
PART 1 - GENERAL

- 1.1 Related Work
- .1 Refer to other Specification Sections for related information.
 - .2 Refer to **Section 01 33 00** for Shop Drawing/Submission requirements.
- 1.2 Source Approval
- .1 Source of materials to be incorporated into work or stockpiled requires acceptance.
 - .2 Inform *Departmental Representative* of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing production.
 - .3 If, in opinion of *Departmental Representative*, materials from the proposed source do not meet, or cannot reasonably be processed to meet specified requirements, procure an alternative source to demonstrate that materials from source in question can be processed to meet specified requirements.
 - .4 Should a change of material source be proposed during work, advise *Departmental Representative* 4 weeks in advance of proposed change to allow sampling and testing.
 - .5 Acceptance of material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.
- 1.3 Production Sampling
- .1 Aggregate will be subject to continual sampling during production.
 - .2 Provide *Departmental Representative* with ready access to source and processed material for purpose of sampling and testing.
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1.4 Measurement for
Payment

- .1 This item will not be measured separately.

PART 2 - PRODUCTS

2.1 Materials

- .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material or other deleterious substances.
- .2 Flat and elongated particles are those whose greatest dimension exceeds four times their least dimension.
- .3 Fine aggregates satisfying requirements of applicable section shall be one, or a blend of following:
 - .1 Natural sand
 - .2 Manufactured sand
 - .3 Screening produced in crushing of quarried rock, boulders, gravel or slag
 - .4 Coarse aggregates satisfying requirements of applicable section shall be one of following:
 - .1 Crushed rock or slag
 - .2 Gravel composed of naturally formed particles of stone.

PART 3 - EXECUTION

3.1 Development of
Aggregate Source

- .1 Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as directed by the *Departmental Representative*.
- .2 Clear, grub and strip an area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.

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| | .3 | When operating in stratified deposits use excavation equipment and methods that will produce a uniform, homogeneous aggregate. |
| | .4 | When excavation is completed, provide drains or ditches as required to prevent surface standing water. |
| | .5 | Trim off and dress slopes of waste material piles and leave site in a neat condition. |
| 3.2 | <u>Processing</u> | |
| | .1 | Process aggregate uniformly using methods that prevent contamination, segregation and degradation. |
| | .2 | Blend aggregate if required to obtain gradation requirements specified. Use approved methods and equipment. |
| | .3 | Blending to increase percentage of crushed particles or decrease percentage of flat and elongated particles is permitted. |
| | .4 | Wash aggregates if required to meet specifications. Use only equipment accepted by <i>Departmental Representative</i> . |
| 3.3 | <u>Handling</u> | |
| | .1 | Handle and transport aggregates to avoid segregation, contamination and degradation. |
| 3.4 | <u>Stockpiling</u> | |
| | .1 | Stockpiling aggregates on stabilized, clean and well drained surfaces. |
| | .2 | To ensure that no material other than stockpiled aggregate is used, do not incorporate bottom 250 mm of stockpile into work, if aggregates are stockpiled on ground. |
| | .3 | Stockpile far enough apart to prevent intermixing. |
| | .4 | Reject intermixed or contaminated materials. Remove and dispose of rejected materials as directed within 48 hours of rejection. |
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- .5 Stockpile materials in uniform layers of thickness as follows:
 - .1 Max 1 m for coarse aggregate and base course materials.
 - .2 Max 2 m for fine aggregate and subbase materials.
 - .3 Max 1.5 m for other materials.
 - .6 Complete each layer over entire stockpile area before beginning next layer.
 - .7 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
 - .8 Coning of piles or spilling of material over edges of pile will not be permitted.
 - .9 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.
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PART 1 - GENERAL

- 1.1 Related Work
- .1 Refer to other Specifications Sections for related information.
 - .2 Refer to **Section 01 33 00** for Shop Drawing/Submissions requirements.
- 1.2 References
- .1 ASTM F3125/F3125M-15a (or latest edition), Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.
 - .2 CSA G40.20/G40.21-13(R2018) (or latest edition), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .3 CSA S16-14 (or latest edition), Design of Steel Structures.
 - .4 CSA W47.1-09(R2014) (or latest edition), Certification of Companies for Fusion Welding of Steel.
 - .5 CSA W48.1-M1991(R1998) (or latest edition), Carbon Steel Covered Electrodes for Shielded Metal Arc Welding.
 - .6 CSA W59-18 (or latest edition), Welded Steel Construction.
 - .7 CSA W59S1-M1989(R1998), Supplement No. 1-M1989, Steel Fixed Offshore Structures, to W59-M1989.
- 1.3 Shop Drawings
- .1 Submit shop drawings in accordance with **Section 01 33 00** - Submissions/Shop Drawings.
 - .2 Indicate the following items:
 - .1 Material
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File Driving Templates

