

## SECTION 7.02 PILES

**7.02.01--Description:** Piles shall be either timber, steel, precast concrete, prestressed concrete or cast-in-place concrete of the required dimensions, furnished and driven, as shown on the plans or as ordered and in accordance with these specifications.

Test piles shall be piles of the type specified, driven in advance of placing orders for the piles, for the purpose of determining length or bearing capacity of piles.

If specified in the plans or directed by the Engineer, piles shall be tipped, shaped, reinforced or otherwise pointed and strengthened.

**7.02.02--Materials:** Piles of the type indicated on the plans shall conform to the requirements of Articles M.09.02 and M.14.01.

**7.02.03--Construction Methods : 1--Timber Piles:** The method of storing and handling timber piles shall be such as to avoid injury to the piles. Special care shall be taken to avoid breaking the surface of treated piles. Cant dogs, hooks, or pike-poles shall not be used. Cuts or breaks in the surface of treated piling shall be given three brush coats of hot creosote oil of approved quality, and hot creosote oil shall be poured into all bolt holes.

**2--Steel Piles :** The methods of storing and handling steel piles shall be such as to prevent injury to the piles and to protect them from corrosion.

**3--Cast-In-Place Concrete Piles :** Cast-in-place concrete piles shall be constructed by driving steel shells and filling them with concrete. Shells shall be continuously or incrementally tapered, or cylindrical, or a combination of continuously or incrementally tapered lower sections which are extended with cylindrical upper sections, unless otherwise provided in the plans or special provisions. The tapered portion of piles shall have a minimum tip diameter of 200 mm and shall change in diameter not less than 7 mm/m. Cylindrical piles and the cylindrical extension portions of tapered piles shall have a minimum diameter of 300 mm. Shells for cast-in-place concrete piles shall be formed by joining sections of the same manufacture, unless otherwise permitted by the Engineer. Composite shell piles, which are piles composed of different thicknesses or of different manufacture, shall not be used unless shown on the plans or approved by the Engineer. Prefabricated driving points or other type tip enclosures shall be subject to the approval of the Engineer.

The Contractor shall furnish shells of a type and gage which can be driven without distortion. Shells which fail, fracture or otherwise distort during driving or after driving shall, unless otherwise directed, be withdrawn or replaced at the Contractor's expense. The metal of shells which are to be driven without a mandrel shall be of sufficient thickness to withstand the driving without failure, fracture or distortion, but in no case shall the thickness be less than No. 7 gage. Shells driven with a mandrel shall have a thickness not less than No. 18 gage. Piles having a shell thickness less than No. 9 gage shall be reinforced as shown on the plans.

Composite shell piles formed by extending lower sections of No. 7 or heavier gage, with upper sections of lighter than No. 7 gage, shall be driven with an internal mandrel in such a manner so as to insure shell alignment and maximum hammer energy transmission throughout the pile shell length. All details concerning compatibility of shell and mandrel construction shall be subject to the approval of the Engineer.

After driving has been completed, the shell shall be inspected and approved before any concrete is placed. The Contractor shall provide suitable lights and other equipment necessary to inspect each shell throughout its length.

All seams, joints and splices in shells shall develop the full strength of the shell and shall be watertight. No payment will be made for any shell which has been improperly driven, is broken, or is otherwise defective. If necessary, any such shell shall be removed and replaced. If removing such a shell is impracticable, it shall be filled with sand and a replacement shell or shells be driven adjacent thereto.

Reinforcement shall be placed in accordance with the requirements of the plans or special provisions.

No concrete shall be placed in a pile until all driving within a radius of 5 m from the pile has been completed, or until all the shells for any one bent have been completely driven. If this is impracticable, all driving within the above limits shall be discontinued until the concrete in the last pile cast has set at least 7 days.

Concrete shall be placed continuously in each pile, care being used to fill every part of the shell, and to work concrete around the reinforcement without displacing it. No concrete shall be placed in shells containing an accumulation of water or any foreign material.

Extensions, or "build-ups" on concrete piles, shall be avoided; but when necessary, they shall be made as specified in Subarticle 7.02.03-9.

