

PART 1 - GENERAL

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| 1.1 | <u>Related Work</u> | .1 | Refer to Section 01 33 00: Submissions/Shop Drawings. |
| | | .2 | Refer to Section 31 61 13: Pile Foundations, General. |
| 1.2 | <u>References</u> | .1 | ASTM A307-14, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile. |
| | | .2 | ASTM A325M-14, Specification for High-Strength Bolts for Structural Steel Joints. |
| | | .3 | CAN/CSA-G40.20-13, General Requirements for Rolled or Welded Structural Quality Steel. |
| | | .4 | CAN/CSA-G40.21-13, Structural Quality Steel. |
| | | .5 | CAN/CSA-S16-14, Design of Steel Structures. |
| | | .6 | CSA W47.1-09(R2014), Certification of Companies for Fusion Welding of Steel Structures. |
| | | .7 | CSA W59-13, Welded Steel Construction (Metal Arc Welding). |
| 1.3 | <u>Shop Drawings</u> | .1 | Submit shop drawings in accordance with Section 01 33 00 - Submissions/Shop Drawings. |
| | | .2 | Indicate the following items: |
| | | .1 | Material |
| | | .2 | Anchorage, field control and alignment methods |
| | | .3 | Design parameters |
| | | .4 | Tolerance for driving pile |
| | | .5 | Removable members |
| | | .6 | Alternatives |
| 1.4 | <u>Design Criteria</u> | .1 | Design templates to safely withstand following loads: |
| | | .1 | All gravity loads to which the template will be subjected. |
| | | .2 | Lateral loads to firmly hold pile in position when driving. |

1.5 Protection .1 Protect templates from damage. Repair damage to templates, formwork or concrete arising from operations to satisfaction of Departmental Representative at no extra cost.

1.6 Measurement for Payment .1 No measurement will be made under this section. Include costs in items of work that require templates.

PART 2 - PRODUCTS

2.1 Materials .1 Steel sections and plates: to CAN/CSA-G40.20 and CAN/CSA-G40.21, Type 350 W.
.2 Welding Materials: to CSA W59.
.3 Bolts, nuts and washers: to ASTM A307 or ASTM A325M.

PART 3 - EXECUTION

3.1 Fabrication .1 Fabricate structural steel for templates in accordance with CAN/CSA-S16 and reviewed shop drawings.
.2 Welding in accordance with CSA W59.
.3 Welding companies shall be qualified under provisions of CSA W47.1.

3.2 Positioning .1 Position and hold template in location to receive piles with an accuracy which will ensure piles are within tolerances specified in Section 31 61 13, Part 3.5.

3.3 Removal of Templates .1 Avoid any damage to piling when removing templates.
.2 When instructed by Departmental Representative move templates from project site.

PART 1 - GENERAL

- 1.1 Description of Work
- .1 This Section specifies requirements for work above Chart Datum, such as furnishing all materials, labour, tools and equipment and performing all operations necessary to strip and remove over burden from areas designated, complete excavation of all types of material encountered, placing of excavated material as backfill in trenches and embankments, disposal of unsuitable or frozen material, disposal of surplus material, furnishing and placing backfill material as specified below, all as shown on the Project Drawings and as specified.
- .2 The work generally includes, but is not necessarily limited to, the following items:
- .1 All normal removals as required to complete the work. All items to be verified by a site visit prior to submission of a tender as per Section 01 10 10, Clause 1.14.
- .2 Preparing ground for excavation.
- .3 Excavation and backfilling.
- .4 Structure excavation and backfilling.
- .5 Control of water by dewatering.
- .6 Providing borrow material when required.
- .7 Removal and disposal of frozen or unsuitable material.
- .8 Removing surplus material.
- .9 Sheet piling, shoring and bracing to support sides of excavations, existing structures or utilities.
- .10 Stripping, and replacing asphalt and granular surfaces.
- 1.2 Related Sections
- .1 Refer to Section 01 33 00 for Submissions/Shop Drawings.
- .2 Section 03 30 00 - Concrete
- .3 Section 32 98 00 - Reinstatement
- 1.3 References
- .1 ASTM C117-13, Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

