$

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**TABLE 1 - DISTANCES DOWNGRADIENT TO  $C_m < MCL$**

GROUP	MCL (mg/L)	Single Pile $a_{ct}$ (feet)		9 - Pile Group $a_{ct}$ (feet)	
		$c_o = 10 \text{ mg/L}$	$c_o = 1000 \text{ mg/L}$	$c_o = 10 \text{ mg/L}$	$c_o = 1000 \text{ mg/L}$
Pet. Hydrocarbon	0.34	<3	10	<3	30
Heavy Metals	0.015	3	60	12	240
Volatile Organics	0.005	6	140	25	550

various common types of contaminants reach U.S. Environmental Protection Agency (USEPA) "Maximum Contaminant Levels" (MCL's): the maximum concentrations of various constituents that the U.S. EPA will allow in groundwater. Petroleum hydrocarbons, heavy metals, and/or volatile organics are the common contaminants in most industrial settings. Table 1 presents  $x_o$  distances for various initial concentrations  $c_o$  of these groups, again assuming the worst case for Direct Transfer: flat-tipped piles.

This data indicates that direct transfer is negligible for all but the most highly contaminated sites, even with the worst-case assumption on the plug volume (flat pile tip). The results from *Hayman, teal. (1993)* suggest that using conical pile tips reduces ( $V_{ic}$ ) by 1 to almost 3 orders of magnitude. However, there is some reduction in end-bearing with conical tips. The effect of a conical tip on end bearing of the pile was investigated using data from *Meyerhof, (1961)*.

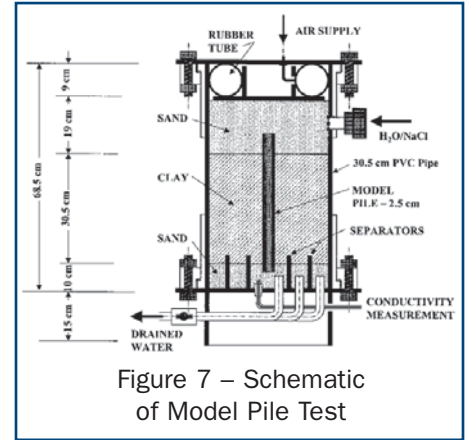


Figure 7 – Schematic of Model Pile Test

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### MODEL STUDIES - CONDUIT AND WICKING

**Model Tests.** We made 6 test chambers, as illustrated in Figure 7. Each test chamber is a 12 inch diameter PVC pipe 27 inches high with sand and clay layers placed to simulate the field conditions of a natural clay aquitard overlying a sand aquifer. The model pile is driven through the clay and then flow induced from top to bottom. The top sand layer distributes the in-flowing "contaminated" permeant uniformly before it enters the clay. The compacted clay layer simulates the aquitard. As the clay was placed, bentonite seals were placed against the chamber walls to minimize wall effects. The bottom sand layer allows collecting and draining the permeant exiting from the clay. This layer is divided by three concentric rings; each sand section has its own collection system so that any edge effects on flow can be accounted for. Each segment also has a conductivity meter for measuring the salinity of its effluent. A rubber "doughnut" above the top sand applies effective overburden pressure to the clay column. The permeant is supplied by a separate pressurized chamber. We used salt water (brine) as the permeant rather than organic chemicals for two reasons: lab safety and ease of concentration measurement. Brine concentration can be determined from simple electric conductivity measurements on the effluent, since salt water is a far better conductor than the original (fresh) pore water.

The clay we used in the tests is also used for liners at the Tangipahoa Parish Regional Solid Waste Facility. It is a sandy clay (CL) with a Liquid Limit of 34 and has about 75% fines. It was compacted into the chamber in 5 layers to about 88% Standard Proctor Compaction.

The model piles we tested were 1 inch in diameter. We used typical pile materials: steel pipe, steel "H", untreated wood, and treated wood. Later, we

plan to include concrete. As controls we had one chamber with no pile and one chamber with an almost full-length sand "pile" to represent the best and worst possible cases for flow. After the clay was placed, we pushed the steel and wood piles into place, then filled the top with water and applied pressure. During the tests, we made periodic measurements of flow and electrical conductivity. The measurements were made for all three collection rings individually.

