

Pile Driving Safety and Environmental

Best Management Practices



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Pile Driving Safety and Environmental Best Management Practices

Document Date: September 19, 2017

Revision Date: None

I. Purpose and Scope

- A. The Pile Driving Safety and Environmental Best Management Practices prescribe the safety and environmental guidelines for pile driving activities based upon industry standard and industry best management practices.
- B. The intent of this best management practice is to provide contractors and owners a guiding document based on safe working principles and risk management for a broad range of pile driving activities.

II. Preconstruction Survey

- A. Perform a site visit
 - 1. Site Access and utilization prior to mobilization of equipment and personnel:
 - a) Establish location of site access for equipment, material and personnel (i.e. employee parking, office trailer, tool box, flammable liquid/gas storage, lane closures, fencing, storm water protection, concrete washout areas
 - b) Pick up and lay down of material and equipment
 - c) Assembly/disassembly of equipment
 - d) Material storage
 - e) Access for delivery truck/trailers to enter site
 - f) Access to barge/floats and other water born equipment
 - 2. Ground stability
 - a) Inspect proposed site access and work area to determine the means and methods required for the proper support of equipment and material. (Pile Driving Contractor must be able to provide the ground bearing pressure of the installation and support of equipment under the maximum anticipated load, to the Controlling Entity of the project).



- b) Ensure adequate room to construct stable slopes for the movement of equipment and materials if there are changes in elevation on the site.
 - c) Inspect site for possible underground hazards and unstable ground conditions.
 - d) Inspect existing structures if they will be incorporated into the work. Perform an engineering structural analysis to establish adequacy for the proposed task or use.
3. Utilities
- a) Perform a “Call Before You Dig – 811” to locate and mark underground utilities.
 - b) Locate all overhead utilities to ensure equipment is within safe working distances. Ref: OSHA 29 CFR 1926.1408 (h) Table A.

TABLE A—MINIMUM CLEARANCE DISTANCES

Voltage (nominal, kV, alternating current)	Minimum clearance distance (feet)
up to 50	10
over 50 to 200	15
over 200 to 350	20
over 350 to 500	25
over 500 to 750	35
over 750 to 1,000	45
over 1,000	(as established by the utility owner/operator or registered P.E. who is a qualified person with respect to electrical power transmission and distribution).

Note: The value that follows "to" is up to and includes that value. For example, over 50 to 200 means up to and including 200kV.

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4. Inspect the site and review the project documents to determine the potential for hazards and environmental requirements such as:
5. Confined or restricted work areas
 - a) Proximity to adjacent structures and the need for pre-construction surveys
 - b) Workers employed in concurrent activities near pile driving operations
 - c) Proximity to public activities and the need for vibration monitoring, noise abatement, special work hours, etc.
 - d) Hazardous materials, i.e., explosives, toxic materials, etc.
 - e) Proximity to aircraft (both fixed wing and rotorcraft).
 - f) Pedestrians and public traffic
 - g) Site specific permits: Know who is responsible for administering required permits, i.e. owner's representative, general contractor, etc.

III. Site Specific Safety Plan

- A. Analyze jobsite from a safety perspective
- B. Plan inclusions
 1. Job Hazard Analysis broken down into tasks
 - a) Identification of risk and exposure to personnel, public, environment and equipment
 - b) Identification of the individuals responsible for the activity
 - c) PPE, equipment and machinery required
 - d) Preventative actions required to prevent injury and/or damage
 - e) Location of overhead and underground utilities and the actions necessary to avoid contact
 - f) Underground hazards (voids, tanks, contaminated soils/water)
 2. Site access for personnel, material and equipment
 - a) Access control at the worksite
 - b) Traffic control at the work site
 3. Assembly and disassembly of equipment
 - a) Establish procedures for the proper transport of equipment
 - b) Establish procedures for the proper assembly and disassembly of equipment
 - c) Verify that the equipment is properly assembled and adequate for the required tasks to be completed
 - d) Establish company Assembly/Disassembly Director (OSHA Ref – A/D [Assembly/Disassembly] Director)
 - e) Connection of fixed lead to crane boom. Ensure it is a positive, fail-safe connection (per manufacturer's requirements, including torque specifications, if required).