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- .2 ASTM C136/C136M-14, Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D698-12e2, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12400 ft-lbf/ft²(600 kN-m/m³)).
 - .4 Prince Edward Island Department of Transportation, Infrastructure and Energy Standard Specifications.
- 1.4 Definitions
- .1 Excavation: excavation of materials of whatever nature including dense tills, hardpan, frozen materials, boulders, bedrock, debris and all other materials encountered on the site.
 - .2 Selected Backfill: excavated on-site material suitable for grading work.
- 1.5 Protection of Existing Features
- .1 Existing buried utilities and structures:
 - .1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed. Carry out test digs as required to locate services, etc.
- 1.6 Shoring and Bracing
- .1 Comply with Section 01 35 29 - Health and Safety Requirements and applicable local regulations.
 - .2 Provide shoring and bracing as required to prevent movement, failure or settlement, to safeguard and maintain integrity of structures, utilities, earth, benchmarks, services and adjacent grades.
 - .3 Engage services of qualified Professional Engineer registered in the Province of Prince Edward Island to inspect and approve shoring equipment required for work.
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- 1.7 Samples
- .1 When requested, submit samples in accordance with Section 01 33 00 - Submissions/Shop Drawings.
 - .2 At least two (2) weeks prior to commencing work, inform Departmental Representative of proposed source of bedding, backfill or cover materials and provide access for sampling.

PART 2 - PRODUCTS

- 2.1 Materials
- .1 Select Backfill Material: approved material from site excavation or borrow pits. Such material must be free from stumps, trees, roots, sod, muck or other deleterious material. The material shall be free from frost, and shall not be placed on frozen ground or in water. It must have a moisture content that will allow compaction to the specified densities.
 - .2 Sandstone Fill: native excavated material in accordance with PEI DOTIE Specifications for Select Borrow.

PART 3 - EXECUTION

- 3.1 Site Preparation
- .1 Remove obstructions from surfaces to be excavated within limits indicated.
- 3.2 Preparation/Protection
- .1 Keep excavations clean, free of standing water and loose soil.
 - .2 Protect natural and man-made features required to remain undisturbed.
 - .3 Protect buried services that are required to remain undisturbed.
- 3.3 Dewatering
- .1 Keep excavations free of water while work is in progress.
 - .2 Protect open excavations against flooding and damage due to surface run-off.

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- .3 Dispose of water in a manner not detrimental to public and private property, or any portion of work completed or under construction.
- 3.4 Excavation
- .1 Carry out excavations and removals. Excavate to lines, grades, elevations and dimensions as indicated.
- .2 Remove rubble and other obstructions encountered during excavation.
- .3 Dispose of surplus and unsuitable excavated material in approved location off site in accordance with PEI Department of Environment regulations.
- .4 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density not less than undisturbed soil.
- .5 Obtain excavation permit prior to starting any on-site excavations.
- 3.5 Backfilling
- .1 Generally, the backfill will be sourced from the excavated material on-site. If additional backfill is required to replace unsuitable material, provide backfill from offsite source that matches the description provided herein. If additional engineered structural fill is required, provide in accordance with the specifications provided herein.
- .2 Do not proceed with backfilling operations until the Departmental Representative has inspected and approved installation.
- .3 Backfill areas that are free from debris, snow, ice, water and frozen ground.
- .4 Do not use backfill material which is frozen or contains ice, snow or debris.
- .5 Backfilling around installations:
.1 Place bedding and surround material as specified elsewhere.
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- .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
- .6 Where earth pressures are liable to develop permit concrete to cure for minimum 28 days to withstand earth and compaction pressures. Do not install earth or backfill until concrete has cured completely.
- .7 Place protective material layer under, around and over minor installations until 600 mm of cover is provided. Dumping material directly on installations will not be permitted.
- .8 Place backfill materials of earth fill around structure in uniform layers not exceeding 150 mm compacted thickness up to finish grade. Compact each layer before placing succeeded layer.
- .9 Compact common backfill and sandstone fill materials:
.1 In all areas, compact to a minimum 95% of Standard Proctor maximum dry density, maximum density ASTM D698, AASHTO T099, Method C.
- .10 Compact granular surface material to a minimum 98% of Standard Proctor maximum dry density, maximum density AASHTO T099, Method C.
- .11 No fill shall be placed against reinforced concrete wall panels until the threaded bars are installed and tightened. Fill will be brought up evenly along the length of wall panels.
- .12 Initial fill placement activities to be scheduled during low tide periods to minimize the amount of fill to be placed directly in water.
- .13 Filling below the chart datum may be carried out by the simple end dumping process. The Contractor will ensure that large pieces, which will not render good consolidation and compaction do not enter the work.