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After some 2,400 hours of permeation, we replaced the water with brine and continued another 1,400 hours. We performed two identical sets of such tests, using fresh soil for the second set.

**Model Test Results.** We analyzed the results two ways: first by the effect on flow and secondly by the change in electrical conductivity (which measured brine transport). Only the data from the innermost collection ring was used, since that ring would have the most effect from the model piles and the least effect from seepage along the soil/PVC interface at the sidewall of the chamber.

Flow was evaluated by calculating the hydraulic conductivity (“permeability”) of the center ring directly from Darcy’s Law:

$$k = Q/4A \quad (\text{Eq. 3})$$

Where

$k$  = Hydraulic Conductivity (cm/sec)

$Q$  = Flow Rate measured from innermost ring (cm<sup>3</sup>/sec)

$4$  = Gross Hydraulic Gradient (about 25)

$A$  = Soil Area above innermost ring, measured horizontally (cm<sup>2</sup>)

The results from the water phases of the two sets of tests were averaged and are illustrated in Figure 8. The brine phase results did not differ to any significant degree. It is clear from Figure 8

that, compared with the no-pile control (which represents a site without piles):

- Steel pipe and treated wood piles caused little change in the flow rate.
- Steel “H” piles caused some change; enough to make the hydraulic conductivity exceed the LDEQ/EPA liner standard of  $1 \times 10^{-7}$  cm/sec.
- Untreated wood piles caused a significant change in flow.

The difference between the behaviors of the pipe and “H” piles is most likely because of the differences in lateral pressures the two pile types develop during driving. The pipe displaces some 6 times the volume of soil displaced by the “H”. This creates far more lateral pressure of the soil against the pile, actually more than the soil’s passive pressure. The displacement-type piles therefore, have a greater tendency to seal any annulus developed during driving. Both types of wood piles are displacement-type piles, but the untreated wood is more permeable, resulting in “wicking” action in the pile material. This “wicking” phenomenon was also observed by *Hayman, et.al., (1993)*.

The electrical conductivity measurements during the brine permeation phase showed the “contaminant” transport behavior of the various tests. To simplify, we measured the effect by the ratio ( $R_c$ ) of the change in conductivity (over background) to the input brine’s conductivity over background. Again, only data from the innermost collection ring was analysed. The results are presented on Figure 9. In that figure,  $c$  = measured conductivity,  $c_o$  = background conductivity, and  $c_b$  = brine conductivity.

The results track those for flow closely. The treated wood and steel pipe piles showed even less increase in relative concentration than did the no-pile case, probably because such piles densify the surrounding soils; increased density causes lower hydraulic conductivity. The untreated wood and steel “H” piles showed increases



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in relative concentration approaching those for the sand pile case.

### CONCLUSIONS

This study and that by Hayman, *et.al.* (1993) were on two different types of contaminants; ionics (UNO) and volatile organics (Hayman). Yet, they both led to the same conclusions where they overlapped. This study also extended the pile types considered. Overall, we concluded that:

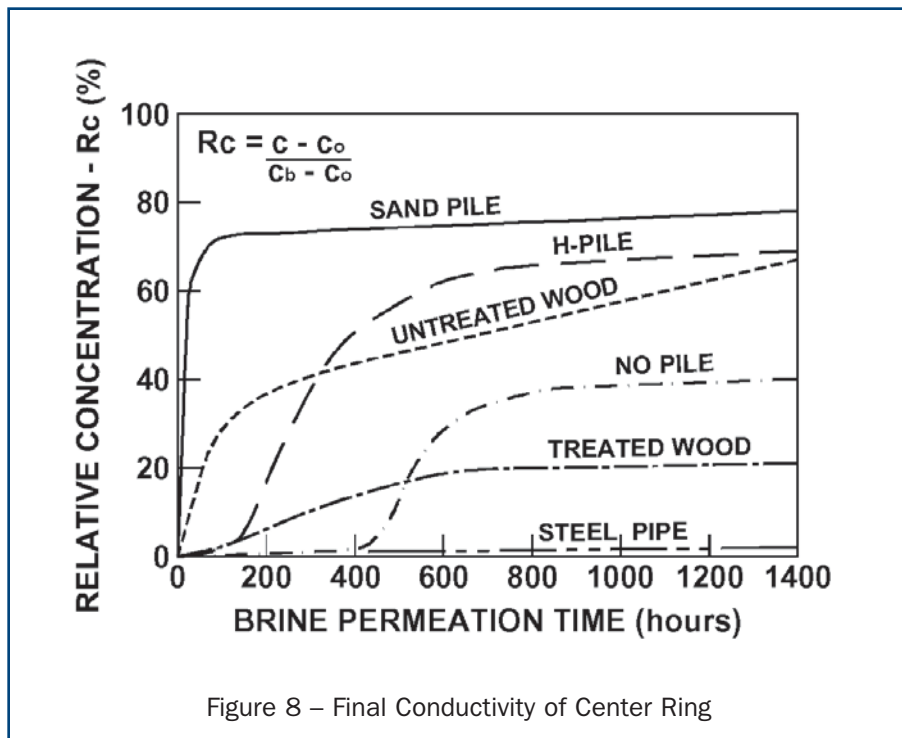
- Displacement-type piles (wood, steel, and probably concrete) do not form conduits for contaminant migration.
- Non-displacement piles (steel “H”) do form such conduits.
- Untreated wood allows contaminant “wicking”, but treated wood does not.
- The effect of Direct Transfer (plug) is negligible, and can be made virtually undetectable by using pointed pile tips.

These findings lead to an important general conclusion: proper pile selection and tip design prevent the contaminant transfer that some regulators are concerned about.

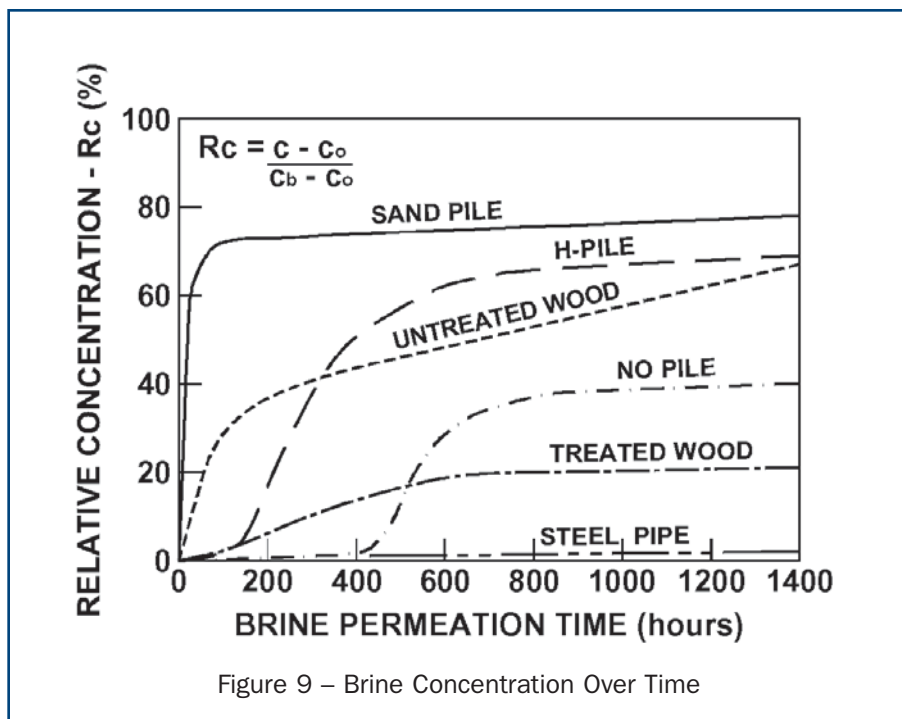
UNO is conducting further tests, including bored piles (drilled shafts), driven concrete piles, different pile embedments, etc. This work will extend the present study to made the results even more useful to the design and environmental communities. ▼

---

Dr. Gordon Boutwell, P.E., is president of Soil Testing Engineers, Inc., Baton Rouge, Louisiana, and an adjunct professor of civil engineering at the University of New Orleans. He holds BCE and MSCE degrees from Georgia Tech and a PhD from Duke. He has been a practicing geotechnical engineer in Louisiana for almost 40 years. He is a licensed professional engineer in Louisiana and Mississippi and is a member of the editorial board of ASCE.