- f) If used, ensure mounting for hydraulic power unit / air compressor has been designed by registered professional engineer and does not affect rearward stability or capacity of the crane
- 4. Ground stability
 - a) Establish means and methods to ensure that equipment and material are adequately supported, i.e. explore different types of matting.
- 5. Surroundings
 - a) Establish means and methods to:
 - i. Avoid conflicts with concurrent work and activities
 - ii. Protect the public and environment from construction activities
 - iii. Prevent damage to adjacent structures
 - iv. Mitigate excessive noise, vibration and/or other related impacts
- 6. Emergency Response and Facilities
 - a) Location of first aid supplies
 - b) Emergency phone numbers
 - c) Contact local Fire/Rescue and invite them for a site visit. This way they will know how to access site, in the event of an emergency.
 - d) Walk-in clinic for non-emergencies
 - i. Phone number
 - ii. Address
 - iii. Directions
 - e) Hospital for emergencies
 - i. Phone number
 - ii. Address
 - iii. Directions
 - f) Designated Trained Employees
 - i. First Aid
 - ii. CPR
- 7. Notification and reporting requirements for:
 - a) Accidents
 - b) Hazardous spills
- 8. Hazard Communication Plan
 - a) Copies of Safety Data Sheets (SDS) for all chemicals used onsite by piling contractor (i.e. diesel fuel, grease, oxygen acetylene, gasoline, welding rods/wire, treated wood), and available to all employees.
- 9. Environmental boundaries, possible impact, and methods of mitigation.

IV. Pile Driving Safety

A. General

- 1. Personal Protective Equipment
 - a) Hard Hats

- b) Work Gloves
 - i. Gloves should fit snugly so that they do not get caught in equipment or rigging.
 - ii. Consider potential exposure/hazards specific to the task when selecting glove types, i.e.: rubber, leather, cotton, neoprene, cut resistant, etc.
 - c) Safety Glasses
 - d) Safety Toed Footwear
 - e) Hearing protection
- B. Ensure time weighted average (TWA) does not exceed 90dB; otherwise double hearing protection may be required.
- a) Safety vest or high-visibility outerwear
 - b) Clothing
 - i. Wear long pants
 - ii. Clothing should fit well. Avoid wearing baggy or loose clothing that can get caught in equipment or rigging.
 - iii. Secure long hair so that it does not get caught in equipment or rigging.
 - iv. Wear long-sleeve shirts for protection while welding, burning or other activities where appropriate. (Wear protective sleeves/coat while welding, burning, or grinding)
 - v. Wear welding hoods w/clear safety glasses under (for chipping), face shields and burning glasses/goggles when burning, and face shields and safety glasses when grinding.
 - vi. In addition to hearing, face and eye protection, wear protective chaps when using a chain saw.
2. Utilities
- a) Schedule pre-construction meeting to establish who is responsible for locating, marking, protecting and/or relocating site utilities.
- C. Perform a "Call Before You Dig – 811" to locate and mark underground utilities.

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- D. Locate all overhead utilities to ensure equipment is within safe working distances. Ref: OSHA 29 CFR 1926.1408 (h) Table A.

TABLE A—MINIMUM CLEARANCE DISTANCES – Referenced on Page 2 of this manual



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- E. Update your "Utility Location Ticket" every 15 days
 - a) Overhead Electrical Lines
 - i. Assume all electrical lines are energized unless they are visibly grounded at the site
 - ii. Have a representative from the local electrical utility company onsite to confirm that their lines are not energized.
 - iii. Know the voltage of all overhead electrical lines and the required clearance for those lines. Ref: OSHA 1926.1408 (h) Table A. (See Table Above)
 - iv. When working in the vicinity of energized power lines consider grounding your crane (supplement with additional information)
 - v. Provide a warning line, warning device, and/or dedicated line spotter(s) when working in the vicinity of overhead power lines to ensure that the all equipment and loads maintain adequate clearance. Ref: OSHA 1926.1408 (See Table Above)
 - vi.
 - b) Training
 - i. Ensure all employees are familiar with the safety plan and follow proper procedures to ensure jobsite safety.
 - ii. Ensure all employees
 - (a) Are adequately trained for the job they are to perform
 - (b) Have the proper equipment and ensure it is in good working order
 - (c) Utilize the appropriate personal protective equipment (PPE)
 - (d) Avoid complacency with interactive pre-task meetings before beginning work for each shift.
- F. Hazardous Material
 - 1. When working with treated timber products
 - a) Wear protective clothing to minimize contact with bare skin
 - b) Wash thoroughly at the completion of work and prior to eating
 - c) Use proper personal protective equipment such as a respirator, eye protection and gloves or protective lotions when cutting treated timber
 - 2. Environmental Protection
 - a) Consider developing a fuel spill containment plan
- G. Ensure that the interior of all pipe piling are clean of all flammable or noxious materials
- H. Research the proper method for cutting galvanized or coated material
- I. It is strongly recommended that any grinding, welding or cutting of steel with a galvanized coating be performed with adequate ventilation, local exhaust (if possible) and the employee wearing a respirator with the appropriate filter cartridge.

