
Part 1 GENERAL

1.1 Related Work

- .1 Refer to Section 01 33 00 for Shop Drawing/Submissions 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 four (4) weeks prior to commencing production.
- .3 If, in the 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* four (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.

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.
 - .4 Refer to section 31 23 10 – Excavating and Backfilling for additional material requirements.
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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
- .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 Processing

- .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 *Departmental Representative*.

3.3 Handling

- .1 Handle and transport aggregates to avoid segregation, contamination and degradation.

3.4 Stockpiling

- .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.
 - .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 sub-base 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.
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- .9 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

END OF SECTION

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.
- .3 Section 31 61 13 – Pile Foundations – General.
- .4 Section 31 62 18 – Steel H-Piles.
- .5 Section 31 62 19 – Wood Piles.

1.2 References

- .1 ASTM A252-A252-19, Standard Specification for Welded and Seamless Steel Pipe Piles.
- .2 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength.
- .3 ASTM F3125 / F3125M-19e2, 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.
- .4 CSA G40.20-13 / G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel.
- .5 CSA-S16:19, Design of Steel Structures.
- .6 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel.
- .7 CSA W59-18, Welded Steel Construction.
- .8 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submissions/Shop Drawing.
- .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 Design Criteria

- .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.
 - .3 All weather-related loads that may be applied during driving activities.

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 CSA G40.20 and CSAG40.21, Type 350W.
- .2 Welding Materials: to CSA W59.
- .3 Bolts, nuts and washers: to ASTM A307 or ASTM F3125.

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.
- .2 Before driving batter piles set templates to within 10 mm of elevations indicated on shop drawings.

3.3 Placing Batter Piles

- .1 Remove members in templates as necessary to place batter piles. Replace members prior to placing other batter piles or driving of batter piles. Indicate members to be removed for this operation on shop drawings. Mark them "Removable".

3.4 Removal of Templates

- .1 Avoid any damage to piling when removing templates.
- .2 When instructed by *Departmental Representative* remove templates from project site.

END OF SECTION

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 Submissions

- .1 Methodology:
 - .1 When requested provide methodology for carrying out the work
- .2 Provide submission in accordance with Section 01 33 00.

1.3 Protection

- .1 Prevent movement, settlement or damage of adjacent structures. Provide bracing and shoring as required. In event of damage, immediately replace such items or make repairs to approval of *Departmental Representative* and at no additional cost to *Departmental Representative*.
- .2 Prevent debris from going adrift and becoming a menace to navigation.
- .3 All damage to existing structures, roadways, pipelines, electrical systems not specified for removal to be repaired at the Contractor's cost to the satisfaction of the *Departmental Representative*.

1.4 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*.
- .4 Existing fill and vent pipes, oil waste tanks and underground storage tanks to be protected from any damages. All repairs to damages as a result of Contractor's operations to be at their cost and to the satisfaction of 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 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 to be disposed 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.

3.4 Restoration

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

END OF SECTION

Part 1 GENERAL

1.1 Description

- .1 This section specifies requirements for excavating and backfilling to accommodate the new Berlin Walls and transition ramps.

1.2 Reference Standards

- .1 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- .2 AASHTO T99-19, Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and 305 mm (12 in) Drop.
- .3 AASHTO C127-15, Standard Test Method for Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
- .4 ASTM C136/C136M - 19, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .5 ASTM C117-17, Standard Test Method for Materials Finer than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing.

1.3 Related Work

- .1 Refer to other Specification Sections for related information.
- .2 Refer to Section 01 33 00 for Shop Drawing/Submissions requirements.

1.4 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 dense tills, hardpan, frozen materials and partially cemented materials such as asphalt which can be ripped and excavated with heavy construction equipment.

1.5 Protection of Existing Features

- .1 Existing buried utilities and structures:
 - .1 Prior to commencing any excavation work, notify applicable owner or 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.

1.6 Shoring and Bracing

- .1 Comply with applicable local regulations to protect existing features.
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1.7 Samples

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

1.8 Measurement for Payment

- .1 Work performed under this Section will be incidental to work involved in other sections of this specification.

Part 2 PRODUCTS

2.1 Materials

- .1 Granular Backfill: to consist of hard, durable, quarry or pit run material of an approved quality. The material will be free from frost, snow stumps, weeds, sod, roots, logs, silt, organic material, garbage, or any other waste materials and must be capable of being compacted to degree as specified herein and meeting approval of the *Departmental Representative*. Material to be uniformly graded having a stone size between 75 to 200 mm (R5 random rip-rap) on any dimension. Slate, sandstone or shale rock shall not be accepted. Specific gravity not less than 2.65 when tested to ASTM C127-12 (AASHTO T85-14).