**We civil engineers frequently work on expansions of existing industrial plants, which may have near-surface zones containing some contaminants.**



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A very similar version of this article appeared in the February 2001 issue of *The Louisiana Civil Engineer*.


<sup>(1)</sup> President, Soil Testing Engineers, Baton Rouge, Louisiana.

<sup>(2)</sup> Professor of Civil Engineering, University of New Orleans.



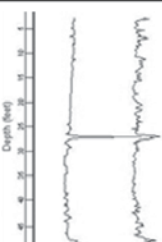
<sup>(3)</sup> Chairman, Department of Civil Engineering, University of New Orleans.



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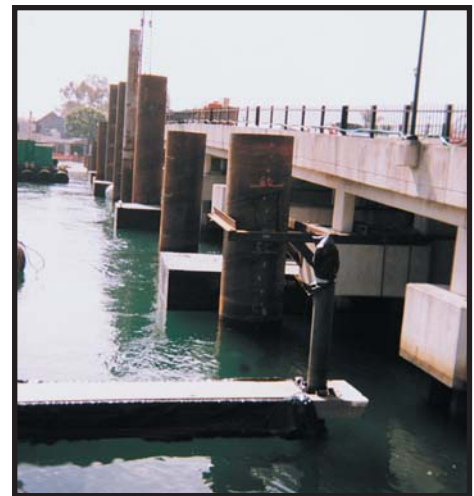
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# DR. GEORGE GOBLE Recalls 40 Years of Changes in the Pile-driving Industry

By Lisa Kopochinski, *Pile Driver Editor*

If you ask Dr. George Goble what he enjoys most about the pile-driving industry, an industry he's worked in for 40 years, he'll tell you, without a doubt, it's the people.

"I've always enjoyed the time I've spent on the job site. This industry consists of a lot of colorful and delightful people," he says.

Even after four decades and retiring from three places – the University of Colorado, Boulder; Pile Dynamics Inc. (PDI); and GRL, he is still busy in the industry.

He does consulting work in the deep foundations area and conducts numerous continuing education seminars. He is also active with the PDCA Technical Committee and the Education Committee. About 15 years ago, he started a business that tests and load rates bridges and is still involved with that. "I suppose that the pile-driving industry is the nearest thing that I have as a hobby. I don't make much money in it, so I guess it must be a hobby."

Goble, who was born on a farm near Boise, Idaho, earned a Bachelor of Science degree in civil engineering from the University of Idaho in Moscow in 1951. The Korean War started in 1950 and, immediately upon graduation from the University, he served two years with the Air Force. After that, he worked as a bridge construction inspector for the Oregon Highway Department for two years. He then went to graduate school at the University of Washington at Seattle where he received an M.S. degree in structural engineering in 1957 and a Ph.D. in the same discipline in 1961. He spent the academic year of

1957-58 as a Fulbright student at the Stuttgart Technische Hochschule in Stuttgart, Germany.

During the years of his graduate studies, Goble worked as a structural engineer at an industrial facilities design firm in Seattle. He joined the faculty at Case Institute of Technology in Cleveland in 1961.

He was there until 1977 when he moved to the University of Colorado, Boulder as chairman of the civil engineering department and retired from the University of Colorado in 1992.

He says his career in the pile driving industry started in 1964 while on the faculty at Case Institute.

"We developed the capability to measure (routinely) pile top force and motion during hammer impact. From this, we developed methods of analysis that are quite accurate in predicting pile capacity. Also, hammer performance can be evaluated from those measurements. An electronic device was developed that processed the measurements in the field and provided the pile capacity prediction and the hammer performance information after each hammer blow."