V. Material Handling

A. Material Loading/Unloading

1. Do not stand on the “blind side” of the trailer during loading/unloading operations. The “blind side” is the side of the trailer opposite from the loading/unloading operations. Always stand at the end of the trailer when loading/unloading material.
2. Utilize A-frame step-ladders to access and egress flatbed trailers and avoid accidents related to climbing or jumping from trailers. Ladders should be in compliance with OSHA regulations and positively secured by rope or by another person. Ref: OSHA 1926.1051
3. Do not stand in between a fixed object and a suspended load or piece of equipment. Have an escape plan.
4. Use proper sized and type of rigging, qualified riggers, and qualified crane signal persons per OSHA regulations. Ref: OSHA 1926.1501
5. Never stand under a suspended load.
6. Use adequate dunnage and blocking to ensure that material can be transported and unloaded safely.
7. Ensure loads are tied down securely so that they cannot shift during transport.
8. Utilize stanchions for ANY material that could roll, such as rebar cages, pipe, augers, etc.

B. Material Storage

1. Use adequate dunnage and blocking
2. Stack material in such a way that it is secure from rolling and/or falling. OSHA recommendation is 4:1 ratio.

VI. Equipment Safety

A. General

1. Never adjust or repair equipment while it is in operation
2. If a guard is removed for inspection / service, be sure to replace it correctly.
3. Secure all tools, electrical cords and hoses that might become entangled in moving parts before starting equipment.
4. Keep oily rags away from exhaust systems and hot objects.
5. Never store flammable liquids near equipment.
6. Ensure employees are properly protected from fall exposure when working 6’ or more above the ground or lower level.
7. Fuel-operated equipment shall not be operated in confined spaces unless the exhaust is adequately vented or ducted away from the site.
8. Inspect all equipment prior to operation. Ensure all systems are operating properly. Ensure computerized controls are properly configured. Inspections should be performed daily or per manufacturer’s requirements/specifications.

B. Cranes

1. Connection between the boom tip and fixed leads (horse's head) should be inspected weekly when fittings are greased.
2. Consult with crane manufacturer before connecting fixed leads to crane tips to ensure that the connection is adequate and no components are overstressed.
3. Know the capacity for the size and configuration of your crane and driving setup.
4. Develop and review the assembly and disassembly plan
 - a) Install boom pins from the inside-out so cotter keys are visible from the ground.
 - b) Provide adequate blocking under boom sections.
 - c) Never stand or crawl under a boom section
 - d) Inspect boom cords, lacing, and pendant lines for damage. Repair or replace as needed.
5. Perform daily, and monthly documented crane inspections. Include boom, wire rope (running and standing) per OSHA CFR 1926.1412(d) (1) (A competent person must begin a visual inspection prior to each shift the equipment will be used, which must be completed before or during that shift. The inspection must consist of observation for apparent deficiencies. Taking apart equipment components and booming down is not required as part of this inspection unless the results of the visual inspection or trial operation indicate that further investigation necessitating taking apart equipment components or booming down is needed. Determinations made in conducting the inspection must be reassessed in light of observations made during operation. At a minimum the inspection must include all of the following: 1926(d)(1)(i-xiv), including ground conditions and for level position within the tolerances specified by the equipment manufacturer.
6. Develop and review a detailed lift plan for each critical lift. Ref: OSHA 1926.1400.
7. Lift plans should be specific to each crane.
8. Be aware of wind conditions and reduce load according to manufacturer's recommendation and job application.
9. When working from a barge, reduce load capacity in accordance with manufacturer's on-water lift chart and OSHA / Corps regulations.
10. When working in the vicinity of overhead power lines follow the guidelines established in OSHA 1926.1408 (h) Table A (See Table Above).
11. Ensure that the working surface for the crane is level and firm.

C. Pile Hammers

1. Read and understand the operator's manual for your specific hammer to ensure proper assembly, disassembly and operation
2. When lifting piles with the pile hammer, ensure that the connection between the rigging and the pile hammer is adequate for the task. Use the hammer manufacturers' designed attachment point(s).

3. Ensure that all bolts on the hammer are properly tightened. Inspect hammer before each shift and periodically during the shift, depending on driving conditions.
4. Ensure that hammer cushion is of adequate size, shape and material, and that there are no cracks in the hammer components.
5. Ensure adequate hearing protection is utilized when hammer is operating.
6. When working on a hammer in the leads, ensure that all tools used have been retrieved and returned to the ground.
7. When hammer is operating maintain a safe working distance from the pile and leads. Never stand under the hammer or pile. All non-essential personnel are not allowed to be within the 'Fall Zone". Ref: OSHA 1926.1401 Definitions. "Best Practice" recommendation is to allow for a distance of 1.5 x the suspended load.
8. When transporting a hammer in the leads:
 - a) Remove the drive cap assembly from the hammer.
 - b) Bind hammer so that the piston cannot come out of the cylinder.
9. Ensure the hammer is adequately restrained from downward movement in the leads when working under the hammer.
10. Ensure hammer remains on the pile throughout installation. Do not let the hammer hang up in the leads to avoid an increase in stroke that can cause damage.
11. Use two wire ropes to attach the drive cap/insert to the lower cylinder of the hammer. Do not attach cables to the out end ring.
12. Never leave a running hammer unattended.

