


A Presentation of





*From a stick in the mud
to a technologically
proven tool, driven piles
are as old as history and
as new as tomorrow!*

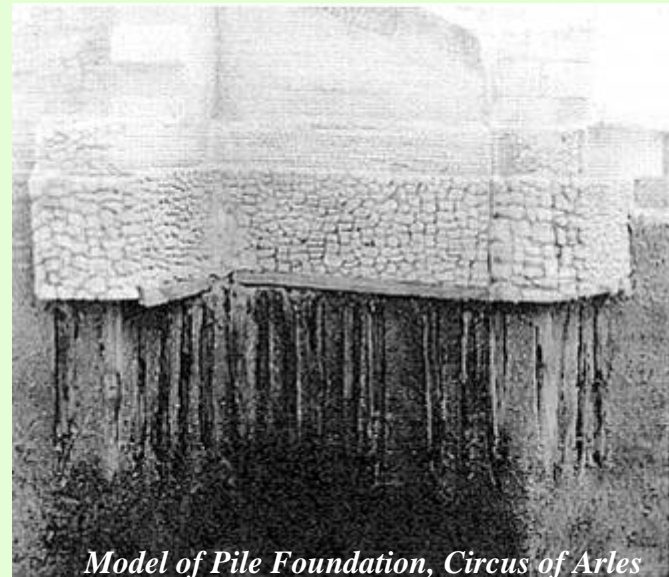


Archeologists have determined that driven piles have been used since Neolithic times. The lake dwellers of what is now Switzerland, northern Italy, Austria and eastern France constructed their villages on driven pile supported platforms as a defensive measure. The builders of the ancient village discovered at Wangen, Switzerland utilized 50,000 piles in the construction of their village. Primitive civilizations around the world have used driven piles and poles to support their homes in water and in flood prone areas. Predecessors to the Aztecs in the Mexico City area built their sites on lakes in the area on pile supported mats topped with soil called “Chinampas” or on areas contained by driven piles and filled with soil and stone. Ancient tribes in the Java Sea area built stilted villages. Ancient Chinese engineers built bridges on driven piles.

The Greeks and Romans utilized driven piles to support bridges, aqueducts and other structures in poor soils, many of which are in use today. Bridges crossing the major rivers of Europe were constructed by the Romans to maintain control of their empire. The Roman Circus at Arles in France was founded on driven piles and in modern archeological excavations found to be in good condition and to have supported their loads for about a thousand years until the structure fell into disuse. Amsterdam was founded in the early 1300's. During a major growth period in the 1600's the digging of canals created a hundred man-made islands for housing. These residential areas were connected by 300 pile supported bridges. Even today, most of the city is pile supported. Other examples of historical use of driven piles abound throughout Europe.