- .1 Gradation to meet PE TIE 'R5' Random Rip-Rap limits as follows:

ASTM SIEVE SIZE	% PASSING BY MASS
220 mm	100
190 mm	70 – 90
150 mm	40 – 55
75 mm	0 – 3

- .2 Gradation to meet PE TIE 'R25' Random Rip-Rap limits as follows:

ASTM SIEVE SIZE	% PASSING BY MASS
380 mm	100
330 mm	50 – 90
260 mm	0 – 20
220 mm	0 – 5

- .2 Granular Base: rock, clear, hard durable, angular, crushed quarried rock aggregate free from silt, clay lumps, organic matter, foreign substances and free from splits, seams or defects. Specific gravity not less than 2.6 when tested to ASTM C127-15 (AASHTO T85-14(2018)).

- .1 Gradation to be within the following limits when tested to ASTM C136-19 and ASTM C117012 and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart.

- .1 Gradation – PE TIE Class A Gravel:

ASTM SIEVE SIZE	% PASSING BY MASS
25.0 mm	95 – 100
12.5 mm	50 – 83
4.75 mm	30 – 60
1.18 mm	15 – 40
600 µm	10 – 32
300 µm	5 – 22
75 µm	3 – 9

- .3 Armourstone: Hard durable crushed quarried rock, free from silt, clay, organic matter and other foreign substances and free from splits, seams, and defects likely to impair its soundness during handling or under action of water. Specific gravity not less than 2.65 when tested to ASTM C127-15 (AASHTO T85-14(2018)). Armourstone shall be sized as shown on drawings.

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 indicted or as directed by *Departmental Representative*.
.2 Dispose of surplus and unsuitable excavated material in approved location off site.
.3 Do not obstruct flow of surface drainage or natural watercourses.
.4 Stockpile suitable excavated materials required for backfill in approved location.
.5 Dispose of surplus and unsuitable excavated material off site.

3.5 Pre-Installation Inspection

- .1 Excavations require inspection and approval prior to commencement of installation operations.

3.6 Backfilling

- .1 Do not proceed with backfilling operations until *Departmental Representative* has inspected and approved installations.
- .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.
- .4 Backfilling around installations:
 - .1 Place bedding and surround material as specified elsewhere.
 - .2 Place material by hand under, around, and over installations until 300 mm of cover is provided. Dumping material directly on installations will not be permitted.
- .5 Place backfill material in uniform layers not exceeding 150 mm in thickness up to subgrade elevation or top of trench. Compact each layer before placing succeeding layer.
- .6 Compact common backfill materials:
 - .1 In non-pavement areas, to a density at least equal to density of adjacent, undisturbed soil.
 - .2 In pavement areas, compact to a minimum of 90% for cohesive soils and 95% for cohesionless soils of corrected maximum dry density, maximum density ASTM D698, AASHTO T99, Method C.
- .7 Compact granular backfill material to a minimum 95% of corrected maximum dry density, maximum density AASHTO T99, Method C.
- .8 Compact using approved mechanical tamping devices, or by hand tamping to achieve specified compaction.
- .9 Refer to Section 31 63 26 for backfilling requirements for Berlin Wall backfill (R5 and R25 random riprap).

3.7 Granular Base

- .1 Do not place granular base until finished sub-grade is inspected and approved by *Departmental Representative*.
- .2 Place material only on a clean unfrozen surface, properly shaped and compacted and free from snow and ice
- .3 Begin spreading base material on a crown line or high side of a one way slope.
- .4 Place material in uniform layers not exceeding 150 mm when compacted or to such other depth as approved by *Departmental Representative*.
- .5 Shape each layer to a smooth contour and compact to specified density before a succeeding layer is placed.
- .6 Remove and replace portion of a layer in which material has become segregated during spreading.
- .7 Compact to a density not less than 95% of maximum dry density, AASHTO T99-10, Method except last 150 mm up to subgrade elevation. Compact last 150 mm to 100% maximum density, AASHTO T99-10, Method D.
- .8 Shape and roll alternately to obtain a smooth, even and uniformly compacted base.
- .9 Apply water as is necessary during compacting to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.

- .10 In areas not accessible to rolling equipment, compact to required density with approved mechanical tampers.

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*.

