

ITEM 403

DRIVING TIMBER PILING

403.1 Description. This specification shall govern the driving of treated or untreated timber piling. The piling shall be of the type and dimensions shown on the plans and shall be in accordance with the lines and grades shown therein.

403.2 Construction Methods. Timber piling shall be driven with a gravity hammer or power hammer, water jets, a combination of water jets and hammer, or in bored pilot holes.

When the nature of the driving is such as to unduly injure the heads, timber piling shall be protected by caps of approved design preferably having a rope or other suitable cushion next to the pile head and fitting into a casting which in turn supports a timber shock block. When the area of the head of the 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 the piling against splitting and brooming shall be provided.

403.3 Driving Equipment Timber Piling shall be driven with gravity or power hammers, as described herein.

A. Gravity Hammer - Contractor shall furnish a certified scale weight of the hammer to be used. Gravity hammers for driving timber piling shall weigh not less than 2000 pounds and not more than 3500 pounds. The drop shall be regulated so as to avoid injury to the pile, and in no case shall exceed 15 feet.

B. Power Hammers shall ensure the designated stroke length and number of blows per minute. Power hammers shall operate at not less than 80 percent of the manufacturer's rated capacity. The weight of the ram shall be not less than 2000 pounds. Power hammers shall develop not less than 6000 and not more than 9000 foot pounds of energy per blow at each full stroke of the piston.

1. Diesel hammers shall be of the enclosed ram type, equipped with gauges and charts to evaluate equivalent energy produced during driving. Maximum ram stroke shall be 10 feet.

2. Steam, hydraulic or compressed air hammers shall be equipped with a boiler or air compressor with a capacity at least equal to that specified by the hammer manufacturer.

The boiler or compressor shall be equipped with an accurate pressure gauge to ensure proper operating conditions. The maximum ram stroke shall be 5 feet.

- 403.4 Leads. Pile driver leads shall be constructed in such a manner as to afford freedom of movement to the hammer, and shall be held in position by guys or stiff braces to insure support to the pile during driving. Except where piling are driven through water, the leads shall be of sufficient length that the use of a follower will not be necessary.
- 403.5 Jetting. Jetting shall only be done when the specified penetration cannot be obtained by driving or other methods. Contractor shall provide sufficient power for jetting operation to operate one pump and two, 2 1/2 inch diameter pipes equipped with 3/4 inch diameter jet nozzles at a pressure of 150 psi. Drive piling with hammer to at least one foot below depth of jetting, or 100 hammer blows, but not less than the approximate penetration and required bearing value. For bridge piling, the piling shall be driven a minimum of 2 feet after jetting has ceased.
- 403.6 Pilot Holes. Contractor shall provide pilot holes when penetration cannot be obtained without damage to piling and for the purpose of maintaining alignment. The maximum depth of the pilot hole shall be 5 feet and the maximum diameter shall be equal to the diameter of the pile tip. Increase the diameter or depth of the pilot hole only after prior approval by the Engineer and drive piling two (2) feet below bottom of hole to the required penetration.
- 403.7 Tolerance for Driving. Drive piling to the vertical or batter line indicated. Use templates, when necessary, to comply with allowable tolerances and variation from plan alignment as follows:
- A. Perpendicular to the longitudinal centerline of the cap, top of piling to be not more than 2 inches from true position indicated on the plans for bridge trestle pile bents, bulkheads, etc.
 - B. Parallel to the longitudinal centerline of the cap, top of piling to be not more than 4 inches from true position indicated on plans for bridge trestle pile bents, bulkheads, etc.
 - C. For cluster piling, not more than 4 inches in any direction from true position indicated on the plans. If center of gravity of pile cluster varies by more than 3-inches from center of gravity determined from plan location, structural analysis will be required at no additional cost to the City of Deer Park. Modifications required by this structural

analysis shall be done at no additional cost to the City. Minimum edge distance from face of piling to edge of footing is to be 6- inches. Additional concrete and reinforcing required by modifications shall be provided at no expense to the City.

