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PILEDRIVER

THE OFFICIAL PUBLICATION OF THE PILE DRIVING CONTRACTORS ASSOCIATION | Q1 2005 VOL. 2, NO. 2

PROJECT SPOTLIGHT:

PDCA Project of the Year

The new L'Auberge du Lac Hotel and Casino

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COVER:
The new L'Auberge du Lac Hotel and Casino in Lake Charles, Louisiana is the 2004 PDCA Project of the Year! Photo: Patrick Mercantel, Focal Point Media

We Have Great Things Planned!

By Randy Dietel, PDCA President

For those of you who did not attend our ninth Annual Winter Roundtable Conference in Charleston, S.C. in mid-February, I can only say you missed several very good opportunities to experience an assortment of the wonderful things that PDCA offers its members and those associated with the profession of driven-pile foundations.

Even though our Executive Director Tanya Goble will be highlighting the conference in this same issue, I feel compelled to tell you that we had some excellent presentations, a great host city, a fantastic hotel, a special program for the spouses and wonderful weather. As a bonus, we also offered several short courses, which counted for continuing educational credits.

Our first local chapter, the PDCA Chapter of South Carolina, under the able leadership of Harry Robbins and John King, were invaluable to making this conference a success. The chapter also hosted a dinner for the PDCA board of directors at the Citadel Alumni Center on campus and a subsequent walking tour led by one of their resident professors, Dr. Keith Plemmons.

I am happy to say that we are offering our Professors Institute again this year. It is our third time to do so and it will be held again from June 19-24 on the enchanting campus of Utah State University, which is nestled in the quaint valley of Logan. We have room for 25 participants and there are only a few slots available at the time of this writing.

If you are a university professor or know a professor who you would like to sponsor to attend this week-long institute, I encourage you to make reservations with our home office as soon as possible.

This course also provides attendees with an actual "in-the-field" pile-driving experience, along with the rigging and running of a pile load test. PDCA contractor member Richard Stromness, of Build, Inc., has agreed to again provide the pile-driving crew and equipment.

These first-hand experiences, along with handouts, CDs and a workbook are given to each participant. This program provides the best opportunity available to learn under the tutelage of some of the most knowledgeable professors in the United States. The Professors Institute is not scheduled to be offered again until 2007.

One of the most rewarding experiences I have had while associated with the PDCA is the personal comments, thank-you notes and phone calls we have received from attendees of this workshop for professors. It is one of the best programs of work we have initiated. ▼

Students Tour PDCA Member Jobsite

A group of civil engineering students from the University of North Florida visited a jobsite of PDCA Member Ed Waters and Sons Contracting Co., Inc. in Jacksonville, Florida on March 4. The students observed several phases of bulkhead construction, including the installation of steel sheet pile using a vibratory hammer, the installation of tiebacks and the construction of a concrete cap. The class was lead by Dr. Nick Hudyma, a participant in the 2003 Professors Piling Institute. ▼

2005 Winter Roundtable Conference Review

By Tanya Goble, PDCA Executive Director

Historic Charleston, South Carolina provided a beautiful setting for this year's Winter Roundtable Conference and was greatly enjoyed by all. This year's conference was among the best-attended Winter Roundtables as well as the most profitable conference to date for the PDCA. Revenues from this event provide a significant source of funding for other PDCA activities. Thanks to all of you who attended, exhibited or sponsored the conference.

Short Courses

The conference got started with two one-day short courses, which received stellar reviews from the approximately 45 people in attendance. *Driven Pile Foundation Inspection* was delivered by Jerry DiMaggio and Richard Barrow of the FHWA. This course provided an excellent overview of the driven pile construction from fabrication and delivery to installation and testing for piling contractors and their employees. *Pile Foundation Design, Construction and Quality Control* was delivered by Jerry DiMaggio of the FHWA and Mohammad Hussein of GRL Engineers. This course presented the fundamental principles and modern technologies aiding the design, installation and quality control of driven pile foundations. PDCA sends a big thank you to all three instructors for their generous support of and contributions to the association and piling industry. Look for PDCA to offer new short courses at future Winter Roundtable conferences.

Conference Presentations

The main conference included many outstanding presentations. PDCA wishes to recognize and thank our outstanding speakers. Some of the highlights are shown below.

- William Camp of S&ME presented a case history of a power plant design, showing how using driven piles instead of drilled shafts saved $7 million.
- Jerry DiMaggio of the FHWA provided guidance on the effective use and interpretation of the wave equation program and dynamic pile monitoring.
- Dale Biggers of Boh Bros, presented an overview of a casino resort project that utilized testing to achieve a very efficient use of driven piles. This project is one of the 2004 Project of the Year award winners (foundation value over $1 million) and is presented in this edition of *Piledriver*.
- Ed Hajduk of WPC presented a case history where a large number of H-piles were driven immediately adjacent to a historic building in Charleston with no structural damage from vibrations. This project

Mohammad Hussein, Richard Barrow and Jerry Dimaggio.

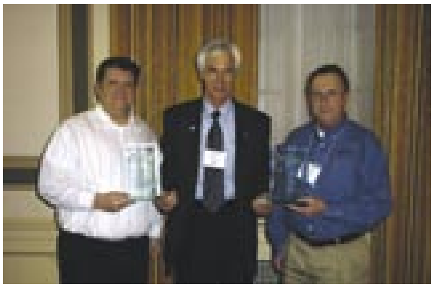
also received a 2004 Project of the Year award (for foundation value under $1 Million) and will be presented in an upcoming edition of *Piledriver* magazine.

- Ed Hajduk of WPC also presented an update on the PDCA National Noise and Vibrations database initiative, which has been very well received by the membership so far.
- Dr. Gordon Boutwell of Soil Testing Engineers discussed the environmental challenges and best practices for pile installation in brownfield sites.
- George Goble discussed the new guide specification for driven pile installation currently under development by the PDCA Technical Committee.

If you are a PDCA member and were unable to attend the Winter Roundtable, we have a few copies left of the conference proceedings. Please call the PDCA office at (303) 517-0421 to request your copy.

2004 Project of the Year Awards

PDCA President Randy Dietel presents Project of the Year award to Dale Biggers of Boh Bros.



PDCA President Randy Dietel presents Project of the Year award to Ed Hajduk of WPC and Harry Robbins of Palmetto Piling.

PDCA 2005 Winter Roundtable Sponsors

A special thanks goes to our Winter Roundtable corporate sponsors. The conference would not have been possible without the generous support of these sponsors, whose contributions make it possible for our attendees to enjoy most of the special events of the Roundtable – from coffee breaks to receptions.

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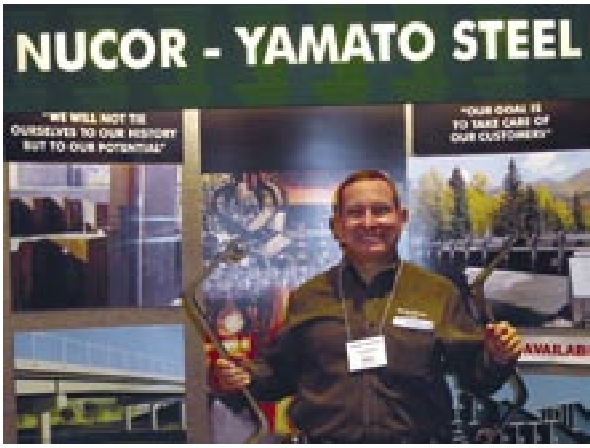

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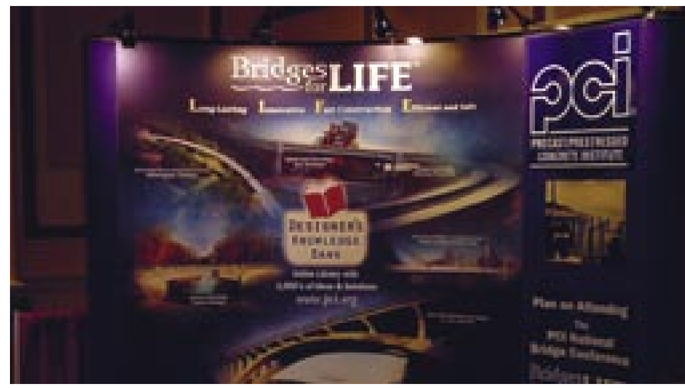

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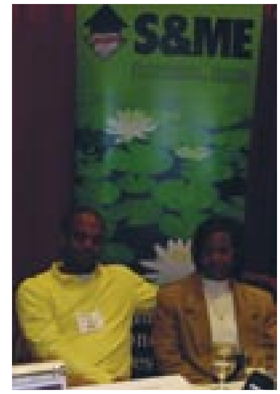

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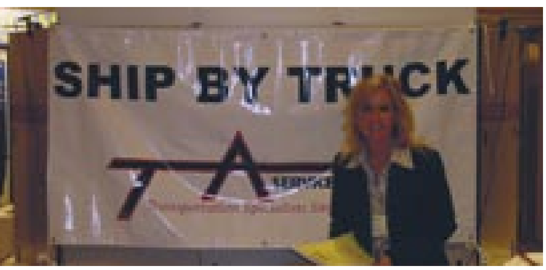

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❑ **(Annual Gross Sales <$1 Mil./year: $350/year)**

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.

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PDCA 2004 PROJECT OF THE YEAR
(Over $1 Million)

PDCA 2004 PROJECT OF THE YEAR: **Over $1 Million**

Bienvenue and Welcome to Louisiana's New L'Auberge du Lac Hotel and Casino!

By Lisa Kopochinski, Piledriver Editor

Louisiana (the most intriguing state in the Union, in this author's opinion) is the home of the exciting new L'Auberge du Lac Hotel and Casino.

The casino, which opens in May, is located in Lake Charles, Louisiana, a locale with a rich and fabled history. This premier facility will be ideal for the business traveler or the customer who is looking for the ultimate in hospitality and dining experiences, plus non-stop gaming action.

The property, owned by Pinnacle Entertainment, Inc., sits on 227 acres and contains approximately 770,000 square feet.

