

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 31 61 13 – Pile Foundations, General Requirements
- .3 Section 31 62 16.16 – Steel Piles

1.2 REFERENCES

- .1 All reference standards in this section shall be current issue or latest revision at the first date of project tender advertisement.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A252/A253M-19, Standard Specification for Welded and Seamless Steel Pipe Piles.
 - .2 ASTM A307-21, Standard Specification for Carbon Steel Bolts and Studs, and Threaded Rods 60,000 PSI Tensile.
 - .3 ASTM F3125/F3125M-21, Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.
 - .4 ASTM A490M-04a, Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3 for Structural Steel Joints Metric.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA G40.20-13/G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.
 - .2 CSA S16-14 (R2019), Design of Steel Structures.
 - .3 CSA W47.1-19, Certification of Companies for Fusion Welding of Steel Structures.
 - .4 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
 - .5 CSA W59-18, Welded Steel Construction.
 - .6 CSA S6-19, Canadian Highway Bridge Design Code (CHBDC).

1.3 SYSTEM DESCRIPTION

- .1 Design Requirements: design templates to safely withstand following loads:
 - .1 Gravity loads to which templates are subjected.
 - .2 Lateral loads to firmly hold pile in position when driving.

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: submit manufacturer's printed product literature, specifications, and datasheet.

- .1 Include product characteristics, performance criteria, and limitations.
- .3 Submit shop drawings and indicate following items:
 - .1 Material.
 - .2 Anchorage, field control and alignment methods.
 - .3 Design parameters.
 - .4 Tolerance for driving pile.
 - .5 Removal method.
 - .6 Engineered drawing for all template designs stamped by a Professional Engineer registered to practice in the Province of New Brunswick.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

1.6 MEASUREMENT FOR PAYMENT

- .1 Refer to Section 01 29 10– Measurement and Payment.

Part 2 Products

2.1 MATERIALS

- .1 Steel sections and plates: to CSA G40.20/G40.21- Type 350W.
- .2 Welding materials: to CSA W48 and CSA W59.
- .3 Bolts, nuts, and washers: to ASTM F3125M, Grade A325.

2.2 FABRICATION

- .1 Fabricate structural steel for templates: to CSA-S16.
- .2 Welding: to CSA W59.
- .3 Use welding companies qualified under CSA W47.1.

Part 3 Execution

- .1 The design of all templates is the responsibility of the Contractor. All template designs shall be stamped by a Professional Engineer Licensed to Practice in the Province of New Brunswick, Canada.

3.2 POSITIONING

- .1 Position and hold template in location to receive piles.
 - .1 Ensure pile positions are within tolerances specified.
- .2 Secure templates to piles in accordance with shop drawings

3.3 REMOVAL OF TEMPLATES

- .1 Avoid damage to piling when removing templates.
- .2 When instructed by Departmental Representative, remove templates from Project site.

3.4 PROTECTION

- .1 Protect templates from damage.
- .2 Repair damage to templates, formwork or concrete arising from operations as reviewed by Departmental Representative at no extra cost.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 35 44 - Environmental Procedures.
- .3 Section 01 50 00 - Temporary Facilities.
- .4 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .5 Section 02 41 13 – Selective Site Demolition.
- .6 Section 31 37 00 – Fills

1.2 MEASUREMENT PROCEDURES

- .1 Excavated materials will be measured in accordance with Section 01 29 10.
- .2 Shoring, bracing, cofferdams, underpinning and de-watering of excavation, as required, will not be measured separately for payment.
- .3 Backfilling to authorized excavation limits will be measured in accordance with Section 01 29 10.
- .4 Placing and spreading of gravel will be measured for payment in accordance with Section 01 29 10.

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C117-17, Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C 136/C136M-19, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D698-12 (2021), Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .4 ASTM D 1557-12 (2021), Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .5 ASTM D 4318-17, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - .6 ASTM D6913/D6913M-17, Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
 - .7 ASTM D7928-21, Standard Tet Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis
- .2 Canadian General Standards Board (CGSB)
 - .1 CGSB 8.1-Latest Edition, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CGSB 8.2-Latest Edition, Sieves, Testing, Woven Wire, Metric.