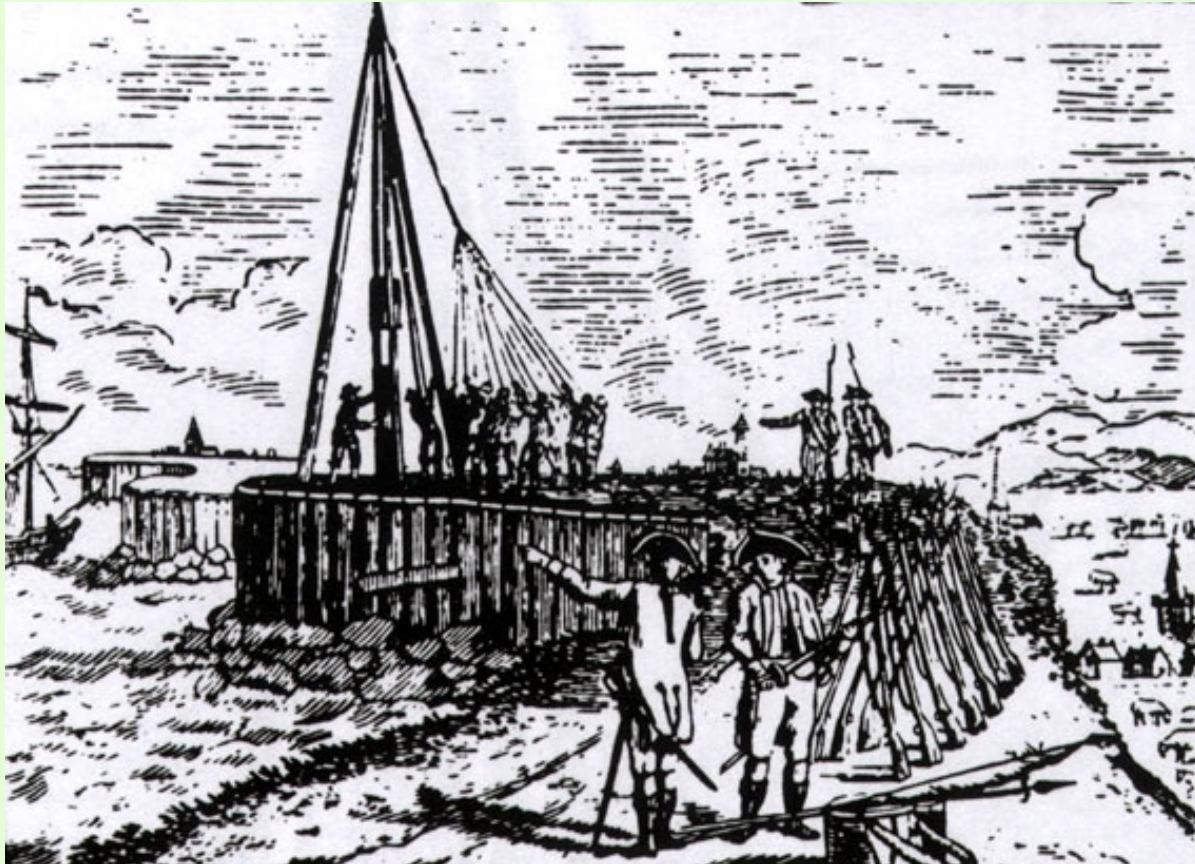


Roman Aqueduct

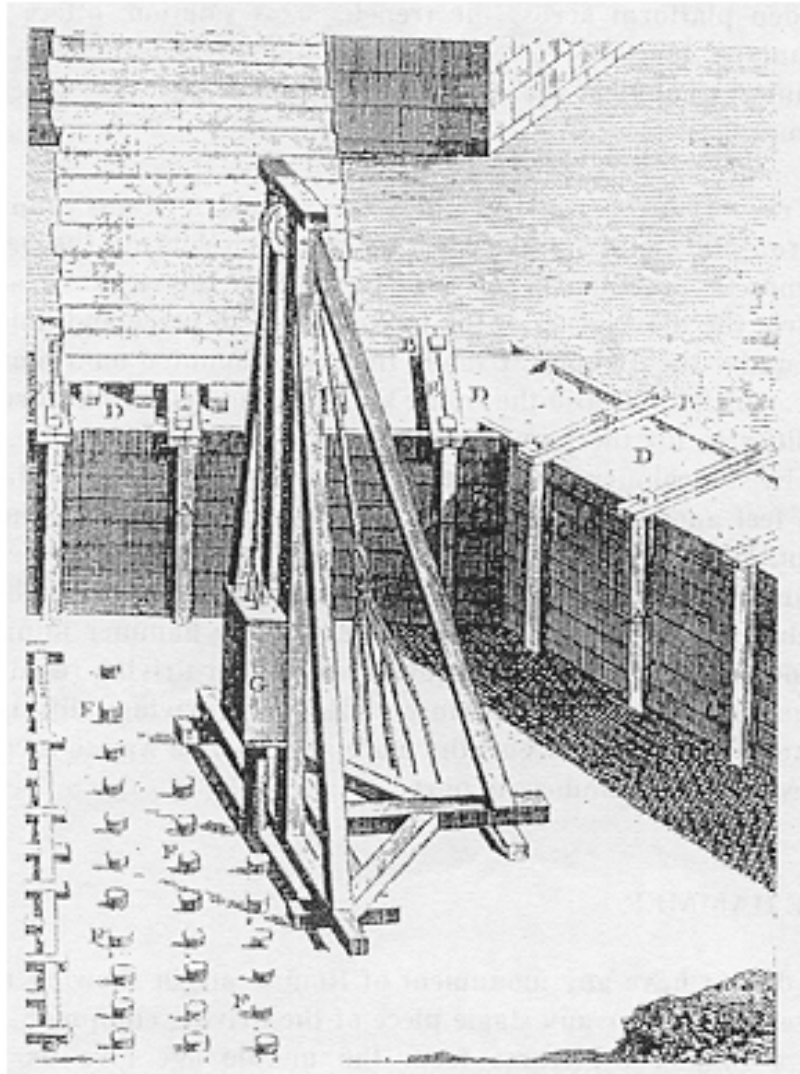


Model of Pile Foundation, Circus of Arles

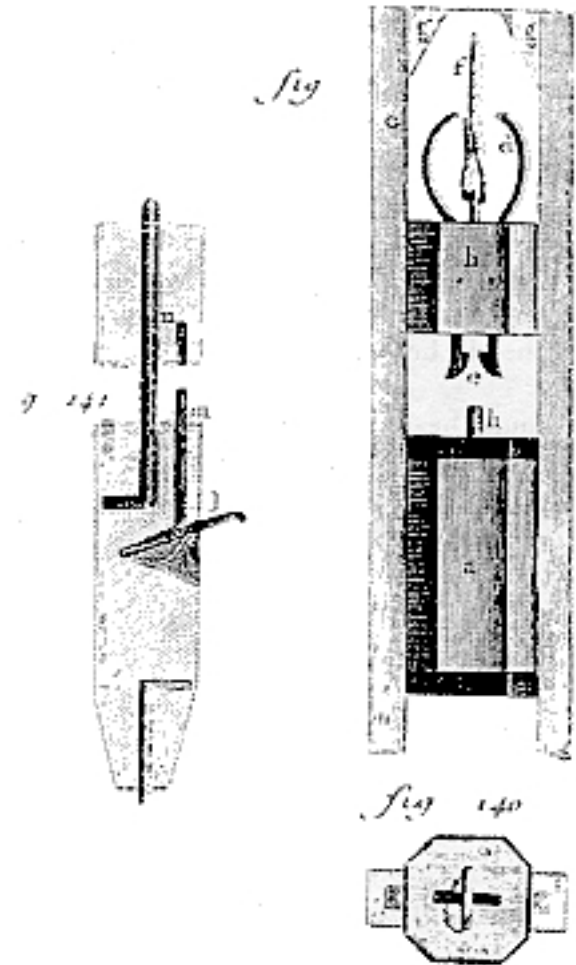
Equipment used to drive piles by the ancient builders developed very slowly and was obviously very simple in design in the early stages. Prior to about 1600 all post and pile drivers were hand operated. After that time developments began to be made using other sources of power.



From this, to...



Pile driving equipment 18th century.



Drop hammer with automatic release.

These, primitive rigs, to...

*An early 20th
Century skid rig, ...*





A modern barge mounted rig utilizing an accurately placed template.

Today owners, engineers and contractors have a whole arsenal of modern technology and tools available to them to assist in providing efficient and economical deep foundation solutions.

From site investigation to design, better understanding of soil properties and new computerized tools are available to engineers. Installation problems, equipment capabilities and load carrying characteristics of various pile types are able to be anticipated with a high degree of accuracy even before the design is completed. Better understanding of the performance and strength of materials, in conjunction with new and stronger materials, and working together with modern codes, permit greater efficiencies in the selection of pile types.

Modern equipment can be employed by contractors to ensure safe, quick and adequate installation of driven piles. Global Positioning Systems (GPS) aid in survey and accurate layout of pile locations. New hammers are capable of energy adjustments and monitoring to provide the required hammer performance while protecting the piles from damage. Instruments can be used during testing and installation to confirm the design and pile load capabilities. Testing techniques are also available to check the performance of previously driven piles to compare them with the requirements of the specifications.

*A driven pile is a
tested pile!*

*Definitions and comparison to
other deep foundation elements.*

A pile can be defined as a structural column installed in earth and provided to offer support or to resist forces.

A Driven Pile is a relatively long, slender column, provided to offer support or to resist forces, made of preformed material, and having a predetermined shape and size that can be physically inspected prior to, and during installation, and which is installed by impact hammering, vibrating, or pushing into the earth.

A Drilled Pile is made of concrete or grout and cast or poured, in a plastic state, into a drilled hole in the earth. Augercast, Drilled Shafts, Drilled Cast-in-Place and, their variations are all forms of drilled piles. Completed drilled piles cannot be easily inspected after installation and can be difficult to install in very soft or loose soils, wet, and marine conditions.

A Drilled Pile removes soil from the ground and the resulting round hole is filled with concrete or grout.

A Driven Pile is installed as a whole, rigid, structural member into the ground from the surface. Driven Piles are said to be either “displacement” or “non-displacement” piles.

Displacement Piles are considered solid shapes that during installation, displace the soil laterally.

Non-displacement Piles are of hollow or “outline” shape and displace little or no soil during installation.

***Basic Pile Installation
Techniques
(driven vs. drilling)***

Drilled Piles are installed by drilling a hole in the soil, typically using an auger. Grout or concrete is placed in the hole to form the pile.