Construction on the project began in September 2003. The architecture was inspired by that found in the Texas Hill County and will provide a unique addition to the gaming market in southern Louisiana. Natural materials, including stone and wood, will set the overall relaxing and welcoming mood of the facility.

Set amidst lush landscaping of the resort's golf course, guests will enter the property through a wood-adorned ceiling vestibule, which leads to a fireplace lobby lounge. This space, reaching up three stories to a beamed ceiling, will be layered with a ring of balconies and lit by skylights providing natural light. The main lobby will feature massive stone fireplaces, defining a lobby lounge on one side and a coffee bar on the other. Warm woods, natural stone and rich fabrics add color and texture to the space (see sidebar).

Driven-pile considerations

L'Auberge due Lac Hotel and Casino was selected as the PDCA Project of the Year (over $1 million) for a number of reasons.

This project was a major $325 million development at a site with unusually poor foundation conditions. Soil conditions



Installation of steel sheet pile to construct casino vessel basin.

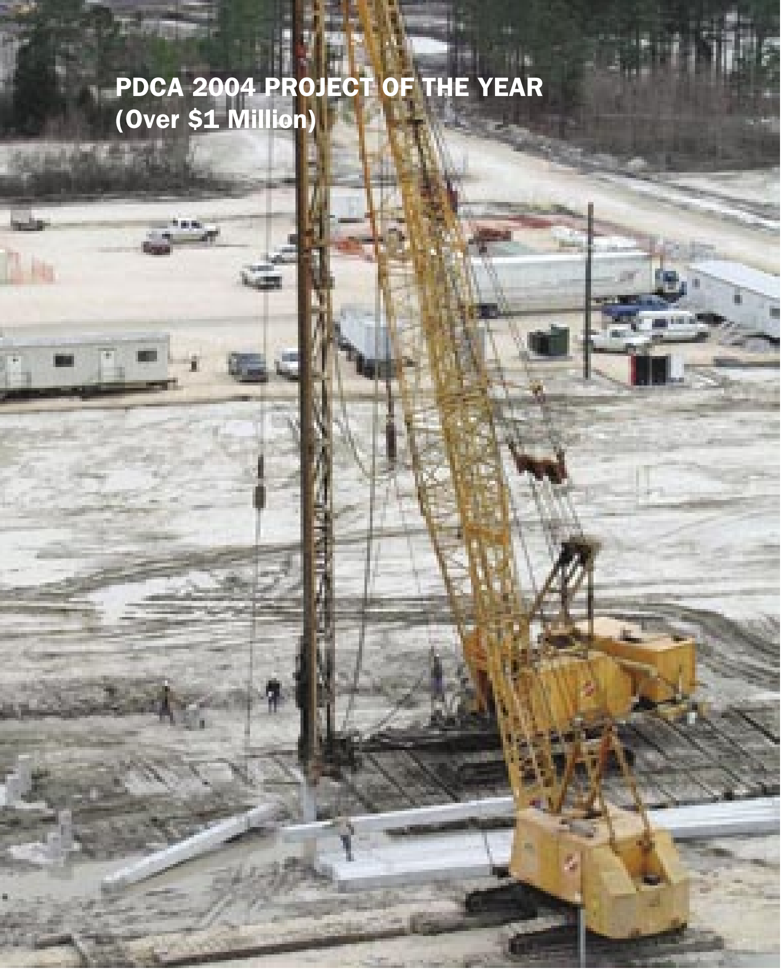
included a shallow stratum of very soft organic clay which had been overlain by a loose, saturated hydraulic fill of silt and sand. Ground subsidence and long-term settlements were a major issue for all of the hotel and other structures, as well as for construction of a boat basin for the floating casino.

PDCA member Boh Bros. Construction Co., LLC of New Orleans, was the piledriver on this fascinating project.

"The project schedule was extremely tight," explains Fred Fuchs, project manager at Boh Bros. "The general contractor, Manhattan Construction Co., had 20 months to complete the project. We worked an expedited schedule from the start with as many as three rigs to install pre-stressed concrete piles rigs and one sheet-pile installation rig."

Many alternatives were seriously considered for this project, including auger cast piles, drilled shafts and ground treatment technologies of a variety of types. Ultimately, more than 35 miles of driven prestressed concrete piles were utilized because of the economy and reliability of this foundation alternate. Steel sheet piling was used for the boat basin and rock structures.

In order to achieve the optimum economy and reliability with the driven pile solution, an extensive test pile program was conducted. Wherever possible, short piles were driven to achieve bearing in a shallow but relatively thin sand stratum. These piles achieved little or no setup after installation. The heaviest loads on the site were founded on deeper piles penetrating to depths of about 80 feet into stiff over consolidated clay. These piles achieved



Installation of prestressed concrete bearing pile.

The Players

Owner: Pinnacle Entertainment, Lake Charles, LA
Piledriving Contractor: Boh Bros. Construction Co., LLC, New Orleans, LA
General Contractor: Manhattan Construction, Lake Charles, LA
Architect: Bergman, Walls & Associates, Las Vegas, NV
Structural Engineer: M.A. Engineering, Las Vegas, NV
Geotechnical Engineer: CBK & Associates, Lake Charles, LA

enormous setup, which was utilized for design and construction to achieve maximum economy. The pile testing program was used to help establish which areas and structures could utilize the shorter and more economical piles. The most heavily loaded structure on the site was the high-rise hotel, which was founded on a pile-supported raft foundation.

"The working relationship between the owner, design engineers, the general contractor, and our personnel was probably the most enjoyable part of the project," says Fuchs. "On-site project manager, Kermit Miller, did a spectacular job of coordinating our crews with the requirements of meeting the critical milestones of pile installation for the various structures."

Design considerations

The major design considerations for bearing piles included the settlement consideration of heavily loaded structures, the additional settlement possible from down drag of the fill overlying the soft organic soils and the installation sequence with the sheet piling in the nearby boat basin. Settlements of the 26-story hotel were a major consideration because of the intense heavy load under this structure. The solution was a pile-supported mat which provided a very stiff and uniform platform for support. The lateral loads on the boat basin sheet piling were quite large for the height of the wall and the bottom of the basin was so soft that bottom stability precluded dewatering the basin without a major subsurface dewatering project. Ground treatment was seriously considered in this area, but the organic soils were difficult to treat economically. Ultimately, the use of cantilever steel sheet piling proved to be the most reliable solution which could be installed in a timely manner with a minimum of disruption to nearby ongoing construction activity.

Obstacles

Fuchs says there were definitely a few problems to be overcome during construction. The first was the thinning of the shallow bearing sand stratum in the area near the river and the fact that short bearing piles in this area did not achieve the required capacity and had little or no setup. Thanks to the early and ongoing testing program, these areas were identified and appropriate modifications made to the installation plan so that the short economical piles could be used where possible, but longer piles used where needed.

Another potential problem was the tendency of some piles to drift off location during installation and a few piles were even broken. Fortunately, due to close inspection on the jobsite by the project geotechnical engineering team, the few damaged

Project Highlights

- Single level riverboat casino with non-stop gaming
- Tom Fazio-designed championship golf course
- Pool and lazy river with a sandy beach and private pool-side cabana courtyard
- First-class spa and fully-equipped exercise facility
- A variety of innovative dining options, including:
- an upscale steakhouse – seating for 150
- a 400-seat buffet
- a 24-hour casual dining experience – seats 150
- a noodle bar featuring Asian-fusion cuisine – seats 36
- a Cajun barbeque brewpub/entertainment lounge – seats 225
- an ice cream parlor
- Coffee bar
- VIP check-in
- Bus center
- Meeting and Events Center
- Performance Venue
- Large Event Lawn
- Arcade
- Retail Shops

piles were quickly identified and additional piles added before a small problem became a large one.

"There were many advantages of a driven-pile foundation on this project since the underlying soils were erratic," explains Fuchs. "Geotechnical Consultant Ron Jones of CBK was onsite nearly everyday to review the pile installation records and to adjust the installation procedures. The extensive test pile program using both dynamic pile testing as well as static load tests was crucial to optimizing the pile lengths and sizes, which resulted in considerable savings in project costs. Since a driven pile is a tested pile, the adequacy of each pile installed was evaluated daily and the project progressed with confidence in the foundation. The old adage that driven piles are cheaper, faster, and safer was proven out on this project. Driven piles allowed for pile caps to be poured within 24 hours of the installation."

Unique Application of Driven Piles

The most innovative aspect of the project was the ongoing inclusion of testing and evaluation during construction to maximize economy of the foundation system and to ensure reliability in spite of variable conditions for pile driving.

"No project is successful without good communication and coordination between all the parties involved," adds Fuchs. "This project was really about the application of tried and true foundation technology with innovation applied to testing and monitoring as a perfect demonstration of the motto "a driven pile is a tested pile." ▼

A shot of the casino and hotel from late February 2005.

Photo: Patrick Mercantel, Focal Point Media

Piledriving Used in the Project

The project included a variety of difficult types of driven piles. A list of the types and lengths is as follows:

- Test Pile Program – an extensive test-pile program was performed using both static and dynamic testing of 16-inch x 16-inch and 18-inch x 18-inch prestressed piles. Static load tests up to 400 tons ultimate load were performed.
- Prestressed Concrete Piles – more than 2,950 prestressed piles were installed, a total of 186,000 linear feet.
- More than 1,050 18-inch square prestressed concrete piles were installed ranging in length from 65 feet to 80 feet. The design load was 120 tons. The piles were pre-drilled using a wet rotary drill and then driven with Vulcan 010 and 012 pile hammers.
- Over 1,900 16-inch x 16 square prestressed concrete piles were installed with lengths ranging from 30 feet to 75 feet. The design load for these piles was 85 tons and driven with Vulcan 010 and 012 pile hammers.
- 14 x 89 x 80 foot steel H-piles were installed at the casino vessel mooring points. The piles were battered 4 on 12 and driven with a Vulcan 010 pile hammer.
- Permanent Steel Sheet Pile – Over 1,575 wall feet of Arbed AZ-26 and AZ-48 steel sheet-pile was installed to form the casino vessel basin. This sheet pile was coated with 16 mils of coal tar epoxy and installed with MKT V35 and ICE 44-50 vibratory hammers.
- Temporary Sheet Pile – a 90 foot x 115 foot cofferdam was installed at the hotel tower elevator core foundation. The cofferdam was constructed of PZ-27 x 40 foot steel-sheet pile.
- Concrete Cylinder piles – Five 54-inch x 56-foot spun-cast post-tensioned cylinder piles were installed to support the vessel emergency egress ramps on the riverside of the casino vessel. A Vulcan 020 pile hammer was used to install these piles.