D. Drop Hammers

1. Frequently inspect the connection between the hoist line and the hammer.
2. Inspect the wire rope for wear and damage.
3. Ensure that hammer cushion is adequate.
4. Ensure that that the hammer is properly aligned with the pile.
5. Ensure that drive cap is properly connected to the hammer when setting piles.

E. Air Hammers

1. Frequently inspect the connection between the hoist line and the hammer.
2. Maintain adequate clearance from all moving parts.
3. Air line controls shall consist of two shutoff valves. At least one shutoff valve shall be equipped with a quick-acting lever within easy reach of the pile hammer operator.
4. All air hose connections, including those to the pile hammer, shall be securely tethered with chain or wire rope whip checks, or whip socks to prevent the line from thrashing around in case the coupling becomes disconnected.
5. Correctly sized air flow reduction valves should be used to prevent uncontrolled whipping of a burst supply hose at locations other than at a joint connection.
6. Periodically check the hose connections to ensure all bolts are tight.

7. Avoid the exhaust ports when the hammer is in operation.
8. Periodically inspect the wedges and keepers to ensure they are tight.
9. Grease hammer and adjust packing while the hammer is on the ground and the air supply shut off.

F. Diesel

1. Frequently inspect the connection between the hoist line and the hammer.
2. After hammer operation, ensure the leads remain clean to ensure good grip and footing while climbing.
3. Ensure the hammer trip lever is properly engaged when moving the hammer.
4. Refuel, lube and grease the hammer while it is on the ground. If not possible, an aerial lift is recommended when fueling above 6'.
5. Ensure hammer control ropes are secure and cannot become entangled with people or equipment operating in close proximity to the hammer.
6. Avoid the exhaust ports when the hammer is in operation.
7. Maintain adequate clearance from all moving parts.
8. Ensure the hammer shut off is attended at all times anytime the hammer is in operation.
9. Only lift the hammer with the ram locked at the bottom of the cylinder. The tripping device must always be lowered to the lower stop to ensure that the pawl projects fully and is locked. Slowly pull the tripping device upwards to engage the safety dogs using the crane cable.
10. Avoid build-up of excess fuel and lubricant in the cylinder. Either dry fire or use a reduced fuel pump setting when starting the hammer on a previously driven pile.
11. Utilize a cylinder extension when driving piles in excess of a 1:3 batter.
12. Ensure the hammer trip remains above the lifting lugs while hammer is in operation.

G. Hydraulic

1. Frequently inspect the connection between the hoist line and the hammer.
2. Ensure hoses are in good condition.
3. Do not stand under the hoses.
4. Inspect power unit for proper fluid levels, operating temperatures and pressures. Also inspect the hammer controls, especially the emergency shut off switch, for proper operation.

H. Vibratory Hammers

1. Frequently inspect the connection between the hoist line and the hammer.
2. Ensure the hammer controls are attended at all times when in operation. Inspect power unit for proper fluid levels, operating temperatures and pressures. Also inspect the hammer controls, especially the emergency shut off switch, for proper operation.

3. Periodically inspect the hammer to ensure there are no loose bolts or leaking fittings. This includes the jaw bolts. Ensure bolts are properly torqued.
4. Do not use hoses as a tagline to pull equipment. Disconnect the hose prior to moving the power unit. Utilize an appropriate restraining device to prevent unintended stress on the connection of the hoses to the power unit.
5. Remove twists and kinks from hydraulic hoses.
6. Do not depend on the hydraulic jaws to hold the pile aloft. Attach a hoist line to the pile if there is any danger of injury or property damage.
7. Never leave the hammer clamped to a pile when it is disconnected from the crane. Lay the hammer down when not in use or use the cradle designed to hold the vibratory hammer.
8. Stay clear of hydraulic hoses when the hammer is being raised and lowered.
9. Use safety wire on screw pin shackles to ensure the pin does not back out. Inspect shackle pins frequently for thread wear.
10. Adequately support hydraulic hoses while hammer is in operation to avoid excess bending.
11. Inspect hoses for damage prior to each use. Replace hoses if broken wire strands are visible.
12. Ensure that the hammer's jaws are set securely on the pile.
13. Do not exceed the capacity of the hammer, crane or rigging when extracting a pile.