Augered Cast-in-Place Pile Installation

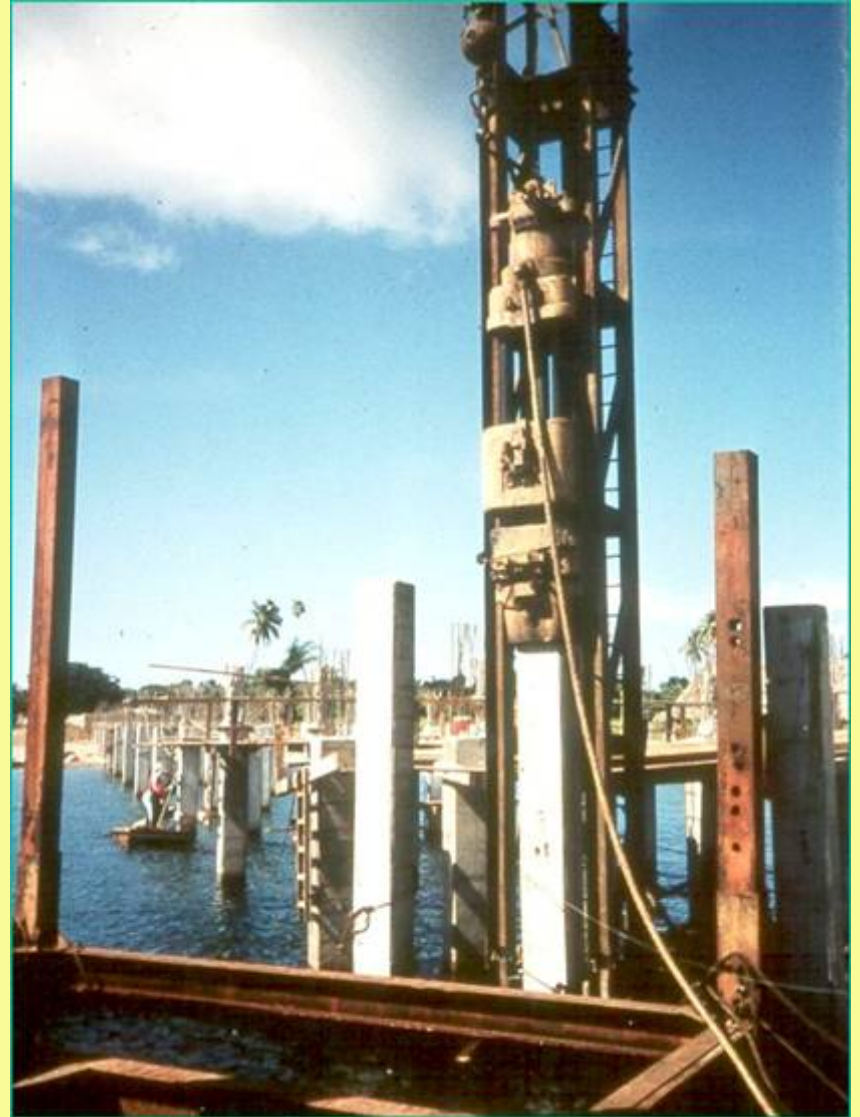


Drilled Shaft Installation



Driven piles are installed using an impact hammer, vibro driver or hydraulic press and performance is routinely monitored during operation. Modern driven pile installation equipment is capable of providing consistent, known energy that can be easily measured during operation. Advancement of the pile into the earth can be monitored and recorded for future study and comparison to other tested and installed piles.

A Driven Pile is one which is of predetermined solid material, shape and size, that can be seen, felt, and, inspected prior to installation and which is installed by driving or pushing into the earth.



Types of Driven Piles

Driven Piles can be classified by their structural use (design function) or, by the materials from which they are made.

Piles classed by structural use will fall into one of the following groups or combinations of these groups.

- *Resisting Vertical Compressive Forces*
- *Resisting Lateral Forces*
- *Resisting Tension Forces*

*Resisting Vertical
Compressive
Forces - where the
anticipated support
requires resistance to
vertical compressive
loads, such as for
buildings, bridges,
docks, towers, tanks,
etc.*





Resisting Lateral Forces - where the forces to be supported are from the side or laterally, as in sheet piles, mooring and fender piles and other similar situations.

Resisting Tension Forces - counteracting wind or overturn loads (guyed anchors for towers, signs); opposing buoyancy and floatation forces as in tanks, pools, mooring pile, etc.; load balance in footing design limitations, etc.



*Piles classed by the materials
from which they are made will
be one of the following or
combinations of these:*

- *Timber*
- *Concrete (Precast & Precast-prestressed).*
- *Pipe Piles (Open-end & Closed-end concrete filled).*
- *Structural Steel & Aluminum Shapes ("H" sections, sheets, combo piles).*
- *Synthetic materials (fiberglass, polymers, vinyl, etc.)*

Driven piles can be either displacement piles, i.e. of solid shape or, non-displacement, i.e. hollow or of outline shape. Sheet piles are specialized types of non-displacement piles formed in sheets and having connections on the edges to permit interlocking with adjacent piles. Composites and combinations of these are also used.

Timber Piles

Timber piles are made from the trunks of tall, straight trees. The more typical species are conifers such as Southern Yellow Pine and Douglas Fir. Untreated timber piles are suitable for temporary situations and in situations where the top of the pile will always be in soil below groundwater level. All permanent timber piles driven in marine environments and where the butt (upper end) will be above groundwater levels require a preservative treatment to resist rot and insect and marine borer attack. Combinations of untreated timber topped by a metal shell filled with concrete are in common use in some areas of the U.S. where ground water is found to be within approximately 10 feet of the surface.

Timber Piles (Displacement Pile)



Timber Piles (Displacement Pile)



Timber Piles (Displacement Pile)



Combination Piles



(Untreated timber with a concrete filled metal shell)

Concrete Piles

Concrete piles (Precast & Precast-Prestressed) are commonly manufactured in solid or hollow form and, square, octagonal or round cross section. Modern manufacturing employs a technique of pre-stressing which increases resistance to bending and reduces the amount of internal steel reinforcement required. This process involves the placing of special cables in the form used to make the piles. The cables are pre-tensioned before the placement of the concrete and, after the concrete begins curing, the tension is released. This has the effect of providing internal compressive forces in the pile and, increasing stiffness and toughness of the pile, permitting longer lengths and harder driving. Because of the inherent resistance to corrosion, concrete piles provide a good material for marine applications.

Solid Precast Concrete (Displacement Pile)



Solid Precast Concrete (Displacement Pile)



Solid Precast Concrete (Displacement Pile)



Concrete Cylinder Pile (Non-Displacement)



Concrete Cylinder Pile (Non-Displacement)



Combination Piles



(Tapered Concrete & Pipe Piles)

Combination Piles



(Precast Concrete & “H” Pile Points)

Pipe Piles

Pipe piles made of steel can be of varying diameters from less than 6 inches to as large as 8 feet or more. The strength of the pipe pile is largely determined by the thickness of the wall and the strength of the steel. In situations where additional strength or resistance to bending is required concrete is placed in the pile after driving. Pipe piles can be driven either with a steel plate welded on the bottom (closed-end) as a displacement pile or open-ended as a non-displacement pile. Pipe piles can be easily spliced to extend the piles when required, either by welding or through the use of mechanical connectors.

Pipe piles can be coated to provide protection from corrosion where required. A unique form of the pipe pile is the tapered steel pile, driven with a closed end and having increasing diameters from the tip. This wedge shape provides additional load capacity in some applications and can be increased in length by splicing a section of uniform diameter pipe pile to the top.

