SECTION 316219 - TIMBER PILES

1. GENERAL
	* + 1. RELATED DOCUMENTS
				1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			2. SUMMARY
				1. Section includes round timber piles.
			3. PREINSTALLATION MEETINGS

Retain "Preinstallation Conference" Paragraph below if Work of this Section is extensive or complex enough to justify a conference.

* + - * 1. Preinstallation Conference: Conduct conference at [**Project site**] <**Insert location**>.
			1. SUBMITTALS
				1. Submittals for this Section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each type of product.
				5. Shop Drawings: For timber piles. Show fabrication and installation details for piles, including details of driving shoes, tips or boots, and pile butt protection.

Retain subparagraph below if specifying static pile tests.

Include arrangement of static pile reaction frame, test and anchor piles, equipment, and instrumentation. Submit structural analysis data signed and sealed by the qualified professional engineer, licensed in the State of New York, responsible for their preparation.

Include pile numbering plan.

* + - * 1. Qualification Data: For [**Installer**] [**Professional Engineer**] [**and**] [**testing agency**].
				2. Round timber pile treatment data as follows, including chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material:

For each type of preservative-treated timber product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.

For waterborne-treated products, include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.

"Pile-Driving Equipment Data" Paragraph below is based on impact equipment. Revise equipment data submittal if vibratory hammers, or other nonimpact equipment, are required or revise to include special driving assistance such as jetting, preboring, spudding, or followers if permitted.

* + - * 1. Pile-Driving Equipment Data: Include type, make, and rated energy range; weight of striking part of hammer; weight of drive cap; and, type, size, and properties of hammer cushion.

Three weeks prior to delivery of pile driving equipment to the site, complete and submit the NYSDOT Pile And Driving Equipment Data form BD 138 (in the APPENDIX) to the Director’s Representative. The submitted information on this form will be used to determine a driving blow count. Each separate combination of pile and pile driving equipment proposed by the Contractor will require the submission of a corresponding NYSDOT form BD 138.

* + - * 1. Pile load testing plan.
				2. Static Pile Test Reports: Submit within three days of completing each test.
				3. Pile-Driving Records: Submit within three days of driving each pile.
				4. Certified Piles Survey: Submit within [**seven**] <**Insert number**> days of pile driving completion.

Retain "Field quality-control reports" Paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
				2. Material Certificates: For preservative-treated piles. Indicate type of preservative used and net amount of preservative retained.

Retain "Preconstruction Photographs" Paragraph below if preconstruction photographs are required in "Project Conditions" Article.

* + - * 1. Preconstruction Survey: Submit before work begins.

Existing conditions survey conducted by licensed NYS Land Surveyor of area in vicinity of proposed pile installation including adjacent buildings and utilities.

Preconstruction Photographs: Photographs or video of existing conditions of adjacent construction.

* + - 1. QUALITY ASSURANCE
				1. Installer Qualifications: The firm performing the Work of this Section shall have been regularly engaged in pile work for a period of not less than 5 years and shall be properly equipped to execute the Work. If directed, furnish a list of projects of a similar type and magnitude executed by the firm.
			2. PRECONSTRUCTION TESTING

Retain this article if load testing is required to verify design assumptions during pile installation. Load testing is usually performed before permanent pile installation.

* + - * 1. General: Static pile tests are used to verify driving criteria and pile lengths and to confirm allowable load of piles.

Revise subparagraphs below to suit Project.

Furnish test piles [**60 inches**] <**Insert dimension**> longer than production piles.

Determination of actual length of piles is based on results of static pile tests.

* + - * 1. Pile Tests: Arrange and perform the following pile tests:

Retain appropriate tests in subparagraphs below. Insert optional loading apparatus and loading procedures if required.

Axial Compressive Static Load Test: ASTM D1143. Procedure A, Quick Test[**and the following Procedures:**].

Delete, revise, or add other Procedures in first three subparagraphs below to suit Project. Retain first option in "Axial Compressive Static Load Test" Subparagraph above if retaining below.

Procedure B, Maintained Test.

Procedure C, Loading in Excess of Maintained Test.

Procedure G, Cyclic Loading Test.

Axial Tension Static Load Test: ASTM D3689.

Lateral Load Test: ASTM D3966.

Retain first paragraph below if required. Telltale rods or strain rods are used for incremental strain measurements, an optional test described in ASTM D1143.

* + - * 1. Equip each test pile with two telltale rods, according to ASTM D1143, for measuring deformation during load test.
				2. Provide pile reaction frame, anchor piles, equipment, and instrumentation with enough reaction capacity to perform tests. Notify Director’s Representative at least 48 hours in advance of performing tests. On completion of testing, remove testing structure, anchor piles, equipment, and instrumentation.