- .14 Commence infill above the chart datum as soon as possible with maximum 300 mm layers. Each layer will be brought to its required degree of compaction before the next layer is placed. When using hand operated tamping devices, deposit backfill material
- .15 Compact using approved mechanical tamping devices, or by hand tamping to achieve specified compaction. Care must be taken while compacting near Berlin walls to prevent disturbance of the H-piles and wall panels.

3.6 Restoration

- .1 Upon completion of work, remove surplus materials and debris, trim slopes, and correct defects noted by Departmental Representative.
 - .2 Clean and reinstate areas affected by work as directed by Departmental Representative.
 - .3 Restore site to its normal state prior to excavation.
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PART 1 - GENERAL

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| 1.1 | <u>Related Work</u> | .1 | Refer to Section 01 33 00 - Submissions/Shop Drawings. |
| | | .2 | Refer to Section 31 62 18 - Steel H-piles. |
| 1.2 | <u>Reference Standards</u> | .1 | CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding |
| 1.3 | <u>Submissions</u> | .1 | Methodology:
.1 Provide methodology including type of pile driving equipment to carry out the work. |
| | | .2 | Provide submissions in accordance with Section 01 33 00. |
| 1.4 | <u>Existing Sub-Surface Conditions</u> | .1 | Sub-surface investigation reports are appended to the specification. Relevant borehole logs are included on the drawings. |
| | | .2 | Notify the Departmental Representative immediately if subsurface conditions at site differ from those indicated. |
| 1.5 | <u>Protection</u> | .1 | Protect public and construction personnel, adjacent structures and work of other sections from hazards attributes to pile driving operations or any other operations. |
| 1.6 | <u>Scheduling of Work</u> | .1 | Submit schedule of planned sequence of driving to Departmental Representative for review, not less than two (2) weeks prior to commencement of pile driving for structure. |
| 1.7 | <u>Measurement for Payment</u> | .1 | This item will not be measured separately. |
| 1.8 | <u>Delivery, Storage and Handling</u> | .1 | Protect piles from damage due to excessive bending stresses impact, abrasion or other damages during storage and handling. |

- .2 Replace damaged piles to the satisfaction of the Departmental Representative.

PART 2 - PRODUCTS

2.1 Materials

- .1 For material requirements, refer to Section 31 62 18 - Steel H-piles.
- .2 Provide equipment of sufficient capacity to handle full length piles without cutting and splicing.
- .3 Pile lengths indicated in Unit Price Table are based on lengths estimated to remain in completed structure, plus a 1.0 metre cut-off allowance.
- .4 Splicing of piles will not be permitted unless specifically agreed to by the Departmental Representative. Design details for splice to bear dated signature stamp of professional engineer licensed in the Province of PEI.

PART 3 - EXECUTION

3.1 Equipment Requirements

- .1 Contractor is responsible to determine and provide equipment suitable for driving piles and prevent failure of existing structure and works during construction.
- .2 Equipment information: prior to commencement of pile installation operation, submit to Departmental Representative for review, details of equipment for installation of piles. For impact hammers give manufacturer's name, type, rated energy per blow at normal working rate, mass of striking parts of hammer and mass of driving cap.
- .3 Hammer:
 - .1 Provide hammer of suitable size to achieve the necessary penetration into bedrock as noted. H-piles shall be driven

with a hammer rated to deliver approximately 350 joules per square cm of steel cross sectional area. The hammer selected will be of sufficient energy so as not to damage the piles.