END OF SECTION

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/Submissions requirements.

1.2 References

- .1 ASTM D4751-20a, Standard Test Methods for Determining Apparent Opening Size of a Geotextile.
- .2 ASTM D4632-15a, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
- .3 ASTM D4533/D4533M-15, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
- .4 ASTM D4491/D4491M-15, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
- .5 ASTM A123/A123M-17, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .6 CSA G40.20-13 / G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel

1.3 Mill Certificates

- .1 At least two weeks prior to start of work, furnish *Departmental Representative* with copies of mill test data and certificate that filter fabric delivered to job site meets requirements of this section.

1.4 Approval

- .1 Obtain written approval of *Departmental Representative* for filter fabric before installation of material in work.

1.5 Measurement for Payment

- .1 Filter fabric shall not be measured for payment but considered incidental to the work.

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 D4632, ASTM D4533, and ASTM D4751.
 - .1 Tensile Strength 900 N.
 - .2 Tear Strength 360 N.
 - .3 Elongation at break 50%.
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- .4 Filtration Opening Size = 60 – 100 µm.
- .5 Securing pins and washers: to CSA G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m² to ASTM A123.

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 Installation

- .1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position with pins or weights.
- .2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.
- .3 Allow one (1) metre of fabric for overlapping and anchoring purposes, 700 mm at the top and 300 mm at the bottom of the slope.
- .4 Longitudinal seams will have a minimum of 450 mm overlap and will be pinned every 600 mm with 100 mm nails.
- .5 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.
- .6 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
- .7 After installation, cover with overlying layer within 4 hr of placement.
- .8 Replace damaged or deteriorated geotextile to the approval of the *Departmental Representative*.
- .9 Place and compact soil layers in accordance with Section 31 23 10 - Excavating and Backfilling.

END OF SECTION

Part 1 GENERAL

1.1 Related Work

- .1 Refer to other Specification Section for related information.
- .2 Refer to Section 01 33 00 for Shop Drawings/Submissions requirements.
- .3 Section 31 09 18 – Pile Driving Templates.
- .4 Section 31 62 18 – Steel H-Piles.
- .5 Section 31 62 19 – Wood Piles.
- .6 Section 31 63 26 – Berlin Wall Construction.

1.2 Submissions

- .1 Methodology:
 - .1 Contractor shall submit pile driving methodology to *Departmental Representative* for review and approval prior to proceeding with the work. Infilling / temporary structures shall not be permitted outside footprint of existing structure.
 - .2 Methodology shall include type of pile driving equipment to carry out the work.
 - .3 The Contractor is required to submit the bearing pile (H-Pile) refusal criteria as determined by a Geotechnical engineer registered in the Province of Prince Edward Island.
 - .4 Provide submissions in accordance with Section 01 33 00.

1.3 Existing Sub-Surface Conditions

- .1 Sub-surface investigation reports are bound into the specifications in Appendix ‘A’.
- .2 Notify the *Departmental Representative* immediately if subsurface conditions at site differ from these indicated.

1.4 Protection

- .1 Protect public and construction personnel, adjacent structures and work of other sections from hazards attributed to pile driving operations or any other operations.

1.5 Scheduling of Work

- .1 Submit schedule of planned sequence of pile driving to *Departmental Representative* for review, not less than 2 weeks prior to commencement of pile driving for structure.

1.6 Delivery, Storage and Handling

- .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*.
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Part 2 PRODUCTS

2.1 Materials

- .1 Supply full length steel H-Piles as indicated in accordance with Section 31 62 18 – Steel H Piles.
- .2 Supply full length timber piles as indicated in accordance with Section 31 62 19 – Wood Piles.
- .3 Provide equipment of sufficient capacity to handle full length piles without cutting and splicing.
- .4 Pile lengths indicated are based on lengths estimated to remain in completed structure plus a 1.0 metre cut-off allowance.
- .5 Do not splice piles without written permission of *Departmental Representative*. When permitted, provide details for *Departmental Representative* review. Design details of splice to bear dated signature stamp of professional engineer registered or licensed in the Province of Prince Edward Island, Canada.
- .6 Welding materials: to CSA W48.1

