

SECTION 505

PILING

505-1.01 DESCRIPTION. Furnish and drive piles, and assist in pile testing.

505-1.02 DEFINITIONS.

CUT-OFF. The cut off end of a pile, or cutting a pile end at the finish elevation.

DIFFICULT DRIVING. A layer of soil or rock that is difficult to drive a piling in with normal driving equipment, and in which there is a high probability that pile refusal may occur^[1].

DRIVECAP. A pile driver component that is used to transmit impact forces from the hammer ram to the pile top. The drivecap includes the anvil or striker plate, hammer cushion (capblock), helmet, and pile cushion, if used. (Also termed the driving head)

ESTIMATED TIP ELEVATION. The elevation at which the Department expects the nominal axial resistance to be achieved.

FRESH HEADING. Cutting the end of a pile perpendicular to the long axis to remove damage, and to obtain a proper driving or splicing surface.

FOLLOWER. A pile driving aid placed between the helmet and the pile top when the pile head is below the reach of the hammer.

HAMMER CUSHION. A disk of material placed on top of the helmet but below the anvil or striker plate to relieve impact shock and provide protection for the hammer and pile.

HAMMER ENERGY:

MAXIMUM RATED HAMMER ENERGY. The theoretical maximum amount of gross energy that a pile driving hammer can generate.

TRANSFERRED HAMMER ENERGY. The amount of energy transferred to the pile for a given blow accounting for friction energy during the ram down stroke, energy retained in the ram and pilecap during rebound, and other impact losses.

HELMET. A pile driver component that fits closely on top of the pile to ensure the impact force is transmitted uniformly across the top of the pile and concentric with the axis of the pile.

JETTING. Use of water jets to create a hole for the pile. Prejetting is done prior to pile driving. Side jetting is done adjacent to the pile during driving.

LEADS. Pile driver components used to maintain pile and hammer alignment during driving, and on which the pile hammer may travel. **Types of leads include**^[2]:

~~**FIXED LEADS.** Pile driving leads that are attached at the top of the boom by a pivot and to the crane at the bottom with a brace. The pile is held at the top by the helmet and is guided at the bottom by the pile gate.~~

~~**SEMI-FIXED LEADS.** Pile driving leads that are attached at the top of the boom by a pivot and supported by the lead line. The lead can slide axially along the pivoted boom point and may be fitted with an extendable brace at the bottom of the leads.~~

~~**SWINGING LEADS.** Pile driving leads that are suspended from the boom by the cable and are not attached to the crane at the bottom with a brace. (Also known as offshore leads)~~

MINIMUM PENETRATION. The minimum length of pile below the footing or finished ground elevation to which the pile must be driven.

NOMINAL AXIAL RESISTANCE. The required axial resistance, in units of force, to be achieved during pile driving.

PILE GATE. A device at the base of the leads that is closed around the pile to maintain alignment.

PILE REFUSAL. Refusal occurs when the hammer requires 15 or more blows to move the pile one inch, and the hammer is operating near the maximum allowable compressive driving stress (transferred hammer energy is within 80-90% of the specified pile yield stress). ~~The condition reached during pile driving which results in a pile driven by an impact hammer having a negligible rate of penetration, or when the transferred energy from a properly sized, maintained, operating and efficient impact hammer is no longer sufficient to advance the pile tip without damage~~^[3].

SPUDDING (PUNCHING). The driving of a short and stout section of pile-like material into the ground to punch through or break up a hard ground strata.

SUBSTRUCTURE UNIT. An abutment or pier that (1) transmits loads directly from the superstructure to the ground and (2) retains the earth underneath and adjacent to the approach roadway.

TEST PILE. A pile that has a high-strain dynamic test performed on it.

WAVE EQUATION ANALYSIS. A numerical method of analysis for the behavior of driven piles that predicts the pile capacity versus blow count relationship (bearing graph) and pile driving stress.