**4--Prestressed Concrete Piles (Pretensioned):** The piles shall be manufactured in accordance with the provision of Article 5.14.03, except as follows:

**(a)--Forms:** The forms for the piles shall be of substantial construction and shall produce a uniformly smooth surface on all formed sides. A minimum concrete cover of 50 mm shall be maintained for prestressing elements by the use of spreaders or by bundling in areas adjacent to openings or inserts. Ties shall also have a minimum cover of 50 mm at these locations. Side forms carrying no load may be removed after 24 hours with the permission of the Engineer or after the concrete has reached the minimum transfer strength as required by Subarticle M.09.02-6

**(b)--Finishing:** The topside surface of the piles shall be given a uniformly smooth steel trowel finish to match the surface of the formed sides. The prestressing elements shall be cut flush or recessed 3 mm to the top of the pile. Projecting fins and surface imperfections shall be removed in a workmanlike manner.

Exposed jet pipe connections, inserts or other devices shall be removed or recessed to a depth as directed, and the hole or opening patched with non-shrink grout in a workmanlike manner. The patching material shall have a degree of finish comparable to the adjacent surfaces.

Additional finishing of piles, if required, shall be as shown on the plans or as otherwise directed.

**(c)--Handling and Storage:** Care shall be taken during storage, transporting, hoisting and handling of the prestressed piles to prevent cracking or damage. Piles damaged by improper storing, transporting or handling shall be replaced by the Contractor at his expense.

Lifting and support points shall be marked on the piles as required.

**(d)--Pile Extensions:** Pile extensions shall normally be fabricated especially for this purpose in accordance with the specifications. However, sound sections of pile cutoffs or sound portions of rejected piles may be used, subject to the approval of the Engineer.

Short pile extensions may, with the permission of the Engineer, be cast-in-place monolithically with the footing or cap.

**5--Driving Equipment:** Piles shall be driven with an acceptable pile driving hammer or a combination of acceptable hammer and water jet. Sufficient boiler or compressor capacity must be provided at all times to maintain the rated speed of hammer during the full time of driving a pile. The valve mechanism and other parts of the hammer shall be maintained in first-class condition so that the length of stroke for a single-acting hammer and the number of blows per minute for a double-acting hammer, for which the hammer is designed, will be obtained. Any hammer, its connecting hose and source of compressed air or steam (if so supplied) which operates at less than its rated speed or range of speeds, as set forth in the manufacturer's catalog, shall be deemed unsatisfactory and shall be removed from the site.

The size of hammer shall be adapted to the type and size of piles and the driving conditions. Unless otherwise specified, the minimum rated striking energy per blow for hammers used shall be 9500 J for driving timber piles; 20 000 J for driving steel piles and for driving shells for cast-in-place concrete piles; and 25 000 J for driving precast concrete piles and for driving prestressed concrete piles. The hammer model used for the driving of test piles shall be used for the driving of service or production piles, unless a change is authorized by the Engineer in writing. Hammers delivering an energy which the Engineer considers detrimental to the piles shall not be used. The hammer used to drive prestressed concrete piles shall be single-acting, and the length of the stroke shall be variable and readily adjustable.

Diesel hammers and vibratory or sonic methods for driving piles, other than prestressed concrete piles, will be permitted subject to the following restrictions:

(a) The Engineer reserves the right to require the Contractor to demonstrate to the satisfaction of the Engineer that such hammers or methods are capable of driving the piles to the penetration, bearing surface or material and resistance required in the plans and specifications, or as determined. Such demonstrations shall consist of a comparison of the performance of one or more piles driven by an acceptable air or steam hammer of adequate size with one or more piles driven by the diesel hammer or vibratory or sonic method. Comparisons will be based on the results of load tests of each of the piles driven, or check driving of one or more piles driven by diesel hammer or vibratory or sonic method by an adequate air or steam hammer of adequate size, or by evaluation of data derived from the instrumentation of the diesel hammer or vibratory or sonic equipment, or by such combination of these comparisons and evaluations as the Engineer may direct. The piles in the foregoing demonstration will be at locations designated for permanent piles in the structures.

The Engineer reserves the right to require check driving (by means of an acceptable air or steam hammer of adequate size) of piles driven by diesel hammers or vibratory or sonic methods in order to verify final resistance penetration.

(b) **Costs:** There shall be no direct payment for the cost for tests, check driving and instrumentation carried out for the sole purpose of comparison demonstrations under (a) above. The total length of piles which are accepted in the structure will be paid for at the contract unit price for furnishing and driving piles or at the contract unit price each for test piles, as the case may be.