This device became known as the Pile Driving Analyzer or PDA. In 1972, he founded Pile Dynamics, Inc. (PDI) to commercialize the PDA and was active with PDI together with

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**Goble was a founding member of PDCA. He recalls that the forming of the association grew out of a conversation he had with Chuck Whitaker, who was with Skyline Steel at that time.**

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"I began a research project that was funded by the Ohio DOT and the Federal Highway Administration. This project continued until I left Case in 1977."

The goal of the project, he says, was to develop methods of predicting the load carrying capacity of a driven pile by making measurements on the pile under the pile driving hammer at the end of driving.

Frank Rausche and Garland Likins, who had been his graduate students on the research project, until about four years ago when he sold his interest to them.

"I also founded GRL Engineers at about the same time as PDI. GRL developed engineering software and does engineering work with the PDA and other devices to help understand

pile driving. The PDA is now used in about 40 countries around the world.”

### PDCA and the industry

Goble was also a founding member of PDCA. He recalls that the forming of the association grew out of a conversation he had with Chuck Whitaker, who was with Skyline Steel at that time.

“I had been in Taiwan and saw the use of cast-in-place piles in applications that were clearly not economical. We talked about the need for an organization that would promote driven piles. Chuck picked it up and did the work of forming the beginning of the organization. He really did a great job in getting it underway and in mobilizing Skyline to support the organization. I was a member of the original board of directors.”

Since the early 1960s, Goble has seen a major metamorphosis in the industry. “The changes in 40 years have been enormous. Hammers have become much bigger, the hydraulic hammer has appeared, hammer performance has become much more reliable, pile capacities have greatly increased, quality of operations is greatly improved and the industry understands pile driving much better.”

Even with the changes and advancements, he says the industry still faces its share of challenges.

“The driven pile is a very high quality deep foundation element,” he explains. “It can be installed in most subsurface conditions in a very cost effective manner. I believe that many designers do not understand this. The challenge facing the industry is to educate engineers about the advantages of the driven pile. PDCA is currently working to provide education for university professors and we’re also doing an annual seminar. We must continually look for other opportunities.”

In his spare time, Goble, who lives near Boulder, CO, enjoys spending time with his wife, Christine, and considers himself to be an avid gardener.

He also enjoys a close relationship with his son, Greg, and daughter, Tanya, who is the executive director of PDCA.

“It is very interesting to have the opportunity to work with one of your children. One sees them in a completely different light. It is sometimes a bit difficult, however, to take orders from them!” he smiles. ▼

**“The changes in 40 years have been enormous.**

**Hammers have become much bigger, the hydraulic hammer has appeared, hammer performance has become much more reliable, pile capacities have greatly increased, quality of operations is greatly improved and the industry understands pile driving much better.”**

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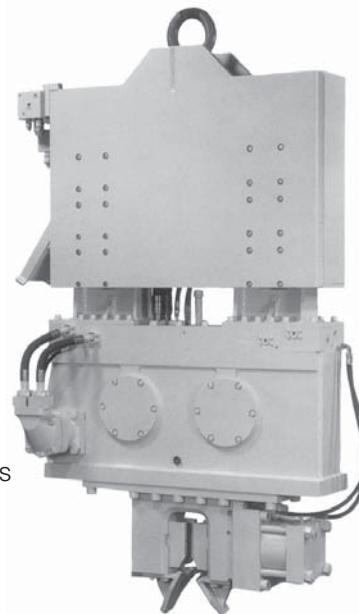
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## Step 1: Select Membership Type

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

- Contractor**  (Annual Gross Sales >\$1 Mil./year: \$700/year).  (Annual Gross Sales <\$1 Mil./year: \$350/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 (\$700/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. 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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#### Step 4. Company Description (complete only the category for which you are applying)

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

- |  |  |                                       |
|--|--|---------------------------------------|
| <input type="checkbox"/> Bridge Building         | <input type="checkbox"/> Docks & Wharves       | <input type="checkbox"/> Marine       |
| <input type="checkbox"/> Bulkheads               | <input type="checkbox"/> Earth Retention       | <input type="checkbox"/> Pile Driving |
| <input type="checkbox"/> Deep Dynamic Compaction | <input type="checkbox"/> General               | <input type="checkbox"/> Other _____  |
| <input type="checkbox"/> Deep Excavation         | <input type="checkbox"/> Highway & Heavy Civil |                                       |