MATERIAL REQUIREMENTS AND SUBMITTALS

505-2.01 MATERIALS. Use materials that conform to the following:

Timber Piles	Section 713
Preservatives for Timber	Section 714
Structural Steel Piles	Section 715

505-2.02 PILES. Furnish piles sufficient in length to obtain the nominal axial resistance and to extend to the estimated tip elevation shown on the Plans. Furnish full-length piles where practical. Furnish enough pile length to account for waste from fresh heading, cutoffs, and to suit your method of operation. Use metal shoes or reinforced tips when noted on the Plans, or as directed by the Engineer. Store and handle piles in ways that protect them from damage.

1. Steel Piles. Furnish rolled steel H-pile sections, steel pipe piles, sheet piles or other structural steel sections described in the Contract. Do not furnish spirally welded pipe piles. Submit four signed certificates of compliance for piles, metal shoes, and reinforced tip material.

Notify the Engineer at least 30 days before welding or fabricating piles to allow for inspection. The Engineer will reject welds that do not meet Subsection 504-3.01.

The Engineer will reject steel piles that are bent, damaged, exceed allowable mill tolerances, or does not meet the Contract requirements.

Steel piles and pile shells that protrude above the final ground line must be galvanized, from the top of pile to a distance not less than 10 feet below the finished ground line, according to AASHTO M 111 to a thickness of 4 mils. When paint is designated on the Plans, ~~instead of galvanizing~~ use paint [instead of galvanizing](#) to coat steel piles and steel pile shells, from the top of pile to a distance not less than 3 feet below the finished ground line according to Sections 513 and 708.

2. Timber Piles. Use treated full length round timber piles.

505-2.03 PILE DRIVING PLAN.

Submit a pile driving plan to the Engineer, no less than 30 days prior to the anticipated start of pile driving. [Submittals will be received and reviewed by the Engineer according to Subsection 106-1.08, and returned as either: approved, conditionally approved, or rejected with the reasons listed.](#) Do not begin pile driving until after the Engineer has approved the pile driving plan.

Include in the pile driving plan:

1. A completed Pile Driving Equipment Data (Form 25D-098).
2. Manufacturer's catalog cuts, specifications, guidelines, and technical bulletins for all pile driving equipment to be used.
3. A description of the techniques to be used for ensuring proper placement and alignment of the piles, obtaining the nominal axial resistance, and advancing the piles to the estimated tip elevation.
4. [Alternate M](#) methods of [pile installation when obstruction removal when obstructions are layers of soil or rock, are identified as "Difficult Driving" or "Refusal",](#) ~~indicated~~ in the Contract ~~or geotechnical investigations~~^[4].

The Department will evaluate the suitability of the pile driving plan based on a wave equation analysis of the hammer-pile-soil system using the computer program "GRLWEAP" and the GRLWEAP industry standard hammer input data.

Approval of the pile driving plan will be based on whether the Department's evaluation determines that the proposed pile driving equipment can:

1. Advance the piles, undamaged, to the nominal axial resistance and to estimated tip elevations shown on the Plans; and
2. Limit compressive driving stresses to less than 90% of the specified pile yield stress.

[Contractor is Responsible.](#) The Engineer's approval of the pile driving plan, doesn't relieve the Contractor of responsibility for driving each pile:

1. without damaging the pile;
2. until the pile has reached the minimum penetration or deeper;
3. until the pile has reached nominal axial resistance; and
4. within the placement and alignment tolerances specified.

[Revisions.](#) Submit all revisions to the approved pile driving plan to the Engineer, for [review approval](#). For all pile driving equipment not previously identified in the pile driving plan, include in the submittal all of the information required for the pile driving plan. Explain to the Engineer, in writing, which portions of the approved pile driving plan will be superseded by the

revision and which portions remain unchanged. Allow at least five days for the Engineer's review~~approval~~ of pile driving plan revisions.