An Introduction into the **Production and Specification of Steel Pipe**

By Bill Buckland, President, Mandal Pipe Company

To understand the production of steel pipe, we must start at the beginning of basic steel production. Most steel products are downstream, value added products made from these four basic or primary forms of raw steel: ingots, billets, blooms and slabs. These forms can be produced in great volumes and are easily re-heated, extruded, squeezed or formed into many other configurations so as to make virtually every steel product used today.

Steel pipe is produced from two of these basic forms of steel, the round billet and the slab. A billet is a solid round bar of steel used to produce many other downstream products such as seamless pipe. The other types of steel pipe are produced from slabs, which are solid rectangular blocks of steel. The slabs are reheated and processed into plate and coils.

There are four methods used to produce steel pipe: Fusion Weld, Electric Resistance Weld, Seamless and Double Submerged Arc Weld.

Fusion Weld

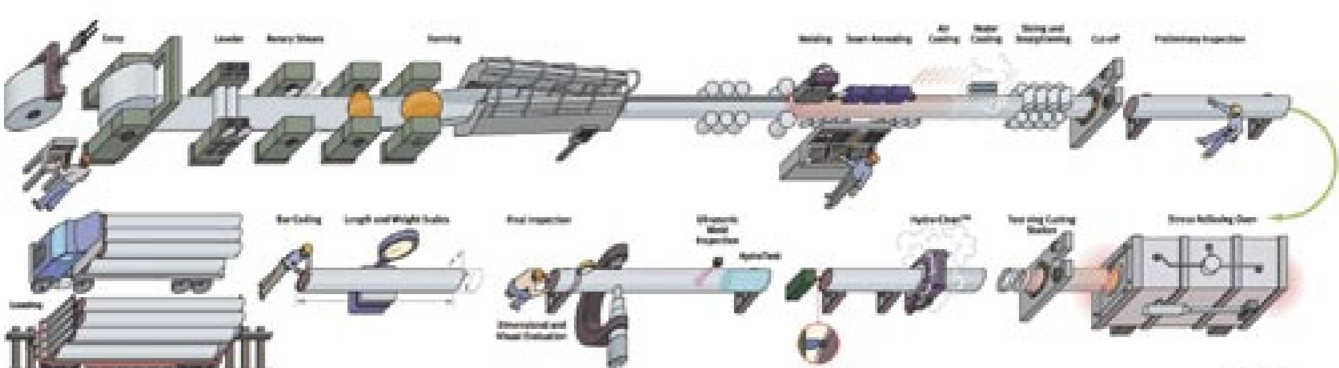
One process for producing pipe is Fusion Weld, sometimes called "Continuous Weld" and is produced in sizes 1/8" to 4-1/2". Fusion Weld pipe begins as coiled steel of the required width and thickness for the size and weight of pipe to be made. Successive coils of steel are welded end to end to form a continuous ribbon of steel. The ribbon of steel is fed into a leveler and then into a gas furnace where it is heated to the required temperature for forming and fusing. The forming rolls at the end of the furnace shape the heated skelp into an oval. The edges of the skelp are then firmly pressed together by rolls to obtain a forged weld. The heat of the skelp, combined with the pressure exerted by the rolls, form the weld. No metal is added into the operation. Final sizing rolls bring the pipe into its required dimensions.

Seamless Pipe (SMLS)

Seamless Pipe is made when steel in a solid, round cylindrical shape, called a "billet" or a "tube round" is heated and then either pushed or pulled (while being rapidly rotated) over a mandrel with a piercing point positioned in the center of the billet. This activity produces a hollow tube or "shell". The tube is then further finished until it becomes the size and wall thickness desired. (Because the pipe is formed in a heated manner the pipe is normalized and should have a consistent steel cellular pattern throughout its circumference). Seamless pipe is made in sizes from 1/8" to 26" and is widely used in construction, oil refining, chemical and petro-chemical industries. It is available in heavy wall thicknesses and exotic chemistries, and is suitable for coiling, flanging and threading. It is, however, expensive, in short supply and unavailable in long lengths.

Electric Resistance Weld

The processing of Electric Resistance Welded (ERW) pipe begins as a coiled plate of steel with appropriate thickness and specific width to form a pipe that conforms to its relevant specification. ERW pipe is cold formed. The ribbon is pulled



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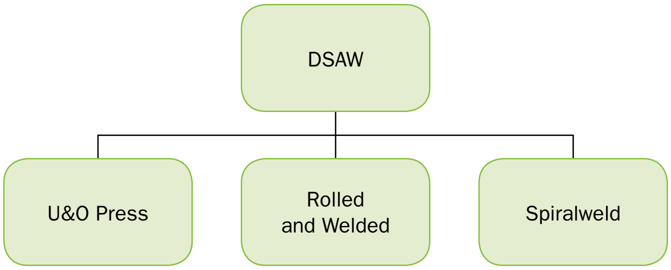
through a series of rollers that gradually form it into a cylindrical tube. As the edges of the now cylindrical plate come together, an electric charge is applied at the proper points to heat the edges so they can be welded together.

Electric Resistance Welded pipe is a high speed production product that can be made in continuous lengths up to 115'. It produces uniform wall thicknesses and outside dimensions and is made in a wide range of specifications. It does, however, require minimum tonnage to set up on a specific size and sometimes has long lead times.

Double Submerged Arc Weld (DSAW)

Submerged Arc Welded (SAW) pipe derives its name from the process wherein the welding arc is submerged in flux while the welding takes place. The flux protects the steel in the weld area from any impurities in the air when heated to welding temperatures. When both inside welds and outside welds are performed, the welding is accomplished in separate processes and the pipe is considered to be Double Submerged Arc Welded (DSAW).

There are three common types of pipe produced by the DSAW process.



U&O Method

The U&O Method is so called because it first uses a "U" press, then an "O" press to complete cylinder forming from 40' long plates ordered to size and grade. The cylinder is then welded inside and outside by the submerged arc process by using as many as five welding wires. Most U&O is cold expanded either mechanically or hydraulically. When it is cold expanded, DSAW pipe gains in yield strength. This method of pipe production produces exceptional quality with exact dimensional tolerances. The primary use of this type of pipe is gas and oil transmission. It requires large minimum tonnages for size setup and is only produced domestically in 40-foot lengths.

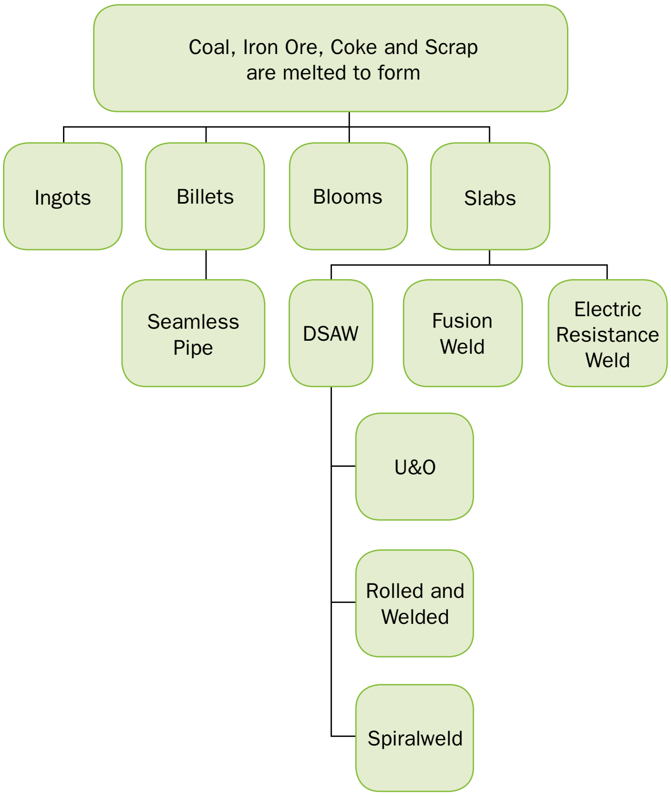
Rolled and Welded

This method of manufacturing is also called the "Pyramid Roll Method" because it uses three rolls arranged in a pyramidal structure. The plate, ordered by grade and thickness, is rolled back and forth between the pyramid rolls until the cylinder is formed. The cylinder is then moved to the welding stations. Most pyramid rolls are 20 feet in length or shorter. Greater lengths are achieved by girth welding the five-foot, 10-foot or 20-foot sections (or cans) together. Berg Steel is the only producer capable of rolling 40-foot plates without a mid-weld and it is the only producer capable of sizing its product. Rolled and welded pipe has the advantage of being rolled in small quantities with short lead times. It can be produced in very large diameters, either ID or OD, and in extremely thick walls. Since the cans are short in length, the production of composite piles or pieces varying in yield and tensile are easily attained. The rate of production of this material is slow and the cost is high due to multiple girth welds.

Spiral Weld

Spiralweld pipe is a steel pipe having a DSAW seam the entire length of the pipe in a spiral form. The outside diameter is determined by the angle of the de-coiled steel against the forming head. The more acute the angle, the greater the diameter. The production of large, hot rolled coils of sufficient width and the development of dependable non-destructive testing methods has enabled this product to be placed in more demanding service. Spiralweld pipe can be rolled in exact lengths up to 115 feet in either ID or OD dimensions up to 144 inches. There is a minimum tonnage required for rolling. Because the manufacturing process is slow, it gives the contractor an advantage of short term changes to the order. This same slow production can also be a disadvantage when large tonnages are needed with a short lead time. Spiralweld pipe is produced to limited specifications.

Now, if this is confusing to you, don't get discouraged. Steel pipe is a complex world to understand. A few charts might help.