Page 2

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| | | .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 template shall be subjected. |
| | | .2 | Lateral loads to firmly hold pile in position when driving. |
| 1.5 | <u>Protection</u> | .1 | Protect templates from damage. Repair damage to templates, formwork or concrete arising from operations to satisfaction of <i>Departmental Representative</i> at no extra cost. |
| 1.6 | <u>Measurement for Payment</u> | .1 | No measurement will be made under this section. Include costs in items of work that require templates. |

PART 2 - PRODUCTS

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| 2.1 | <u>Materials</u> | .1 | Steel sections and plates: to CSA G40.20/ G40.21, Type 300 W. |
| | | .2 | Welding Materials: to CSA W59. |
| | | .3 | Bolts, nuts and washers: to ASTM F3125/ F3125M, Grade A325. |
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PART 3 - EXECUTION

- 3.1 Fabrication
- .1 Fabricate structural steel for templates in accordance with 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.
- 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.
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PART 1 - GENERAL

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| 1.1 <u>Description of Work</u> | .1 | Section includes but is not limited to the to the following:

.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. All available plans of the existing structure are available for viewing at the Project Manager's office, 2nd floor, 1713 Bedford Row, Halifax, N.S. |
| 1.2 <u>Related Work</u> | .1 | Refer to other specification sections for related information. |
| | .2 | Refer to Section 01 33 00 for Shop Drawing/Submission requirements. |
| 1.3 <u>Submissions</u> | .1 | Methodology:
.1 Provide methodology for carrying out the work |
| | .2 | Provide submission in accordance with Section 01 33 00 . |
| 1.4 <u>Protection</u> | .1 | Prevent movement, settlement or damage of existing structure and adjacent structures. Provided bracing and shoring as required. In event of damage, immediately replace such items or make repairs to approval of <i>Departmental Representative</i> and at no additional cost to <i>Departmental Representative</i> . |
| | .2 | Keep noise, dust and inconvenience to occupants to a minimum. |
| | .3 | Prevent debris from going adrift and becoming a menace to navigation. |
| | .4 | All damage to existing structures, roadways, pipelines, electrical systems not specified for removal to be repaired at the |
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Contractor's cost to the satisfaction of the
Departmental Representative.

1.5 Measurement for
Payment

- .1 Sitework, demolition and removals will be measured in accordance with **Section 01 29 00**.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

3.1 Preparation

- .1 Inspect site and verify with *Departmental Representative* items designated for removal and items to be preserved.
- .2 Locate and protect utility lines. Preserve in operating condition active utilities traversing site.
- .3 Provide temporary power and lighting as shown on the plan or as required by the *Departmental Representative*.

3.2 Removal

- .1 Remove items indicated.
- .2 Do not disturb adjacent structures designated to remain in place.
- .3 At end of each day's work, leave work in safe condition so no part is in danger of toppling or falling.

3.3 Partial Demolition
of Existing Steel
Sheet Pile Wall

- .1 Remove and dispose of portion of existing deteriorated sheet pile wall as indicated.
- .2 Do not demolish and remove existing sheet pile wall until new Berlin wall has been constructed and secured.
- .3 Remove sheet pile areas which are loose, ready to fall or can be easily removed without endangering the existing sheet pile wall structure.

3.4 Removal of
Collapsed Area

- .1 Remove material from collapsed wharf area. The material may include sheet pile sections, fill, concrete elements, tie rods, stones, timber, etc. Dispose of materials off-site.

3.5 Disposal of
Material

- .1 Disposal of materials not designated for salvage or re-use in work, will be the contractor's responsibility, and must be disposed of off-site.
- .2 The material from site to be disposed of is to be transported and disposed of in an environmentally acceptable manner to the satisfaction of the *Departmental Representative*, and in accordance with any local, Municipal, Provincial, and Federal restrictions and regulations.

3.6 Restoration

- .1 Upon completion of work, remove debris, trim surfaces and leave work site clean.
- .2 Reinststate areas and existing works outside areas of demolition to conditions that existed prior to commencement of work. Match condition of adjacent, undisturbed areas.

PART 1 - GENERAL

1.1 Reference Standards

- .1 ASTM G`64-15 (or latest edition), Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.
- .2 ASTM D698-12e2 (or latest edition) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft) (600 kN-m/m³).
- .3 AASHTO T85-14 (or latest edition), Method of Test for Specific Gravity and Absorption of Coarse Aggregate.
- .4 AASHTO T99-17 (or latest edition) Moisture-Density Relations of Soils Using a 2.5 kg (5.5-lb.) Rammer and a 305 mm (12 in.) Drop.