(c) **Instrumentation:** Diesel hammers having an enclosed top ram shall be equipped with a calibrated pressure gage which shall register on record chamber pressure at any time during driving. When rebound of ram is unrestricted, hammers shall be equipped with a graduated stroke rod so as to permit observation of the height of stroke at any time during driving.

When required by the Engineer, vibratory or sonic drivers shall be equipped with such instrumentation as will permit an accurate, continuous and simultaneous graphic recording of the rate of penetration of the pile and the energy output of the primary power unit. This graphic recording shall be continuous throughout the driving of piles for demonstration purposes and for test piles.

In case the required penetration is not obtained by use of a hammer complying with the above minimum requirements, the Contractor shall employ such other driving methods as the use of a hammer with a greater mass than that being used, resort to jetting, spudding, preholing or a combination of these methods, and perform such other work as may be necessary to obtain the required penetration.

If it becomes necessary and is authorized by the Engineer to resort to jetting, spudding or preholing--and further, if no contract bid price is asked for in the proposal for jetting, spudding, or preholing--such work will be paid for as "extra work" in accordance with Articles 1.04.05 and 1.09.04.

The use of a hammer with a greater mass, or the use of piles manufactured or designed with pile tips of a nature to provide for better penetration such as but not limited to composite shells, tapered sections or H-pile sections, shall not be considered as extra work. Authorized point reinforcement for piles shall be a separate item.

Pile driver leads shall be used for driving all piles, unless written permission to the contrary is given by the Engineer. They shall be constructed in such a manner as to afford freedom of movement to the hammer, and they shall be held in position to assure support and alignment of the piles within the tolerances specified. Except where piles are driven through water, the leads shall be of sufficient length so that the use of a follower will not be necessary. Inclined leads shall be used in driving batter piles.

Piles for exposed pile bents shall be driven with pile driver leads and templates. They shall be of rigid design and construction and shall maintain the required position and alignment of the piles within the tolerances hereinafter specified. Templates shall be anchored or spudded into position, shall be capable of guiding all piles required for the bent and shall remain in place until all the piles in the bent are driven.

The driving of piles with followers shall be avoided if practicable, and shall be done only with the special permission of the Engineer. All test piles shall be driven without a follower.

During driving of precast or prestressed concrete piles, cushion block material shall be used between the driving head and the pile head. This block shall be fabricated of a wood approved by the Engineer. The total thickness of the cushion block shall be varied, based on the driving equipment used and the driving resistance encountered. When necessary, an additional cushion block shall be used between the striking parts and the driving head. Cushion blocks shall be inspected frequently during driving, and no driving shall be done with blocks which have become distressed and unduly compacted with use. Use of cushion block and packing material other than that specified herein may be substituted by the Contractor, subject to the approval of the Engineer. The cushion block and driving head shall not restrain the pile from rotating during driving so as to cause torsion stresses.

When water jets are used, the number of jets and the volume and pressure of water at the jet nozzles shall be sufficient to freely erode the material adjacent to the pile. The plant shall have sufficient capacity to deliver at all times at least 700 kPa pressure at two 19 mm jet nozzles. Before the desired penetration is reached, the jets shall be withdrawn; and the piles shall be driven with the hammer to secure the final penetration. Jetting of piles shall be done only with the special permission of the Engineer.

Other equipment required and not herein described shall be suitable for the use intended and shall be approved by the Engineer.

**6--Point Reinforcement for Piles :** When directed by the Engineer, the contractor shall point-reinforce piles. Such point-reinforcement shall be in accordance with the plans or as directed.

**7--Order Lists and Test Piles :** The length of piles to be furnished shall be specified by the Engineer and will be based upon the best information available at the time the order is placed. The lengths shown on the plans or proposal form are approximate only and may be varied to conform to conditions actually encountered.

Before specifying the lengths of piles to be ordered, the Engineer may require the Contractor to furnish and drive one or more test piles of such lengths as stated in the contract and complete such pile loading tests as the Engineer deems necessary. The length or lengths of piles required will be determined by the Engineer, based upon the results obtained in driving the test piles and making the required pile loading tests.

Test piles shall be of the same type, species, manufacture, shell thickness, taper and cross-sectional dimension as the piles to be installed in the finished structure.

**8--Driving Piles** Piles shall not be driven until after the excavation is complete or the embankment has been completely placed, whichever the case may be. Any material forced up between the piles shall be removed to correct elevation, without expense to the Department, before masonry for the foundation is placed.