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 Hammer:
 - .1 Supply a hammer with a minimum rated energy of 70,000 joules. When required penetration is not achieved by the use of hammers complying with minimum requirements, either provide larger hammer or take other measures acceptable to the *Departmental Representative*. Drop hammers are permitted. Replace all piles damaged due to overdriving at no additional expense to the Contract. Acceptance of hammer chosen will be based on confirmation of pile capacities as determined by the pile driving analyzer.
 - .2 All steel H-piles for wharf structure and approach ramps shall be driven to a minimum ultimate unfactored geotechnical capacity in axial compression of 2,200kN (1,100 kN factored ULS value) to be determined by the pile driving analyzer. This resistance is based on a 70,000 joule hammer with a refusal criteria of 10 blows per inch. This refusal criteria shall be confirmed with the pile driving analyzer as directed by the *Departmental Representative*. Penetration depths shown on drawings is assumed and shall be confirmed by the pile driving analyzer.
 - .3 Leads:
 - .1 Construct pile driver leads to provide free movement of hammer. Hold leads in position at top and bottom, with guys, stiff braces, or other means reviewed 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:
 - .1 Firmly guy top and bottom to hold pile in position during driving operation. Method to be reviewed by *Departmental Representative*.
 - .4 Followers:
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- .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 Pile Driving Analyzer

- .1 *Departmental Representative* to arrange for Pile Driving Analyzer (PDA) testing.
- .2 Contractor shall notify *Departmental Representative* of pile driving operations at least seven (7) days in advance of the work.
- .3 If pile is suspect of meeting refusal on a boulder within the native soils, PDA testing shall be conducted to confirm capacity.
- .4 Contractor shall allow adequate time for *Departmental Representative* to perform PDA testing as required by the *Departmental Representative*.

3.4 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 500mm 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 pile driving analyzer and wave equation analysis.
 - .10 Record actual length of pile placed and blow count for final 25 mm on pile schedule provided in the drawings and submit to the *Departmental Representative*.
- .2 Provide *Departmental Representative* with three copies of records.

3.5 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 Reinforce pile heads if necessary.

- .6 Do not drive piles within a radius of 8 m of concrete which has been in place less than 3 days.
- .7 Redrive piles lifted during driving of adjacent piles.
- .8 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 690 kPa 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 re-driving. Re-drive where necessary after jetting operations in area have been completed.
- .9 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.
- .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 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
- .12 Shape bottom of timber pile so that shoe will have full bearing on pile prior to driving. Install pile shoes using spikes.
- .13 Wood fender piles have to be driven to competent soil to develop the required lateral resistance. The required driving resistance is 4 blows for the last 25mm of pile penetration. Fender piles shall be driven to tip elevation indicated on drawings (3 m below harbour bottom).
- .14 Contractor shall install temporary lateral bracing during construction to maintain position of the piles until casting of the deck.

3.6 Driving Tolerances – Steel H-Piles

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

3.7 Driving Tolerances – Timber Fender Piles

- .1 Pile heads to be within 10 mm of locations indicated.
- .2 Piles not to more than 1% out of alignment.

3.8 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.

3.9 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.

3.10 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 original or better condition at Contractor's expense and to the satisfaction of the *Departmental Representative*.

END OF SECTION

Part 1 GENERAL

1.1 Related Sections

- .1 Refer to other Specifications Sections for related information.
- .2 Refer to Section 01 33 00 for Shop Drawing/Submissions requirements.
- .3 Section 31 09 18 – Pile Driving Templates
- .4 Section 31 61 13 – Pile Foundations, General Requirements.
- .5 Section 31 63 26 – Berlin Wall Construction.

1.2 References

- .1 CSA W47.1-09 (R2014) Certification of Companies for Fusion Welding of Steel.
- .2 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
- .3 CSA W59-18, Welded Steel Construction.
- .4 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submissions/shop drawings.
- .2 Each drawing submitted shall bear the signature and stamp of qualified Professional Engineer registered or licensed in the Province of Prince Edward Island, Canada.

1.4 Test Reports

- .1 Furnish mill test reports indicating yield and chemical analysis of steel piles if requested by *Departmental Representative*.

1.5 Existing Sub-Surface Conditions

- .1 Sub-surface investigation reports may be available for viewing at the offices of Fisheries and Oceans Canada, 165 John Yeo Drive Charlottetown, PE. Relevant borehole logs are included on the drawings.
- .2 Notify the *Departmental Representative* immediately if subsurface conditions at site differ from these indicated.