CONSTRUCTION REQUIREMENTS

505-3.01 PILE INSTALLATION EQUIPMENT. Use pile driving equipment can that drive the piles, undamaged, to the minimum penetration and nominal axial resistance shown on the Plans. Use equipment that limits compressive driving stresses to less than 90% of the specified pile yield stress. Use impact hammers or a combination of hammers to drive piles. You may use vibratory hammers for initial placement of steel bearing piles, and entire placement of steel sheet piles. Use pile driver leads that allow the hammer to move freely along the projected axis of the pile. Do not use followers to drive piles.

1. Helmet. Fit the pile driving hammer with a cast steel helmet (or similar device) that is recommended in the hammer manufacturer's guidelines and is compatible with the pile. Use a helmet that aligns concentrically and fits closely with the top of the pile.
2. Hammer Cushion. Fit the pile driving hammer with a hammer cushion recommended in the hammer manufacturer's guidelines. Use a hammer cushion that is of appropriate thickness to prevent damage to the hammer or pile, and to produce uniform driving performance. Replace the hammer cushion when its thickness is reduced to less than 75% of the original manufactured thickness. Do not use wood, wire rope, or asbestos hammer cushions. Some equipment does not require hammer cushions, in that case follow manufacturer's guidelines.

~~3. Leads and Templates. Provide equipment that will laterally support the piles near the pile cut off and finished ground line, to ensure proper placement and alignment of the piles. Do not use equipment to forcibly manipulate misaligned piles into proper position. A template is not required when driving piles with fixed leads, or when installing signal and lighting structures according to Section 740.~~

~~Use a template when driving piles with semi-fixed leads or swinging leads. Provide a template that is fixed in place and rigid enough to ensure proper placement and alignment of the piles. Where practical, place the template so that the piles can be driven to estimated tip elevation before removing the template. Locate single level templates within 5 feet of the pile cut off.~~

~~For piles with cut off elevations more than 10 foot above finished ground elevations, provide a double template or other approved equipment to maintain alignment of the pile. Use a double template consisting of a pile template within 5 feet of the finished ground line or waterline and a second upper support with 5 feet of the pile cut off.~~

~~Wooden templates are not permitted. Do not use floating templates attached to a barge, except when the floating template is physically pinned or fixed to the ground [5].~~

Use only equipment included in the approved pile driving plan. The Engineer will inspect the pile driving equipment after it has been mobilized to the site and prior to beginning pile driving operations.

505-3.02 PILE DRIVING CRITERIA AND TESTING. The Engineer will provide criteria for determining pile acceptance based on pile driving performance. The Engineer may perform pile testing to calibrate the wave equation analysis, determine actual pile bearing capacity, hammer system efficiency, pile driving stresses, and pile integrity. Unless otherwise specified in the

Contract, the Engineer will use one or more of the following to establish pile driving criteria for acceptance and verify the nominal axial resistance of the pile has been achieved:

1. Wave Equation Analysis. The Engineer will establish the pile driving criteria using a Wave Equation Analysis. The Engineer will provide acceptance curves, based on stroke height, blow count, and driving rate relative to each substructure location.
2. High-Strain Dynamic Testing. The Engineer will perform high-strain dynamic testing on piles at locations noted on the Plans. The Engineer may perform testing on piles at other locations if, in the opinion of the Engineer, the performance of the hammer-pile-soil system changes from that of the original wave equation analysis or the test pile program. The Engineer will perform the high-strain dynamic testing in accordance with ASTM D 4945.

Attend a meeting with the Engineer at least 14 days prior to the beginning of pile driving operations to discuss the pile testing program. Give the Engineer seven days advance notice before driving each test pile.

The Engineer may test the initial pile driven at each substructure unit or location indicated on the Plans. Drive each test pile to the minimum penetration and nominal axial resistance shown on the Plans, as indicated by the wave equation analysis criteria established by the Engineer. The Engineer will record test data (hammer energy, stroke height, blow counts, penetration rate) for the entire driving of the pile. If the pile encounters an obstruction during driving, testing will not be performed on that pile, but will be performed on the next pile driven at the substructure unit.