.2 When required penetration is not obtained by use of hammers complying with minimum requirements, either provide larger hammer or take other measures, acceptable to Departmental Representative. Drop hammers are permitted. All piles damaged due to overdriving to be replaced at the Contractor's cost.

.4 Leads:

.1 Construction pile driver leads to provide free movement of hammer. Hold leads in position at top and bottom, with guys, stiff braces, or other means approved by Departmental Representative, to ensure support to pile while being driven.

.2 Length: except for piles driven through water, provide length of leads so that use of a follower is unnecessary.

.3 Swing leads: firmly guy top and bottom to hold pile in position during driving operations. Method to be reviewed by Departmental Representative.

.5 Followers:

.1 When permitted, provide followers of such size, shape, length and mass to permit driving pile in desired location to required depth and resistance. Provide followers with socket or hood carefully fitted to top of pile to minimize loss of energy and prevent damage to pile.

3.2 Preparation

.1 Confirm conditions at pile locations are adequate to support pile driving operation. Make provision for access and support of piling equipment during performance of work.

3.3 Field Measurement

.1 Maintain accurate records of driving for each pile, including:
.1 Type and make of hammer, stroke or related energy.

- .2 Other driving equipment including water jet, driving cap, cushion.
- .3 Pile size, length and location.
- .4 Sequence of driving piles.
- .5 Number of blows per metre for entire length of pile and number of blows per 25 mm for last 100 mm.
- .6 Final tip and cut-off elevations.
- .7 Other pertinent information such as interruption of continuous driving, pile damage.
- .8 Record elevation taken on adjacent piles during driving of each pile.
- .9 All measurements, observations and calculations associated with wave equation analysis.

- .2 Provide Departmental Representative with three (3) copies of records.

3.4 Driving

- .1 Use driving caps to protect piles. Reinforce pile heads if necessary. Piles with damaged heads as determined by Departmental Representative will be rejected.
- .2 Use steel drive shoes to protect pile toes during driving to the approval of the Departmental Representative.
- .3 Hold piles securely and accurately in position while driving.
- .4 Deliver hammer blows in direct axis of pile.
- .5 Do not drive piles within a radius of 8 m of concrete which has been in place less than three (3) days.
- .6 Redrive piles lifted during driving of adjacent piles.
- .7 Use of water jet:
 - .1 Use water jets only with written permission of Departmental Representative.
 - .2 When water jets are permitted number of jets and volume and pressure of water must be sufficient to freely erode material immediately adjacent to pile.

Plant must be capable of delivering water pressure of at least 690kPa as measured at two 20 mm nozzles.

- .3 Restriction: stop jetting at a minimum of 1 m above tip elevation of piles previously driven within 2 m of jet, except where piles are to be carried to rock surface. Drive piles down beyond depth of jetting until required resistance is obtained. If there is evidence that jetting has disturbed load-bearing capacities of previously installed piles, restore bearing capacity of those piles by redriving. Redrive where necessary after jetting operations in area have been completed.

- .8 Cut off piles neatly and squarely at elevations indicated. Provide sufficient length above cut-off elevation so that part damage during driving is cut off.
- .9 Remove cut-off lengths from site on completion of work.
- .10 Installation of each pile will be subject to acceptable by Departmental Representative. Departmental Representative will be sole judge of acceptability of each pile with respect to final driving resistance and depth of penetration. Departmental Representative to accept final driving of all piles prior to removal of pile driving rig from site.
- .11 Drive each pile to a minimum penetration into bedrock indicated on the drawings, or to driving resistance, as determined by the Departmental Representative.

3.5 Driving Tolerances

- .1 Pile heads to be within 50 mm of locations indicated.
- .2 Piles not to be more than 2% of length out of alignment.