When the nature of the driving is such as to unduly injure the heads of piles, they shall be protected by steel caps of approved design. When the area of the head of any timber pile is greater than that of the face of the hammer, a suitable cap shall be provided to distribute the blow of the hammer throughout the cross-section of the pile and thus avoid, as far as possible, the tendency to split or shatter the pile.

Collars or bands to protect timber piles against splitting and brooming shall be provided where necessary.

Piles shall be driven with a variation of not more than 20 mm/m from the vertical or from the batter line indicated, except that piles for trestle bents shall be so driven that the cap may be placed in its proper location without inducing excessive stresses in the piles. Upon completion of driving and released from leads, exposed piles such as in bents shall not have a variation of more than 50 mm at the cut-off elevation from the position shown on the plans. Unless otherwise permitted in writing by the Engineer, failure to meet this tolerance shall be cause for rejection. Other foundation piles shall not be out of the position shown on the plans more than 150 mm after driving.

The Engineer reserves the right to require the Contractor to redrive any test pile or production pile when the information so derived is necessary for the determination of order lengths or bearing capacity. The period of time between the original driving and the redriving shall be determined by the Engineer. Payment for such redriving will be in accordance with the requirement of Article 1.09.04.

Except for incidental upset and minor spalling or cracking, pile heads damaged while driving shall be cut back and repaired as directed before driving is resumed.

Damaged piles that have been rejected by the Engineer shall be removed if there is any interference with proper positioning and driving of the replacement pile.

Open holes vacated by withdrawal of piles shall be immediately filled with sand or sandy material.

Driving equipment, appurtenances and techniques to be used in the installation of prestressed concrete piles shall be in accordance with the recommendations of the pile manufacturer, subject to the approval of the Engineer. Such recommendation shall be prepared by a manufacturer's representative skilled in the installation of prestressed concrete piles, and the Contractor shall certify to the Engineer that this representative will be available to the Contractor to aid and instruct in the installation of piles to obtain results satisfactory to the Engineer. Prior to driving the piles, the Contractor shall submit to the Engineer for written approval complete details of the equipment and appurtenances he proposes to use in the driving operation. Such details shall also outline the driving techniques and sequence of driving to be followed by the Contractor. Driving equipment, appurtenances and techniques shall be subject to the continuing approval of the Engineer throughout the period of pile installation and shall be modified as necessary to achieve the required penetration and to prevent cracking, spalling or other damage to the piles.

**9--Splicing Piles and Extensions:** Full length piles shall be used when practicable; but if splices cannot be avoided, piles or shells for cast-in-place piles may be spliced in accordance with the requirements of the plans. Piles shall not be spliced except with the approval of the Engineer. Splices in excess of two per pile for timber, steel and cast-in-place concrete piles will not be permitted except with special permission of the Engineer. Only one splice per pile will be permitted in precast concrete or prestressed concrete piles. In the absence of splice details in the plans, piles or shells for cast-in-place concrete piles shall be spliced in accordance with the pile or shell manufacturer's recommendations, subject to the approval of the Engineer. The use of prefabricated splicing devices and their method of installation shall be subject to the approval of the Engineer. All seams, joints and splices shall develop the full strength of the pile.

After a precast pile is driven, the concrete at the end of the pile shall be cut away, leaving the reinforcing steel exposed for a length of forty diameters. The final cut of the concrete shall be perpendicular to the axis of the pile. Reinforcement similar to that used in the pile shall be securely fastened to the projecting steel, and the necessary form work shall be placed, care being taken to prevent leakage along the pile. The concrete shall be of the same quality as that used in the pile. Just prior to placing concrete, the top of the pile shall be thoroughly wetted and covered with a thin coating of neat cement or other suitable bonding material. The forms shall remain in place not less than 7 days, shall then be carefully removed, and the entire exposed surface of the pile finished as above specified.