After initial placement of the test pile, provide a reasonable and safe means for the Engineer to access the top of pile. Furnish electrical power (a 115 volt, 55-60 cycle AC outlet, 10 amp minimum) for the Engineer's use during the installation and operation of the testing instruments. Allow the Engineer four hours to set up and install the test equipment, and one hour to disassemble and remove the test equipment after testing is complete. The Engineer will attach testing instruments near the top of the test pile through drilled and threaded holes. If splices are required, allow the Engineer four hours time and access, to disassemble and reinstall testing instruments at the top of the new pile length. The Department will furnish the equipment, materials and labor necessary to mount the testing instruments to the pile.

Adjust the energy or fuel setting of the hammer to the maximum position that won't damage the pile. Strike the test pile until you have reached minimum penetration and nominal axial resistance, with the Engineer present to record test data.

3. Restriking. If the test results do not confirm the nominal axial resistance, the Engineer may direct you to wait 48 hours and then restrike the pile, with the Engineer present to record test data. Perform the re-strike with a warmed-up hammer, and with the energy or fuel setting adjusted to the maximum position that won't damage the pile. Strike the test pile with 60 consecutive blows or until the pile penetrates an additional 3 inches, whichever comes first. The Engineer may terminate the re-strike after 25 blows if pile movement is less than 1 inch.

If the results from the high-strain dynamic testing or restriking validate the wave equation analysis, drive the remaining piles at the substructure unit using the criteria from the wave equation analysis. Otherwise, the Engineer may change driving criteria or tip elevations, for the remaining piles at the test location, based on the driving record or the results of the high-strain dynamic testing of the test pile.

Account for the time required by the Engineer to perform the pile test program in the progress schedule submitted under Subsection 108-1.03. The Department will not allow additional contract time or additional compensation, for delays caused by testing or restriking.

505-3.03 DRIVING PILES. Drive all piles to the nominal axial resistance and minimum penetration shown on the Plans. If piles do not achieve the required nominal axial resistance when minimum penetration is reached, continue driving the pile until the nominal axial capacity is achieved. Install piles in groups starting from the center of the group and proceed outward in either direction.

Use an impact hammer to drive piles, except as noted in this paragraph. A vibratory hammer may be used to drive steel sheet piles to tip elevation. A vibratory hammer may be used for initial placement of steel bearing piles, provided the last 10 feet of driving is by impact hammer.

When the Contract identifies a layer of soil or rock, as "Difficult Driving" or "Refusal", then use alternate methods of driving to penetrate the layer and install the piling through that layer. You may use, including those methods listed under Subsection 505-3.03.2 Obstruction Removal. All alternate methods of driving are subsidiary to the Drive Pile pay item. [j6]

1. Driving Piles through New Embankment. When piles are driven through or embedded in more than 5 feet of new embankment, preform a hole or preinstall casing through the embankment in the pile location. Make the hole or inside casing diameter not less than the nominal size of the pile plus 6 inches. Install the pile through the hole or casing. Fill the annular space around the pile with dry sand or pea gravel. Dispose of excess excavated material as provided in Subsection 203-3.01.
2. Obstruction Removal and Alternate Methods of Driving. When pile refusal occurs before the pile reaches the minimum penetration shown on the Plans, then remove the obstruction and continue driving the pile. If the obstruction is not ~~identified~~indicated in the Contract ~~or geotechnical investigations~~, the Department will compensate according to Subsection 505-5.01 for removing the obstruction. ~~The Department will not be liable for any delays or other impacts to the work.~~ If the Contract identifies a layer of soil or rock, as "Difficult Driving" or "Refusal", and pile refusal occurs~~the obstruction is indicated in the Contract~~ in the identified layer, then ~~or geotechnical investigations~~, obstruction removal in that layer is subsidiary.