- .3 Canadian Standards Association (CSA)
 - .1 CSA A3000-18, Cementitious Materials Compendium.
 - .2 CSA A23.1-00, Concrete Materials and Methods of Concrete Construction.

1.4 SUBMITTALS

- .1 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Inform a Departmental Representative at least 4 weeks prior to commencing Work, of proposed source of fill materials and provide access for sampling.
 - .3 Upon Request, submit 70 kg samples of type of fill specified including representative samples of excavated material.
 - .4 Upon request, ship samples prepaid to an address specified by the Departmental Representative in tightly closed containers to prevent contamination.

Part 2 Products

2.1 MATERIALS

- .1 See Section 31 37 00 for material specifications.

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 the laydown area. Stockpile granular materials in a manner to prevent segregation.
- .2 Protect fill materials from contamination.
- .3 Stockpiling of fills in the existing asphalt parking lot is not permitted. Any damage to the asphalt parking lot from material or equipment storage shall be repaired by the Contractor at no additional expense to the project.

3.3 EXCAVATION

- .1 Advise a Departmental Representative at least 7 days in advance of excavation operations.
- .2 Excavate to lines, grades, elevations, and dimensions as directed by a Departmental Representative.
- .3 Remove concrete and other obstructions encountered during excavation in accordance with Section 02 41 13 - Selective Site Demolition.
- .4 Excavation must not interfere with bearing capacity of adjacent foundations.

- .5 Dispose of surplus and unsuitable excavated material in approved location.
- .6 Do not obstruct flow of surface drainage or natural watercourses.

3.4 FILL TYPES AND COMPACTION

- .1 All fill materials will be in accordance with Section 31 37 00 – Fills. Compaction densities are percentages of maximum densities obtained from ASTM D 698. See Section 31 37 00 for compaction requirements for different fills.

3.5 BACKFILLING

- .1 Do not proceed with backfilling operations until a 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 Place backfill material in uniform layers not exceeding 300 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .5 Backfilling around installations.
 - .1 Place bedding and surround material as specified elsewhere.
 - .2 Do not backfill around or over cast-in-place concrete until the concrete has reached its design strength.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation of polymeric geotextiles purpose of which is to:
 - .1 Separate and prevent mixing of granular materials of different grading.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.

1.3 MEASUREMENT PROCEDURES

- .1 Refer Sections 01 29 10 for measurements for payment.

1.4 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM D4632. Grab Tensile strength test.
 - .2 ASTM D 4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-4.2 No. 11.2-M89(April 1997), Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).
 - .2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.
 - .1 No.7.3-92, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.

1.5 SUBMITTALS

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit samples to a Departmental Representative at least 4 weeks prior to beginning the Work.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris, and rodents.

1.7 MEASUREMENT FOR PAYMENT

- .1 Refer to Section 01 29 10 – Measurement and Payment

1.8 MATERIAL

- .1 Geotextile: Non-Woven synthetic fiber fabric, supplied in rolls.
 - .1 Width: 4 m minimum.
 - .2 Length: 100 m minimum.

- .2 Synthetic non-woven geotextile (also referred to as filter fabric) to be used to:
- .1 Provide filtration and separation of the new rock fill from the existing harbour bottom or existing crib.
- .3 Minimum Geotextile Properties:

<u>PROPERTY</u>	<u>ASTM TEST METHOD</u>	<u>VALUE (METRIC UNITS)</u>
Grab Tensile Strength	D4632	1690 N
Grab Elongation	D4632	50-105%
Tear Resistance	D4533	644 N
Puncture CBR	D6241	4820 N
Permittivity	D4491	0.7 sec ⁻¹
Water Flow	D4491	2035 l/min/m ²
Apparent Opening Size	D4751	0.150 mm
U.V. Stability	D4355	70% @ 500 hrs

- .4 Securing pins and washers: to CAN/CSA-G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m² to CAN/CSA G164.