1.2 Related Work

- .1 Refer to other Specification Sections for related information.

1.3 Definitions

- .1 Rock excavation: excavation of material from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass, and boulders or rock fragments having individual volume in excess of 1.5 m³.
- .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation including soft clay, dense tills, hardpan, frozen materials and partially cemented materials such as asphalt which can be ripped and excavated with heavy construction equipment.

1.4 Protection of Existing Features

- .1 Existing buried utilities and structures:
 - .1 Prior to commencing any excavation work, notify applicable owner or
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authorities, establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during work.

.2 Existing buildings and surface features:

.1 Protect existing buildings and surface features which may be affected by work from damage while work is in progress and repair damage resulting from work.

1.5 Shoring and Bracing

.1 Comply with applicable local regulations to protect existing features.

1.6 Samples

.1 At least 2 weeks prior to commencing work, inform *Departmental Representative* of proposed source of fill materials and provide access for sampling.

1.7 Measurement for Payment

.1 Work performed under this Section will be measured in accordance with **Section 01 29 00.**

PART 2 - PRODUCTS

2.1 Materials

.1 Trench excavation for steel H-piles and concrete panels to be included in lump sum price in accordance with **Section 01 29 00.**

.2 Rock fill material: in accordance with **Section 31 37 10.**

.3 Granular Sub-Base material in accordance with **Section 32 11 19.**

.4 Granular Base material in accordance with **Section 32 11 23.**

.5 Nominal clear stone material in accordance with **Section 32 11 25.**

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- .6 Armour stone material in accordance with
Section 35 31 19.

PART 3 - EXECUTION

- 3.1 Site Preparation .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- 3.2 Stockpiling .1 Stockpile fill materials in areas approved by *Departmental Representative*. Stockpile granular materials in manner to prevent segregation.
- 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.
- .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 Excavate to lines, grades, elevations and dimensions indicated or as directed by *Departmental Representative*.
- .2 Excavate area behind existing sheet pile wall as indicated on drawings to relieve pressure on existing sheet pile wall prior to removal of existing concrete anchor blocks.
- .3 Keep excavation clean, free of standing water and loose soil.
- .4 Do not obstruct flow of surface drainage or natural watercourses.
- .5 Notify *Departmental Representative* when bottom of excavation is reached.
- .6 Dispose of excavated material off site. The material to be transported and disposed of
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in an environmentally acceptable manner to the satisfaction of *Departmental Representative* and in accordance with any local municipal, provincial and federal restrictions and regulations.

3.5 Pre-Excavation
for Confirmation
of H-Pile Locations

- .1 Excavate and expose the top of existing concrete anchor walls.
- .2 Verify location of new tie rods and H-piles as shown on the drawings to ensure that they do not interfere with existing concrete anchor walls. Advise *Departmental Representative* if any changes are required to proposed H-pile locations and tie rods prior to proceeding with the installation of H-piles.

3.6 Trench Excavation
For H-Piles and
Concrete Panels

- .1 Excavate harbour bottom material including silt, clay, boulders and stones etc. to facilitate installation of H-piles and concrete panels.
- .2 Remove and dispose of all excavated material from harbour bottom trench in an environmentally acceptable manner to the satisfaction of *Departmental Representative*, and in accordance with any local, municipal, provincial and federal restrictions and regulations.