To remove obstructions, use alternate methods of driving including, but are not limited to:

- a. Pre-boring;
- b. Blasting;
- c. Spudding;
- d. Jetting; ~~and~~
- e. Using a larger capacity, heavier or faster striking hammer; ~~and~~
- f. Excavation.

Obtain written approval from the Engineer before employing any alternative methods of pile driving. After exhausting all practicable means to obtain minimum penetration, but without success, the Engineer will evaluate the structural adequacy of the pile and substructure at a lesser penetration. This review will be based on the required design loads, nominal axial resistance of the pile, and actual pile penetration. If the Engineer finds the pile and substructure to be structurally adequate, the Engineer will accept the pile at the lesser penetration.

3. Placement and Alignment. Place and align piles at the locations shown on the Plans. Ensure that the axial alignment of driven piles do not deviate by more than 1/4 inch per foot from the vertical or batter line indicated on the Plans. Limit the rotation of steel piles about their longitudinal axis to 15 degrees from the plan position. In addition, ensure the position of piles is within the following tolerances:
 - a. Abutments and Retaining Walls. Position the piles at the bottom of an abutment or retaining wall within 3 inches of the position shown on the Plans. Do not vary the distance

between piles more than 3 inches from that shown on the Plans, and keep the clear distance from the edge of pile to the edge of footing to at least 6 inches.

- b. Pier Footings. Position the piles at the bottom of a footing within 6 inches of the position shown on the Plans. Do not vary the distance between piles more than 6 inches from that shown on the Plans, and keep the clear distance from the edge of pile to the edge of footing to at least 9 inches.
 - c. Exposed Piles. For piles exposed in the completed work, position the piles within 2 1/2 inches of the plan position at cut-off elevation and within 3 inches of the plan position at the finished ground line elevation, but do not deviate by more than 1/4 inch per foot from vertical.
 - d. Sheet Piles. Position the sheet piles at the original ground line elevation and at the top of retaining structures, within 3 inches of the position shown on the Plans. Position tiebacks and walers within 6 inches of the position shown on the Plans.
4. Protection of New Concrete. To minimize the detrimental effects of pile driving vibrations on new concrete less than 28 days old, do not drive piles closer to the new concrete than the distance determined by the following formula or 30 feet, whichever is greater:

$$D = C\sqrt{E}$$

Where: D = Distance in feet

E = Maximum rated hammer energy in foot-pounds

C = Coefficient shown below based on the number of days of curing time

Curing Time (Days)	Coefficient (C)	Curing Time (Days)	Coefficient (C)
1	0.34	6	0.12
2	0.23	7-9	0.11
3	0.18	10-13	0.10
4	0.15	14-20	0.09
5	0.13	21-28	0.08

5. Concrete Filled Pipe Piles. After pile driving, clean out the pile to the bottom of concrete elevation shown on the Plans. Immediately prior to placing concrete, verify that the soil level in the pile has not rebounded more than six inches. Do not place concrete until the soil level in the pile stabilizes. Fill pile with concrete according to Subsection 501.
6. Steel Sheet Piling. Drive steel sheet piling and cut off true to line and grade. Install steel sheet piling with a suitable hammer. Remove and replace any section damaged during handling and installation at no additional expense to the Department.

Where rock or hard soil is encountered such that the sheet piles cannot be set to grade by driving, remove the rock or hard soil by other acceptable means; such as rock blasting, excavation and backfilling, or by punching.

7. Driving Timber Piles. Use a metal collar on every timber pile, except when the head is fitted into a steel head block. Protect the heads of the piles with caps of approved design, when needed.

Distribute piles of various sizes within each bent to obtain uniform strength and rigidity in the bents of each structure and to avoid undue bending or distortion of the sway bracing.

Carefully handle timber piles. Do not drop the piles, break the outer fibers, bruise the surface, or penetrate the piles except in fastener locations.