The piling industry uses virtually no Fusion Weld pipe as it is produced in small sizes and is used mostly for plumbing, handrails and fencing. DSAW pipe and ERW pipe are used extensively and to a lesser extent seamless pipe. To illustrate the speed with which each method of production is capable, the following chart will be illustrative. We use the 24" diameter pipe because it is the only size common to all the forms of production.

Manufacturing Output Using 24” OD x .500 Wall Per Eight Hour Shift				
ERW	SMLS	U&O Press	Spiralweld	Rolled & Welded
1000 Tons or 16000’	350 Tons or 6000’	250 Tons or 4000’	50 Tons or 800’	10 Tons or 160’

There are hundreds of specifications governing the production and use of steel pipe. The following chart will examine just a few of the common specifications you will normally see in the piling industry.

Pipe Specifications		
Grade	Domestic Size Range	Usage
ASTM A-53	1/8” thru 26”	Domestic and plumbing piping under normal pressures and temperatures
ASTM A-106	1/8” thru 26”	Seamless pipe for high temperatures and pressures
ASTM A-139	4” and larger	Industrial piping, mainly water
ASTM A-252	Any size	Pipe piling, drilled shafts and other structural applications
ASTM A-500	Maximum 64” OD	Structural applications for welding, riveting or bolted construction
API 5 L	1/8” thru 48”	Oil and natural gas transmission
API 2 B	54” and larger	Rolled and welded for oil and gas offshore platform construction
AWWA C-200	6” and larger	Water and waste water piping

These specifications vary by their production methods.

Methods of Manufacture-Pipe Specifications						
Grade	FW	ERW	SMLS	U&O	SPIRAL	R&W
Domestic size range	1/8”-4”	2”-24”	1/8”-26”	20”-48”	4”-144”	20”-144”
ASTM A-53	Yes	Yes	Yes	No	No	No
ASTM A-106	No	No	Yes	No	No	No
ASTM A-139	No	No	No	Yes	Yes	Yes
ASTM A-252	No	Yes	Yes	Yes	Yes	Yes
ASTM A-500	No	Yes	Yes	No	No	No
API 5 L	Yes	Yes	Yes	Yes	Yes	Yes
AWWA C200	No	Yes	Yes	Yes	Yes	Yes

Digest of Common Specifications				
	A-53	**A-500**	**A-252**	**API 5L**
Type	Type E Type S	Seamless Welded	Seamless ERW, DSAW	Seamless ERW, DSAW
Grades	A B	None	1,2,3	X-42, X-52, X-56, X-60, X-65
Chemistry	% Max C, MN, P, S	% Max of C, P, S	0.05 Max % Phos	C, MN, S, CB, V
Yield	A=30,000 B=35,000	36,000	1=30,000 2=35,000 3=46,000	X-42=42,000 X-52=52,000 X-60=60,000
Tensile	A=48,000 Min PSI B=60,000 Min PSI	58,000	1=50,000 2=60,000 3=66,000	X-42=60,000 X-52=66,000 X-60=75,000
Hydro	Yes	None	None	Yes
Wall Tolerance	Minimum wall not more than 12.5% under nom	+/- 10% of nominal wall thickness	Minimum wall not more than 12.5% under nom	+15%, -12.5%
OD Tolerance	+/- 1% of OD	+/- .75% of OD	+/-1% of OD	+/- .75% of OD
Weight Tolerance	=/- 10% of theoretical weight	None	Not more than 12.5% over or 5% under theoretical weight	Not more than 10% over or 3.5 % under theoretical weight

Each specification will vary slightly from the other as the only specification designed specifically for piling is ASTM A-252. The other specifications, though intended for different uses, can be used in a structural application. The differences, though subtle, may be great enough to cause problems in substitution and care must be taken to evaluate any change.

Notice that there is a weight tolerance for the ASTM A-252 pipe specification and that this tolerance is one half that of A-53. This means that the same wall thickness ordered for one specification may be thinner than that of the other. For instance, if you ordered 24 x .500 ASTM A-53 and same amount of 24 x .500 ASTM A-252, the minimum wall thickness as addressed in the allowable variations section of the specification would be the same. However, the weight tolerance for A-53 is double that of A-252. In other words, the minimum weight allowable for 24 x .500 A-53, whose theoretical weight is 125.61#/ft, is 113.05#/ft (125.61#/ft - 12.6#/ft). But the minimum weight allowable for the 24 x .500 steel pipe under the A-252 specification is 119.33#/ft (125.61#/ft - 6.28#/ft). Put more simply, the mill is allowed to ship as low a wall thickness as .450 under the A-53 specification, but can only ship as low as .475 under the A-252 specification. But, if you followed the wall thickness tolerance only, the mill would be allowed to ship as low as .438 wall (.500 less 12.5%).

For quality control purposes, all the pertinent information about each piece of pipe can be found on the stencil affixed to that pipe. Some mills stencil on the exterior and some on the interior of the tube. Some mills are using the more modern bar codes affixed to the interior of the pipe. Most mills will stencil

Ordering Pipe	
Quantity	Feet, Tons or Pieces
Diameter	OD or ID
Wall Thickness	Standard or Special
Coating	Lacquer or Bare
Method of Manufacture	SMLS, ERW, or DSAW
Specification	ASTM, AWWA, ASME, API
Plain or Threaded	PE, Threaded
End Preparation	Bevel or Square Cut
Length	SRL, DRL, TRL, or Specified
Price	Per Foot or Per Ton
Terms	COD, Net 30, L/C, Discount
Delivery Instructions	Destination, Arrival, FOB

Example	
10,000’	24” OD X .500 Wall Bare ERW ASTM A-252 Gr. 3 Steel Pipe, PE, BEV, in 50’ Lengths
Price:	$81.50/ft.
Terms:	Net 30 Days
Delivery:	Mid March
F.O.B.:	SP/FA Charleston, SC Via Truck

When you are ready to order steel pipe, there are certain parts to the nomenclature that are required. The knowledge of these parts is beneficial to both the seller and purchaser. The more detail that can be imparted to writing, the fewer problems can occur.

additional information needed by the purchaser if instructed at the time of order entry.

There are many quality control tests available for pipe as they pertain to various industries. If you have any questions, you should ask a qualified sales representative.

When you are ready to order steel pipe, there are certain parts to the nomenclature that are required. The knowledge of these parts is beneficial to both the seller and purchaser. The more detail that can be imparted to writing, the fewer problems can occur.

Most of these items are self explanatory. The F.O.B. point, however, is probably the most misunderstood. This item delineates the understanding between the buyer and seller as to how the material is to be delivered. The letters SP mean "Shipping Point" and the letters FA mean "Freight Allowed." It is important to understand that the seller will end his liability for insurance purposes at the shipping point with the material safely loaded to the truck; and, it is at this point that the title of ownership passes hands from the seller to the buyer. The seller will, however, "allow" the freight to the jobsite in his price. The responsibility for the material from point A to point B is for the insurance of the Truck Line. The responsibility for unloading the material is for the Contractor. If the seller were to quote the material F.O.B.: Delivered, he would then take responsibility for the material until it is unloaded to the ground, and the title would not pass to the buyer until the material is safely unloaded. In the event of an accident, the paperwork trail will be very important. Some industries will quote their products "Delivered", such as sod or wall board. Steel pipe, however, is generally quoted at the shipping point, with the freight allowed in the price. Sometimes, the contractor wants the material quoted SP/PPD-ADD. This means that the title will again pass at the shipping point, after safely loading, but the freight will be prepaid and added to the invoice as a separate item. This designation is useful when projects require many truck or rail shipments and the freight cost is a non-taxable item. The pipe will be taxed at the appropriate rate and the freight costs will pass through untaxed. If the contractor wishes to pick up the material on his own trucks or wishes to take responsibility for the shipping, the FOB point will simply state SP (Shipping Point).

The following associations publish their specifications for all to use and it would be prudent to have the proper updated versions of their specifications in your library for reference:

Reference Material

- ASTM (American Society for Testing Material)
- API (American Petroleum Institute)
- ASME (American Society of Mechanical Engineers)
- AWWA (American Water Works Association)
- NAPCA (National Association of Steel Pipe Distributors)
- NACPA (National Association of Pipe Coating Applicators) ▼

Bill Buckland is president of Mandal Pipe Company, located in Atlanta, GA., and has been active in the steel pipe business for more than three decades. He has provided steel pipe for many high profile construction projects throughout the United States. He is currently on the board of directors of the National Association of Steel Pipe Distributors and is chairman of its Education Committee while also a member of the Education Committee for the Pile Driving Contractors Association. Direct your comments to billbuckland@mandalpipe.com.

Reading the Mill Stencil

1. Manufacture-5L – API Registration
2. Hydro pressure 3030, E = symbol for welded pipe
3. Weight/piece and length
4. F = Foreign plate then Heat #
5. SR5=Charpy 70ftLBS @ 23 degrees F
6. ß (supplemental requirement)
7. Customer and purchase order #
8. Size and wall thickness
9. Piece number and grade

THE VIBRATORY PILE INSTALLATION TECHNIQUE

By Kenneth Viking, Ramboll Sverige AB
Email: kenneth.viking@ramboll.se, Web: www.ramboll.se

Part II

Vibratory motion of vibratory driven piles

The penetrative motion, u(t), of a vibratory driven pile is best described by a downwardly-directed sinusoidal motion in-time, in accordance with Figure 4, and the following expression.

$$u(t) = tv_p + s_o \sin(\omega t)$$

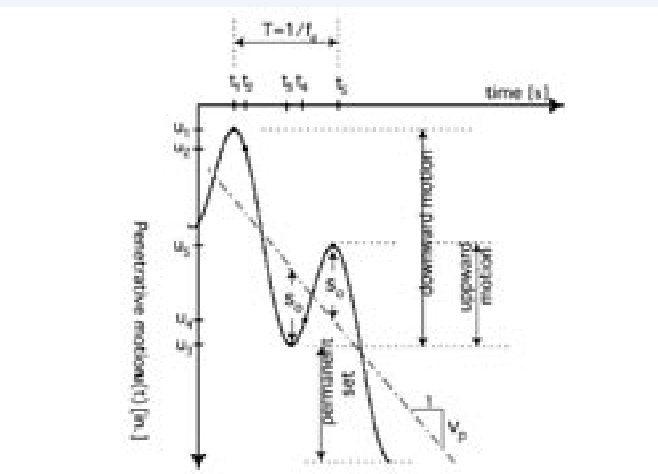


Figure 4. Penetrative motion of a vibratory driven pile, [16].