For prestressed concrete piles, the end of the pile to be extended shall be trimmed back neatly to the directed cutoff elevation by means of pneumatic tools, sawing or any other method approved by the Engineer, except that the use of explosives will not be permitted. Where the splice is to be exposed, the pile shall be sawed to a minimum depth of 12 mm around its perimeter. Holes for the mild steel dowels shall be drilled or preformed as directed, and the top of the pile bush-hammered and cleansed by compressed air. A substantial yoke must be used to align and hold the pile section collinearly until the splicing cement has attained a strength to permit driving. Metal spacers to separate the piles shall be used as required. The splicing cement shall be prepared and injected into the dowel holes and joint in strict conformance with the manufacturer's printed instructions. In no case shall the splicing cement be used when the time lapse between date of manufacture and usage exceeds the manufacturer's recommendations. Nor shall the temperature limits for the material, air or piles be exceeded at time of application. All work shall be done in a workmanlike manner. Exposed splices shall have a degree of finish comparable to the adjacent surfaces. Cracks, separation of material or other signs of distress in the splice shall be cause for rejection. If a splice becomes defective upon resumption of driving, the splice shall be removed and replaced following the same preparatory procedures as before. The upper pile section shall normally be fabricated especially for this purpose in accordance with these specifications. However, sound sections of pile cutoffs or of rejected piles may be used, subject to the approval of the Engineer. Short pile extensions may, with the permission of the Engineer, be cast in place monolithically with the footing or cap.

**10--Determination of Bearing Values of Piles:** The safe bearing capacity of piles will normally be determined by loading tests. Each test shall consist of loading, unloading, reloading and unloading a pile designated by the Engineer. Where excavation is to be made or embankment placed at the location of such test pile, the excavation or embankment shall be completed to the plan elevation of proposed bottom of footing before any test piles are driven. Except where otherwise required, such excavation shall be completed to at least 1.5 m horizontally, and embankment completed to at least 10 m horizontally in all directions from such piles. The load shall be applied not more than 1.0 m above the plan cutoff.

Unless otherwise specified or ordered, piles shall be loaded to 100 percent of design load, unloaded, then loaded to 200 percent of design load and unloaded. Loading increments, unloading decrements and the time interval between increments and decrements shall be as directed by the Engineer. The total test period shall not exceed 7 calendar days. After completion of driving of the pile to be tested, the load test shall not commence until expiration of the minimum waiting period specified, or as directed by the Engineer.

The load may be applied by the "Boot Strap" method or by jacking against a dead load. Non-jacking methods will not be permitted. The "Boot Strap" method of load testing shall not be used on precast concrete or prestressed concrete piles if the anchor piles are to be either type of concrete pile.

Choice of the method to be used shall be made by the Contractor. He shall submit to the Engineer a drawing giving dimensions, sizes and other details of the test apparatus and must receive approval of the Engineer before commencing work on the test. The jack shall be equipped with a calibrated pressure gage for measuring the test load. The pressure gage shall be calibrated immediately prior to use and shall be recalibrated if at any time the Engineer shall so direct. Certified results of such calibration by an approved commercial laboratory shall be furnished to the Engineer for his review and approval.

For settlement measurement, the Contractor shall furnish and install two dial indicators having a range of 25 mm and graduated to 0.02 mm divisions, or such other means of measurement as are acceptable to the Engineer. Method of installation of dial indicators or other measurement devices shall be as directed by the Engineer. The safe allowable load will be determined by the Engineer from analysis of the loading test data.

The Contractor shall exercise care to prevent eccentric loading of the pile. If the test fails because of eccentric loading, no payment will be made for the test, and no future test shall be performed on the eccentrically loaded pile.

The "Boot Strap" method shall be performed by jacking down on the test pile or piles with a calibrated hydraulic jack placed beneath a horizontal girder. The girder shall be fastened to anchor piles which shall be located so they can remain in place as part of the completed foundation. In no case shall piles nearer than 2 m from the test pile or piles be used to assist in anchoring down the girder, unless otherwise permitted by the

Engineer. The connections of the girders to the anchors and to the hydraulic jack shall be tight when the test is commenced, and the jack shall then be capable of moving the test pile or piles a distance of at least 125 mm during the period of the test.

If temperature variations are found to affect the dial indicators during the test, such equipment shall be suitably protected and maintained at uniform temperature conditions by the Contractor.

If the load is applied to the pile or piles by jacking against a dead load, such dead load shall not have supports closer than 2 m from the test pile or piles. The jack shall be capable of moving the test pile or piles a minimum of 125 mm during the period of the test.

The Contractor shall have a qualified employee present at all times during the performance of the test to maintain the required load exerted by the hydraulic jack. If the test is stopped before completion and the load wholly or partially removed from the pile or piles because of defects in the jack, yield of connections, insufficient load or travel capacity in the jack, or for other mechanical reasons, the Engineer shall order the test abandoned and replaced by a new test on another pile or piles at an adjacent location. Where a loading test is abandoned because of reasons for which the Contractor is responsible, there shall be no payment for such an abandoned test.