3.7 Backfilling

- .1 Do not proceed with backfilling operations until *Departmental Representative* has inspected and approved Berlin wall installations and sub-soil conditions.
 - .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
 - .3 Do not use backfill material which is frozen or contains ice, snow or debris.
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- .4 Install and secure filter fabric to **Section 31 32 21.**
 - .5 Backfilling around installations:
 - .1 Place material by hand under, around, and over tie rod installations until 300 mm of cover is provided. Dumping material directly on installations will not be permitted.
 - .2 Backfill using approved mechanical tamping devices, or by hand as approved by *Departmental Representative*. Compact clear stone to 70% relative density in accordance with ASTM C127. Compact rock fill to 95% maximum dry density in accordance with ASTM D698.
 - .6 Backfilling of area behind Berlin wall and existing sheet pile wall:
 - .1 After H-piles, concrete panels and tie rods are installed and approved by *Departmental Representative*, fill area with rock fill material.
 - .2 Prior to placing clear stone and rock fill materials, install filter fabric to **Section 31 32 21.**
 - .3 Place clear stone and rock fill materials to the level and grades as shown.
 - .4 Place clear stone and rock fill materials in lifts, each lift not to exceed 300 mm.
 - .5 Compact each layer with 6 passes of 10T vibratory roller or other equipment approved by *Departmental Representative*. Compact area within 2 m of Berlin wall using approved mechanical tamping devices, or by hand as approved by *Departmental Representative*. Compact clear stone to 70% relative density in accordance with ASTM C127. Compact rock fill to 95% maximum dry density in accordance with ASTM D698.
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- .6 Do not over-compact clear stone and rock fill materials to avoid damage to filter fabric and concrete panels.
 - .7 Backfilling of collapsed area and sink holes:
 - .1 Remove all debris, fill and other materials from the collapsed area or sink holes.
 - .2 Backfill large collapsed area and sink hole areas with rock fill material. For smaller areas, use Type 2 material.
 - .3 Place material in 300 mm thick lifts. Compact each layer using approved mechanical tamping devices, or by hand as approved by *Departmental Representative*. Compact clear stone to 70% relative density in accordance with ASTM C127. Compact rock fill to 95% maximum dry density in accordance with ASTM D698.
 - .8 Compact in smaller and difficult to reach areas using approved mechanical tamping devices, or by hand as approved by *Departmental Representative*.
- 3.8 Restoration
- .1 Upon completion of work, remove surplus materials and debris and correct defects noted by *Departmental Representative*.
 - .2 Clean and reinstate areas affected by work as directed by *Departmental Representative*.
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PART 1 - GENERAL

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| 1.1 <u>Related Work</u> | .1 Refer to other Specification Sections for related information. |
| 1.2 <u>References</u> | <p>.1 ASTM D4355-14(2018) (or latest edition), Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.</p> <p>.2 ASTM D4491-17 (or latest edition), Standard Test Methods for Water Permeability of Geotextiles by Permittivity.</p> <p>.3 ASTM D4533-15 (or latest edition), Standard Test Method for Trapezoid Tearing Strength of Geotextiles.</p> <p>.4 ASTM D4632/D4632M-15a (or latest edition), Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.</p> <p>.5 ASTM D4751-16 (or latest edition), Standard Test Method for Determining Apparent Opening Size of a Geotextile.</p> <p>.6 ASTM D5261-10 (or latest edition), Standard Test Method for Measuring Mass per Unit Area of Geotextiles.</p> <p>.7 ASTM D6241-14 (or latest edition), Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.</p> |
| 1.3 <u>Mill Certificates</u> | .1 At least two weeks prior to start of work, furnish <i>Departmental Representative</i> with copies of mill test data and certificate that filter fabric delivered to job site meets requirements of this section. |
| 1.4 <u>Approval</u> | .1 Obtain written approval of <i>Departmental Representative</i> for filter fabric before installation of material in work. |
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1.5 Measurement
for Payment

- .1 Filter fabric will not be measured, but will be considered incidental to backfilling.

PART 2 - PRODUCTS

2.1 Materials

- .1 Synthetic fiber: rot proof, unaffected by action of oil or salt water and not subject to attack by insects or rodents.
- .2 Fabric: nonwoven polyester and/or polypropylene fabric.
- .3 Seams: sewn in accordance with manufacturer's recommendations.
- .4 Physical properties: to ASTM D4355, ASTM D4491, ASTM D4533, ASTM D4632, ASTM D4751, ASTM D5261, ASTM D6241.
 - .1 Tensile Strength 900 N
 - .2 Tear Strength 360 N
 - .3 Elongation at break 50%
 - .4 Filtration Opening Size = 100 - 80um.
 - .5 Permeability = 2×10^{-1} cm sec.

PART 3 - EXECUTION

3.1 Preparation
of Base

- .1 Fine grade area to be covered with filter fabric to a uniform surface area. Fill depressions with suitable material.

3.2 Placing
Filter Fabric

- .1 Place filter fabric on prepared surface loosely from top of the sheet pile wall to the bottom allowing fabric to conform easily to shape of the sheet pile wall.
- .2 Allow one (1) metre of fabric for overlapping and anchoring purposes, 700 mm at the top and 300 mm at the bottom.