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

###### Accessories

- |  |   |   |
|--|---|---|
| <input type="checkbox"/> Cutter Heads & Drill Bits | <input type="checkbox"/> Lubricants & Greases   | <input type="checkbox"/> Safety Equipment |
| <input type="checkbox"/> Dock & Marine Supplies    | <input type="checkbox"/> Pile Cushions          | <input type="checkbox"/> Other _____      |
| <input type="checkbox"/> Hammer Cushions           | <input type="checkbox"/> Pile Points & Splicers |   |
| <input type="checkbox"/> Hoses & Fittings          | <input type="checkbox"/> Rigging Supplies       |   |

###### Applications Systems

- |   |   |  |
|---|---|--|
| <input type="checkbox"/> Aluminum Sheet Piles     | <input type="checkbox"/> Steel Pipe Piles           | <input type="checkbox"/> Timber Piles/Treated Lumber & Timbers |
| <input type="checkbox"/> Coatings & Chemicals     | <input type="checkbox"/> Steel Sheet Piles          | <input type="checkbox"/> Concrete Piles                        |
| <input type="checkbox"/> Structural Steel         | <input type="checkbox"/> Vinyl Sheet Piles          | <input type="checkbox"/> Composite Piles                       |
| <input type="checkbox"/> Synthetic Material Piles | <input type="checkbox"/> Other Structural Materials | <input type="checkbox"/> H-Piles                               |
| <input type="checkbox"/> Other _____              |   |  |

###### Equipment

- |   |  |   |
|---|--|---|
| <input type="checkbox"/> Air Compressors      | <input type="checkbox"/> Hammers               | <input type="checkbox"/> Specialized Rigs & Equipment |
| <input type="checkbox"/> Cranes               | <input type="checkbox"/> Hydraulic Power Packs | <input type="checkbox"/> Other                        |
| <input type="checkbox"/> Drill Equipment      | <input type="checkbox"/> Leads & Spotters      |   |
| <input type="checkbox"/> Drive Caps & Inserts | <input type="checkbox"/> Pumps                 |   |

###### Services

- |  |   |   |
|--|---|---|
| <input type="checkbox"/> Consulting        | <input type="checkbox"/> Marine Drayage | <input type="checkbox"/> Vibration Monitoring _____ |
| <input type="checkbox"/> Design            | <input type="checkbox"/> Surveying      | <input type="checkbox"/> Other _____                |
| <input type="checkbox"/> Freight Brokerage | <input type="checkbox"/> Testing        |   |
| <input type="checkbox"/> Geotechnical      | <input type="checkbox"/> Trucking       |   |

###### General

- |                                 |                                |                                      |                                      |
|---------------------------------|--------------------------------|--------------------------------------|--------------------------------------|
| <input type="checkbox"/> Rental | <input type="checkbox"/> Sales | <input type="checkbox"/> Other _____ | <input type="checkbox"/> Other _____ |
|---------------------------------|--------------------------------|--------------------------------------|--------------------------------------|

##### C. Technical Affiliate Only (check all that apply)

- |                                       |   |  |  |
|---------------------------------------|---|--|--|
| <input type="checkbox"/> Analysis     | <input type="checkbox"/> Civil & Design       | <input type="checkbox"/> Consulting              | <input type="checkbox"/> Educational/Association |
| <input type="checkbox"/> Geotechnical | <input type="checkbox"/> Materials Testing    | <input type="checkbox"/> Pile Driving Monitoring |  |
| <input type="checkbox"/> Surveying    | <input type="checkbox"/> Vibration Monitoring | <input type="checkbox"/> Other                   |  |