Carefully trim all cuts and abrasions in treated piles and coat with at least 3 applications of hot creosote oil and cover with hot roofing pitch. Treat all bolt holes according to AWPA standards before driving bolts. After treating the holes, plug all unfilled holes with treated plugs.

8. Equipment Maintenance and Operation. Keep pile driving equipment in good working order. Perform regularly scheduled maintenance on pile driving equipment while on site. ~~Repair~~~~Remove~~ inefficient or malfunctioning equipment, or remove them from the work.
9. Restriking Piles ~~that are not Test Piles~~. The Engineer may direct you to restrike a pile ~~that is not a test pile~~, to confirm the pile has reached nominal axial resistance. The pile will be instrumented and tested by restriking according to Subsection 505-3.02. Compensation will be paid according to Subsection 505-5.01.

505-3.04 SPLICES, AND EXTENSIONS ~~AND BUILD-UPS~~. Splice steel piles if the length of pile is not sufficient to obtain the minimum penetration and nominal axial resistance shown on the Plans. Use additions with cross sections identical to the pile cross sections. If approved, piles may be spliced using pile cut-offs and short pieces if no more than one piece used is less than 10 feet long. Fresh head piles before splicing by cutting and removing all damaged portions of the piles.

Make splices with complete penetration butt welds over the entire cross section. Meet the welding requirements of Sub~~Section~~ 504-3.01.8. Do not deviate the axial alignment of the pile at a splice to a slope greater than 1/4 inch per ten foot length with respect to the centerline of the pile.

505-3.05 DEFECTIVE PILES. Use a pile driving method that does not subject the piles to excessive or undue abuse. Do not split, splinter, or broom timber. Do not permanently deform steel. Do not damage piles by forcing them into proper position or alignment.

Correct damaged or improperly driven piles using a method approved by the Engineer. Methods may include one of the following:

1. Withdraw and replace the pile with a new and, when necessary, longer pile.
2. Drive a second pile adjacent to the defective pile.
3. Splice ~~or build up~~ the pile as provided in Subsection 505-3.04, or extend a sufficient portion of the footing to properly imbed the pile. Do not splice timber piles without specific permission.
4. Drive down all piles pushed up by driving adjacent piles or by any other cause.

505-3.06 CUTTING OFF PILES. Cut off the piles at the elevations or embedment indicated on the Plans. Ensure that all injured material is removed.

When steel piles are shown embedded in concrete footings or pile caps, cut off piles within -1/2 inch to +3 inches of the plan embedment elevation, but do not interfere with reinforcing steel or other items embedded in concrete. When steel pipe piles are shown cutoff below concrete footings or pile caps, cut off piles within -1/2 inch to +1/2 inch of the plan elevation. In pile bents with steel cap beams, make cut-offs at plan elevation, and accurate enough to ensure full bearing between the caps and piles.

In timber pile bents, make cut-offs at plan elevation, and accurate enough to ensure full bearing between the caps and piles. After cutting each treated pile to receive the cap, give the sawed surface 3 coats of hot creosote oil. Cover it with hot tar pitch and place 2 layers of 20 inches x 20 inches heavy canvas saturated with hot pitch over the surface. Place a 28 gage galvanized metal

cover which overlaps the pile at least 6 inches in each direction. Bend the metal cover down over the edges and secure it with galvanized roofing nails.

505-3.07 CLEANUP. Upon completion of the structure and before final acceptance, leave the piles and pile driving site in a clean and orderly condition. Sweep and wash piles. Leave the piles with an aesthetically pleasing appearance by removing all concrete splatter, paint marks, laitance, rust staining, chamfer strips, and all other material that does not provide a uniform texture and color to the metal surface. Remove temporary buildings, equipment, unused materials, debris, templates, and falsework. Remove falsework piling or cut them off at least two feet below the finished ground line. Remove all waste from the site.