Allow a minimum of [**seven**] <**Insert number**> days to elapse after driving test piles before starting pile testing.

Revise "Number of Test Piles" Subparagraph below to suit Project.

Number of Test Piles: [**One pile**] [**As indicated**] <**Insert number**>.

* + - * 1. Drive test piles at locations indicated to the minimum penetration or driving resistance indicated. Use test piles identical to those required for Project, and drive with appropriate pile-driving equipment operating at rated driving energy to be used in driving permanent piles.

Revise "Pile Design Load" Subparagraph below to include pile design loads if required. Respective ASTM load-test standards include default loading procedures as percentages of pile design loads. Revise if piles are loaded to failure.

Pile Design Load: [**As indicated**] <**Insert load**>.

Revise "Approval Criteria" Paragraph below to suit Project. Criteria are examples only.

* + - * 1. Approval Criteria: Allowable load shall be the load acting on the test pile when[**the lesser of**] the following criteria are met, divided by a factor of safety of [**2**] <**Insert value**>:

Retain one or more of three subparagraphs below, or insert other criteria to suit Project.

Net settlement, after deducting rebound, of not more than 0.01 inch/ton of test load.

Total settlement exceeds the pile elastic compression by 0.15 inch, plus 1.0 percent of the tip diagonal dimension.

A plunging failure or sharp break in the load settlement curve.

* + - * 1. Test Pile-Driving Records: Prepare driving records for each test pile[**, compiled and attested to by a qualified professional engineer, licensed in the State of New York**]. Include same data as required for driving records of permanent piles.
				2. Test piles that comply with requirements, including location tolerances, may be used on Project.
			1. DELIVERY, STORAGE, AND HANDLING
				1. Deliver piles to Project site in such quantities and at such times to ensure continuity of installation. Handle and store piles at Project site to prevent breaks, cuts, abrasions, or other physical damage and as required by AWPA M4.

Do not drill holes or drive spikes or nails into pile below cutoff elevation.

* + - 1. FIELD CONDITIONS
				1. Protect structures, underground utilities, and other construction from damage caused by pile driving.

Revise "Site Information" Paragraph below to suit Project and office practice.

* + - * 1. Site Information: A geotechnical report has been prepared for this Project and is [**included**] [**referenced**] elsewhere in the Project Manual for information only.

Retain "Preconstruction Photographs" Paragraph below if adjacent construction is sensitive to vibrational effects of pile driving. Delete if not required or if Owner provides preconstruction photographs.

* + - * 1. Preconstruction Photographs: Inventory and record the condition of adjacent structures, underground utilities, and other construction. Document conditions that might be misconstrued as damage caused by pile driving.
1. PRODUCTS
	* + 1. TIMBER PILES
				1. Round Timber Piles: ASTM D25, unused, clean peeled, one piece from butt to tip; of the following species and size basis:

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

<**Insert, in separate subparagraphs, manufacturer's name**>.

Retain one option in "Species" Subparagraph below. Although coastal Douglas fir on West Coast and southern pine on East Coast prevail, other species may predominate in other regions. Alternatively, if species selection is left to Contractor, revise subparagraph and specify allowable unit stresses.

Species: [**Coastal Douglas fir**] [**Southern yellow pine**] <**Insert species**>.

Retain one option in "Size Basis" Subparagraph below. ASTM D25 separately tabulates a range of butt and tip circumferences for timber piles as well as butt and tip circumferences for Class A and Class B piles. Tip circumference is specified solely for 8-inch tip and natural taper piles. Typically, butt circumference is specified for friction piles; tip circumference, for end-bearing piles. Indicate lengths and sizes here or on Drawings.

Size Basis: [**Butt circumference**] [**Class A**] [**Class B**] [**Tip circumference**] [**8-inch tip and natural taper**].

In first paragraph below, AWPA U1 below is the basic standard for preservative treatment of piles.

* + - * 1. Pressure-treat round timber piles according to AWPA U1 as follows:

Retain one option in "Service Condition" Subparagraph below.

Service Condition: [**UC4C Ground Contact, Extreme Duty**] [**UC5A Marine Use Northern Waters**] [**UC5B Marine Use Central Waters**] [**UC5C Marine Use Southern Waters**]

Retain one option in "Treatment" Subparagraph below or insert other preservative treatments. Oil-borne preservatives such as PCP-A (Pentachlorophenol Solvent A) are not permitted by AWPA U1 for marine service. Last two options reflect higher retentions of waterborne treatments or dual treatment of tropical water marine piles subject to severe borer hazard. Verify whether local restrictions of preservatives' VOCs apply. See AWPA U1 for additional information.