Filter Fabric

Page 3

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- .3 Longitudinal seems will have a minimum of 450 mm overlap and will be pinned every 600 mm with 100 mm nails.
 - .4 Anchor top of fabric at 1 metre intervals with 15mm diameter steel rods 600 mm in length. Anchor bottom of fabric by folding fabric and placing fill on top.
 - .5 Place granular base material over filter fabric to a depth of 200 mm. No equipment will be permitted on fabric.
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PART 1 - GENERAL

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| 1.1 <u>Related Work</u> | .1 Refer to other Specification Sections for related information. |
| | .2 Refer to Section 01 33 00 for Shop Drawing/Submission requirements. |
| 1.2 <u>Reference Standards</u> | .1 ASTM C127-15 (or latest edition), Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate |
| | .2 AASHTO T85-14 (or latest edition), Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate |
| 1.3 <u>Submissions</u> | .1 Product Data/Samples:
.1 Provide samples of materials proposed for the work. |
| | .2 Methodology:
.1 Provide methodology for carrying out the work. |
| | .3 Provide submissions in accordance with Section 01 33 00 . |
| 1.4 <u>Measurement for Payment</u> | .1 Rock fill will be measured in accordance with Section 01 29 00 . |
| | .2 Prices will include the entire cost of supplying and placing the material in the work, rough grading as necessary, all as shown on the drawings, and as specified. |

PART 2 - PRODUCTS

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| 2.1 <u>Materials</u> | .1 Hard durable crushed quarried rock, free from silt, clay, organic matter and other foreign substances and free from splits, seams or defects likely to impair its soundness during handling or under action of water. |
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- .2 Specific gravity of not less than 2.65 when tested to ASTM C127 or AASHTO T85.
- .3 Rock fill shall be well graded, and conform to the following gradations:

ASTM SIEVE SIZE	% PASSING BY MASS
200 mm	100
150 mm	50 - 80
100 mm	20 - 65
50 mm	0 - 25
5 mm	0 - 5

PART 3 - EXECUTION

3.1 Placement

- .1 Rock fill placement:
 - .1 Place rock fill to **Section 31 23 10**.
 - .2 Do not place rock fill material until area has been accepted by *Departmental Representative*.
 - .3 Do not place material under poor weather conditions.

3.2 Tolerances

- .1 Surface of layers to be within 100 mm of lines shown.

3.3 Protection

- .1 Take into account anticipated weather conditions and degree of exposure of site in setting requirements for protection.
- .2 Schedule and carry out construction so that each phase of work is not left exposed longer than necessary.
- .3 The Contractor should note that the work site is subject to water level variations due to tidal action.

PART 1 - GENERAL

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| 1.1 <u>Related Work</u> | <ul style="list-style-type: none">.1 Refer to other Specification Sections for related information..2 Refer to Section 01 33 00 for Shop Drawings/Submissions requirements..3 Refer to Section 31 09 18, Pile Driving Templates..4 Refer to Section 31 23 10, Excavating and Backfilling..5 Refer to Section 31 62 18, Steel H-Piles. |
| 1.2 <u>Submissions</u> | <ul style="list-style-type: none">.1 Methodology:<ul style="list-style-type: none">.1 Provide methodology including type of pile driving equipment to carry out the work..2 Provide submissions in accordance with Section 01 33 00. |
| 1.3 <u>Existing Sub-Surface Conditions</u> | <ul style="list-style-type: none">.1 Sub-surface investigation reports may be available for inspection. |
| 1.4 <u>Protection</u> | <ul style="list-style-type: none">.1 Protect public and construction personnel, adjacent structures and work of other sections from hazards attributes to pile driving operations or any other operations. |
| 1.5 <u>Scheduling of Work</u> | <ul style="list-style-type: none">.1 Submit method and schedule of planned sequence of driving to <i>Departmental Representative</i> for review, not less than 2 weeks prior to commencement of pile driving for structure. |
| 1.6 <u>Measurement for Payment</u> | <ul style="list-style-type: none">.1 This item will not be measured separately, except as noted. |
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- .2 Mobilization of piling equipment will be paid as a fixed price item.

PART 2 - PRODUCTS

2.1 Materials

- .1 For material requirements refer to **Section 31 62 18.**
- .2 Provide equipment of sufficient capacity to handle full length piles without cutting and splicing.
- .3 Pile lengths indicated are based on lengths estimated to remain in completed structure.

PART 3 - EXECUTION

3.1 Equipment Requirements

- .1 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.
 - .2 Hammers:
 - .1 Hammers to weigh between 817 - 1,000 kg and be capable of developing a blow at normal speed of 20340 joules. 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 over driving to be replaced at the Contractor's cost.
 - .3 Leads:
 - .1 Construction pile driver leads to provide free movement of hammer.
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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.

.4 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 Ensure that 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.