505-4.01 METHOD OF MEASUREMENT. Section 109 and as follows:

Furnish Piles. The sum of the lengths of the piles in place in the completed structure, conforming to the Contract, measured along the centerline of piles from the tip of pile to the intersection with the cut-off elevation shown on the Plans; [or the quantity on the bid schedule.](#)

Drive Piles. ~~The number of piles driven in place in the completed structure conforming to the Contract.~~ [The sum of the lengths of the piles in place in the completed structure, conforming to the Contract, measured along the centerline of piles from the tip of pile to the intersection with the cut-off elevation shown on the Plans](#)^[j8].

Equipment. [Paid lump sum.](#)

High Strain Dynamic Testing. The number of tests completed, as required in the bid schedule or ordered in writing.

Sheet Piles. The projected vertical area of the furnished and driven sheet piles, that are incorporated into a permanent structure, as shown on the Plans, measured in final position.

505-5.01 BASIS OF PAYMENT.

Contingent sum items are subsidiary unless they (1) appear on the bid schedule, or (2) the Engineer preauthorizes payment in writing.

Furnish Piles. The contract price includes pile materials delivered to the site. [Payment will be for the installed length of pile or quantity on the bid schedule, whichever is greater](#)^[j9]; ~~pile crew time, including payroll and administrative additives; and equipment rental for the driving crane, leads and hammer.~~

Pile shoes, reinforced tips, ~~splices, preformed pile holes and~~ casing, and unused pile lengths removed by cut offs and fresh heading, are subsidiary.

Drive Piles. The contract price includes but is not limited to: [pile driving, pile crew time including payroll and administrative additives, equipment rental for the driving crane with leads and hammer, equipment movements,](#) pile splices, cutoffs, [fresh heading, templates, crane or work platforms, pile cleanout, drilling to specified depths,](#) and other fixed or variable items. [Payment will be for the installed length of pile](#)^[j10].

[Preformed pile holes in locations identified in the Contract are subsidiary. Alternate methods of pile installation, through layers of soil or rock, that are identified in the Contract as "Difficult Driving" or "Refusal", are subsidiary.](#)

~~_____ For piles driven less than 15 feet below the estimated pile tip elevation shown on the plans, there will be no adjustment to the contract unit price. For piles driven more than 15 feet below the estimated pile tip elevation, and when total installed amount of Furnish Piles increases by more than 5% over original bid quantity, additional compensation will be determined according to Section 104-1.02.~~

Equipment. The contract price includes mobilization and demobilization of pile equipment, equipment^[j11] movements, templates, rigging, constructing crane or work platforms, ~~and pile clean-out.~~ Payment will be lump sum with 75% paid after mobilization of equipment on-site, and 25% paid after demobilization of equipment.

Sheet Piles. Sheet piles used as temporary shoring for excavation, whether removed or left in place at your option with permission of the Engineer, are subsidiary.

High-Strain Dynamic Testing. For each high-strain dynamic test performed by the Engineer, ~~including restriking,~~ the contract price includes all work, excluding pile driving, required to assist the Engineer in performing the test.

Restrike of Pile. All restriking of piles, ~~that are not test piles,~~ as directed by the Engineer, will be paid according to Subsection 104-1.02 on a contingent sum basis.

Obstruction Removal. Obstructions that the Engineer directs you to remove, unless they are identified as subsidiary, will be paid according to Subsection 104-1.02 on a contingent sum basis.

Payment will be made under^[j12]:

Pay Item	Pay Unit
505(1) Reserved	
505(2) Reserved	
505(3) Furnish Treated Timber Piles	Linear Foot
505(4) Drive Treated Timber Piles	Each
505(5) Furnish Structural Steel Piles	Linear Foot
505(6) Drive Structural Steel Piles	Each Linear Foot
505(7) Reserved Equipment	Lump Sum
505(8) Reserved	
505(9) Structural Steel Sheet Piles	Square Foot
505(10) Reserved	
505(11) High-Strain Dynamic Testing	Each
505(12) Restrike of Pile	Contingent Sum
505(13) Obstruction Removal	Contingent Sum