The magnitude of the penetration speed vp (read vibro-drivability) in the expression of the penetrative motion u(t) corresponds, in theory, to the dynamic equilibrium of the forces acting on the system. These are generally evaluated by applying Newton's second law ($F_o + \xi F_v - R_t - R_s - R_c = am_{dyn}$), as schematically graphed by Figure 5. However, the application of Newton's second law is only justified if the system behaves as a rigid body. Section 'The axial rigidity assumption' describes a rule of thumb, which can be applied in order to check if the vibro-pile-system tends to behave as a rigid body.

The vibro-parameter $S_p=2s_o$, named "displacement amplitude", is normally listed in the specs of vibro-manufacturers. However, the manufacturer-provided specs normally refer to S_p as the peak-to-peak amplitude of a free-hanging vibro-unit, without weight of pile and clamp. However, the theoretically generated displacement amplitude, S_p, of a free-vibrating pile is assessed by the following expression:

$$S_p = \frac{2M_e}{m_{dyn}} = \frac{2M_e\,[\text{lb-in}]}{(m_v\,[\text{lb}] + m_c\,[\text{lb}] + m_p\,[\text{lb}])}$$

The theoretical value of S_p is governed by the dynamic mass m_{dyn} (weight of vibrator m_v, clamp m_{cl}, and pile m_p) and the eccentric moment M_e. However, this is an expression that omits effects of soil resistance as well as developed energy losses; it should therefore be noted by the reader that

Table 2. Recommended choice of vibratory driver parameters in relation to type of soil and pile, after [3].

Cohesive soils	Dense cohesionless soils		Loose cohesionless soils	
All situations	Low toe resistance	High toe resistance	Heavy piles	Light piles
• High acceleration • Low displacement amplitude • Predominant shaft resistance • Requires high acceleration for either shearing or thixotropic transformation	• High acceleration • Predominant shaft resistance • Requires high acceleration for fluidization	• Low frequency, and large displacement amplitude • Predominant toe resistance • Requires high displacement amplitude and low frequency for maximum impact to permit elastoplastic penetration		• High acceleration • Predominant shaft resistance • Requires high acceleration for fluidization
Choice of vibratory driver parameters in relation to type of soil and pile				
f_d >40 Hz	f_d : 10-40 Hz	f_d : 4-16 Hz		f_d : 10-40 Hz
a: 6-20 g	a: 5-15 g	a: 3-14 g		a: 5-15 g
S_p: 0.04-0.4 in	S_p: 0.04-0.4 in	S_p: 0.35-0.78 in		S_p: 0.04-0.4 in

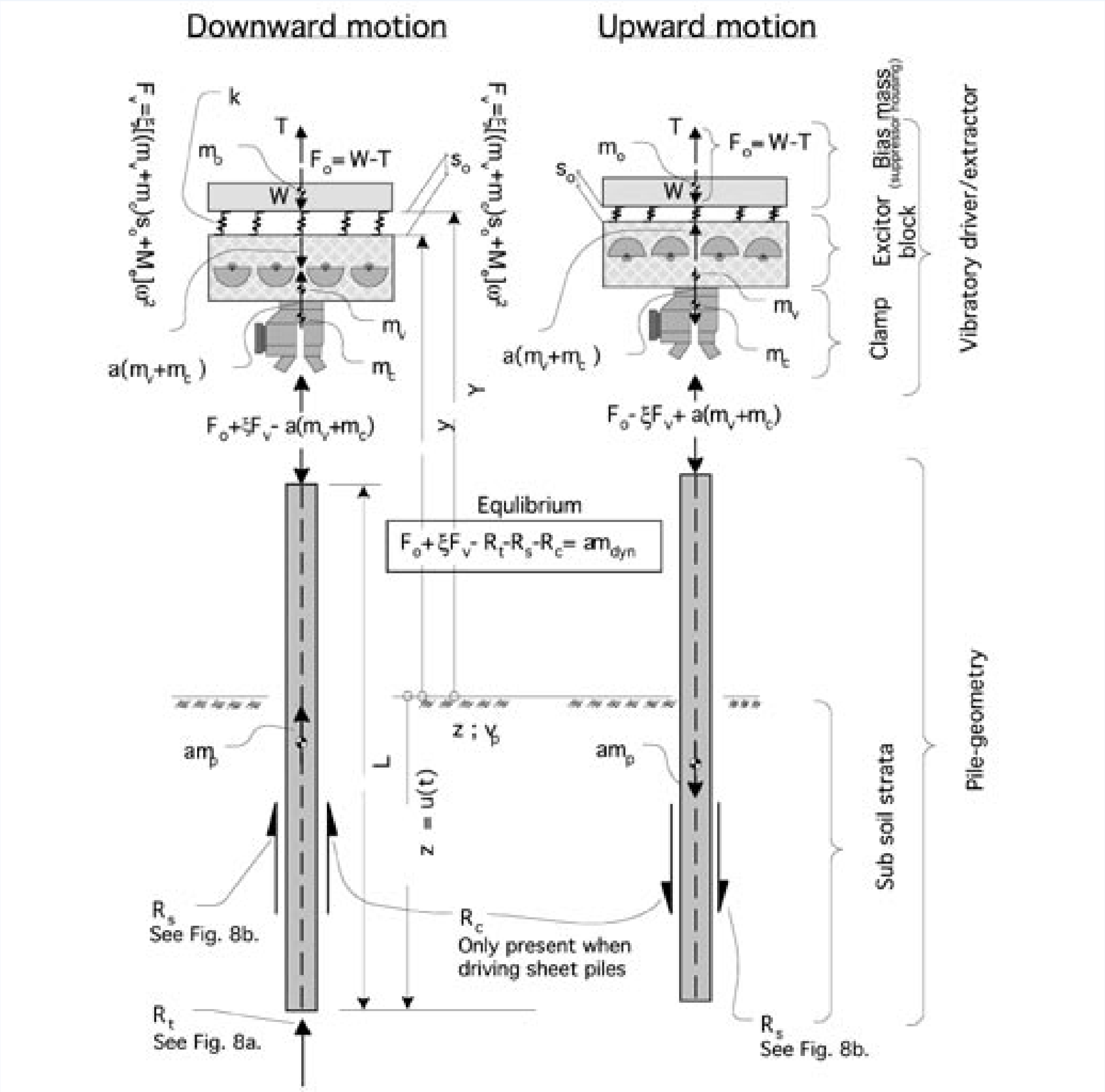


Figure 5. Forces at play when driving piles (free-hanging vibro equipment), after [16].

the in-field observed value of S_p will always be less than the theoretically estimated value.

Choice of vibratory driver-related parameters

Choice of vibro-parameters amongst practitioners is generally based on previous experience and field verifications. Authors of [3] have summarized their experience into a table recommending driving frequency and displacement amplitude for different piles and soil types. Those recommendations are reproduced herein as Table 2.

The following vibro-parameters are not mentioned, or chosen in a different range, than those summarized by Table 2. They are based on recent developments, author's experience and new features of modern equipment.

- System efficiency: just a few published experiences exist regarding measurements of ξ. From these experiences, field conditions could be estimated to be in the range 66<ξ<75 percent. But, until further research is conducted regarding internal energy losses in every part of the vibro-system, accurate terms of ξ cannot be incorporated into the theoretical computation of F_d.

- Surcharge force: optimum ratio between surcharge force and peak value of centrifugal force appears to be in the vicinity of F_o/F_v~½, and theoretically not to exceed F_o/F_v>1.0.

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Domestic Pipe Suppliers: SAW Pipes and Berg Steel

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Table 1. Type of modern vibratory drivers/extractors.				
Type	Frequency range [rpm]	Eccentric moment M_e [lb-in.]	Max F_v force [tons]	Displacement amplitude S_p [in.]
1. Standard frequency	<1,800	20,835	517	1.26
2. High frequency	>1,800	520 - 3,980	45 - 303	0.51 - 0.87
3. Variable eccentricity	1,800 - 2,400	866 - 4,670	67 - 371	0.55 - 0.67
4. Excavator mounted	1,800 - 3,000	90 - 1,125	8 - 56	0.24 - 0.79
5. Directional force*	1,800 - 2,400	*	*	*

*Still not commercially available, but considered as the next generation of vibratory drivers.

- Displacement amplitude: a first pre-assessment check of S_p indicates if a given vibro-unit will be able to mobilize a specific profile. It should at least exceed a theoretically peak-to-peak value of approximately 4/10 [in.]. But some vibro-manufacturers recommend to pick a larger vibro-unit first when $S_p=2s_o<1/8$ [in.], which is too optimistic when considering the field related attenuation of S_p due to effects of shaft resistance.

Accessories and driving aides

Because of the diverse conditions under which different pile geometries are driven, it might be necessary to supplement the regular equipment by various pieces of additional equipment, such as: i) air- and/or water-jetting equipment, in order to displace a proper soil volume by means of a jet with the right pressure and volume of either water or air to allow the discharged soil volume to come up around the pile to the surface; ii) appropriate clamping device matched to the size of the vibro-unit, as well as the shape and type of pile; iii) the use of biodegradable oils if environmental concerns are an important issue due to possible oil spill; and iv) silencing accessories for noisy power units when excessive noise is a concern.

Vibratory driven piles

Vibratory drivers/extractors can be used to drive a large variety of piles. However, the technique performs best with non- or low-displacement piles such as: sheet piles, H- and I-beams, open-end pipe piles such as caissons and anchor piles. However, this will most likely change when the mentioned new "directional force" vibrator comes into full production (see Table 1). Furthermore, some pile-related engineering issues are also mentioned in the following sections, which contractors frequently neglect and sometimes become a concern.