- .2 **Provide *Departmental Representative* with three copies of records.**

3.4 Driving

- .1 Use driving caps to protect piles.
 - .2 Hold piles securely and accurately in position while driving.
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- .3 Deliver hammer blows in direct axis of pile.
 - .4 Reinforce pile heads if necessary.
 - .5 Do not drive piles within a radius of 8 m of concrete which has been in place less than 3 days.
 - .6 Redrive piles lifted during driving of adjacent piles.
 - .7 Use of water jet:
 - .1 Use of water jets is not permitted.
 - .8 Use of pre-drilling:
 - .1 Pre-drill of obstructions only with written permission of *Departmental Representative*.
 - .2 Submit written pre-drilling plan to *Departmental Representative* for approval prior to commencement of pre-drilling.
 - .9 Cut off piles neatly and squarely at elevations indicated. Provide sufficient length above cut-off elevation so that part damaged during driving is cut off.
 - .10 Remove cut-off lengths from site on completion of work.
 - .11 Installation of each pile will be subject to acceptance by *Departmental Representative*. *Departmental Representative* will be sole judge of acceptability of each pile with respect to depth of penetration. *Departmental Representative* to accept final driving of all piles prior to removal of pile driving rig from site.
 - .12 Ensure that all piles have full bearing on pile shoe prior to driving. Shape bottom of timber pile and secure timber pile shoes with spikes.
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| | .13 | Drive each steel pile to a minimum penetration depth of tip elevation as indicated on drawings. In the event refusal (12 blows per 25 mm) occurs prior to the minimum pile penetration, contact <i>Departmental Representative</i> . |
| | .14 | Drive timber pile to refusal (5 blows per 25 mm for last 75 mm of penetration). Minimum pile embedment to match existing pile embedment. Maximum pile embedment to ensure exposed portion pile matches existing pile conditions with allowances for cut-off. |
| 3.5 | <u>Driving Tolerances</u> | |
| | .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 | <u>Damaged or Defective Piles</u> | |
| | .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. |
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PART 1 - GENERAL

- 1.1 Related Work
- .1 Refer to other Specification Sections for related information.
 - .2 Refer to **Section 01 33 00** for Shop Drawings/Submissions Requirements.
 - .3 Refer to **Section 01 74 11**, Cleaning.
 - .4 Refer to **Section 31 09 18**, Pile Driving Templates.
 - .5 Refer to **Section 31 23 10**, Excavating and Backfilling.
 - .6 Refer to **Section 31 61 13**, Pile Foundations, General Requirements.
- 1.2 References
- .1 American Society for Testing and Materials (ASTM) International:
 - .1 ASTM A615/A615M-16, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - .2 Canadian Standards Association (CSA)
 - .1 CSA W47.1-09(R2014) (or latest edition), Notification of Companies for Fusion Welding of Steel Structures.
 - .2 CSA W48-18 (or latest edition), Filler Metals and Allied Materials for Metal Arc Welding.
 - .3 CSA W59-18 (or latest edition), Welded Steel Construction.
 - .4 CSA W59S1-M1989(R1998) (or latest edition), Supplement No.1-M1989, Steel Fixed Offshore Structures to W59-M1989, Welded Steel Construction (Metal Arc Welding).
 - .5 CSA-G40.20-13/G40.21-13(R2018) (or latest edition), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.
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| 1.3 <u>Shop Drawings</u> | .1 | Submit shop drawings in accordance with Section 01 33 00 . |
| | .2 | Indicate: pile shoes, splice detail, pile cap, and tip reinforcement. |
| | .3 | Each drawing submitted shall bear the signature and stamp of qualified Professional Engineer registered or licensed in the Province of Nova Scotia, Canada. |
| 1.4 <u>Test Reports</u> | .1 | Furnish mill test reports indicating yield and chemical analysis of steel piles to <i>Departmental Representative</i> . |
| 1.5 <u>Waste Management
And Disposal</u> | .1 | Separate and recycle waste materials in accordance with Section 01 74 11 . |
| | .2 | Collect and separate for disposal paper, plastic, polystyrene, 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 <i>Departmental Representative</i> . |
| | .5 | Fold up metal banding, flatten and place in designated area for recycling. |
| | .6 | 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. |
| 1.6 <u>Measurement
Procedures</u> | .1 | Consider shoes, brackets, lugs, cap plates, splices and steel point reinforcement incidental to supply and installation of piles. |
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- .2 Supply of steel H-piles will be measured in accordance with **Section 01 29 00.**
- .3 Mobilization of equipment will be measured in accordance with **Section 01 29 00.**
- .4 Tie rods will be measured in accordance with **Section 01 29 00.**
- .5 *Departmental Representative* will establish actual number and lengths of piles installed from driving records.
- .6 Adjustments in contract price due to changes in number and length of piles will be based on unit prices established in contract.