Treatment: [**Waterborne preservative**] [**Creosote or creosote solution**] [**Oil-borne preservative**] [**Waterborne preservative, creosote or creosote solution, or oil-borne preservative**] [**Waterborne preservative, severe marine borer hazard**] [**Dual treatment consisting of waterborne preservative, followed by creosote or creosote solution**] <**Insert treatment**>.

* + - 1. PILE ACCESSORIES

Retain this article if pile-tip reinforcement is required. Pile shoes differ in shape from arrow points to flat boots. Revise "Driving Shoes" Paragraph below if steel-sheet-fabricated boot or another type of tip is required.

* + - * 1. Driving Shoes: Fabricate from ASTM A1011, hot-rolled carbon-steel strip to suit pile-tip diameter, of the following type and thickness, and secure to pile tip so as to not affect pile alignment during driving:

Type: [**Flat boot**] [**Arrow point**].

Thickness: [**3/16 inch**] [**1/4 inch**].

* + - 1. FABRICATION
				1. Pile Tips: Cut and shape pile tips to accept driving shoes. Fit and fasten driving shoes to pile tips according to manufacturer's written instructions.
				2. Pile Butt: Trim pile butt and cut perpendicular to longitudinal axis of pile. Chamfer and shape butt to fit tightly to driving cap of hammer.
				3. Field-Applied Wood Preservative: Treat field cuts, holes, and other penetrations according to AWPA M4.

Coal-tar roofing cement for treating drilled holes or sealing cutoffs shall be free of asbestos.

Revise "Pile Splices" Paragraph below if splices are permitted, and add splice details to Drawings.

* + - * 1. Pile Splices: Splices are not permitted.
				2. Pile-Length Markings: Mark each pile with horizontal lines at 12-inch intervals; label the distance from pile tip at 60-inch intervals. Maintain markings on piles until driven.
1. EXECUTION
	* + 1. EXAMINATION
				1. Perform Preinstallation Survey and document existing conditions using photographs and videos.
			2. DRIVING EQUIPMENT

Revise "Pile Hammer" Paragraph below by inserting a rated energy range if required.

* + - * 1. Pile Hammer: Air-, steam-, hydraulic-, or diesel-powered type capable of consistently delivering adequate peak-force duration and magnitude to develop the ultimate capacity required for type and size of pile driven and character of subsurface material anticipated.
				2. Hammer Cushions and Driving Caps: Between hammer and top of pile, provide hammer cushion and steel driving cap as recommended by hammer manufacturer and as required to drive pile without damage.

Revise "Leads" Paragraph below if templates may be used in lieu of leads.

* + - * 1. Leads: Use fixed, semifixed, or hanging-type pile-driver leads that hold the full length of pile firmly in position and in axial alignment with hammer.
			1. PREPARATION
				1. Notify the Director’s Representative of intent to drive piles at least 5 working days before scheduled start of pile driving.
			2. DRIVING PILES

Indicate tip elevations and limiting penetration resistance on Drawings or insert here if retaining "General" Paragraph below without retaining option. If retaining option, coordinate with "Preconstruction Testing" Article.

* + - * 1. General: Continuously drive piles to elevations or penetration resistance indicated [**or established by static load testing of piles**]. Establish and maintain axial alignment of leads and piles before and during driving.

Retain "Spudding" Paragraph below if required.

* + - * 1. Spudding: Drive spud piles through overlying highly resistant strata or obstructions and withdraw for reuse.

Retain "Predrilling" Paragraph below if predrilling is permitted. Predrilling is generally prohibited for friction pilings but, if approved by Engineer, predrilling can be an effective method of penetrating hardpan, cemented strata, hard clay, or dense compacted clay. Revise to suit Project or if prejetting or other methods to facilitate pile driving are permitted.

* + - * 1. Predrilling: Provide pre-excavated holes where indicated, to depths indicated. Drill holes with a diameter less than the largest cross-section dimension of pile.

Firmly seat pile in predrilled hole by driving with reduced energy before starting final driving.

* + - * 1. Heaved Piles: Redrive heaved piles to tip elevation at least as deep as original tip elevation with a driving resistance at least as great as original driving resistance, or as directed. Additional driving shall be at the expense of the Contractor.
				2. Driving Tolerances: Drive piles without exceeding the following tolerances, measured at pile heads:

Review tolerances in "Location," "Plumb," and "Batter Angle" subparagraphs below, and revise to suit Project or office standards.

Location: 3 inches from location indicated, measured from center of pile. .

Plumb: Maintain 1 inch in 48 inches from vertical, or a maximum of 4 inches, measured when pile is aboveground in leads.