In cases where pile loading tests are not performed, the safe bearing value of piles will be determined by the Engineer.

While a pile-loading test is being performed and during a period 48 hours prior thereto, no blasting, driving of piles or piling will be permitted within 100 m of the location where a pile-loading test is being conducted or is to be conducted.

The Engineer reserves the right to require the Contractor to perform such loading tests on one or more piles prior to construction of the footing or bent.

**11--Treatment of Pile Heads :** The tops of all timber piles shall be sawed to a true plane as shown on the plans and at the elevation fixed by the Engineer. Piles which support timber caps or grillage shall be sawed to conform to the plane of the bottom of the superimposed structure. Broken, split or misplaced piles shall be withdrawn and properly replaced. Piles driven below the cut-off grade fixed by the Engineer shall be withdrawn and replaced by new, and if necessary, longer piles at the expense of the Contractor. All piles pushed up during the process of driving adjacent piles shall be driven down again.

Steel piles and concrete piles shall be cut off to the correct elevation as shown on the plans. Piles damaged in driving or not driven in correct position shall be withdrawn and replaced when so ordered.

Structural steel caps of an approved type shall be provided for steel piles where called for on the plans or required by the Engineer; and in such cases, the ends of the piles shall be smoothed as may be necessary to permit proper attachment.

The portion of the pile heads of concrete piles which is to be embedded in concrete shall be thoroughly roughened and cleaned of all dirt and loose material. Just prior to placing concrete, this portion of the pile shall be thoroughly wetted.

After reaching the required penetration, prestressed concrete piles shall be cut neatly to the proper elevation by means of pneumatic tools, sawing or any other method approved by the Engineer, except that the use of explosives will not be permitted. The projecting tendons shall be cut to the length shown on the plans, or as directed. Where shown on the plans, deformed steel bars shall be placed in drilled holes and grouted in accordance with Subarticle 7.02.03-10.

**12--Painting Steel Piles and Steel Pile Shells :** When steel piles or steel pile shells extend above the ground surface or water surface, they shall be painted as specified elsewhere in the contract documents or as ordered by

the Engineer. This protection shall extend from an elevation 600 mm below the ground or water surface to the top of the exposed steel.

**13--Welding on Piles:** When required or permitted, all welding on piles shall be done in accordance with the requirements of the current AWS Structural Welding Code.

**14--Disposition of Pile Cutoffs:** All pile cutoffs not incorporated in work shall be the property of the Contractor.

The Contractor shall remove the cutoff material from within the limits of the highway.

#### **7.02.04--Method of Measurement:**

**1--Steel Piles -Timber Piles-Precast Concrete Piles:** The length of (type) piles which will be the basis for the pay computation to be included under the item of furnishing (type) piles, shall be the number of meters of (type) piles authorized by the Engineer or actually furnished by the Contractor, whichever is the lesser amount.

Length of pile cutoffs previously paid for under authorized lengths of piles and subsequently incorporated into the work will not be measured for payment.

The work, materials, tools, equipment and labor incidental to the disposal of pile cutoffs will not be measured for payment.

The amounts to be included under the item for driving (type) piles will be the number of meters of piles actually driven and accepted in the completed structure.

**2--Cast-in-Place Concrete Piles:** The amount to be included under the item of cast-in-place concrete piles shall be the number of meters of piles actually driven and accepted in place in the completed structure.

Cut-off materials from shells shall remain the property of the Contractor. They will be paid for in accordance with the unit cost applying in the Contractor's bill or bills for such shells, except that no payment will be made of material cut off from shells furnished by the Contractor in excess of the ordered length. The unit of measurement will be the unit applying in the Contractor's bill or bills for such shells. Material cut off from shells furnished by the Contractor in lengths in excess of those ordered by the Engineer will not be measured for payment hereunder. The work, materials, tools, equipment and labor incidental to the disposal of cutoffs will not be measured for payment.

Reinforcement, if required in cast-in-place concrete piles, will not be measured for payment.

**3--Prestressed Concrete Piles (Pretensioned):** The length of the prestressed concrete piles, which will be the basis for the pay computation, shall be the number of meters of piles authorized by the Engineer or actually furnished by the Contractor, whichever is the lesser amount. The length of any specified pile tip protruding from the concrete will be included in the length measured for payment.