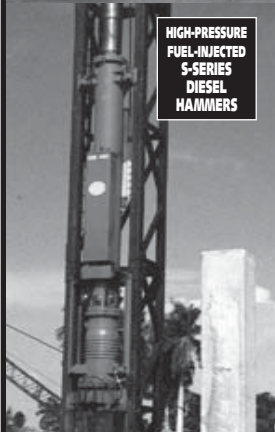
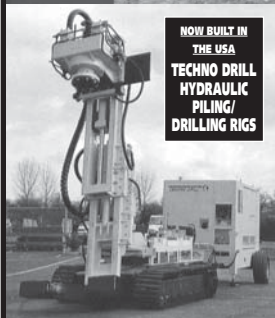
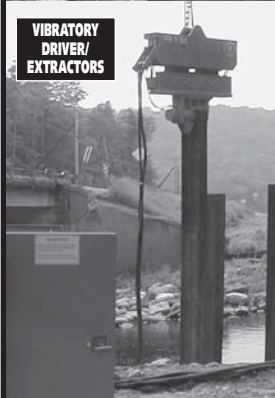
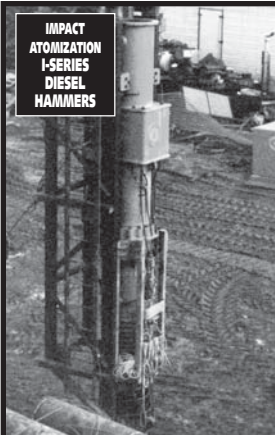
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(All applicants check all that apply)

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| <input type="checkbox"/> AK         | <input type="checkbox"/> DC | <input type="checkbox"/> IL | <input type="checkbox"/> ME | <input type="checkbox"/> ND | <input type="checkbox"/> OK | <input type="checkbox"/> TX | <input type="checkbox"/> WY     |
| <input type="checkbox"/> AL         | <input type="checkbox"/> DE | <input type="checkbox"/> IN | <input type="checkbox"/> MI | <input type="checkbox"/> NH | <input type="checkbox"/> OR | <input type="checkbox"/> UT | <input type="checkbox"/> Canada |
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As a means of recognizing noteworthy contributions to the industry, PDCA will recognize two outstanding projects (contract values <\$200,000 and > \$200,000) that utilized driven piles to solve foundation problems.

Qualification for nomination requires projects only to involve driven piles, that the pile driving be completed during 2003 or 2004 and that at least one participant was a PDCA member during the year as a contractor, technical affiliate or associate member. Projects will be judged on qualities such as, but not limited to, uniqueness, timeliness, unusual aspects of pile driving or unusual solutions to foundation problems, value engineering or value to the public or industry.

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Winning projects will receive an award at the PDCA 2005 “Winter Roundtable.”

*Nominations will close January 1, 2005*

[www.piledrivers.org](http://www.piledrivers.org)

# Calendar of Events

## February 17-19, 2005

### 9th Annual PDCA

### Winter Roundtable Conference

Francis Marion Hotel

Charleston, South Carolina

## June 17-24, 2005

### PDCA Professors Piling Institute

Utah State University

Logan, Utah

## September 15-16, 2005

### PDCA Design & Installation

### of Driven Piles Seminar

Sheraton Framingham Hotel

Boston, Massachusetts



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# PDCA New Member List

We would like to welcome the following new members. Please visit the PDCA Web site at [www.piledrivers.org](http://www.piledrivers.org) and click on Member Search for complete contact information on all members.

## NEW CONTRACTOR MEMBERS

### Cianbro

Pittsfield, Maine  
Contact: Tom Ruksznis  
Services provided: bridge building, bulkheads, docks and wharves, earth retention, general contracting, marine, pile driving.

### Hal Jones Contractor, Inc.

Jacksonville, Florida  
Contact: Paul C. Kirkland  
Services provided: bridge building, bulkheads, docks and wharves, pile driving, marine.

### R.L. Morrison and Sons

McClellanville, South Carolina  
Michael Morrison  
Services provided:  
pile-driving contractor.

### Signor Enterprises

Austin, Texas  
Contact: Rusty Signor  
Services provided: pile-driving contractor

### Williams Brothers Construction Co.

Houston, Texas  
Contact: James Pitcock  
Services provided: pile driving, bridge building.

