

SPECIFICATIONS FOR
SUPPLYING AND DRIVING STEEL BEARING PILES

1.0 DESCRIPTION

The Work shall consist of:

- .1 Supplying, handling, hauling, storing, aligning and driving steel bearing piles;
- .2 Cutting off piles at the required elevations;
- .3 Pre-boring of piles, if applicable;
- .4 Splicing piles, if shown on the Drawings or deemed necessary by the Engineer; and
- .5 Supplying and installing pile tips, if shown on the Drawings or deemed necessary by the Engineer.

Steel bearing piles, steel "H" piles, and steel "HP" piles shall be considered one and the same for the Drawings, this Specification and the Special Provisions.

2.0 REFERENCES AND RELATED SPECIFICATIONS

All reference standards and related specifications shall be current issue or latest revision at the date of tender advertisement.

2.1 References

- CAN/CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel
- CSA W59, Welded Steel Construction (Metal Arc Welding)
- AASHTO/AWS D1.5M/D1.5 Bridge Welding Code
- MIT's Approved Products List

2.2 Related Specifications

- Specifications for Supply, Fabrication and Erection of Miscellaneous Metal

3.0 SUBMITTALS

The Contractor shall submit the following to the Engineer, in accordance with the Special Provisions:

- .1 Copies of Mill Test Certificates showing chemical analysis and physical tests for piling material. Piling material without this certification will be rejected.
- .2 Manufacturer's specifications and catalogue for all mechanical hammers to be used.
- .3 Certificate of mass for gravity or drop hammers. If this certificate is not available, the gravity or drop hammers shall be weighed in the presence of the Engineer. Hammers so weighed shall have the exact mass marked on them. Gravity hammers shall weigh at least 1.5 ton but in no case shall the mass of the hammer be less than the combined mass of the pile and pile cap.

- .4 Pile driving procedures to be used for the installation of the driven steel bearing piles.
- .5 Proof of certification for the welders conducting the Work (if applicable). All welders shall satisfy one of the following requirements:
 - i. Welders qualified in accordance with the requirements of AASHTO/AWS D1.5M/D1.5,
 - ii. Valid Canadian Welding Bureau (CWB) Welding ticket, or
 - iii. Valid "Welder's Licence" as issued by the Mechanical and Engineering Division, Department of Labour and Manpower, Province of Manitoba, with a minimum of 5 years of experience welding on steel structures.
- .6 Welding procedures specific to the Work (if applicable).

4.0 MATERIALS

4.1 Steel Bearing Piles

As a minimum, steel bearing piles shall conform to the requirements of CAN/CSA G40.21M, Grade 300W. Where piling is designated in metric dimensions, imperial equivalent piling will be acceptable. Mill certificates shall be provided to the Engineer prior to pile installation.

All piles crushed excessively or bent through negligence or carelessness in driving operations shall be replaced by the Contractor at his own expense unless, at the discretion of the Engineer, the damage is so slight that the pile can be repaired properly by the Contractor at his own expense.

4.2 Pile Tips

Pile tips shall conform to the requirements of CAN/CSA G40.21M, Grade 300W.

Pile tips must be approved as identified in MIT's Approved Products List and shall be to the satisfaction of the Engineer. Any pile tips that are not in MIT's Approved Products List will be subject to approval by the Engineer.

4.3 Splice Plates

Splice plates shall conform to the requirements of CAN/CSA G40.21M, Grade 300W.

4.4 Welding Materials

The Contractor is responsible for supplying all welding materials. All welding materials shall conform to the requirements of the Specifications for Supply, Fabrication and Erection of Miscellaneous Metal.

5.0 CONSTRUCTION METHODS

5.1 Handling and Storage

Piling shall be handled, hauled and stored in a manner that avoids damage to the piling materials. Loading and unloading shall be by crane, loader or other appropriate hoisting equipment.

The Contractor, in the handling and lifting of the piles, will not be permitted to drag them along the ground. Piles shall be stockpiled off the ground on timber blocking and handled in a manner to avoid

any damage.

If piles are damaged due to the Contractor's handling operations, the Contractor shall, at his own expense, replace all damaged piles with piles meeting the requirements of this Specification and as shown on the Drawings.

5.2 Location and Alignment

The piles shall be driven in the positions shown on the Drawings or as directed by the Engineer. Piles shall

be driven vertically unless shown otherwise on the Drawings, and shall not deviate more than 2 percent out-of-plumb. Batter piles shall be driven to the batter specified, and shall not deviate more than 2 percent from the batter specified. Piles shall not be more than 75 mm off centre measured at cut-off elevation.