Also included in the length measured for payment will be the length of precast pile extensions ordered by the Engineer. Not to be included, however, is the length of pile extension furnished in excess of the ordered length. The length of projection dowels shall not be included in the length measured for payment.

Extensions to prestressed concrete piles which are poured monolithically with the footing or pier cap will be paid for at the Contract unit prices for the several items involved, which prices shall be full compensation for all materials, tools, equipment and labor necessary to the completion of the work.

Cut-offs shall not be used for pile extension. The work, material, tools equipment and labor incidental to the disposal of cutoffs will not be measured for payment.



The amounts to be included under the item for driving prestressed concrete piles shall be the number of meters of piles actually driven and accepted in the completed structure.

**4--Test Piles :** The amounts to be included under the respective items for test piles, of the type and length specified, shall be the number of test piles actually driven and accepted. Lengths of test piles ordered by the Engineer in excess of the length or lengths specified in the contract will be measured for payment by the actual number of meters ordered, furnished and accepted by the Engineer. Driving of such pile extensions will be measured for payment by the actual length driven and left in place.

Authorized splices performed on test piles will be measured for payment by the number of authorized splices actually completed and accepted. Splicing of test piles shall not be considered as authorized splices when such splicing is done to complete piles to the test pile length specified in the contract.

**5--Loading Tests:** The amount to be included under the item of loading tests shall be the actual number of loading tests completed and accepted.

**6--Splices :** The amount to be included under the items for splicing timber, steel, cast-in-place concrete, precast concrete and prestressed concrete piles (pretensioned) shall be the number of authorized pile splices actually completed and accepted.

The splicing of timber and steel piles, steel shells for cast-in-place concrete piles, precast concrete piles and prestressed concrete piles (pretensioned) shall not be considered as authorized splices when such splicing is done to complete piles to the order lengths, as defined in Subarticle 7.02.03-7, or when the furnished lengths of such piles are less than the order lengths approved by the Engineer.

**7--Point Reinforcement for Piles :** The amount to be included under the item of "Point Reinforcement for Piles" for the type of piles specified shall be the number of authorized reinforced points actually completed and accepted.

**7.02.05--Basis of Payment** This work will be paid for as follows:

**1--Steel Piles :** Payment for furnishing steel piles of the lengths authorized will be at the Contract unit price per kilogram for "Furnishing Steel Piles," which price shall include furnishing, delivery, storage and handling, and all materials, equipment, tools and labor incidental thereto. The mass of steel pile caps will be included with and paid for under this item.

Payment for driving steel piles will be at the contract unit price per meter for "Driving Steel Piles," complete in place, which price shall include all materials, equipment, tools and labor incidental thereto.

**2--Timber Piles :** Payment for furnishing timber piles or treated timber piles, up to a length 3 m greater than that specified on the plans or in the proposal form, will be at the Contract unit price per meter for "Furnishing Timber Piles (m Length)" and "Furnishing Treated Timber Piles (m Length)," respectively, which price shall include furnishing, delivery, peeling, storage and handling, and all materials, equipment, tools and labor incidental thereto.

In case the length of any piles finally ordered is more than 3 m, but less than 6 m, greater than the length specified on the plans or proposal form, payment for furnishing such piles shall be at a price per meter equal to the original contract price, plus 20 percent thereof.

In case the length of any piles finally ordered is 6 m or more greater than the length specified on the plans or proposal form, payment for furnishing such piles shall be at a price per meter equal to the original contract price plus 40 percent thereof.

Payment for driving timber piles or treated timber piles will be at the contract unit price per meter for "Driving Timber Piles" and "Driving Treated Timber Piles," respectively, complete in place and regardless of length, which price shall include all materials, equipment, tools and labor incidental thereto.

**3--Cast-in-Place Concrete Piles :** Payment for cast-in-place concrete piles will be at the contract unit price per meter for "Cast-in-Place Concrete Piles," complete in place, including all materials, equipment, tools and labor incidental thereto.

Cut-off materials from shells shall remain the property of the Contractor. They will be paid for in accordance with the unit cost applying in the Contractor's bill or bills for such shells, except that no payment will be made for material cut off from shells furnished by the Contractor in excess of the ordered length.