Type of piles installed with vibratory drivers

The vast majority of pile-types installed by vibratory drivers/extractors are low-displacement piles, such as sheet piles and H- and I-beams. The use of vibro-technique to install bearing piles (normally equivalent to displacement piles) is very rare in the United States, mostly from a historical point of view (but more common in other parts of the world) mainly because of the lack of methods to determine ultimate capacity from vibratory driving records. There is a lack of field observational methods as well as instrumentation methods to the obtained bearing capacity (such as blow counts and PDA monitoring). Today engineering acceptance of vibro-driven piles requires using an impact hammer to re-drive the vibro-installed piles in conjunction with a PDA system to assess the achieved capacity.

Close-ended pipe piles and concrete piles, categorized as displacement piles, are normally not as easy to vibrate in comparison to low displacement piles, mainly because of the difficulty in picking a vibro-unit that has the capacity to overcome the dynamic toe resistance R_t. The vibratory equipment needs to be able to generate both enough F_d as well as S_p to overcome corresponding R_t (thus allowing the pile to penetrate), representing the soil volume needed to be displaced during each loading cycle. Furthermore, the initial stress states of either dense or medium dense sand appear to give rise to either the fast or the slow vibratory penetrative modes. This topic is at present poorly understood, but has been extensively studied by [4] and [5].

Precast prestressed (PCPS) concrete piles do not always need to be driven with conventional impact hammers. It's actually feasible to drive PCPS piles successfully using the vibratory technique. Previously successful experiences do in fact exist. Indeed, there are several obstacles to consider when driving PCPS piles, compared to driving sheet piles. To briefly mention a few of these considerations:

i) the limited tensile strength of PCPS piles needs to be considered during installation;
ii) how to grip the PCPS piles rigidly with an appropriate clamp needs to be considered, together with proper alignment of the generated driving force F_d with the neutral axis of the pile;
iii) being able to control the static surcharge force F_o on the fly is of great importance when driving PCPS piles. Complete control of F_o makes it possible to minimize the effects of tensile forces during the installation phase;
iv) furthermore, complete control of M_e is another key factor to consider when driving PCPS piles. The ability to change M_e on the fly relates to the use of so called "resonant free vibro-units", which minimize the exposure of the pile from harmful resonant effects during the start-up and shut down phases.

The axial rigidity assumption

Engineering issues regarding longitudinal effects of vibro-driven piles normally relate to the question of whether or not it's justified to treat the vibrating pile as a rigid body.

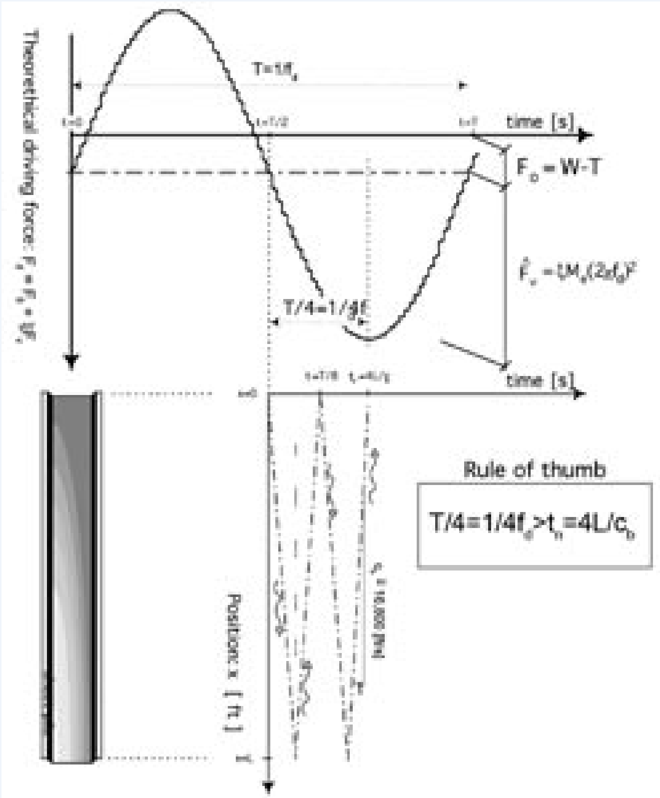


Figure 6. Illustration of the "rule of thumb" for the justification of a rigid body assumption, [6].

A vibratory driven pile can be treated as a rigid body if the following "rule of thumb" is fulfilled, in accordance with Figure 6, and the following expression: $T/4=(4f_d)^{-1}\geq t_n=4L/c_b$. With the foregoing phenomenological equation, a quarter of the time period T of chosen driving frequency f_d should be equal to or greater than the time t_n it takes a stress wave to travel the distance 4L along the driven pile.

Lateral vibrations and flexibility

Another important pile-related factor to consider is the lateral vibration and flexibility during driving, which normally relates to the use of slender and low-displacement piles such as sheet piles, and H- and I beams [6]. However, this neglected pile-related factor can also be of great concern when driving PCPS piles [7].

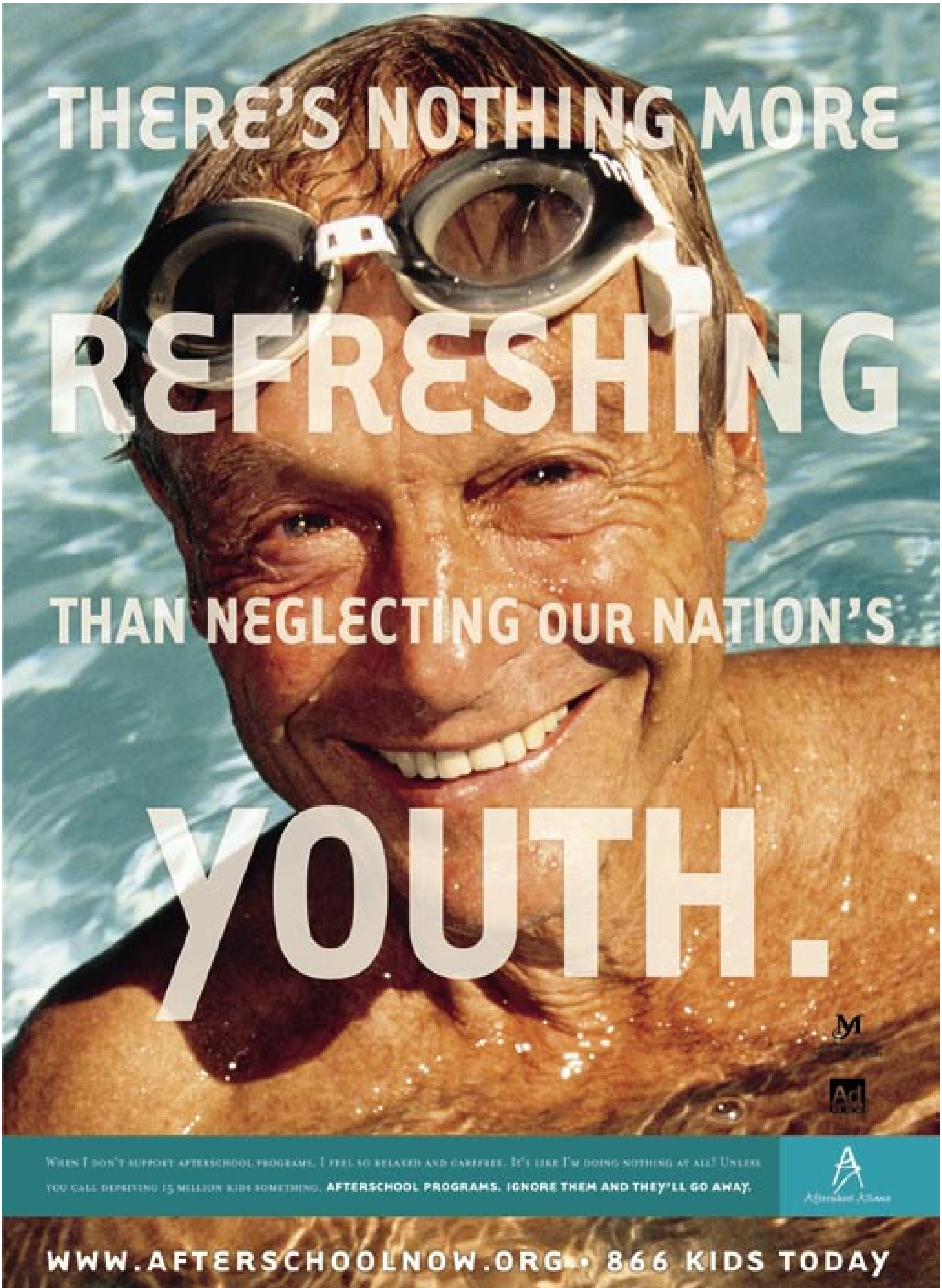
These undesired lateral vibrations during the installation phase normally relate to improper alignment of the driving force F_d and the axial symmetry of the pile. Simply, if the clamp does not hold the pile correctly, a bending moment M_{ecc} is introduced at the pile head, which might cause a situation where the pile profile vibrates as much laterally as it does axially. The engineering consequence of neglecting the effects of lateral motion of the pile includes lower vibro-drivability as well as an increasing amount of induced ground vibrations. Lower vibro-drivability as well as higher ground vibrations occurs because the pre-installed sheet piles forming the sheet pile wall are coupled to the next profile being driven into the sheet-pile interlock. The pre-installed sheet-pile wall acts like the membrane of a loud speaker, sending out laterally induced P-waves, as discussed and visualized in [6].

Interlock-friction force of sheet piles

The dynamic interlock-friction force R_c is a sheet-pile related factor, well known to have a tremendous impact on both vibro-drivability as well as generated ground vibrations. The magnitude of the developed interlock-friction force R_c is primarily due to the presence of soil particles in the interlocks, but also due to steel-to-steel friction. Other significant factors are: low manufacture tolerances of interlocks, re-use of profiles with interlocks in poor condition and/or impurities in the locks (corrosion and soil), together with mode of operation.

The developed magnitude of the friction force r_c per unit length during driving appears to be at least in the range of $69< r_c <6{,}900$ lb/ft [8].