Closed-End Pipe Pile (Displacement Pile)



Closed End Pipe (Displacement Pile)



Closed-End Pipe Pile (Displacement Pile)



Closed-End Pipe Pile (Displacement Pile)



(with corrosion protection coating)

Closed-End Pipe Pile (Displacement Pile)



(with Spin Fins© for added tension capacity)

Open End Pipe (Non-Displacement Pile)



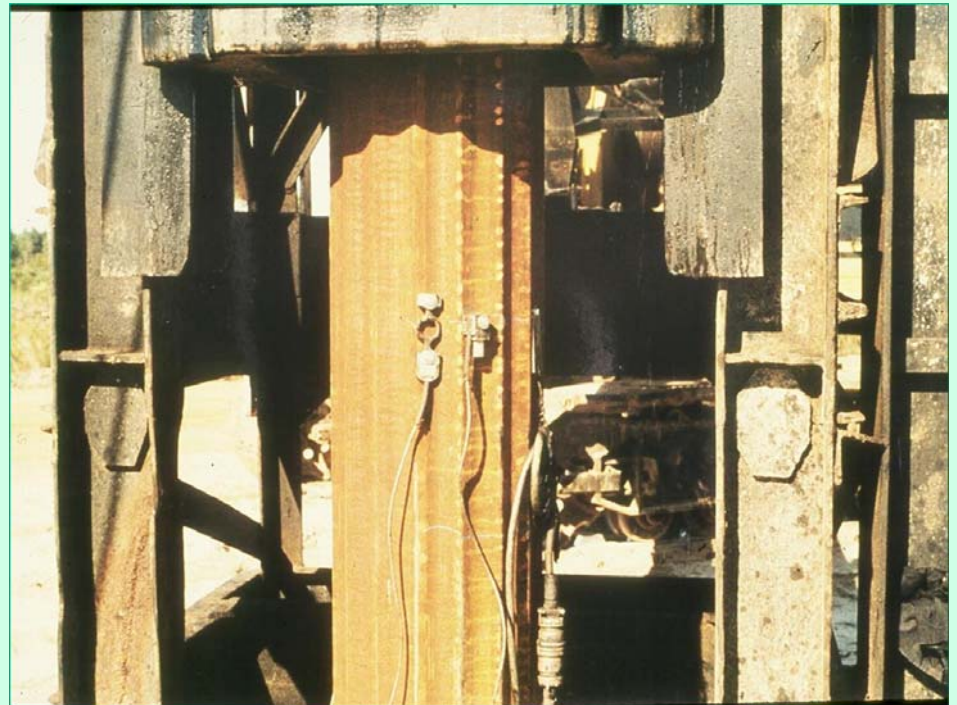
Open End Pipe (Non-Displacement Pile)



Open End Pipe (Non-Displacement Pile)



Closed-End Pipe Pile (Displacement Pile)



(Tapered, fluted steel piles)

Structural Shapes - Steel & Aluminum

Piles have been made from structural steel shapes for over 125 years and are commonly rolled steel formed into an “H” cross section shape. “I” beams and fabrications of railroad rail have also been used. Structural steel piles are, non displacement piles and have an advantage of high strength to weight ratio, great bending resistance, ease of splicing for longer lengths and by their nature, lower rates of soil displacement to affect adjacent areas. Steel is the most common material used for sheet piles and in some instances are combined with other shapes to form “combo piles” for use in applications requiring additional bending strength.

“H” Piles (Non-Displacement Pile)



“H” Piles (Non-Displacement Pile)



(Extending “H” piles by welding)

“H” Piles (Non-Displacement Pile)



“I ” Beam Piles (Non-Displacement Pile)



Sheet Piles

Steel sheet piles in a “Z”, arched or, flat cross section are other steel piles in common use. Sheet Piles are unique in that they are designed to be joined with adjacent piles by the use of integral interlocks. Galvanized light gauge steel and Aluminum sheet piles are gaining acceptance for lightly loaded sheeting applications and offer the advantage of corrosion resistance in bulkhead applications.

Steel Sheet Piles



Steel Sheet Piles



Steel Sheet Piles



Combination (Combo) Piles



*(Steel Sheet
Piles & WF
Beams)*

Synthetic Materials

Vinyl, Fiberglass and, polymers are a few of the recently used materials for piles, particularly in special applications. Vinyl sheet piles are becoming a common application where aesthetics are important and the lateral loads are not great. Examples of this are found in residential waterfront bulkheads where an owner can have a clean white wall at the waters edge. Fiberglass reinforced plastic (or polymer) piles are used in applications where resiliency or spring action is required, such as vessel mooring or fender piles along a dock. Other materials and applications are employed when special concerns require them.

Vinyl Sheet Piles



Pile Installation Equipment

The primary tools used in the actual driving (installing) of piles are

- *Impact Hammers,*
- *Vibratory Driver / Extractors*
- *Special Hydraulic Presses*
- *Supporting Equipment - power sources, hoisting & material handling equipment, etc.*

Impact Hammers

In the simplest sense, Impact Hammers are those which advance the pile in the soil by the raising of a weight (or ram) which is then allowed to fall or, is accelerated downward to strike the pile and “drive” it downward. In use all Impact Hammers are provided with an attachment (called a drive cap, bonnet, helmet or sometimes a hood) between the top of the pile and the lower end or base of the hammer. The purpose of this attachment is to adapt the end of the pile to the base of the hammer, to maintain alignment of the pile to the hammer and lead guides and, to protect the top of the pile from excessive impact shock forces. Most caps incorporate a cushioning element to aid in reducing shock loads to the hammer and the pile.

Types of Impact Hammers

Impact Hammers are identified by their method of operation or the motive force employed. They are generally identified as:

- *Drop Hammers*
- *Air or Steam Hammers*
- *Diesel Hammers*
- *Hydraulic Impact Hammers*

Drop Hammers

Drop Hammers are the simplest and oldest type of Impact Hammer. In this style of hammer, an outside lifting force (a winch) raises a weight and then releases it to free fall, impacting the drive cap or follow block resting on the top of the pile, driving the pile into the ground. The mass of the weight or ram is usually known and, if the height of the drop is regulated, the driving energy (kinetic energy) can be determined and regulated. Frictional losses, especially in the winch, diminish substantially the actual energy output of this type hammer. Though not often used, in some applications, the techniques of old are the economical and practical solution to some of today's foundation problems.