1.6 Measurement for Payment

- .1 Consider shoes and cap plates incidental to installation of piles.
 - .2 Supply of steel H-Piles will be measured in accordance with Section 01 29 00.
 - .3 Installation of steel H-Piles will be measured in accordance with Section 01 29 00.
 - .4 Mobilization of equipment will be considered incidental to installation of piles.
 - .5 Base tender on number and lengths of piles indicated on the plan. Pile lengths indicated in the pile schedule shown on the drawings include a 1 m cut off allowance.
-

- .6 *Departmental Representative* will establish actual number and lengths of piles installed from driving records
- .7 Adjustments in contract price due to changes in number and lengths of piles will be based on unit prices established in Contract.

1.7 Waste Management and Disposal

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

Part 2 PRODUCTS

2.1 Materials

- .1 Steel H piles: to CSA G40.20/G40.21, Grade 350W. Size and weight as indicated on drawings.
- .2 Welding materials: to CSA W48.
- .3 Pile driving shoes: Titus Standard Pile Point (HPP-S-14) or approved equal.

Part 3 EXECUTION

3.1 Installation

- .1 Install piling in accordance with Section 31 61 13 - Pile Foundations – General.
- .2 Hold piles securely and accurately in position during installation.
- .3 Prior to commencement of pile installation operation, submit to *Departmental Representative* for approval, details of equipment and method to be used for the installation of piles.
- .4 Cut off piles squarely at required elevation.

3.2 Welding

- .1 Weld to CSA W59.
- .2 Welding certification of companies: to CSA W47.1.

3.3 Records

- .1 Keep complete and accurate record of each pile driven.
- .2 Indicate:
 - .1 Pile location.
 - .2 Deviations from design location.
 - .3 Cross section shape and dimensions.
 - .4 Original length.
 - .5 Ground elevation.
 - .6 Tip elevation.
 - .7 Cut off elevation.

- .8 Record actual length of pile placed and blow count for final 25 mm on pile schedule provided in the drawings and submit to the *Departmental Representative*.

3.4 Cleaning

- .1 Proceed in accordance with Section 01 74 11 – Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

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.
- .3 Section 31 09 18 – Pile Driving Templates.
- .4 Section 31 61 13 – Pile Foundations – General.

1.2 Reference Standards

- .1 CSA O80 Series-15, Wood Preservation.
- .2 NLGA standard grading rules for Canadian Lumber 1980 edition or most recent edition at time of tendering.
- .3 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .4 ASTM A307-14e1, Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength.
- .5 CSA O56-10 (R2015), Round Wood Piles.
- .6 CSA G40.21-13, Structural Quality Steel.
- .7 CSA W59-18, Welded Steel Construction.

1.3 Submissions

- .1 At least two (2) 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 CSA O80 using field applied preservative.

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 Consider shoes and cap plates incidental to installation of piles.
- .2 Supply of timber fender piles will be measured in accordance with Section 01 29 00.
- .3 Installation of timber fender piles will be measured in accordance with Section 01 29 00.
- .4 Mobilization of equipment will be considered incidental to installation of piles.
- .5 Base tender on number and lengths of piles indicated on the plan.
- .6 *Departmental Representative* will establish actual number and lengths of piles installed from driving records.
- .7 Adjustments in contract price due to changes in number and lengths of piles will be based on unit prices established in Contract.

Part 2 PRODUCTS

2.1 Materials

- .1 Round Wood Piles:
 - .1 Fender Piles: Red pine, with minimum butt size of 300 mm and tip diameter in accordance with Table A-1 CSA-O56. *Departmental Representative* shall be sole judge as to quality and dimension of piles or equal to CSA-O56.
- .2 Timber Treatment:
 - .1 Preservative treatment to CSA O80 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 fender 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 wood; 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 Field Inspection: Providing same information as above and facilitating the inspection in the field.
 - .3 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.
 - .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: same as pile preservative.
- .3 Miscellaneous Hardware: Hardware must meet the following specifications:
 - .1 Machine bolts, drift bolts, nuts, round plate washers: to ASTM A307
 - .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 Wood Preservation

- .1 Wood piles are to be treated with wood preservative treatment as specified.

Part 3 EXECUTION

3.1 Handling Timber

- .1 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.

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 preservative, as specified herein, regardless of plant treatment type.
- .3 Treat boreholes, 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.
- .4 Treat field cuts and any abrasions with minimum of two liberal applications, using either spray or brush.
- .5 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.
- .6 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.
- .7 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 Installation

- .1 Install piles in accordance with Section 31 61 13 – Pile Foundations – General.
- .2 Cut off fender piles giving a bevel of 4H:1V.
- .3 Treat tops of cut off fender piles with two liberal coats of copper naphthenate.