Results of conducted field studies by [9] and [10] on the effects of interlock-friction R_c in relation to generated ground vibrations, showed a two to five times increase in the magnitude compared with equivalent situations without R_c present. It should be noted that the two mentioned studies were of a purely research nature, featuring new sheet piles, which also didn't consider any production capacity related aspects.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Mode of operation

Sometimes it doesn't matter which equipment or what kind of profile is chosen, especially if the operator of the equipment isn't aware of effects such as keeping a vibro-driven sheet pile correctly aligned with the next interlock, or if the resonant free vibro-unit isn't started up or shut down correctly. The mode of operation is as important as picking the right equipment. ▼

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Tom Miller of Edward E. Gillen Co.

By Lisa Kopochinski, Piledriver Editor

It's a good thing Tom Miller is an avid cyclist. He needs all the energy he can get for his position as general superintendent for the Edward E. Gillen Co.

"A couple of years ago a group of us started biking about 20 miles, three days a week before work," says Miller. "We get out between 5:00 and 5:30 a.m. during the summer months. I found it to be a great way to clear my mind and get ready for the day."

His responsibilities for the Milwaukee, Wisconsin-based contractor include the management of field operations, coordination of manpower, materials and equipment. He also assists estimators in determining methods and procedures for jobs being bid and is responsible for major equipment purchases and repairs.

"Safety is a prime goal of both the Gillen Co. and myself," he adds. "I am responsible for the design and implementation of safety incentives for field operations."

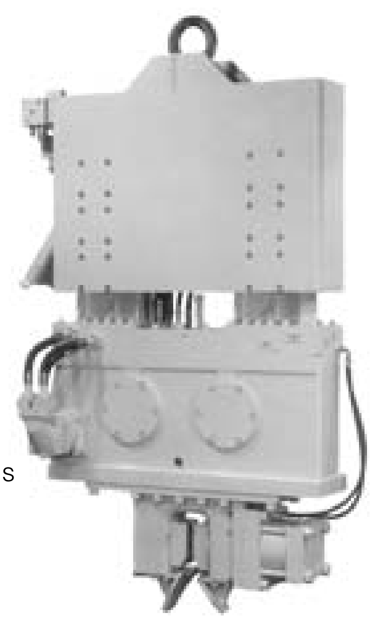
Miller was born and raised in Milwaukee, Wisconsin to a construction family. "Growing up in a family with five other brothers and one sister, we always had a remodeling or building project going on at home," he recalls. "I learned to enjoy the industry."

Miller started in the construction industry back in 1973 after graduating from high school. "While at school at the Milwaukee School of Engineering, I labored for Lunda Construction Company. Upon receiving a Bachelor of Science degree in architectural and building construction technology, I started full time for Lunda working on bridges and dams as an assistant superintendent. I gained a lot of experience on inland marine pile driving projects during the eight years as Lunda superintendent. I then joined the Edward E. Gillen Company in 1985 as project superintendent. I learned a great deal about marine projects on the open waters of Lake Michigan. Projects included dredging, revetments and breakwaters, docks and river walks, as well as diving and marine salvage, intakes, outfalls, and river crossings. I've become a weather forecaster of winds and associated wave action. My predictions are as accurate as any meteorologist, 50 percent right and 50 percent wrong."

On land, Gillen provides a variety of deep foundation and earth retention services including driven piling, drilled piers, helical piers, soldier piles and lagging, soil nailing, dynamic compaction and cofferdams. Miller says he was not only forced to learn the specifics of the foundation discipline, but also needed to learn United States Coast Guard regulations and American Bureau of Shipping requirements for vessels on the Great Lakes. Although Gillen generally performs as a subcontractor, some of the marine projects require the company to be the general contractor. Because of the specialty nature of the business, the company is often required to design and build many of its projects. Miller was involved in the design and fabrication of specialty equipment in 2000 and was selected as Superintendent of the Year by the local AGC Milwaukee chapter.

PDCA membership

Edward E. Gillen became a PDCA member five years ago. "We, as a company, thought it would be in our interest to join an organization that would voice our opinions to the engineering community," Miller explains. "The PDCA strives to promote the driven pile and how it can be used most effectively and economically. We hope that the PDCA can provide training for our project



Some of the most exciting projects Miller has been involved in include:

Installed approximately 1,500 pieces of monotube piling by approximately 80 foot lengths and 328 drilled shafts with 36-inch rock sockets. Gillen performed load tests for both pile and drilled shaft systems. When the job was put out for bids using all drilled shafts, Gillen submitted a driven-pile alternate for the outfield, thus saving the owner a substantial amount of money. Under a tight schedule, the project was completed in time and under budget. "The greatest lesson learned was to size the rig larger than might normally be required in order to achieve maximum production," says Miller. "The job was started with a 100 ton American as the first pile rig. When it came time to get a second rig, the local dealer only had Manitowoc 4100 available in its fleet. We therefore agreed on a discounted rate. Amazingly, the 4100 out-drove the American rig consistently because of the ability to reach out and drive the piles as needed. Since then, we have adopted a ruling of working a crane to only 80 percent of load chart for maximum, thus for greater productivity and safety. Profits are up!"

Installed 7,800 linear feet of 48-inch diameter prestressed intake pipe in Lake Michigan with a maximum water depth of 50 feet. Each piece of pipe weighed more than 65,000 lbs. The trench was excavated with a Manitowoc 4000 crane mounted on a 45 foot x 150 foot x 12 foot deep barge. A 65-foot square x 14 foot high timber crib was built on land and then rolled onto the barge using heavy wall pipes as rollers. The barge was ballasted to roll crib off barge into water and placed into position with the Manitowoc crane. The timber crib does float; however, the purpose is to protect the end of the intake pipe at the bottom of the lake. The crib was built on land and then transferred to a barge. The barge was transported 75 miles south to the point of installation where it was removed from the barge by sinking the barge under it. As the crib is floating in the lake, the crib is filled with stone to sink it into the final position. As a superintendent," Miller adds, "it is challenging to balance the affects of weather, divers' bottom time and production."

Water Intake for Northbrook Water Utilities at Glenco, Illinois.

Foundation system for Miller Park Baseball Stadium in Milwaukee, Wisconsin. ▼

engineers and estimators as well as our field staff. Through the association, we can develop relationships with consultants and equipment manufacturers to make the Gillen Company more productive and profitable by adapting new ideas and innovations to our industry. Ultimately we become better individually and corporately! I was told very early in my career that if you are doing things the same today as you were five years ago, you are falling behind."

Miller, 49, adds that the greatest benefit of PDCA membership is his association with other members, sharing successes and failures. "We may not be willing to share our story with our local competitor, but we can share ideas with other contractors from other parts of the country where we don't feel threatened with our 'secrets'."

Miller adds that the greatest challenge he faces in the industry is "people, people, people. Leaders in the field are one of our greatest challenges. The equipment manufacturers are coming up with new equipment all the time. Our greatest challenge is managing our labor staff to handle the fluctuating demand. We need to develop leaders for our field operations. We first need to teach them the technical skills and then the leadership skills to make the right decisions as they represent your company. They need to develop a willing 'can do' attitude!"

He feels the PDCA could improve on some of its services to members by offering training for field people (because he represents the field end of the business). He says the training could be "in the area of operating and maintaining equipment, skills of pile driving, training in marine construction (barge loading, coast guard regulations, marine safety) and safety training specific to pile driving. I think the PDCA spends a lot of time promoting the driven pile (which is good), but not enough time improving the skills of the membership."

In his limited spare time, Miller enjoys spending time with his wife Valerie, and three children – Jennifer, 24, a hairstylist; son Brian, a sophomore in mechanical engineering at the Milwaukee School of Engineering; and Diana, a junior in high school.

And, let's not forget about those early morning cycling adventures. ▼

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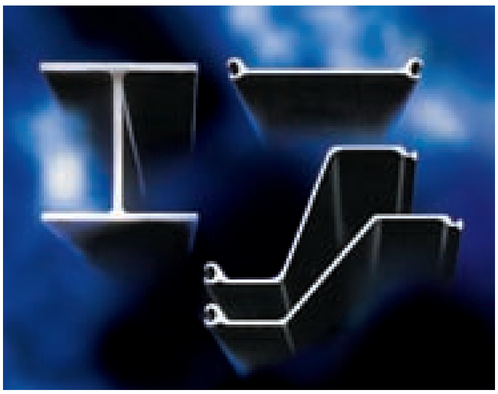

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Section Designation	AREA		WIDTH		HEIGHT		WEIGHT (MASS) PER SINGLE		WEIGHT (MASS) PER WALL		MOMENT OF INERTIA		SECTION MODULUS Per Single		SECTION MODULUS Per Wall		SURFACE AREA Total Area		SURFACE AREA Nominal Area*	
	in²	cm²	in	mm	in	mm	lb/ft	kg/m²	lb/ft²	kg/m²	in⁴	cm⁴	in³	cm³	in³/ft	cm³/m	ft²/ft	m²/m	ft²/n	m²/m
PZ22	11.9	76.6	22.0	559	9.0	228.6	40.3	60.1	22.0	107	151	6301	32.5	532	17.7	952	4.92	1.50	4.48	1.37
PZ27	12.1	78.2	18.0	457	12.0	304.8	40.5	61.3	27.5	134	282	11734	45.3	742	30.2	1622	4.93	1.50	4.48	1.37
PS27.5	13.4	86.6	19.7	500	—	—	45.1	67.9	27.8	136	5.02	209	3.19	52.2	1.94	104	4.58	1.40	3.88	1.18
PS31	15.2	98.2	19.7	500	—	—	50.9	77.0	31.5	154	5.51	229	3.35	55.0	2.04	110	4.58	1.40	3.87	1.18

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APRIL 2004

PDCA New Member List

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

NEW CONTRACTOR MEMBERS

Hasse Contracting
Albuquerque, New Mexico.
Contact: William Hasse
Services provided: pile driving

Foundation Materials
New Orleans, Louisiana
Contact: Paul Tassin
Services provided: pile driving, general contractor

Frank's Casing Crew and Rental
Lafayette, Louisiana
Contact: Donnie Crain
Services provided: marine, pile driving, off-shore, pipe sales, equipment sales and rental

Herlihy Mid-Continent Co.
Romeoville, Illinois
Contact: Arthur Haggerty
Services provided: bridge building, docks and wharves, earth retention, general, highway and heavy civil, marine, pile driving