403.8 Driving. Foundation piling shall not be driven until after the excavation is approximately complete. The driving of piling with followers shall be avoided if practicable. Where a follower is required for driving piling underwater, one piling in each ten must be of sufficient length that a follower is not required.

All piling raised during the process of driving adjacent piling shall be driven again. Broken, split or misplaced piling shall be withdrawn and properly replaced. Piling driven below established cut-off grade, except when directed by the Engineer, shall be withdrawn and replaced by new and if necessary, longer piling at the expense of the Contractor.

Unless otherwise indicated on the plans, the embankment at bridge ends shall be made to grade as shown on the plans and thoroughly compacted as provided in the governing specifications prior to the driving of end bent piling.

403.9 Penetration. The piling shall be driven approximately to the depth shown on the plans and to a greater depth whenever necessary to secure the bearing resistance. Bearing resistance shall be determined by the specified formula as directed by the Engineer. Except as noted, piling lengths shown on the plans are lengths estimated to give required bearing and are for estimating purposes only.

When plans indicate a "required penetration" into a particular stratum of shale or other hard material, this penetration is required, although strata may be higher or lower in elevation than indicated. Where no required penetration is indicated on the plans, lengths shown on the plans are minimum.

403.10 Bearing Evaluation. Unless indicated on the plans, the bearing values of timber piling shall be determined by the following formulas:

A. For Gravity Hammers

$$P = \frac{2WH}{S+1.0}$$

B. For Single Acting Power Hammers

$$P = \frac{2WH}{S+0.1}$$

C. For Double Acting Power Hammers

$$P = \frac{2E}{S+0.1}$$

Where,

P=Dynamic Resistance in pounds.

S=Average penetration in inches, per blow, for the last 20 blows.

W=Weight of ram, in pounds

H=Height of fall of ram in feet.

E=Manufacturer's rated energy in foot-pounds (for double-acting power hammers).

E=Equivalent energy in foot pounds determined by calibrated gauge attached to the hammer and taken when the average penetration in inches per blow is determined (for enclosed ram diesel hammers). Drive the piling to the penetration required by the plans and as defined herein. Use the appropriate formula to evaluate the bearing resistance.

In case water jets are used in connection with the driving, the bearing value shall be determined by the above formulas from the results of driving after the jets have been withdrawn.

403.11 Points & Shoes. Contractor shall point or square-cut piling as required by soil conditions. Where necessary, pile shall be shoed with metal shoes. Piling points shall be shaped to secure even and uniform bearing on shoes.

403.12 Cut-Offs. After driving, saw the piling off at a true plane as indicated on the plans. The final plan elevations are to be within 2-inches of the established elevation.

403.13 Treatment of Cuts, etc. After the necessary cutting has been done, the heads of treated timber piling shall be given three coats of hot creosote oil and one coat of hot tar pitch. When indicated on the plans, the pile heads shall then be covered with a sheet of roofing felt weighing 55-pounds per 100 square feet or 20 gage galvanized metal. The cover shall measure at least 6- inches more in each dimension than the diameter of the piling and it shall be bent down over the piling and the edges fastened with large headed galvanized nails.

The heads of untreated timber piling shall, unless otherwise provided, be thoroughly coated with a thick protective coat of red lead and oil, hot tar, hot asphaltum or hot tar creosote and when indicated on the plans, and covered with felt or galvanized metal as provided above.

All places where the surface of treated piling is broken by cutting, boring or otherwise, shall be thoroughly coated with hot creosoted oil and then with a coating of hot tar pitch. Hot creosote oil shall be injected under pressure into the bolt holes, before insertion of the bolts, in such a manner that the entire surface of the holes shall receive a coating oil.

403.14 Measurement. Piling shall be measured as provided under the Item, Treated and Untreated Timber Piling.

403.15 Payment. No separate payment for work performed under this item. Include the cost in the Item, Treated and Untreated Timber Piling.

END OF ITEM 403