Part 2 Execution

2.1 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 Overlap each successive strip of geotextile a minimum of 600 mm over previously laid strip.
- .4 Pin successive strips of geotextile with securing pins at 600 mm interval at mid-point of lap.
- .5 Protect installed geotextile material from displacement, damage, or deterioration before, during and after placement of material layers.
- .6 After installation, cover with overlying layer within 4 h of placement
- .7 Replace damaged or deteriorated geotextile to approval of a Departmental Representative.
- .8 Place and compact fill layers in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling.

2.2 PROTECTION

- .1 Vehicular traffic not permitted directly on geotextile.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Refer to Section 01 33 00 for submittal requirements.

1.2 REFERENCE STANDARDS

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C117 -17, Standard Test Method for Materials Finer than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C127-12, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
 - .3 ASTM C 131/C131M-20, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .4 ASTM C136/C136M-19, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .5 ASTM D1557-12 (2021), Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-mm<sup>3 - .6 ASTM D4318-17, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - .7 ASTM D5821-13(2017). Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.</sup>
- .2 New Brunswick Department of Transportation and Infrastructure
 - .1 Department of Transportation and Infrastructure Standard Specifications for Highway Construction (NBDTI Standard Specification) – Latest Edition.
- .3 Ministry of Transportation, Ontario Laboratory Testing Manual
 - .1 MTO LS-618 – The Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.
 - .2 MTO LS-614 – Freezing and Thawing of Coarse Aggregate.

1.3 SUBMISSIONS

- .1 Product Data/Samples:
 - .1 Provide samples of materials proposed for the work.
- .2 Methodology:
 - .1 Provide methodologies for carrying out the work
- .3 Provide submissions in accordance with Section 01 33 00.

1.4 MEASUREMENT FOR PAYMENT

- .1 All fills shall be measured in accordance with Section 01 29 10.

- .2 Prices will include the entire cost of supplying and placing the material in the work, rough grading as necessary, the leveling and finish grading of the listed materials, taking soundings, diving inspections, shoring, bracing, underpinning, all as shown on the drawings, and as specified.
- .3 Departmental Representative will only pay for incorporated fills used in the work.

Part 2 Products

2.1 MATERIALS

- .1 Sub-base Material:
 - .1 Sub-base material shall be free from flat, elongated or other objectionable pieces and shall be approved by the Departmental Representative prior to utilization. Sub-base material shall be tested in accordance with ASTM C 117 and C 136 and shall fulfil the gradation requirements detailed in Table 1 – Sub-base material Gradation.

.2 Table 1- Sub-Base Material Gradation:

ASTM Sieve Size, mm	Percent Passing, %
100.0 mm	100
90.0 mm	95-100
75.0 mm	80-100
50.0 mm	60-87
37.5 mm	50-81
19.0 mm	34-68
9.5 mm	25-58
4.75 mm	17-48
2.36 mm	13-39
1.18 mm	9-30
300 µm	4-17
75 µm	0-7

- .3 The sub-base material shall be tested in accordance with ASTM D5821 and have a minimum of 40% of the particles, by mass, having at least one fractured face.
- .2 Aggregate Base 25mm:
 - .1 The gravels shall be crushed quarry stone free from flat, elongated or other objectionable pieces and shall be approved by the Departmental Representative prior to utilization. The gravels shall be tested in accordance with ASTM C 117 and C 136 and shall fulfil the gradation requirements detailed in Table 2 –Gravel Gradation.

.2 Table 2- Aggregate Base 25mm Gradation:

ASTM Sieve Size, mm	Percent Passing, %
31.5 mm	100

25.0 mm	95-100
19.0 mm	75-100
12.5 mm	60-82
9.5 mm	52-75
4.75 mm	36-61
2.36 mm	25-48
1.18 mm	16-36
300 µm	5-16
75 µm	0-6

- .3 The gravel shall be tested in accordance with ASTM D5821 and have a minimum of 40% of the particles, by mass, having at least one fractured face.