**4--Prestressed Concrete Piles :** Payment for furnishing prestressed concrete piles, of the lengths required, will be at the contract unit price per meter for "Furnishing Prestressed Concrete Piles" of the type and size as shown on the plans, which price shall include furnishing, delivery, storage and handling, and all materials, equipment, tools and labor incidental thereto.

Payment for driving prestressed concrete piles will be at the contract unit price per meter for "Driving Prestressed Concrete Piles," complete in place, which price shall include all material, equipment, tools and labor incidental thereto. Also included shall be all work involved in cutting piles to the direct cut-off elevation.

**5--Test Piles :** Test piles will be paid for at the contract unit price each for "Test Pile," of the type and length specified, which price shall constitute the complete compensation for furnishing and driving test piles and shall include all materials, equipment, tools and labor incidental thereto. Authorized splices to test piles will be paid for at 200 percent of the contract unit price bid for Splicing Timber Piles, Splicing Steel Piles, Splicing Cast-in-Place Piles or Splicing Prestressed Concrete Piles, whichever type of test pile the splice has been performed on; and such payment shall be for all costs including materials, equipment, tools and labor incidental thereto.

Extension to test piles in excess of the specified length will be paid for on the following basis, which shall include all equipment, tools, splices, labor and work incidental thereto.

**(a) Timber Test Piles :** Extensions will be paid for at 125 percent of the contract unit price per meter for "Furnishing Timber Piles," of the shortest length specified in the proposal, and at 125 percent of the contract unit price per meter for "Driving Timber Piles."

**(b) Steel Test Piles :** Extensions will be paid for at 125 percent of the contract unit price per kilogram for "Furnishing Steel Piles" and at 125 percent of the contract unit price per meter for "Driving Steel Piles."

**(c) Cast-in-Place Concrete Test Piles :** Extensions will be paid for at 125 percent of the Contract unit price per meter for "Cast-in-Place Concrete Piles." Cut-off materials from shells will be paid for as provided in Subarticle 7.02.05-3.

**(d) Prestressed Concrete Test Piles :** Extensions will be paid for at 125 percent of the contract unit price per meter for "Furnishing Prestressed Concrete Piles," and at 125 percent of the contract unit price per meter for "Driving Prestressed Concrete Piles."

**6--Loading Tests :** Loading tests will be paid for at the contract unit price each for "Pile Loading Test," which price shall include all expenses incidental to loading the pile or group of piles and removing the load, platform, etc., upon completion of the test.

**7--Splices :** Authorized splices in timber, steel, cast-in-place piles, precast concrete and prestressed concrete piles will be paid for at the contract unit price each for "Splicing Timber Piles," "Splicing Steel Piles," "Splicing Cast-in-Place Concrete Piles," "Splicing Precast Concrete Piles," "Splicing Prestressed Concrete Piles," respectively, which price shall include all materials, except as otherwise noted, and all equipment, tools and labor incidental thereto. In the absence of such prices, authorized splices will be paid for as extra work.

**8--Trimming and Cutting:** There shall be no direct compensation for cutting off timber, steel, precast concrete or prestressed concrete piles and shells for cast-in-place concrete piles as ordered; but the cost thereof shall be considered as included in the cost of the pile items.

**9--Point Reinforcement for Piles:** Authorized points for pointing and reinforcing piles will be paid for at the contract unit price each for "Point Reinforcement for Timber Piles," or "Point Reinforcement for Steel Piles," respectively, whichever applies, which price shall include all materials, equipment, tools and labor incidental thereto. In the absence of such prices, authorized points will be paid for as extra work.

**10--Underground Obstructions:** If the required pile penetration is not reached due to the presence of underground obstructions which are not the result of the Contractor's operations but are due to the presence of earlier construction at the site, then the cost of removing these obstructions and back-filling the area will be paid for as extra work unless otherwise specified in the contract documents.

**11--Painting:** There will be no additional payment for painting steel piles and steel pile shells as specified hereinbefore, but the cost thereof shall be considered as included in the cost of furnishing and driving the piles.

**12--Disposal of Pile Cutoffs:** All costs incidental to the disposal of cutoff material will be included in the price of furnishing of the type of pile specified.

Pay Item	Pay Unit
Furnishing (Type) Piles (Lengths)	kg
Driving (Type) Piles	m
Test Pile (Type-Length)	EA.
Splicing (Type) Piles	EA.
Point Reinforcement for (Type) Piles	EA.
Pile Loading Test	EA.