The Contractor shall take adequate precautions to ensure that the piles are in proper alignment, including the use of installation frames, fixed leads or other means as are necessary. The method of maintaining alignment shall be accepted by the Engineer.

Piles shall not be jacked or pulled into their final positions.

5.3 Driving Steel Bearing Piles

Piles shall be driven to the depths and in accordance with the pile driving criteria indicated in the Geotechnical Report, on the Drawings or as directed by the Engineer. All pile driving equipment, driving methods and procedures shall be reviewed by the Engineer before any driving is started. Acceptable driving equipment includes hammers, vibratory hammers, driving frames or other equipment as may be required by the Engineer.

The Contractor shall remove any surface and/or shallow depth obstructions to obtain the required penetration of the piles.

Pile driving equipment to be used by the Contractor shall be of such capacity that the required bearing and penetration shall be obtained without damage being done to the piles. Driving of all piles shall be continuous and without interruption until the pile has been driven to cut-off elevation or the refusal criteria has been met. The driving of the piles with driving extensions should be avoided if practicable, and shall be done only under written permission of the Engineer. When driving extensions are used, one pile from each group of 10 shall be a long pile driven without extensions, and shall be used as a test pile to determine the average bearing capacity of the group.

If the Contractor can demonstrate conclusively that special methods, other than providing a higher capacity hammer, are necessary to advance the pile to the required penetration, such supplementary methods will be subject to the Engineer's approval and will be paid for as a Extra Work in accordance with the General Conditions. For the special types of piling, driving heads, mandrels, or other devices in accordance with the Manufacturer's recommendations shall be provided so that the pile may be driven without damage and without unnecessary drilling.

Pile driver leads shall be used to support the piles while they are being driven and shall be braced to the supporting crane so as to hold the piles securely and accurately in the required position during driving. Leads shall be of sufficient length to be supported firmly on the ground. The use of hanging or swinging leads will not be allowed unless they can be held in a fixed position during the driving operations. Batter piles shall be driven with inclined leads.

The heads of steel bearing piles shall be squared and protected by a cap of a design approved by the Engineer. The cap shall be designed to hold the axis of the pile in line with the axis of the hammer. The top of the cap shall have a timber shock block.

The Contractor shall drive all piling in the sequence as shown on the Drawings or specified by the Engineer to minimize pile upheaval. If upheaval does occur, the Contractor shall re-drive the lifted piles to the specified elevations. The Contractor shall excavate material that has boiled up during pile driving operations. The elevation of all piles previously driven or redriven shall be confirmed to detect uplift. If uplift of 5 mm or more occurs in any pile, that pile shall be redriven to its original elevation and thereafter to the required final driving resistance. If cavities remain around the piles after driving, the cavities shall be filled with sand or other approved material to the satisfaction of the Engineer.

For pile installation monitoring purposes, the Contractor shall paint markings on each pile at 0.25 meter intervals, with a label at each 1.0 meter interval, starting from the toe of the pile.

The Contractor shall ensure the safety of all personnel during pile driving operations. In particular, overhead protection shall be provided for all personnel located adjacent to the pile driving lead and under the pile driving hammer. The overhead protection shall be designed and constructed so as to safely withstand forces from falling debris or other matter.

Pre-boring will not be allowed unless it is specified in the Geotechnical Report, on the Drawings or approved in writing by the Engineer.

5.4 Pile Cut-Offs

The piles shall be cut off level at the required elevations as specified on the Drawings or as directed by the Engineer.

5.5 Splicing Piles and Installing Pile Tips

The Contractor shall splice piles and install pile tips in accordance with the Drawings, this Specification, welding procedures, and the following:

- .1 The butting ends of the driven pile and its extension or the pile and the pile tip shall be cut square to give reasonable bearing between the mating surfaces.
- .2 The butting surface shall be bevelled to facilitate a full penetration butt weld. Temporary clamping plates may be used as required.
- .3 Before welding over previously deposited metal, the slag shall be removed. This requirement shall apply to successive layers, to successive beads, and to the cratered area when welding is resumed after any interruption.
- .4 All butt welds shall have the root of the initial weld arc-air gouged, to sound metal and cleaned by grinding and wire brushing before welding is started from the second side.
- .5 Material to be welded shall be preheated in accordance with CSA W59.
- .6 The piles shall not have more than one splice per pile unless otherwise approved by the Engineer. The location of the splice(s) shall be approved by the Engineer.
- .7 For railway bridges, the pile ends to be spliced shall be flame cut using a steel guide to obtain a square and even cut. The bevel cut shall be made at 45°. Splice plates shall be welded to the upper pile before

positioning. The upper pile shall then be positioned, and the splice plates welded to the lower pile. Butt welds shall then be completed.