I. Leads

1. General

a) Assembly/Disassembly Procedures

- i. Ensure lead connection pins or bolts are properly installed per manufacturer's specifications.
- ii. Use caution when removing pins from leads. Pins can be ejected quickly when hit by a hammer. Ensure the area behind the pin is clear before removing pin or use a backstop to prevent the pin from causing injury or property damage.
- iii. Stand inside the lead sections during assembly/disassembly only as required to install or remove the connecting pins. Align or support leads to avoid sudden movements while installing or removing pins.
- iv. A minimum weekly documented inspection of the pile driving leads, connections to crane, and spotters (if equipped) shall be conducted. If found to be unsafe they shall be immediately taken out of service and their use prohibited until unsafe conditions have been corrected. Inspect lead cords, lacing, ladders and welds for damage. Repair or replace in accordance with manufacturer's specifications. If laying down the leads is not a practical option, visually inspect using binoculars, or aerial lift.

- v. The connection between the boom and fixed leads should be properly installed, serviced and maintained per manufacturer's specifications.
 - vi. Use extreme caution when raising or lowering fixed leads. This creates high stress on the boom connection and leads.
 - vii. Inspect the hammer in the leads to ensure there are no tight spots that might impair the ability of the hammer to properly follow the pile.
- b) Ensure leads are properly designed and configured for the task at hand.
 - c) Know the limitations of your particular lead configuration.
 - d) Pile driving leads shall be equipped with a positive and negative restraint device to prevent the hammer from falling or uncontrolled rising out of the lead, as well as preventing contact with head block or sheaves, if so equipped.
2. Free Hammer
- a) Ensure guides are properly installed on hammer to maintain proper alignment with the pile.
 - b) Ensure operator holds the hammer at all times.
3. Swinging Leads
- a) Use a tag line to prevent uncontrolled movement or swinging.
 - b) Ensure there is a sufficient length of leads to install the piles required, ensure the leads can handle the weight of the hammer and pile at all locations and ensure the crane has sufficient boom to hold the leads and carry the entire weight of the load.
 - c) Keep the hammer at the base of the leads when raising or lowering leads. Ensure the gates can support the weight of the hammer.
 - d) Frequently inspect the connection between the hoist line and the leads.
 - e) Ensure the pile alignment gates are sized for the pile to be driven.
 - f) Do not remove the gate pins/gates while hammer is running.
 - g) When stabbing / spudding the leads into the ground by dropping, ensure all employees are aware and keep clear when dropping the leads in position. One person signals the crane operator.
4. Fixed Leads
- a) Fixed lead attachment points to a mobile crane shall be designed by a registered professional engineer. The components shall be compatible for the specific boom type (tubular, angle, or telescopic).
 - b) Ensure there is a sufficient length of leads to install the piles required, ensure the leads can handle the weight of the hammer and pile at all locations and ensure the crane has sufficient boom to hold the leads and carry the entire weight of the load.
 - c) Spotters (fixed or retractable) shall be compatible with the leads. If shop made, they shall be designed by a registered professional engineer.

- d) Do not exceed the manufacturer's recommendations for the distance from the tip of the crane boom to the top of the fixed lead system.
 - e) Ensure all head and deflector sheaves are turning freely, are well lubricated, and secured using the correct retaining pins / bolts.
 - f) Do not allow employees to stand near the spotter during pile driving operations.
 - g) Ensure the pile alignment gates are sized for the pile to be driven.
 - h) Do not remove the gate pins/gates while hammer is running.
5. Semi-Fixed
- a) Ensure there is a sufficient length of leads to install the piles required, ensure the leads can handle the weight of the hammer and pile at all locations and ensure the crane has sufficient boom to hold the leads and carry the entire weight of the load.
 - b) Keep the hammer at the base of the leads when raising or lowering leads.
 - c) Ensure the gates can support the weight of the hammer.
 - d) Frequently inspect the connection between the hoist line and the leads.
 - e) Spotters (fixed or retractable) shall be compatible with the leads. If shop made, they shall be designed by a registered professional engineer.
 - f) When stabbing / spudding the leads into the ground by dropping, ensure all employees are aware of this action and to keep clear when dropping the leads in position. One person signals the crane operator.
 - g) Ensure the pile alignment gates are sized for the pile to be driven.
 - h) Do not remove the gate pins/gates while hammer is running.
6. Specialty
7. Spud
- a) A steel wide-flange or H-beam used in place of leads. The hammer engages and slides upon one flange of the beam through the use of spud clips bolted to the hammer. Also called H-beam Lead, Monkey Stick.
 - b) If shop made, spud leads shall be designed by a registered professional engineer.
 - c) Ensure there is a sufficient length of leads to install the piles required, ensure the leads can handle the weight of the hammer and pile at all locations and ensure the crane has sufficient boom to hold the leads and carry the entire weight of the load.
 - d) Keep the hammer at the base of the leads when raising or lowering leads.
 - e) Ensure the gates can support the weight of the hammer.
 - f) Frequently inspect the connection between the hoist line and the leads.