END OF SECTION

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.
- .3 Section 03 20 00 – Concrete Reinforcement.
- .4 Section 03 30 00 – Cast in Place Concrete.
- .5 Section 03 41 00 – Precast Structural Concrete.
- .6 Section 05 50 00 – Metal Fabrications.
- .7 Section 31 23 10 – Excavating and Backfilling
- .8 Section 31 61 13 – Pile Foundations – General.
- .9 Section 31 62 18 – Steel H-Piles.

1.2 Submissions

- .1 At least two (2) weeks prior commencing the work, submit Berlin Wall Construction methodology to *Departmental Representative* for review.
- .2 Prior to commencement of pile installation operation, submit to *Departmental Representative* for approval, the details of equipment and method to be used for the installation of piles for Berlin Wall.
- .3 Provide submissions in accordance with Section 01 33 00.

Part 2 PRODUCTS

2.1 Steel H-Piles

- .1 The supply of steel H-piles for the construction of Berlin Wall shall meet the requirements of Section 31 62 18.

2.2 Concrete Panels

- .1 The supply of concrete panels and anchor blocks, as shown on the drawings, shall meet the requirements of Section 03 30 00 – Cast in Place Concrete and Section 03 41 00 – Precast Structural Concrete.

2.3 Lifting Anchors

- .1 ‘Swift Lift’ anchors (recessed) as per manufacturer’s recommendation. Dayton Superior or approved equal.
 - .1 Submit shop drawing for review prior to ordering of lifting anchors.

Part 3 EXECUTION

3.1 General Installation

- .1 The installation of steel H-piles and concrete panels for the construction of the Berlin Wall shall be carried out in accordance with their applicable sections.

3.2 H-Pile Installation

- .1 The steel H-piles for Berlin Wall shall be installed true and plumb along the baseline as shown on the drawings.
- .2 Hold piles securely and accurately in position during installation.
- .3 Cut off piles squarely at required elevation.
- .4 Tolerances:
 - .1 H-piles are to be installed as shown on the drawings and specified herein.
 - .2 Deviations from the vertical in any direction shall not exceed 1 to 50 for any pile.
 - .3 Piles shall be installed in such a manner so the face of the Berlin Wall is straight. Maximum rotation tolerance about axis of pile layout shall be +/- 10 degrees.
 - .4 The piles at the mud line shall be within +/- 30 mm of the location indicated on the drawing for the direction parallel to the Berlin Wall, with no two adjacent piles having a centreline spacing less than 2500 mm unless otherwise indicated. Tolerance at the top of Berlin Wall shall be +/- 15 mm.

3.3 Concrete Panel Installation

- .1 Place concrete panels between flanges of H-piles.
- .2 Temporarily support concrete panels to prevent movement during backfilling operations.

3.4 Tie Rod Installation

- .1 All H-piles must be driven and approved by *Departmental Representative*.
- .2 Weld tie rod connection brackets to all H-piles.
- .3 Install new tie rods to connection brackets.
- .4 Tighten tie rod so that there is no sag in tie rods. *Departmental Representative* to approve final placement of each tie rod.

3.5 Backfilling

- .1 Do not proceed with backfilling operations until the *Departmental Representative* has inspected and approved areas to be backfilled.
 - .2 Install filter fabric on back side of panels and on top of existing fill material as shown on the drawings
 - .3 Place R25 random riprap around perimeter of Berlin Wall to seal gap between exiting harbour bottom and bottom of concrete panels.
 - .4 Place R5 random riprap backfill material into the bottom of the backfilled areas. Backfilling below LNT and up to 400 mm above LNT may be end dumped.
 - .5 Areas to be backfilled to be free from debris, snow, ice, water, and frozen ground.
-

- .6 Do not use backfill material which is frozen or contains ice, snow or debris.
- .7 Place backfill material in uniform layers not exceeding 300 mm compacted thickness. Compact each layer to create a firm, dense and rigid base before placing succeeding layer.
- .8 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 R5 random riprap to 95% maximum dry density in accordance with ASTM D698.
- .9 Place material by hand under, around, and over tie rod installations until 300 mm cover is provided. Dumping material directly on tie rods shall not be permitted.
- .10 When using hand operated tamping devices, place backfill material in layers not exceeding 100 mm in thickness.
- .11 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
- .12 Place backfill material in uniform layers simultaneously on sides of the anchor blocks so loading is equivalent.
- .13 Refer to Section 31 23 10 – Excavating and Backfilling for installation requirements for granular base material.

END OF SECTION