.3 Riprap

- .1 Riprap shall consist of clean, hard, sound, durable quarry rock, having a density of not less than 2.6 t/m³ and angular surfaces such that the rocks interlock when placed. Rip rap shall be approved by the Departmental Representative prior to utilization and shall fulfil the gradation requirements of Table 3 – Riprap Gradation.

- .2 Table 3 – Riprap Gradation:

Mass, kg	Size, mm	Finer by Mass (%)	
		R-5	R-500
1500	1000		100
1000	900		70-90
500	710		40-55
50	330		0-15
15	220	100	
10	190	70-90	
5	150	40-55	
0.5	70	0-15	
¹ Thickness, mm		300	

¹Measured perpendicular to the prepared surface

- .3 Riprap for each rock shall have both thickness and breadth greater than or equal to one-third of its length and tested to meet the following requirements:

- .1 Riprap shall be tested in accordance with MTO LS-618 and achieve a Micro-Deval loss not greater than 70%.
- .2 Riprap shall be tested in accordance with MTO LS-614 and achieve a Freeze/Thaw loss not greater than 30%.

Part 3 Execution

3.1 PREPARATION

- .1 Prior to placing fills in the positions indicated on the drawings, ensure all construction debris is removed and Geotextile is installed as per Section 31 32 19.01.

3.2 PLACEMENT

- .1 Ensure the placement method for all fills are reviewed and approved by a Departmental Representative before commencing the work.
- .2 Install the geotextile as indicated on the drawings.
- .3 Reinstall existing rock fill if the material is deemed acceptable by a Departmental Representative.
- .4 Place new riprap, sub-base and aggregate base 25mm material as stated on the drawings to build up to the underside of the new cast-in-place concrete slab.
- .5 Rock fill, gravel and sub-base material shall be placed and compacted to a minimum of 95% of the ASTM D1557 (modified Proctor) maximum dry density.
- .6 R-5 Riprap shall be placed by hand or machine to avoid waste and to ensure that the stone is in a stable position. The Riprap shall be placed to the elevations and grades shown of the drawings.
- .7 Areas of the existing breakwater outlined on the drawings shall be topped up with new armour stone to a minimum elevation of +4.8m.
 - .1 Removal/handling of existing armor stone is required and included in the work.
 - .2 The placement of the new armour stone shall be complete in such a manner to ensure the stability of the new and existing armour stone.
 - .3 A Departmental Representative will verify, on site, all locations along the existing breakwater which require topping up.
 - .4 A Departmental Representative will review and approve the placement and stability of all new and existing armour stone.

3.3 TOLERANCES

- .1 All fills to be within 19 mm of elevation indicated on drawing.

3.4 PROTECTION

- .1 Consider 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.
- .4 The Contractor will be responsible to replace any materials lost due to storms, tidal erosion or by their own activities.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 31 09 16.01 Pile Driving Template

1.2 REFERENCES

- .1 Geotechnical investigation completed is available upon request.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Sub-surface investigation reports: when site conditions differ from those indicated, submit written notification to a Departmental Representative and await further instructions.
- .3 Submit schedule of planned sequence of driving to a Departmental Representative for review, as specified.
- .4 Equipment:
 - .1 Submit prior to casing installation for review by a Departmental Representative, list and details of equipment for use in installation of casings.
 - .2 Impact hammers: submit manufacturer's written data as specified.
 - .3 Non-impact methods; submit characteristics to evaluate performance.
- .5 Submit drivability analyses as specified, to a Departmental Representative for approval of hammers.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's instructions.
- .2 Protect casings from damage due to excessive bending stresses, impact, abrasion or other causes during delivery, storage and handling.
- .3 Replace damaged casings as directed by a Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Material requirements for piles are specified in Section 31 62 16.16.
- .2 Supply full length casings as indicated and provide equipment to handle full length casings without cutting or splicing.