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- g) Spotters (fixed or retractable) shall be compatible with the leads. If shop made, they shall be designed by a registered professional engineer.
 - h) When stabbing / spudding the leads into the ground by dropping, ensure all employees are aware and keep clear when dropping the leads in position. One person signals the crane operator.
 - i) Ensure the pile alignment gates are sized for the pile to be driven.
 - j) Do not remove the gate pins/gates while hammer is running.
- J. Dedicated Pile Driver (DPD)
- a) A Dedicated Pile-Driver is a machine that is designed to function exclusively as a pile-driver. These machines typically have the ability to both hoist the material that will be pile-driven and to pile-drive that material.
- VII. Dedicated Pile Driver (DPD) operator must be certified to operate the specific machine to which they are assigned (implementation date: November 2017).
- VIII. DPD operator must be capable of reading and understanding the operator's manual for the specific machine to which they are assigned ~~to~~.
- IX. DPD operator must understand the limitations of using said machine to lift and maneuver hoisted material, per the manufacturer's specifications.
- X. Do not side load the mast when hoisting piling into position for driving. Keep piling material as close the DPD as possible to minimize this hazard.
- XI. A DPD must operate from a stable, level, well drained working platform so that the equipment manufacturer's specifications for adequate support and degree of level of the equipment are met.
- XII. Perform daily, and monthly documented equipment inspections. Including boom/mast, hydraulic mast positioning cylinders, wire rope (running and standing) per OSHA CFR 1926.1412(d)(1), including ground conditions and for level position within the tolerances specified by the equipment manufacturer.
- XIII. Perform daily documented inspections of pile hammer, clamps, rigging, drive head, etc. as described in previous sections.
- XIV. DPD crew must develop adequate hand signals for instructions and ensure all crew members understand the meaning of said signals.
- XV. Stack piling material so the individual pieces are not interlocked, to provide hammer access to grab / hoist the material.

XVI. If using auxiliary equipment (mobile crane, forklift, trackhoe, etc.) ensure the operators of each machine is trained and authorized for the specific machine they are to operate.

A. Press-In Rig

1. Follow the manufacturer's recommendations for rig set up and operation. Do not exceed these recommendations.
2. Perform a thorough inspection of the hydraulic system prior to each shift and more frequently under sever operation
3. Maintain a safe distance from the pile being pressed at all times.

B. Excavator-Mounted

1. Pile leads and hammer must not exceed the weight of the rated capacity of the excavator / base machine
2. Do not add any additional counterweight unless approved by the excavator manufacturer or designed by a registered professional engineer.
3. The lead attachment point(s) must be approved by the manufacturer of the base machine (excavator).
4. Follow the recommended operating speeds of the manufacturer of the base machine.

C. Manlifts (AWP)

- (a) Select the proper type of Aerial Work platform (AWP) necessary for the task.
- (b) Employees must be trained in the proper use of the AWP they are using
- (c) Full body harness and retractable lanyards are required to worn for each employee using the AWP
- (d) Maintain both feet on the platform floor at all times – this is your fall protection.
- (e) Do not exceed the manufacturers recommended weight capacities
- (f) Perform a documented inspection of the AWP and the environment where it will be operated, prior to use.