3.6 Obstructions

- .1 Where obstruction is encountered that causes sudden and unexpected change in penetration

resistance or deviation from specified tolerances, advise Departmental Representative and submit for their review the Contractor's proposed method(s) for achieving specified penetrations and tolerances. Incorporate review comments in the proposed method(s) and proceed with the work.

3.7 Damaged or
Defective Piles

- .1 Remove rejected pile and replace with a new, and if necessary, a longer pile.
- .2 No extra compensation will be made for removing and replacing or other work made necessary through rejection of a defective pile.

3.8 Penetration

- .1 Protect adjacent structures, services and work of other section from hazards due to pile driving operations.
 - .2 Arrange sequencing of pile driving operations and methods such that no damage occurs to adjacent existing structures. If damaged, remedy damaged items to restore to original or better condition at own expense.
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PART 1 - GENERAL

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| 1.1 | <u>Related Sections</u> | .1 | Section 01 33 00 - Submissions/Shop Drawings. |
| | | .2 | Section 01 74 00 - Cleaning. |
| | | .3 | Section 31 61 13 - Pile Foundations, General. |
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| 1.2 | <u>Measurement Procedures</u> | .1 | Supply and installation of steel H-piles will be measured for payment in accordance with Section 01 29 00, Project Particulars and Measurement. |
| | | .2 | The following are considered as incidental to supply of piles: shoes and steel point reinforcing. |
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| 1.3 | <u>References</u> | .1 | CAN/CGSB-1.171M-98, Inorganic Zinc Coating. |
| | | .2 | CSA W47.1-09(R2014), Certification of Companies for Fusion Welding of Steel Structures. |
| | | .3 | CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding. |
| | | .4 | CSA W59-13, Welded Steel Construction (Metal Arc Welding) (Metric Version). |
| | | .5 | CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels. |
| | | .6 | SSPC-SP - 2000, Surface Preparation Specification. |
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| 1.4 | <u>Shop Drawings</u> | .1 | Submit shop drawings in accordance with Section 01 33 00 - Submissions/Shop Drawings. |
| | | .2 | Indicate: pile shoes and tip reinforcement. |
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- .3 Each drawing submitted shall bear the signature and stamp of qualified Professional Engineer registered or licensed in the Province of PEI, Canada.
- 1.5 Test Reports
 - .1 Furnish mill test reports indicating yield and chemical analysis of steel piles if requested by Departmental Representative.
- 1.6 Waste Management and Disposal
 - .1 Separate and recycle waste materials in accordance with Section 01 74 00 -Cleaning.
 - .2 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
 - .3 Place materials defined as hazardous or toxic in designated containers.
 - .4 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
 - .5 Unused paint or coating material must be disposed of at an official hazardous material collections site as approved by Departmental Representative.
 - .6 Fold up metal banding, flatten and place in designated area for recycling.
 - .7 Unused paint and coating materials must not be disposed of into sewer system, into streams, lakes, onto ground or in any other location where it will pose a health or environmental hazard.

PART 2 - PRODUCTS

- 2.1 Materials
 - .1 Steel H piles: to CSA-G40.20/G40.21, Type and Grade 350W. Size and weight as indicated.

- .2 Welding materials: to CSA W48.
- .3 Steel plates: to CSA-G40.20/G40.21, Type and grade 350W.
- .4 Pile driving shoes: to CSA-G40.20/G40.21, Grade 350W.

PART 3 - EXECUTION

3.1 Installation

- .1 Install piling in accordance with Section 31 61 13.
- .2 Provide driving shoes for all piles as directed by Departmental Representative.
- .3 Do not splice piles without written permission of Departmental Representative. When permitted, provide splice shop drawings which bear the signature and stamp of a qualified Professional Engineer registered license in the Province of Prince Edward Island.
- .4 Cut off piles squarely at required elevation.
- .5 Touch up scratches on uncoated surfaces before and after driving.
- .6 Cut-off parts of piles will become the property of the Contractor and will be disposed of. Pile cut-offs to be used as pile connection with threaded bars.

3.2 Welding

- .1 Weld to CSA W59, CSA W59S1 and all related supplements.
 - .2 Welding certification of companies: to CSA W47.1.
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