Drop Hammer

*(With follow
block / drive
cap on pile)*

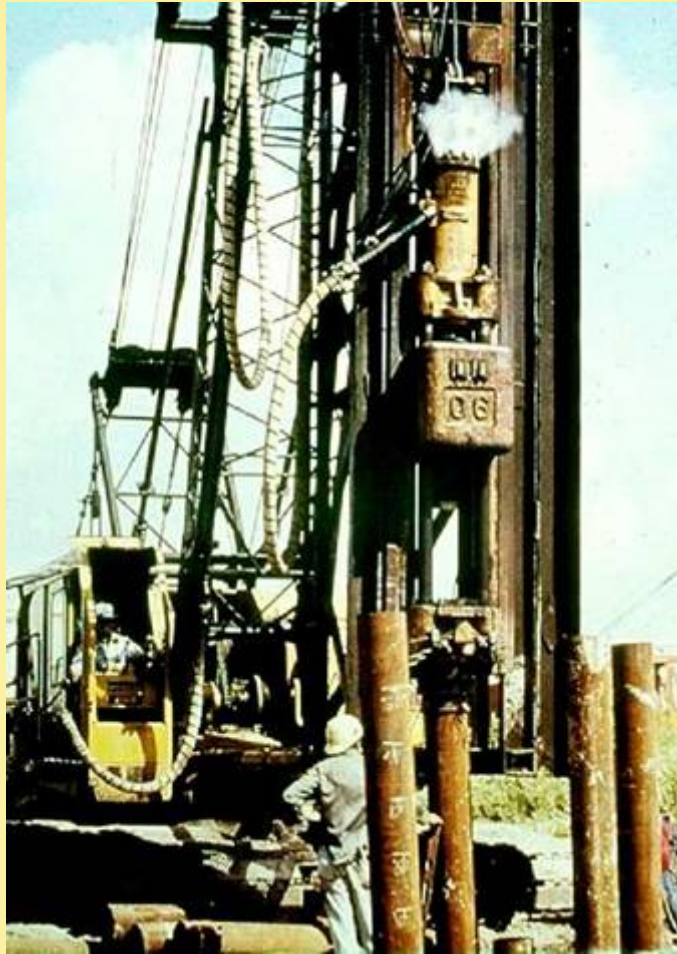


Air (or Steam) Hammers

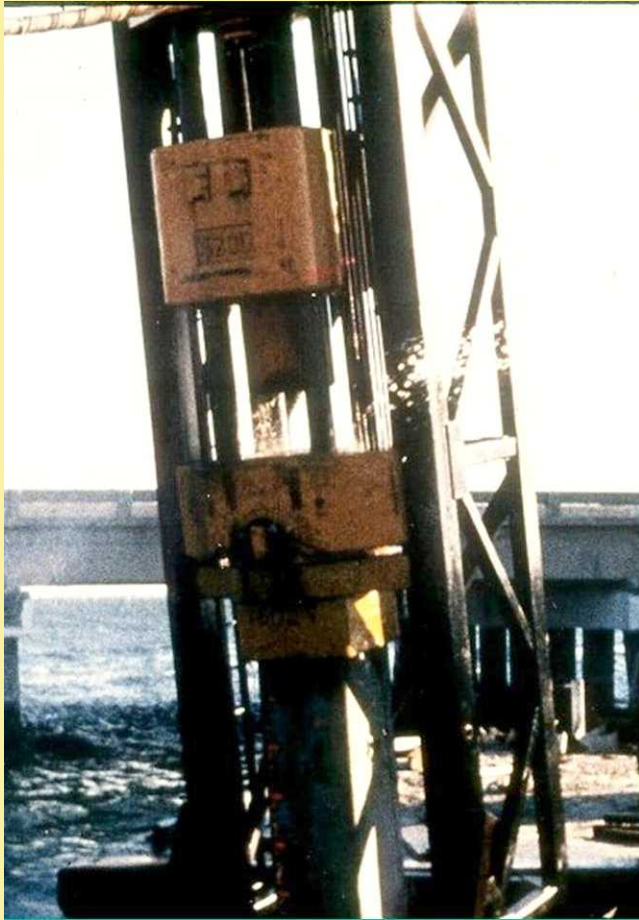
These Hammers are operated by compressed air or steam provided from an air compressor or steam boiler. This motive power is used to raise the ram to a predetermined height and, through automatic valve action, the motive power is shut off. The ram coasts upward some distance, and then, is allowed to fall under the force of gravity. As the ram reaches the limit of downward travel and strikes the top of the drive cap, the pile is driven downward, and the valve actuates, moving the ram upward to start the process over.

In some styles of hammers, additional air (or steam) is introduced into the hammer at the top of the stroke to accelerate the downward travel of the ram. These are referred to as double acting or differential hammers.

Air (or Steam) Hammers



Air (or Steam) Hammers



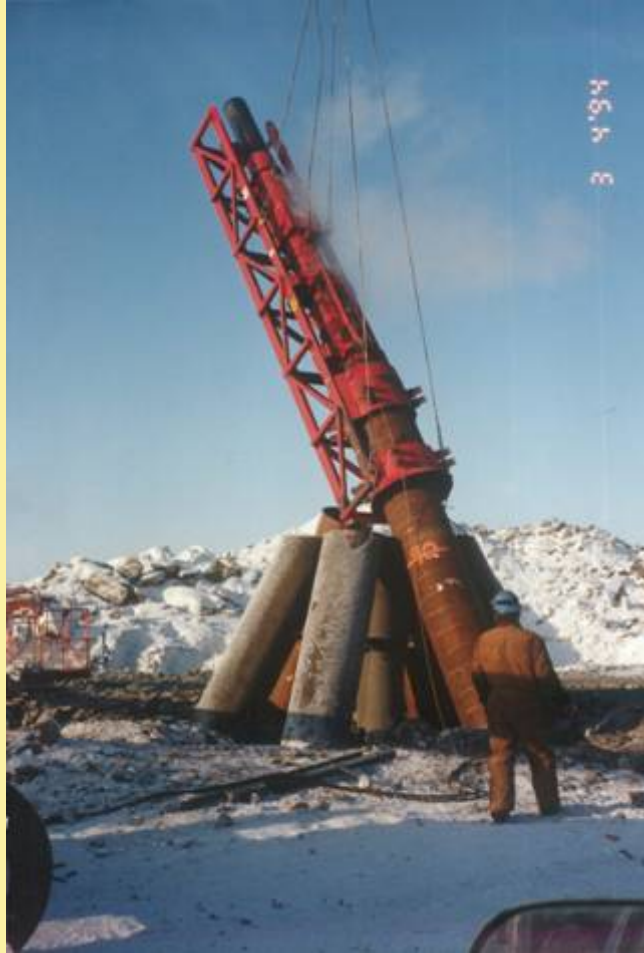
Diesel Hammers

Diesel Hammers operate as single cylinder, internal combustion diesel engines. A mixture of atomized diesel fuel and air are ignited by compression caused by the falling ram. The resulting combustion causes the ram to travel upward. The height of the ram's stroke is determined by the amount of diesel fuel used in combustion and by soil resistance. When the ram reaches its maximum stroke height, gravity then sends the ram downward. As the ram travels downward fresh air and fuel are compressed in the combustion chamber by the ram's downward fall. When the ram reaches the bottom of the stroke it impacts an anvil, driving the pile downward and simultaneously igniting the fuel to start the process over again. Some diesel hammers also incorporate a closed, air filed chamber at the top of the hammer where the air is compressed by the ram's upward travel, and ultimately accelerates the ram downward for extra energy. This type of diesel hammer is said to be double acting, and operates at greater blows per minute.

Diesel Hammers



Diesel Hammers



Hydraulic Impact Hammers

Hydraulic impact hammers employ a hydraulic power-pack, essentially a large engine driven pump system, which pumps special oil under high pressure, through hoses connected to the hammer. The hammer consists of a ram/piston that is forced upward by the pressure of the oil. As the ram approaches the predetermined uppermost travel, automatic valve actuation causes a rapid release of pressure, allowing the ram to coast slightly before falling, under the force of gravity. Double acting hydraulic hammers utilize hydraulic pressure above the ram to accelerate the downward movement of the ram, increasing the driving force and speed of operation. Hydraulic hammers employ sophisticated control systems, providing variable speed and stroke and therefore, precise regulation of energy transmission to the pile. Further, most hydraulic hammers utilize built-in monitoring devices to record the particulars of the driving operation - rate of penetration, frequency and energy of the blows, etc.