McDowell NW Piling, Inc.
Kent, Washington
Contact: Michael McDowell
Services provided: pile driving contractor, earth retention, general contracting

R.L Morrison and Sons
McClellanville, South Carolina
Contact: Michael Morrison
Services provided: pile driving

Saddlebrook Construction
Pickens, South Carolina
Contact: Don White
Services provided: pile driving contractor, bridge building, earth retention, general contracting, highway and heavy civil

Sea & Shore Contracting
Boston, Massachusetts
Contact: Michael Lally
Services provided: bulkheads, deep dynamic compaction, deep excavation, docks and wharves, earth retention, general contracting, marine, pile driving

Signor Enterprises
Austin, Texas
Contact: Rusty Signor
Services provided: pile driving

Sun Marine Maintenance
Frankford, Delaware
Contact: Michael R. Jahnigen
Services provided: pile driving contractor, bulkheads, docks and wharves, marine

WH Engineering
Grand Junction, Colorado
Contact: Sandy Heley
Services provided: bridge building, earth retention, highway and heavy civil, pile driving

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

Instantel
Toronto, Canada
Contact: Ron Mask
Services provided: instrumentation for vibration monitoring

Kobelco Cranes
Houston, Texas
Contact: Jack Fendrick
Services provided: cranes

Standard Concrete Products
Charleston, South Carolina
Contact:Wayne McGowan
Services provided: concrete piles

TA Services, Inc.
Mansfield, Texas
Contact: Lilli Schaefer
Services provided: trucking

NEW TECHNICAL MEMBERS

Buster Blalock
Wahoo Enterprises
Folly Beach, South Carolina
Services Provided: Trucking

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

Ashraf S. Elsayed
Hall, Blake & Associates
Memphis, Tennessee

R. Patrick Flynn
Robertson & Hollingsworth
Charleston, South Carolina
Services provided: consultation and legal consultation

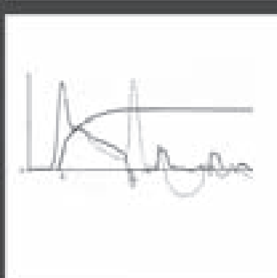
Calendar of Events

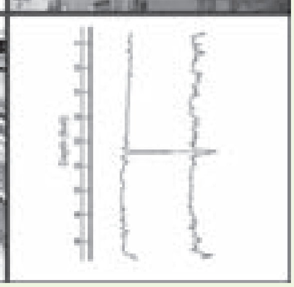
June 19-24, 2005

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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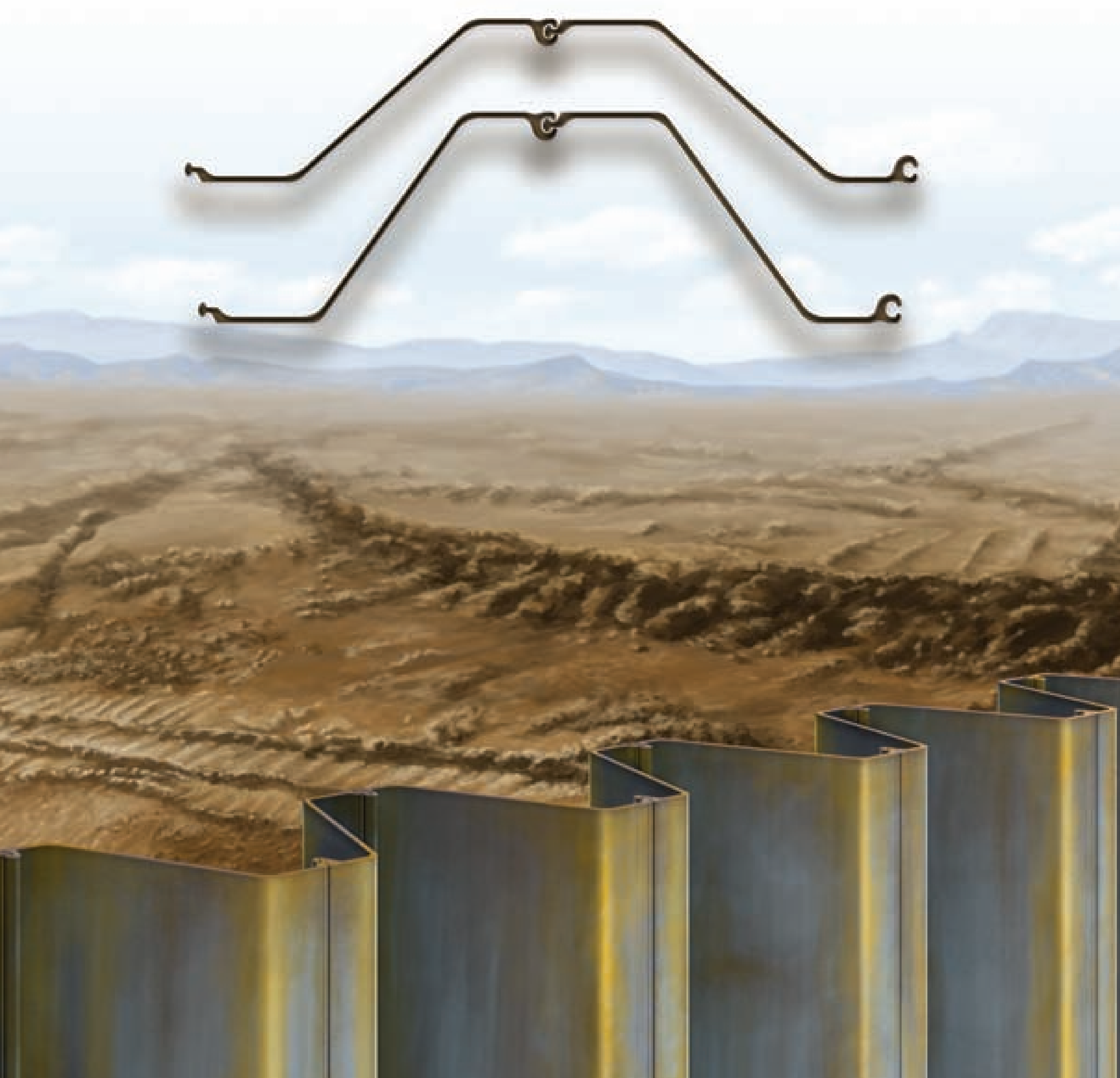

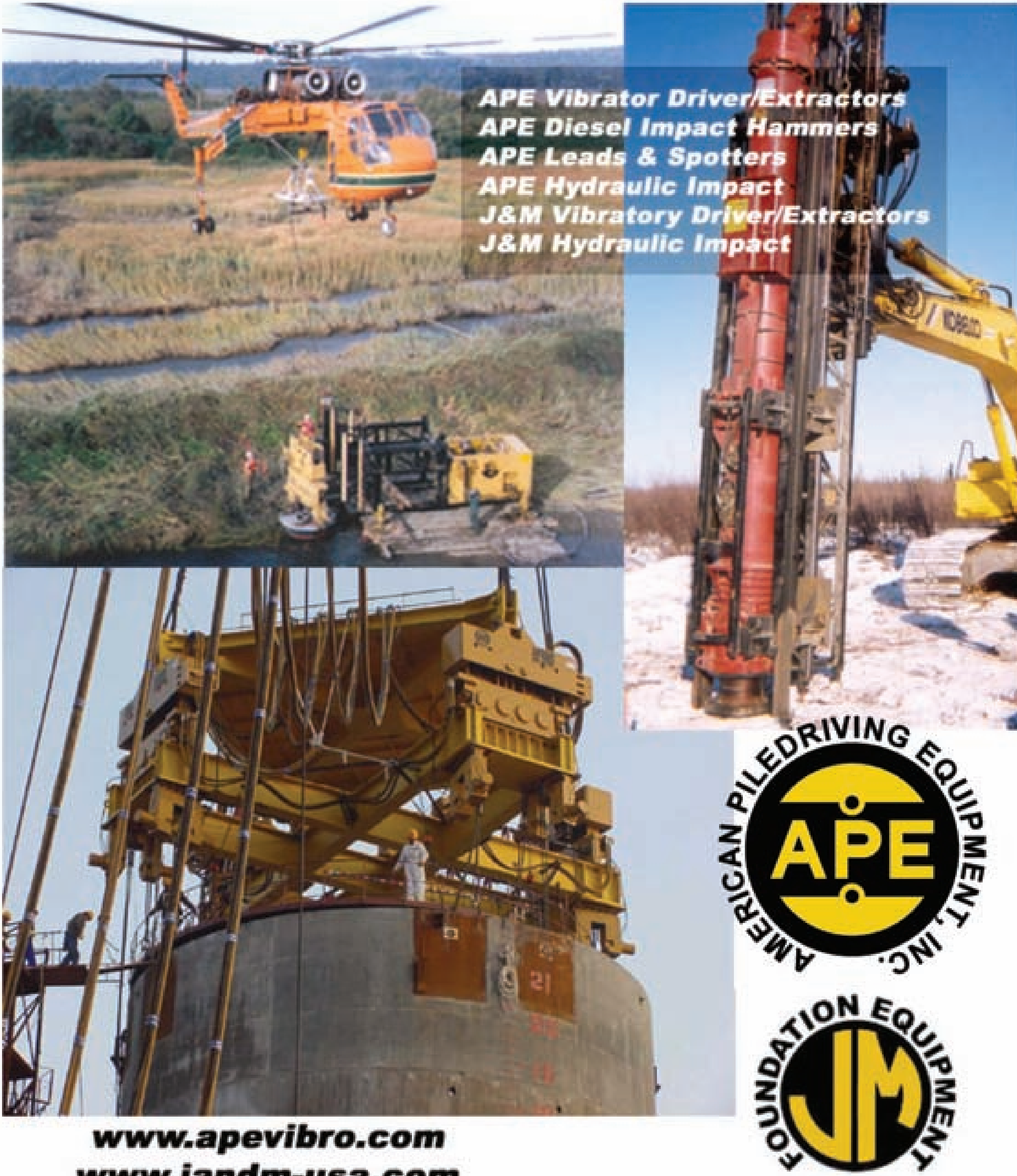
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