Retain "Batter Angle" Subparagraph below for battered piles.

Batter Angle: Maximum 1 inch in 48 inches from required angle, measured when pile is aboveground in leads.

Cutoff Elevation: Top of pile shall be not more than 2 inches from its designed cutoff elevation.

Retain one of first two paragraphs below.

* + - * 1. Withdraw damaged or defective piles and piles that exceed driving tolerances, and install new piles within driving tolerances. Such additional piles shall be at the expense of the Contractor.

If retaining last paragraph above, retain one of two subparagraphs below.

Fill holes left by withdrawn piles using cohesionless soil material such as gravel, broken stone, and gravel-sand mixtures. Place and compact in lifts not exceeding 72 inches.

Fill holes left by withdrawn piles as directed by Director’s Representative.

* + - * 1. Abandon and cut off rejected piles as directed by Director’s Representative. Leave rejected piles in place and install new piles in locations as directed by Director’s Representative. Such additional piles shall be at the expense of the Contractor.
				2. Cut off butts of driven piles square with pile axis and at elevations indicated.

Retain first option in subparagraph below for pilings with cut-off surfaces exposed inside structures; retain second option for pilings cut off at grade.

Cover cut-off piling surfaces with [**caps overlapping pile end by minimum 2 inches**] [**minimum three coats of preservative treatment**] according to AWPA M4.

* + - * 1. Pile-Driving Records: Maintain accurate driving records for each pile[**, compiled and attested to by a qualified Professional Engineer, licensed in the State of New York**]. Include the following data:

Project name and number.

Name of Contractor.

Date of installation.

Pile species.

Pile location in pile group and designation of pile group and pile numbering.

Sequence of driving in pile group.

Pile dimensions.

Ground elevation.

Elevation of tips after driving.

Final tip and cutoff elevations of piles after driving pile group.

Records of redriving.

Elevation of splices.

Type, make, model, and rated energy of hammer.

Weight and stroke of hammer.

Type of pile-driving cap used.

Cushion material and thickness.

Actual stroke and blow rate of hammer.

Pile-driving start and finish times, and total driving time.

Time, pile-tip elevation, and reason for interruptions.

Number of blows for every 12 inches of penetration, and number of blows per 1 inch for the last 6 inches of driving.

Pile deviations from location and plumb.

Preboring, jetting, or special procedures used.

Unusual occurrences during pile driving.

If retaining "Certified Piles Survey" Paragraph below, retain "Certified Piles Survey" Paragraph in "Informational Submittals" Article.

* + - * 1. Certified Piles Survey: Engage a [**Land Surveyor, licensed in the State of New York**] [**Professional Engineer, licensed in the State of New York**] to prepare a piles survey showing final location of piles in relation to the property survey and existing benchmarks.

Notify Director’s Representative when deviations from locations exceed allowable tolerances.

* + - 1. FIELD QUALITY CONTROL

Retain first option in "Special Inspections" Paragraph below if Owner engages special inspector. Consider retaining second option if authorities having jurisdiction allow Contractor to engage special inspector. If retaining second option, retain "Field quality-control reports" Paragraph in "Informational Submittals" Article. See "Special Inspection" Article in the Evaluations.

* + - * 1. Special Inspections: Director’s Representative will engage a special inspector to monitor pile driving operations and perform final inspection of completed work.

Notify Director’s Representative and inspection agencies 24 hours prior to commencement of pile driving operations.

Additional inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

Retain "Testing Agency" Paragraph below, with or without "Special Inspections" Paragraph above, to identify who shall perform tests and inspections. If retaining second option in first paragraph, retain "Field quality-control reports" Paragraph in "Informational Submittals" Article.

* + - * 1. Testing Agency: Director’s Representative will engage a testing agency to perform tests and inspections.

Notify Director’s Representative and testing agencies 24 hours prior to commencement of pile driving operations.

Additional testing, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

Retain "Tests and Inspections" Paragraph below to describe tests and inspections to be performed.

* + - * 1. Tests and Inspections:

Revise number or percentage of piles in "Dynamic Pile Testing" Subparagraph below to suit Project. Numbers are examples only.

Dynamic Pile Testing: High-strain dynamic monitoring shall be performed and reported according to ASTM D4945 during initial driving and during restriking on [**five single**] [**3 percent of**] <**Insert number or percent of**> piles.

* + - 1. CLEANING
				1. Subsequent to driving, clean the top section of each pile which will be embedded in concrete free of adhering soil and other deleterious substances.
			2. DISPOSAL
				1. Remove withdrawn piles and cutoff sections of piles from site and legally dispose of them off State's property.

END OF SECTION 316219