Hydraulic Impact Hammers



Hydraulic Impact Hammers



Vibro Driver/Extractors

Vibro Drivers employ motor driven matched pairs of eccentric weights, revolving on horizontally mounted shafts, at relatively high speeds in counter rotating directions. Because of the synchronization and timing of the rotations, horizontal forces are cancelled and the resulting vertical forces provide a rapid vertical motion to a rigidly clamped pile. The weight of the machine and the rapid vertical motion provides the driving force to advance the pile in the soil. The motive power can be provided by electric, or more typically hydraulic, motors mounted in the drive head. Auxiliary power packs provide energy to the on-board motors. By its nature of operation, the Vibro Driver is most effective in granular soils, and in driving non-displacement piles. Vibro drivers are very effective in installing non-displacement piles - sheet piles, H piles, and open pipe piles. They are also usually very effective in the extraction of all types of piles.

Vibro Driver/Extractors



Vibro Driver/Extractors



Hydraulic Press Installers

Hydraulic Press installers utilize reactive resistance to anchor a hydraulically operated jacking system (rams) to push piles into the ground. Reactive resistance can be from temporary weights or adjacent previously installed piles working in tension. Hydraulic Presses utilize a power pack for motive power and are capable of installing relatively long length piles in confined work areas. Additionally, this installation technique is very nearly vibration free and can operate with little noise. These types of installers work most efficiently with non-displacement piles such as sheet piles or open end pipe and H piles.

Hydraulic Press Installer



Hydraulic Press Installer



Pile Rigs & Configurations

Piledriving rigs are configured in many different ways, depending on the task requirements. However, there are common elements in all configurations. Each must have a method of hoisting and positioning the pile and a means of handling the installation equipment. In addition, the pile and the hammer or driver must be maintained in alignment during driving of the pile. A pile lead or a template is utilized to maintain alignment and position of the pile and driver. Additionally, the complete apparatus must be positioned for successive operations.

Basically, there are three general scenarios for pile rig applications - Land Based Rigs, Inland Marine Rigs, and Offshore Marine Rigs. Each of these will have common features and each can be found in modified arrangements as well.

Land Based Rigs

Land based rigs generally consist of a crane (either a crawler or truck crane) mounted pile rig. Common arrangements can be fixed lead or swinging lead types, with or without a template for guiding the piles during installation. A lead is a vertical structure whose purpose is to align and guide the hammer and pile. Fixed leads are “fixed, or rigidly attached to the crane boom and often extend above the boom tip (cantilevered fixed lead). Fixed leads which do not extend above the boom tip are often referred to as “under slung leads”. This system uses a bottom brace or “spotter” to hold the lower end of the lead in position. A swinging lead is suspended from the boom tip, rather than being fixed to it, and may either be fixed at the bottom by use of stabbing points in the ground or pinning to a template. Other specially designed arrangements are also utilized, including specifically designed pile rigs common in Europe and more recently seen in the US, with adaptations utilizing crawler excavator components.

Land Based Rigs

Cantilevered Fixed Lead



(With Fixed Bottom Brace)



(With Spotter)

Land Based Rigs

Under slung Swinging Lead



(With Fixed Bottom Brace)



(With Stabbing points)

Land Based Rigs

European Style, Fixed Lead with Fixed Bottom Brace



(Driving Aft Batter with Hydraulic Hammer)

Land Based Rigs

European Style, Fixed Lead on Crawler Lower



Inland Marine Rigs

Inland marine and shallow water applications generally require a floating platform to support a crane and the related tools necessary for pile driving. An alternative to this is the use of a fixed platform such as a trestle. A variation of this is the utilization of the previously constructed work as a platform to advance the project. As in land based work, the configuration of the rig can employ fixed leads, swinging leads and or a template. Sometimes contractors elect to employ the bell system typically used offshore. On occasion, because of limited access or other operating restraints, small, truckable, barges are attached together to form a larger work platform.

Inland Marine Rigs



(Swinging Lead with Template)

Inland Marine Rigs



(With Fixed Bottom Brace)



(Swinging Lead with Template)

Inland Marine Rigs



(Driving sheeting from sectional barges)

Inland Marine Rigs



(Working from Trestle)

Inland Marine Rigs



(Working from Trestle)

Offshore Marine Rigs

Offshore piledriving is generally in much deeper water depths than inland marine work. The additional consideration of providing a work platform suitable for open sea operations distinguishes this type work. The bell or, “offshore lead” used in deep water marine environments, is a special, relatively short, swinging lead having a “bell” guide at the lower end to assist and hold alignment of the pile and hammer. It is a specially designed structure used to handle the much larger equipment and piles found in these unique conditions. A template is commonly utilized to maintain pile location in the unstable environment of the sea. Alignment and placement of the pile and rig is frequently determined by GPS and satellite navigation triangulation.

Offshore Marine Rigs



(A Pile Supported Offshore Oil Platform)

Offshore Marine Rigs



(Offshore Pile Rig Using a Template – With Hammers on Deck)

Offshore Marine Rigs



(Hydraulic Offshore Hammers on Deck)

Offshore Marine Rigs

*(Hydraulic Offshore
Hammer capable of
driving underwater to deep
depths)*



Offshore Marine Rigs



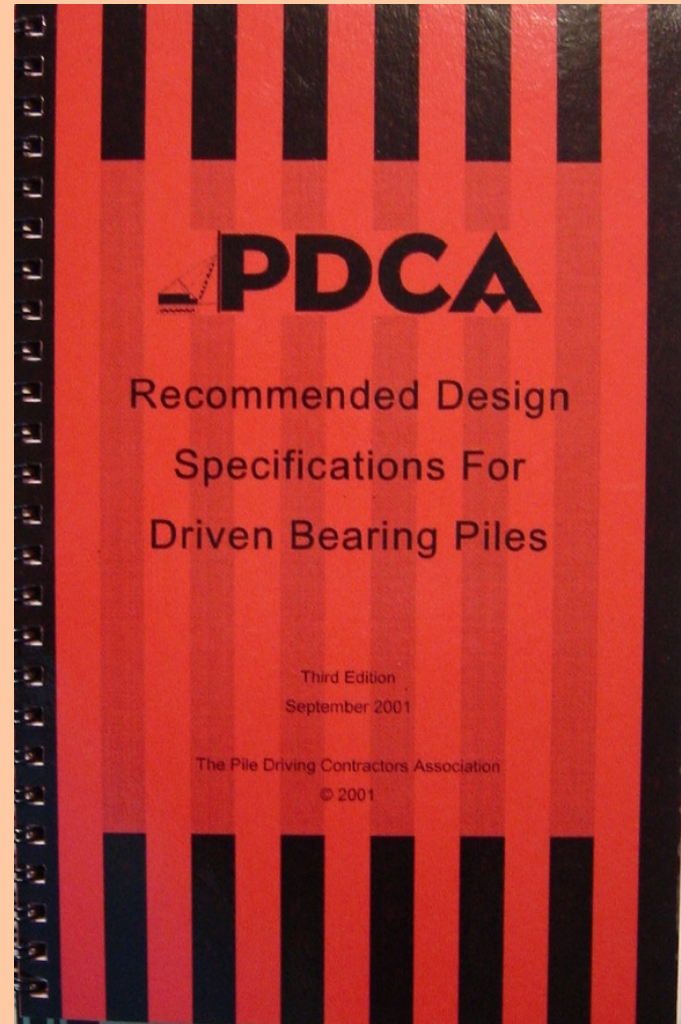
(GPS Positioning for Offshore Pile Locations)

Quality Controls and Product Assurance

With the advent of increased material strengths and recent advances in installation equipment, greater assurances of quality are also available to owners, designers, and contractors.