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.
- .5 Tie rods:
 - .1 Tie rods, tie rod forged steel end connections, couplers and turnbuckles:
 - .1 Tie rods: to ASTM A615/A615M, Grade 80 and to be continuously threaded bars.
 - .2 The tie rod forged steel end connections, pins, coupler, sleeve nuts, and connector sleeves: to have load capacity in excess of ultimate capacity of tie rod.

Steel H-Piles

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- .3 Preassemble, mark and test tie rod assemblies in shop. Align threaded connection to following tolerances at tie rod forged steel connection, connector sleeve: 1/80 of normal diameter, deviation of centerline, 1 in 160.
- .2 Tie rod forged steel end unit:
 - .1 To have forged steel eye section with connecting pin and threaded rod which can be coupled to tie rod.

PART 3 - EXECUTION

- 3.1 Preparation
 - .1 Excavate trench as indicated in the area of pile installation and concrete panel placement to **Section 31 23 10**.
 - .2 Remove all visible stones and rocks which may prevent driving of piles.
- 3.2 Pile Location
 - .1 Confirm location of piles as determined in **Section 31 23 10** and approved by *Departmental Representative*.
 - .2 Do not drive any pile until pile location is confirmed.
- 3.3 Installation
 - .1 Install piling in accordance with **Section 31 61 13**.
 - .2 Supply full length pile as indicated and provide equipment to handle full length piles without cutting and splicing.
 - .3 Splice pile extensions, to details as indicated on approved shop drawings, by using splice plates.
 - .1 Align extension with driven pile when splicing.
 - .2 Provide full bearing of spliced parts.
 - .4 Cut off piles squarely at required elevation.

Steel H-Piles

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- 3.4 Welding
- .1 Weld to CSA W59 and CSA W59S1.
 - .2 Welding certification of companies: to CSA W47.1 and CSA W47.1S1.
 - .3 Weld end connection units to H-pile at location indicated to **Section 05 50 00**.
 - .4 All field welded connections shall be inspected and defective weld repaired prior to acceptance of work.
- 3.5 Tie Rod Anchorage
- .1 All H-piles must be driven and approved by *Departmental Representative*.
 - .2 Concrete anchor wall must be in place and approved by *Departmental Representative*.
 - .3 Excavate a minimum width trench in the existing fill between existing anchor blocks for placement of new tie rods. Do not over-excavate and do not remove any fill material from the front of existing concrete anchor blocks.
 - .4 Weld tie rod end units to H-pile at location indicated.
 - .5 Install new tie rods in excavated trench to details indicated.
 - .6 Connect tie rod to end units with couplers.
 - .7 Tighten tie rod nuts at concrete anchor wall against bearing plate so that there is no sag in the tie rods. *Departmental Representative* to approach final placement of each tie rod.
 - .8 Backfill the trenched area to **Section 31 23 10**.
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PART 1 - GENERAL

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| 1.1 <u>Related Work</u> | .1 | Refer to other Specification Sections for related information. |
| | .2 | Refer to Section 01 33 00 for Shop Drawing/Submission requirements. |
| 1.2 <u>Reference Standards</u> | .1 | CAN/CSA-080 Series 15 (or latest edition)-Wood Preservation. |
| | .2 | AWPA M4-15 (or latest edition), Standard for the Care of Preservative-Treated Wood Products. |
| | .3 | NLGA standard grading rules for Canadian Lumber 2017 edition or most recent edition at time of tendering. |
| | .4 | ASTM A123/A123M-17 (or latest edition), Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products. |
| | .5 | ASTM B111-18 (or latest edition), Wire Nails, Spikes and Staples. |
| | .6 | ASTM F3125/F3125M-15a (or latest edition), Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions. |
| | .7 | CAN/CSA-G40.21-13 (or latest edition), Structural Quality Steels. |
| | .8 | CSA O56-10(R2015) (or latest edition), Round Timber Piles. |
| | .9 | CSA W59-13 (or latest edition), Welded Steel Construction (Metal Arc Welding). |
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- 1.3 Submissions
- .1 At least two weeks prior to finalizing timber order, submit a schedule of pile lengths for review.
 - .2 Submit methodology for field treatment.
 - .3 Provide submissions in accordance with **Section 01 33 00**.
- 1.4 Protection
- .1 Avoid dropping, bruising or breaking of wood fibres.
 - .2 Avoid breaking surfaces of treated piles.
 - .3 Do not damage surfaces of treated piles below cut-off elevation by boring holes or driving nails or spikes into them to support temporary material or staging. Support staging in rope slings carried over tops of piles or by attaching to pile clamps of approved design.
 - .4 Treat cuts, breaks or abrasions on surfaces of treated piles, bolt holes and field cuts in accordance with CAN/CSA-080 using copper naphthenate.
- 1.5 Inspection
- .1 All timber piles to be inspected and accepted by *Departmental Representative* prior to being incorporated in the work.
- 1.6 Measurement for Payment
- .1 Supply and installation of timber piling and all associated costs will not be measured and will be considered incidental to removal and reinstatement of existing timber wharf in accordance with **Section 01 29 00**.