5.6 Defective Piles

The pile driving procedures shall not subject the piles to excessive and undue abuse producing deformation of the steel. Manipulation of piles to force them into proper position will not be permitted. Piles damaged by improper driving, or driven out of proper location, or driven below the cut-off elevation, shall be corrected by one of the following methods accepted by the Engineer:

- .1 The piles shall be withdrawn and replaced by new, if necessary, longer piles, or
- .2 Replacement piles shall be driven adjacent to defective or low piles, or
- .3 The piles shall be spliced or built up, as otherwise provided herein, or a sufficient portion of the footing extended to properly embed the piles. All piles, pushed up by the driving of adjacent piles or by any other cause, shall be driven down again.

In the case of required penetration and bearing capacity are not obtained, the Contractor shall provide a hammer of greater energy, as applicable, or when accepted by the Engineer, resort to pre-drilling.

6.0 QUALITY MANAGEMENT

6.1 Quality Control

The Contractor shall provide a detailed survey of all of the pile locations for a pile cap (foundation) and provide that to the Engineer prior to cutting off any piles for that pile cap.

The Contractor shall replace any piles, or add additional pile(s), for piles that do not meet the specified refusal criteria or do not meet the following tolerances: +/-2% out of alignment for battered piles, +/-2% out of plumb for vertical piles, and 75 mm off centre of the specified locations. Any modifications required to the pile cap, due to piles out of tolerance or due to required additional piles to compensate for out of tolerance piles, shall be carried out as specified by the Engineer at the Contractor's own costs.

6.2 Quality Assurance

All welds will be inspected visually by the Engineer. The Contractor shall allow the Engineer unhindered access to the piling and shall assist the Engineer in carrying out any inspection, including suitable access.

6.3 Pile Driving Records

The Contractor and the Engineer will keep an independent record of each and every pile driven. The records shall give the date, time, diameter, length, location, type, total depth of penetration, rate of penetration, number of blows per 300 mm, penetration of the last five blows, steam, air or diesel pressure and the kind and size of hammer used in driving. Any unusual phenomena shall be noted and recorded, especially if they indicate possible damage to the pile.

Energy output of driving equipment at the time of final set shall be carefully recorded by the Contractor, along with the final penetration readings, and reported immediately to the Engineer. The required set per blow will be subject to acceptance by the Engineer, showing regard to the specified driving equipment and piles permitted.

7.0 METHOD OF MEASUREMENT**7.1 Steel Bearing Piles**

Supplying steel bearing piles will be measured in lineal length of piling. The number of lineal metres to be paid for will be the total number of lineal metres of piling unloaded and stockpiled at the site as authorized by the Engineer.

Driving steel bearing piles will be measured in lineal length of piling. The length to be paid for will be the total number of lineal metres driven, less 50% of the total number of lineal metres of piling cut off after driving. Cut offs will be measured by the Engineer in the presence of the Contractor. Unless determined otherwise by the Engineer, cut offs shall become the property of the Contractor and shall be removed from the site.

7.2 Pile Tips

Supplying and installing pile tips will be measured on a unit basis and the number to be paid for will be the total number of pile tips supplied and installed as accepted by the Engineer.

7.3 Splicing Steel Bearing Piles

Splicing steel bearing piles will be measured on a unit basis and the number to be paid for will be the total number of splices performed by the Contractor and accepted by the Engineer.

7.4 Pre-Boring

Pre-Boring of piles will be considered incidental to supplying and driving steel bearing piles and no separate measurement will be made of this work.

8.0 BASIS OF PAYMENT**8.1 Steel Bearing Piles**

Supplying steel bearing piles will be paid for at the Contract Unit Price per metre for "Supplying Steel H Piles", measured as specified herein, which price will be payment in full for performing all operations herein described and all other items incidental to the Work.

Driving steel bearing piles will be paid for at the Contract Unit Price per metre for "Driving Steel H Piles", measured as specified herein, which price will be payment for performing all operations herein described and all other items incidental to the Work.

8.2 Pile Tips

Supplying pile tips will be paid for at the Contract Unit Price per pile tip for "Supply of Pile Tips", measured as specified herein, which price will be payment for performing all operations herein described and all other items incidental to the Work.

Installing pile tips will be paid for at the Contract Unit Price for "Installation of Pile Tips", measured as specified herein, which price will be payment for performing all operations herein described and all other items incidental to the Work.

8.3 Splicing Steel Bearing Piles

Splicing of steel bearing piles will be paid for at the Contract Unit Price per pile tip for "Splicing Steel H Piles", measured as specified herein, which price will be payment for performing all operations herein described and all other items incidental to the Work.