Design Standards

Building and design codes are being modernized to take advantage of new technology and to meet ever increasing demands of cost, efficiency, and facility of installation. PDCA and its members are active in these efforts. The association has been instrumental in developing and distributing the PDCA Recommended Design Specification for Bearing Piles.



PDCA co-distributes FHWA's National Highway Institute's Design and Construction of Driven Pile Foundations (a design guide and workshop manual).



U.S. Department
of Transportation

Federal Highway
Administration

Publication No. FHWA-HI-96-033
December 1996

NHI Course Nos. 13221 and 13222

Design and Construction of Driven Pile Foundations

Workshop Manual - Volume I



National Highway Institute



PDCA sponsors the dissemination of up-to-date information through the annual “Design & Installation of Cost-Efficient Driven Piles Conference”.

Pile Driving Contractors Association
7th Annual

Design and Installation of Cost Efficient Piles

Minneapolis, Minnesota



*DRIVING
THE
FUTURE*

PDCA
PILE DRIVING CONTRACTORS ASSOCIATION

DICEP
Pre-Conference Course
Deep Foundation
Dynamic Testing and
Analysis
September 12 - 13, 2006

DICEP CONFERENCE

September
14 - 15, 2006

Minneapolis, MN.
Crowne Plaza
Minneapolis - Northstar
Downtown

A Driven Pile Is A Tested Pile !

Material Standards & Inspections

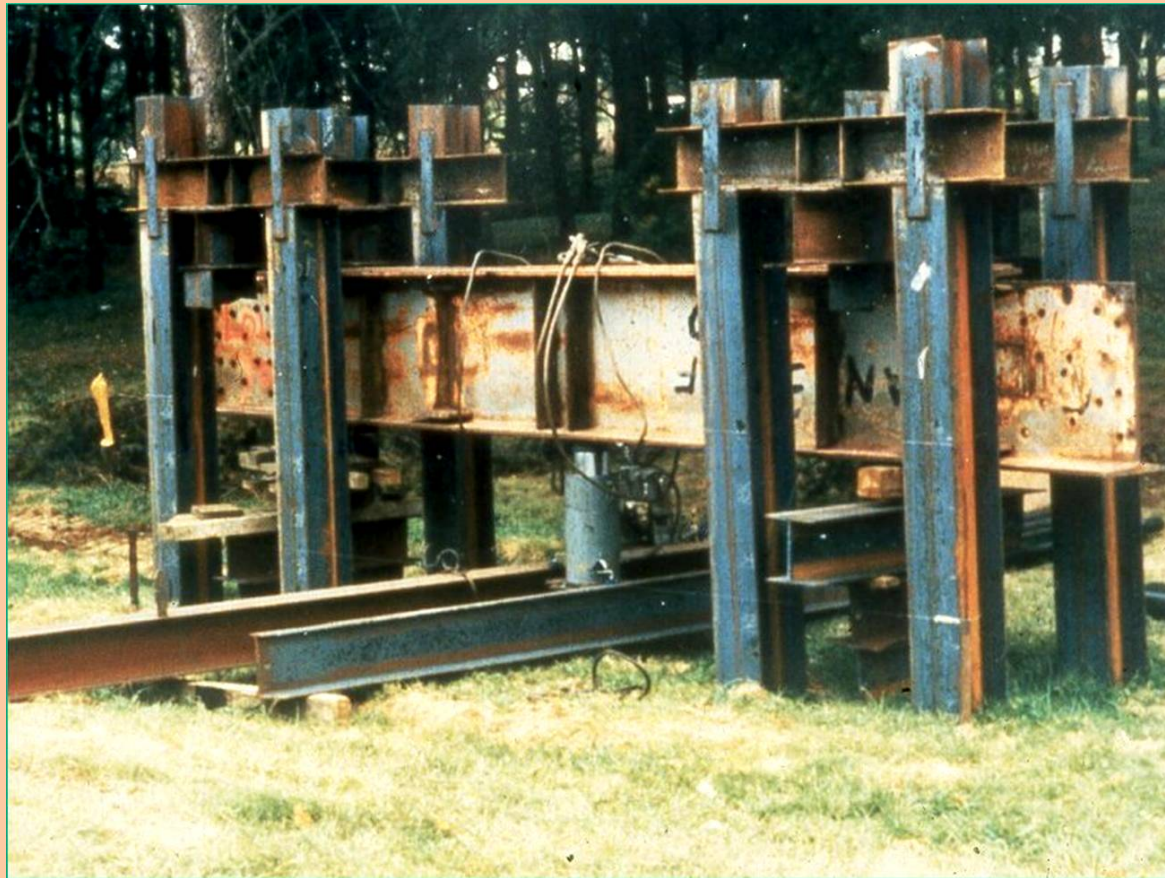
Modern standards recognize advancements in increased strength and application of materials as well as the development of new materials. Driven piles, by their nature, are manufactured prior to installation. This affords for visual inspection and testing to assure compliance with the material standards and specifications prior to installation.

Testing During Design

Frequently the first test made during the design of the foundation is the taking and analysis of soil samples. Core samples are made to depths deeper than the deepest anticipated pile tip embedment. Analysis of the soil properties can determine the size, type and depth of the pile.