2.2 EQUIPMENT

- .1 Impact hammers: provide manufacturer's name, type, rated energy per blow at normal working rate, mass of striking parts of hammer, mass of driving cap and type and elastic properties of hammer and casings cushions.
- .2 Non-impact methods of installation such as auguring (and/or rock socketing), jacking, vibratory hammers or other means: provide full details of characteristics necessary to evaluate performance.
- .3 Hammer:
 - .1 Hammers to be selected on basis of drivability analysis using wave equation theory, performed to show that all casings can be driven to levels indicated.
 - .2 Drivability analysis to include, but not be limited to, following: hammer, cushion, and cap block details; static soil parameters; quake and damping factors, total soil resistance, blow count, casings stresses and energy throughput at representative penetrations.
 - .3 When required criteria cannot be achieved with the proposed hammer, use larger hammer and take other measures as required.
 - .4 It is the contractor's responsibility to seat the casing to drill the pile socket.

Part 3 Execution

3.1 PREPARATION

- .1 Protection:
 - .1 Protect adjacent structures, services and work of other sections from hazards due to casings driving operations.
 - .2 Arrange sequencing of casing driving operations and methods to avoid damages to adjacent existing structures.
 - .3 When damages occur, remedy damaged items to restore to original or better condition at own expense.
- .2 Ensure that conditions at all casing locations are adequate to support casing driving operation. Make provision for access and support of casing equipment during performance of Work.

3.2 INSTALLATION

- .1 Secure casing in position with falsework as required to facilitate installation.
- .2 Leads: construct casing driver leads to provide free movement of hammer.
 - .1 Hold leads in position at top and bottom, with guides, stiff braces, or other means reviewed by Departmental Representative, to ensure support to the casing while being driven.
 - .2 Provide sufficient length of leads to ensure that use of follower is unnecessary.
 - .3 Swing leads are not permitted.
- .3 Installation of the Steel Casing:

- .1 The installation of each casing will be subject to review by the Departmental Representative.
 - .2 The Contractor is solely responsible for developing their own means and methods to advance the casing into bedrock and seal the casing.
 - .3 Both drilling and driving methods may be required to advance the casing into bedrock.
 - .4 The Contractor is responsible to ensure the casing is cleaned out for the full height to ensure the h-pile can be installed on top of sound bedrock.
 - .5 The Contractor shall be aware that cobbles and boulders were identified throughout the till layer in the geotechnical reports.
 - .6 The casings must be installed to not impede the installation of the h-piles both plumb and at the proper northing and easting coordinates.
- .4 Installation of H-Piles:
- .1 The H-Piles shall be installed placed inside the cleaned-out casing, plumb, within 1:50 tolerance in both directions.
 - .2 The H-Piles shall be installed to create 3000 mm center to center pile spacing's.
 - .3 Adjacent H-Piles shall be sufficiently spaced to allow for the panel installation.
 - .4 Adjacent H-Piles shall be spaced to ensure the panels have a minimum of 100mm bearing length on both pile flanges for the full height of the panels.
- .5 All pile casings can be removed after the pile socket is filled with wet concrete, cleaned, and re-used.

3.3 APPLICATION/DRIVING

- .1 Use driving caps and cushions to protect casings.
 - .1 Reinforce pile heads as required by Departmental Representative.
 - .2 Piles with damaged heads as determined by Departmental Representative will be rejected.
- .2 Hold casings securely and accurately in position while driving.
- .3 Deliver hammer blows along axis of casing.
- .4 Ensure no contact between casing and existing structure takes place.
- .5 Re-strike already driven casing lifted during driving of adjacent casing to confirm set.
- .6 Cut off casings, if required, to install the h-piles.
- .7 Remove cut-off lengths from site on completion of work.

3.4 OBSTRUCTIONS

- .1 The presence of cobbles and boulders throughout the till layer was identified in the geotechnical investigations. The Contractor is responsible to remove obstructions if required complete the casing installation.