## NEW ASSOCIATE MEMBERS

### AB Chance / Hubbell Power Systems

Centralia, Missouri  
Contact: Rich Zinser  
Services provided: composite piles, helical steel piers, steel pipe piles, drill equipment, drive caps and inserts, leads and spotters, marine equipment.

### CDS Manufacturing

Quincy, Florida  
Contact: Clayton Sembler  
Services provided: concrete piles, trucking services.

### Geotechnics

East Pittsburg, Pennsylvania  
Contact: Larry Wetzel  
Services provided:  
Deep foundation testing.

### International Construction Services, Inc.

Pittsburg, Pennsylvania  
Contact: Brian Land  
Services provided: coatings and chemicals, steel pipe piles, steel sheet piles, H-piles.

### 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

### Shawn "Tiny" J. Etier

GS2 Engineering & Environmental Consultants, Inc.  
Charleston, South Carolina  
Services provided: geotechnical engineering, pile-driving monitoring, vibration monitoring.

### Allan Yourman

Diaz-Yourman Associates  
Santa Ana, California  
Services provided:  
geotechnical engineering.



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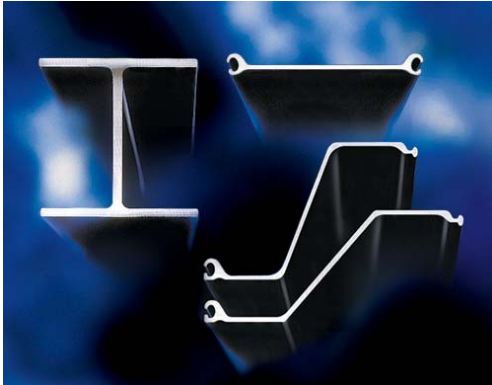
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**SHEET PILING TECHNICAL DATA**

Section Designation	AREA		WIDTH		HEIGHT		WEIGHT (MASS)				MOMENT OF INERTIA		SECTION MODULUS				SURFACE AREA			
	in <sup>2</sup>	cm <sup>2</sup>	in	mm	in	mm	lb/ft	kg/m <sup>2</sup>	lb/ft <sup>2</sup>	kg/m <sup>2</sup>	in <sup>4</sup>	cm <sup>4</sup>	Per Single	Per Wall	Per Single	Per Wall	Total Area	Nominal Area*	Total Area	Nominal Area*
<b>P222</b>	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
<b>P227</b>	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
<b>PS27.5</b>	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
<b>PS31</b>	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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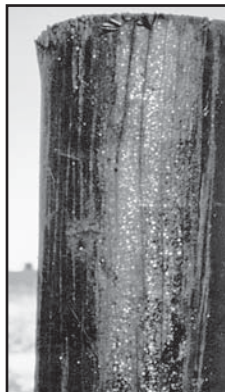
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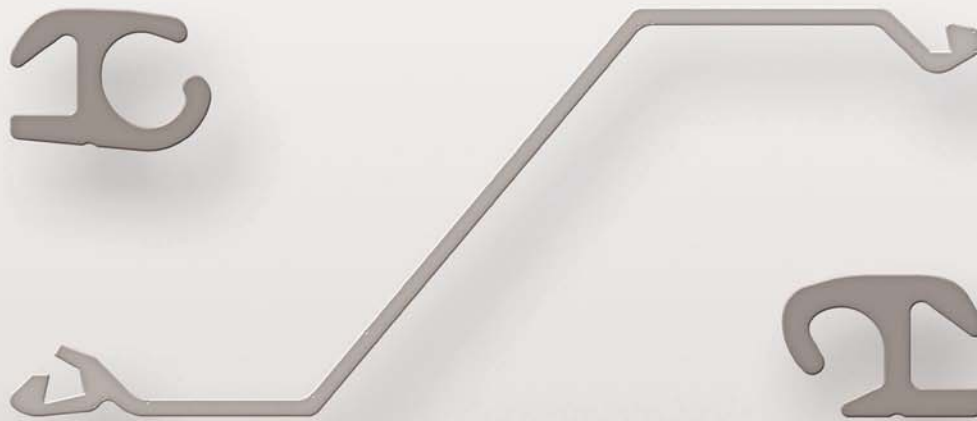
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