PART 2 - PRODUCTS

- 2.1 Materials
- .1 Round Timber Piles:
 - .1 Douglas Fir or Western Larch to CSA 056, to match existing members with minimum butt size of 300 mm and tip
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diameter in accordance with Table A.1. Order length as indicated on Drawings. *Departmental Representative* shall be sole judge as to quality and dimension of piles or equal to CSA O56.

- .2 Provide pile shoes, cushion plates, etc. to CSA-G40.20/40.21 type and grade 350W.

.2 Timber Treatment:

- .1 Preservative treatment to CAN/CSA-080 Series for Marine Construction Coastal Waters. Where assay retentions are not indicated, they are to be taken as 1.5 times the indicated gauge retention. Creosote preservative will not be permitted for piles.

- .2 Make arrangements for timber testing by:

- .1 Plant Inspection: Provide treatment plant identification, date of treatment, list of various pieces in the charge, charge number, plant assay testing results, concentration and type of preservative used, duration of treatment, gauge retention, species of timber; and make arrangements with the treatment plant to locate bundles, move bundles, break open bundles and carry out other measures to facilitate the inspection.

- .2 Filling in and submitting a preprinted form, agreed to by the *Departmental Representative*, containing the above information.

- .3 The *Departmental Representative* may test in the plant or in the field or may choose to not test some charges at either the plant or the field.

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- .4 Timber will be protected during handling, shipping, offloading and field handling, by use of suitable equipment and procedures. Use rope or fabric strap slings on site for moving bundles or individual timbers, rather than metal grabs, chains or cables.
 - .5 Field treatment: Copper naphthenate as per AWPA.
 - .3 Miscellaneous Hardware: Hardware must meet the following specifications:
 - .1 Drift bolts and other bolts, nuts, round plate washers: to ASTM F3125/F3125M, Grade A325.
 - .2 Spikes: to CSA B111.
 - .3 Pile shoes: fabricated from steel plate minimum 6 mm thickness. Steel plate to CSA-G40.21, Grade 300W. Welding to CSA W59. No galvanizing required.
 - .4 Hot dip galvanize bolts, nuts, washers and spikes to ASTM A123 with minimum zinc coating of 600 g/m².
 - .5 All hardware galvanized unless otherwise shown on plans or specified.
- 2.2 Timber Preservation .1 Timber piles are to be treated with timber preservative treatment as specified.

PART 3 - EXECUTION

- 3.1 Preparation .1 Remove all stones, boulders that may interfere with driving of piles.
 - 3.2 Handling Treated Timber
 - .1 Handle treated material to avoid damage causing alteration in original treatment.
 - .2 Treat in field, spike holes, boreholes, plugged holes, cuts and any damage to treated material, using copper naphthenate,
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as specified herein, regardless of plant treatment type.

- .3 Provide methodology pertaining to heating and application. Apply to dry surfaces, wherever possible.
- .4 Treat boreholes and drilled holes, using a pressurized container with an extension rod, to produce a fine spray in the holes with one application. Alternately a cylindrical brush may be used.
- .5 Treat field cuts and any abrasions with minimum of two liberal applications, using either spray or brush.
- .6 In addition, field cuts and underwater damaged areas will receive a coating of plastic compound, capped with lead flashing secured with galvanized roofing nails. Plastic compound not to be water soluble and is subject to approval.
- .7 Environmental Concern: Ensure no spillage or excess application of field preservative. Provide workmen with sufficient training and protective gear to properly and safely handle the treated materials and to apply field treatment, so as to prevent undue hazard to themselves, others, or the environment.
- .8 Contain all debris and leachates (films on water surface) within the area of the work by using containment facilities such as floating booms or screens.

3.3 Preparation

- .1 Protect pile heads during driving and hold in position by using a combination cushion-driving head and pilot. Closely fit driving heads to top of pile, and extend down sides of pile for at least 75 mm. Where necessary protect pile heads by means of heavy steel straps of wrought iron rings.

.2 Equip piles with metal shoes.

3.4 Installation

.1 Install piles in accordance with **Section 31 61 13.**

.2 During driving restrain lateral movement of piling at intervals not exceeding 6 m over length between ground surface and driving head.

.3 Cut off timber piles horizontally.

.4 Secure top of all piles to timber framing to match existing conditions.