3.5 FIELD QUALITY CONTROL

- .1 Required Pile Testing

- .1 Each casing shall be drilled and driven or solely driven to the bedrock elevations outlined on the drawings.
- .2 The Contractor shall record the installation depths and blow counts for each casing installation and submit to the Departmental Representative for review.
- .2 Measurement:
 - .1 Maintain accurate records of driving for each casing, including:
 - .1 Types and make of hammer, stroke or related energy.
 - .2 Pile size and length, location of casing.
 - .3 Numbers of blows per meter for entire length of casing.
 - .4 Number of blows per 25 mm for last 300 mm.
 - .5 Final tip and cut-off elevations.
 - .6 Record pertinent information such as interruption of continuous driving or pile damage.
 - .7 Record elevations taken on adjacent pile before and after driving of each pile.
 - .2 Records must be submitted to the Departmental Representative prior to receiving authorization to cut off piles.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 74 21 - Construction/Demolition Waste Management and Disposal
- .2 Section 05 50 00 – Metal Fabrication
- .3 Section 31 09 16.01 – Pile Driving Templates
- .4 Section 31 61 13 – Pile Foundations General Requirements

1.2 MEASUREMENT PROCEDURES

- .1 See Section 01 29 10– Measurement and Payment.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA W47.1-09 (R2019), Certification of Companies for Fusion Welding of Steel Structures.
 - .2 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
 - .3 CSA W59-18, Welded Steel Construction.
 - .4 CSA-G40.20/G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings and indicate pile size, pile shoes, cut-off elevations, etc.
 - .1 Each drawing shall be signed by qualified professional engineer registered or licensed in Province of New Brunswick, Canada.
- .3 Quality Assurance:
 - .1 Test Reports: submit 3 copies of mill test reports indicating yield and chemical analysis of steel piles.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.
 - .4 Submit pile driving records, as described in Part 3 - Records, for review by Departmental Representative.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 All pipe piles shall be ASTM A252 Grade 3 (Mod)) – 345 MPa yield strength.
- .2 All H-Piles shall be CAN/CSA Grade G40.21-350W – 350 MPa yield strength.
- .3 Welding materials: to CSA W48.
- .4 Pile driving shoes: to CSA-G40.20/G40.21, Grade 350W.
 - .1 Pile shoes shall be welded to the steel casings.
 - .2 The weld detail shall be submitted to a Departmental Representative for review.

Part 3 Execution

3.1 PAINTING AND COATING

- .1 The piles and casings shall not be coated.

3.2 INSTALLATION

- .1 Install piling in accordance with Section 31 61 13 - Pile Foundations, General Requirements.
- .2 Provide driving shoes for all casings.
- .3 All H-Piles shall not be spliced.
- .4 Cut off all H-Piles squarely to create the required elevation.
- .5 All casings are to be removed after placement of h-pile and socket concrete.

3.3 WELDING

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

3.4 BRACING FOR STEEL PILES

- .1 Brace H-Piles plumb and straight with steel angle and other temporary works as required before installing concrete panels.
- .2 Provide fills and shims between bracing and pile as directed by Departmental Representative.

3.5 TOLERANCES

- .1 Steel Casings:
 - .1 The casings must be installed to not impede the installation of the piling both plumb and at the proper northing and easting coordinates.
- .2 H-Piles:
 - .1 The piles shall be installed plumb within 1:50 tolerance in both directions.

- .2 The piles shall be installed to create 3000 mm center to center pile spacing's.
- .3 Adjacent piles shall be sufficiently spaced to allow for the panel installation.
- .4 Adjacent piles shall be spaced to ensure the panels have a minimum of 100mm bearing length on both pile flanges for the full height of the panels.

3.6 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 Penetration in blows per meter for entire length of penetration.
 - .9 Penetration in blows per 25 mm for the last 100 mm.
 - .10 Hammer data including rate of operation, make and size.
 - .11 Unusual pile behavior or circumstances experienced during driving such as re-driving, heaving, weaving, obstructions, jetting, and unanticipated interruptions.

3.7 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