XVII. Pile Installation

A. General

1. Determine the pile type – pre-cast concrete, steel structural section, steel pipe, timber or a composite pile. The pile type is typically selected based on the soil profile, driving difficulties and or a corrosive soil problem.
2. Driving criteria must be established (driven to depth/grade or to a specified blow count).
3. Only workers who are trained on the specific hazards of the operation shall be in the work area where these operations are being carried out
4. No person should stand under the outrigger/spotter. No worker shall be positioned directly under the hammer or pile. Essential employees should stand to the sides or the rear of the leads during installation of the pile. All non-essential personnel are not allowed to be within the 'Fall Zone". Ref: OSHA 1926.1401 Definitions. "Best Practice" recommendation is to allow for a distance of 1.5 x the suspended load.
5. Whenever possible, the top of the pile shall be guided under the hammer from the ground to eliminate the need for climbing the leads to set the pile under the hammer.
6. All employees shall be alerted to and stay clear of the pile hoisting operation.
7. All foreign material such as frozen earth or tack-welded steel shall be removed from the piles before being spotted for driving.
8. Hoisting of piling shall be performed in a manner that positively prevents accidental detachment from the hoisting equipment's rigging.
9. Whenever diesel hammers are being fueled, the oil reservoir shall be also be checked and re-filled as necessary. Grease all fittings (if equipped) on all pile driving hammers at least once per shift or as recommended by the hammer manufacturer.
10. The designated signal person is the only person to signal the pile driving rig operator (Except in an emergency "All STOP" situation).
11. When setting up over a pile location (stake or hub) the leads need to be steadied by hand. When the signal is given, the leads will be dropped (set) so they stab into the ground. Make sure your legs and feet are clear before the leads are set.
12. Do not place any part of your body under the hammer, leads, or pile as they are suspended in the air, or during driving of the pile. (Exception: When momentarily positioning leads over pile hub or inserting or removing pile gates)
13. Shut down the pile hammer when removing the rigging from the pile being driven and or removing the alignment gates at the bottom of the leads.
14. Check for pile plumbness as the pile is being driven. Stop the driving and re-plumb the pile if necessary, before the pile is driven too deeply.
15. Foot marks may be required to be drawn on the pile so the length of the driving can be determined. Use caution when rolling or turning piles to avoid injury.

B. Access to Pile Leads

1. Access ladders should comply with OSHA specifications.
 2. Employees shall be prohibited from remaining on leads or ladders while piles are being driven.
 3. Ensure leads are periodically cleaned to avoid safety hazards when climbing.
 4. Use fall protection when climbing leads. Inspect fall protection before use.
 5. If a worker is “required” to climb the driving leads, the operator of the equipment should apply all brakes and necessary safety devices to ensure no uncontrolled motion of the equipment.
- C. Sheet Pile Access
1. If the sheet pile are driven using a top man, this employee will gain access to the top of the sheets by means of a ladder, aerial lift, or crane suspended personal platform. Fall protection shall be worn at all times.
 2. Riding the overhaul ball or load block is not allowed.
 3. Use ground release shackles when possible, to eliminate using ladders.
- D. Pile Extraction
1. The rated capacity of the vibratory hammer’s suspension shall not be exceeded. The crane and hammer manufacturer’s recommendations for extracting piling shall be observed at all times.
 2. Do not allow piling to be extracted by tipping the crane, releasing the load brake momentarily, and catching the load before the crane has settled.
 3. If using a crane, extract piling using a vibratory or impact hammer to the point where the pile(s) can be pulled without the need of a the hammer. Disconnect the hammer from the crane, and pull the pile(s) as necessary. Lay extracted piling down in a designated area.
 4. Consider applying a safety factor to the lift plan to account for skin friction/resistance when extracting sheeting and/or piling.
- E. Spudding
1. Select an adequate spud for the material it must penetrate
 2. If free-falling the spud, ensure the hoist line does not become fouled on the drum from excess slack in the line.
 3. Drive and pull the spud in short increments to avoid “sticking” the spud into the soils.
 4. Keep all employees clear of the impact area of the spud.
- F. Jetting
1. Inspect all pressurized hoses / lines for damage or leaks. Repair or replace accordingly
 2. Inspect jet pump for damage or wear prior to use
 3. Employees working near jetting operations shall wear hearing and eye protection at all times. Face shields may be necessary.
 4. Keep area clear of excess mud/water build up to avoid slip/trip conditions.

G. Pre-Drilling or Augering

1. Ensure the auger drive/drill motor is mounted securely to the pile leads.
2. Inspect the leads, auger drive/drill motor, auger, and power supply lines to ensure no excessive wear or damage has occurred. Repair or replace as necessary.
3. Never place any body parts in such a manner that they are exposed to the rotating auger. Keep any body part or tool away from the interface of the auger and the guide(s).
4. If you must clear debris from the auger flights, stop auger rotation first.
5. Keep unnecessary employees away from pre-drilling operations

H. Pile Cut Off

1. During pile cut off, make sure the area is clear before cutting begins. Remove all combustibles in the area.
2. If pile material is in excess of five feet in length, attach rigging and lifting equipment first, and then cut the pile to grade. Do not allow the material to simply fall to the ground uncontrollably.
3. Keep the cut off pieces cleaned up to allow access to the piles for concrete trucks and to avoid trip hazards.
4. Use proper chain saw techniques and PPE if trimming wood piles.
5. When it is necessary to cut off the tops of driven piles, pile-driving operations shall be suspended except where the cutting operations are located at least twice the length of the longest pile cut-off from the driver. All persons within the length of the cut-off pile, who are not otherwise engaged in the operation, shall be warned to move to a safe distance. Ref: OSHA 1926.603(c)[5] – “When it is necessary to cut off the tops of driven piles, pile driving operations shall be suspended except where the cutting operations are located at least twice the length of the longest pile from the driver.”