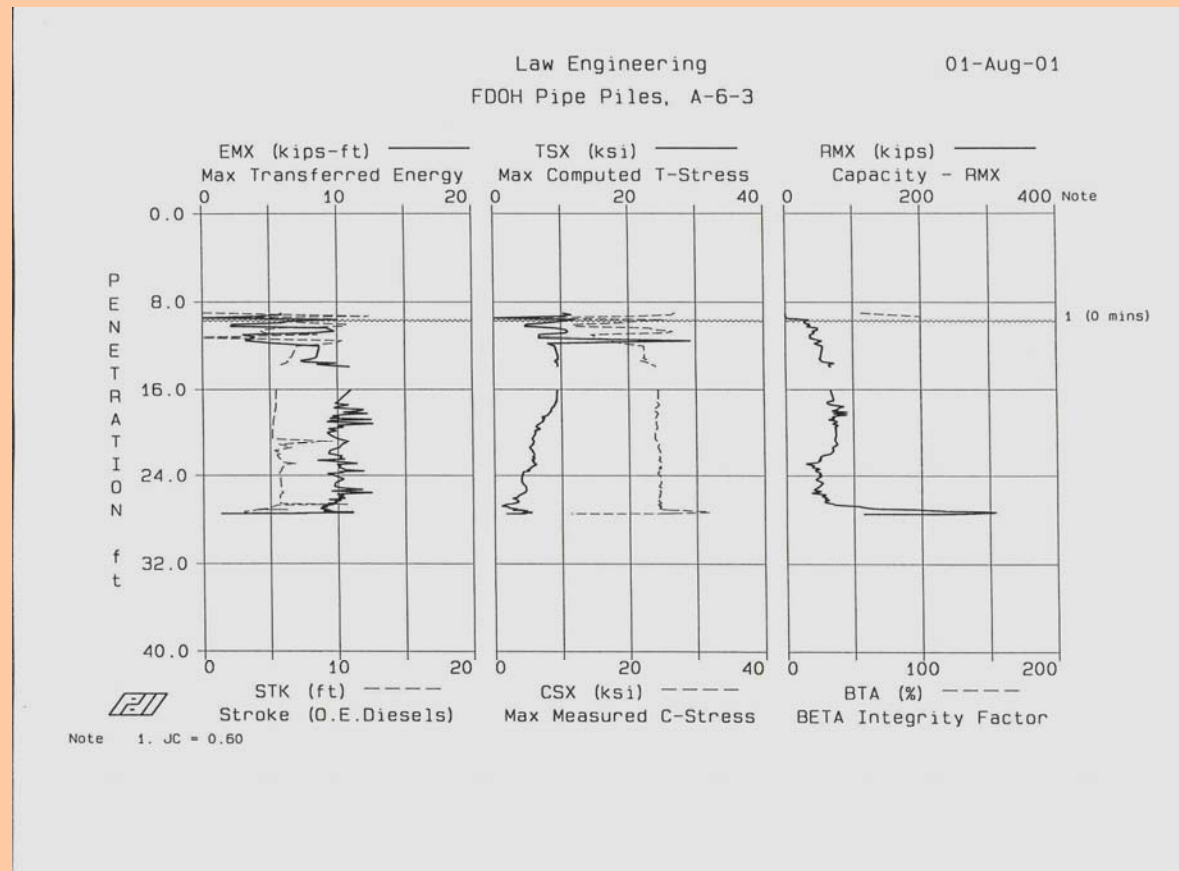
Driven piles are often "proof tested" prior to driving permanent piles. Representative piles are driven in simulation of job site conditions, and by monitoring and recording, the effect of incrementally applied loads capacity of the piles can be confirmed.



Dynamic testing of piles can be accomplished by monitoring instrumented piles during driving, both during the test pile phase, and during permanent pile installation to confirm bearing capacity and/or integrity.



Additionally, or in lieu of load testing, soil, pile, and hammer combinations can be analyzed by computer driven wave equation analysis and fairly accurate predictions of capacity and hammer performance provide confirmation of the design, drivability of the pile and the adequacy of the proposed hammer.



Installation Inspection & Confirmation

During driving of production piles, representative piles can be checked, blow by blow, by dynamic analysis of instrumented piles, verifying integrity of the pile, energy transfer, hammer performance and, pile capacity at the time of driving.



Completed piles can be readily checked for integrity by use of “Pile Integrity Testing”.



In cases where additional confirmation is desired, new load testing methods can be employed to provide results quickly.



SPECIALTY PILING SYSTEMS, INC.
P. O. BOX 1687
SLIDELL, LA 70459-1687
TELEPHONE (985) 643-8690 FAX (985) 643-8690

PILE DRIVING LOG

PROJECT:					CONTRACTOR:				
ENGINEER:					JOB NO.:				
GENERAL CONTRACTOR:					DATE:				
					REPORT NO.:				
					SHEET: OF				
PILE NO.:									
TIP DIA.:									
BUTT DIA.:									
LENGTH (FT.):									
0-5					43				
6-10					44				
11					45				
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42									

PILE TYPE:

ELEVATION: **CUT-OFF ELEV.**

PREDRILL: **BIT DIA.:**

NOTES:

HAMMER:

RAM WEIGHT: **STROKE:**

WEATHER:

LOGGED BY:

Overview of the Process from Design to Finished Installation

Planning

Once the owner defines the parameters of the use and type of structure, the design team goes to work planning the design.

- *Preliminary Analysis & Design (Engineering & Geotechnical Analysis) - This stage includes site and soil investigation and, preliminary calculations to determine the probable load capacities of various types of foundation elements.*
- *Confirmation of Engineering & Design - Often times “Probe”, Indicator”, and/ or ”Test Piles” are driven at this stage and, "Load Tests” are performed to confirm the design parameters. (This stage also often occurs after Contract Award and prior to the start of production pile driving.)*

Bidding & Contract Award

Project plans and specifications, once developed, are provided to the bidders for the preparation of their estimates and bids.

Contract Award is made on the basis of bidder responses, through negotiation, or a combination of these. Some design-build projects combine the design and construction responsibilities and the winning bidder actively participates in the design process.

Frequently, as a result of information learned during previous testing and review, changes can be made to the project design to provide more efficient and economical results, either through material and time savings, or through contractor value engineering suggestions.

Pile Installation

Close coordination with the design team during installation ensures a trouble free installation. Frequent review of job progress avoids problems and confirms that all piles are driven as intended and adequate for the project requirements. Questionable piles can be evaluated and taken care of in a timely manner to avoid unnecessary impact on overall progress.

Unanticipated site condition problems can be solved through open and forthright communication between all parties concerned.

Quality Control

Material inspection reports give assurances of compliance to the specifications and job requirements. A pile log of driving provides a record of progress and a check on the adequacy of each pile, affording the opportunity to take timely corrective actions when necessary. Thus, every pile is a tested pile!

On larger, and on more critical projects additional testing and monitoring is undertaken; with additional dynamic or static testing frequently being employed. When taken with the information developed during pile testing, compliance to the design is assured.

Completion & Acceptance

Upon completion of driving, a review of all inspection reports, and test and driving records, should reveal all piles to have been installed satisfactorily for the design.

Should problems be revealed, modern testing/inspection tools will be able to properly identify those problems so that appropriate corrective actions can be undertaken.

Once all are satisfied that all piles comply with contract requirements, the only thing remaining is that the contractor be paid! The owner having received with assurance, the foundation he requires and, the piling contractor receiving not only the satisfaction of a job done well, but the rewards for his efforts!

Acknowledgements And Sources of Additional Information

This presentation is directed to those interested in learning about driven piles and their benefits to solid foundation installation and design. It is intended to be an introduction and guide to further study about driven piles and their use and application.

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*This presentation is a result of the efforts of
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Driving Contractors Association:*

Van Hogan, Chairman

Garland Likins, Member

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Steve Whitty, Member

The Pile Driving Contractors Association (PDCA) is an organization of pile driving contractors that advocates the increased use of driven piles for deep foundations and earth retention systems. To do this, we:

Promote the use of driven pile solutions in all cases where they are effective.

Support educational programs for engineers on the design and efficiency of driven piles and for contractors on improving installation procedures.

Encourage and support research that will improve the reliability, usefulness, and cost effectiveness of driven piles.

Give contractors a larger voice in establishing procedures and standards for the installation and design of driven piles.

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