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J. Pile templates

1. Walkways shall be kept clear of trip hazards. Each employee on a walking/working surface (horizontal and vertical surface) with an unprotected side or edge which is 6 feet (1.8 m) or more above any part of a temporary or permanent structure, template, or cofferdam shall be protected from falling by some form of fall protection such as guardrails, nets, or personal fall protection

K. Hoisting of personnel:

1. If the employer can demonstrate there is no less hazardous alternative means of access to the piling rig, such as a ladder, stairway, aerial lift, or elevating work platform, due to design of the equipment or actual jobsite conditions, the employer may elect to use a boatswain chair and the pile driving equipment's load line provided:

2. The load line hoist drum shall have a system, other than the load line hoist brake, which regulates the lowering rate of speed of the hoist mechanism. This system or device must be used when hoisting personnel. The hoist line shall be equipped with sufficient weight added to overcome the weight of the hoist line from the tip of the boom or pile leads back to the hoist drum.
3. The employee shall be hoisted in a slow, controlled decent and ascent
4. The boatswain's chair itself (excluding the personal fall protection system's anchorage), shall be capable of supporting, without failure, its own weight and at least five times the maximum intended load.
5. Must comply with OSHA CFR 1926.1431

L. Splicing

1. Ensure the splicing material is correct for the application, and in accordance with the project specifications.
2. If material must be trimmed from the pile material, cut the pile perpendicular to the material, not level to the material.
3. Follow the requirement in the Welding & Burning section.

M. Rigging

1. Inspect all rigging prior to use. Inspection must be performed by a competent person. Inspect for broken wires, kinks, excessive wear, corrosion or other defects. Remove damaged rigging from service immediately.
2. Only qualified riggers are to select and then attach rigging to a load.
3. Ensure the weight of the load is known before lifting.
4. Select the proper capacity rigging for the load.
5. All slings must have the manufacturer's name, rated capacity for the type of hitch used, type of material, and the capacity that must not be exceeded, located on a permanently attached tag.
6. Store rigging where it will not be damaged. Do not leave it on the ground.
7. All material that is stored, must be stacked, racked, blocked, interlocked, or otherwise secured from movement, to prevent sliding, falling, or collapse.
8. Storage areas shall be kept free from accumulation of materials that constitute hazards from tripping, fire, explosion, or pest harborage. Vegetation control will be exercised when necessary. Make sure there is room to access the material with equipment, and that it is cribbed to allow rigging to be attached and removed. In storage areas, there must be adequate room for emergency equipment to maneuver and set up.
9. The chains used to tie down equipment on tractor-trailer transports are NOT to be used as rigging to hoist loads. They are not designed to do so.
10. Eyes made in wire rope slings or bridles are not to be formed by wire rope clips or knots.
11. A flemished eye may be formed only when in accordance with the specifications for the wire rope and cable clamps.

12. Slings need to be padded or protected from the sharp edges of their loads. Shock loading is prohibited.
13. Synthetic slings cannot be used where fumes, vapors, sprays, mists, or liquids of acids or other corrosives are present. They also are not to be used to hoist hot material, or be used near a spark generating process.
14. Synthetic slings must be taken out of service if there are any cuts, snags, tears, punctures, acid or caustic burns, melting, broken or worn stitching, or if the internal red warning threads are showing.
15. No sling is to be shortened by using a knot or other makeshift device.
16. Make sure the slings or spreaders are long enough to pick the load at a minimum sling leg angle. The closer this angle is to vertical, the less strain there is on each leg.
17. Do not make a spreader leg into a choker by hooking it back to itself. If you must, at least make the rigging a basket type and attach the hooks to the steel ring and not to the eye of the spreader leg. Just remember, doing this will most likely permanently kink the legs, and reduce their overall capacity.
18. Shackles and hooks must be inspected for wear and distortion. The rated capacity must be stamped on the unit, **and are not to be exceeded**.
19. Loads must be applied to the hook in the throat area with the safety latch closed. Hooks must have a safety latch in place, unless the hook is designed to be used without one, such as a shakeout or sorting hook. Tip loading of a hook is extremely dangerous.
20. Overhaul (headache) ball swivels have rated capacities. These are found on a tag or are stamped into the unit. As with all rigging, this rated load must not be exceeded. They too must be inspected for wear and distortion and in addition, be maintained and lubricated.

XVIII. Working Over or Near Water

1. Ref: OSHA 1926.605 – Marine Operations and Equipment
2. Ref: OSHA 1926.106 – Working Over or Near Water
3. Ref: OSHA 1926.1437 – Cranes on Barges

