
Part 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 31 32 10 – Excavating and Backfilling.
- .2 Section 35 31 23.13 – Rock Protection.

1.2 REFERENCES

- .1 ASTM D4791-19, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .2 ASTM C127-15, Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.
- .3 ASTM C535-16, Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .4 ASTM C88/C88M-18, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
- .5 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submissions and Shop Drawings.
- .2 Samples:
 - .1 Allow continual sampling by *Departmental Representative* during production.
 - .2 Provide *Departmental Representative* with access to source and processed material for sampling.
 - .3 Install sampling facilities at discharge end of production conveyor, to allow *Departmental Representative* to obtain representative samples of items being produced. Stop conveyor belt when requested by *Departmental Representative* to permit full cross section sampling.
 - .4 Provide front end loader or other suitable equipment including trained operator for stockpile sampling as necessary. Move samples to storage place as directed by *Departmental Representative*.
 - .5 Supply new or clean sample bags or containers according appropriate to aggregate materials.
 - .6 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.
- .3 Sustainable Design Submittals:
 - .1 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with authorities having jurisdiction.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 – Materials and Equipment and with manufacturer's written instructions.
 - .2 Transportation and Handling: handle and transport aggregates to avoid segregation, contamination, and degradation.
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- .3 Storage: store washed materials or materials excavated from underwater 24 hours minimum to allow free water to drain and for materials to attain uniform water content.

1.5 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, clay lumps or minerals, free from adherent coatings and injurious amounts of disintegrated pieces or other deleterious substances.
- .2 Flat and elongated particles of coarse aggregate: to ASTM D4791.
 - .1 Greatest dimension to exceed 5 times least dimension.
- .3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
 - .1 Screenings produced in crushing of quarried rock, boulders, gravel, or slag.
 - .2 Reclaimed asphalt pavement.
 - .3 Reclaimed concrete material.
- .4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:
 - .1 Crushed rock.
 - .2 Gravel and crushed gravel composed of naturally formed particles of stone.
 - .3 Light weight aggregate, including slag and expanded shale.
- .5 Filter Stone and Armour Stone:
 - .1 To be blasted, quarried rock, well graded within size range indicated on the drawings.
 - .2 Greatest dimension of each stone not to exceed two (2) times the least dimensions.
 - .3 Hard, angular rock free from cracks, seams and other defects which may impair durability.
 - .4 Relative density, 2.65 minimum.
 - .5 Absorption: 1.5 to 2.0% maximum as determined by ASTM C127 test procedure.
 - .6 Durability: less than 35% abrasion wear, ASTM C535 test procedure.
 - .7 Sulphate Soundness Determination Maximum 12% by ASTM C88.

2.2 Source Quality Control

- .1 Inform *Departmental Representative* of proposed source of aggregates and provide access for sampling 4 weeks minimum before starting production.
- .2 If materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate alternative source.
- .3 Advise *Departmental Representative* 4 weeks minimum in advance of proposed change of material source.
- .4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified,

Part 3 EXECUTION

3.1 Examination

- .1 Verification of Conditions: verify that conditions are acceptable for topsoil stripping.
 - .1 Visually inspect substrate in presence of *Departmental Representative*.
 - .2 Inform *Departmental Representative* of unacceptable conditions immediately upon discovery.

3.2 Preparation

- .1 Aggregate source preparation:
 - .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 approved by authority having jurisdiction.
 - .2 Where clearing is required, leave screen of trees between cleared area and roadways as directed.
 - .3 Clear, grub and strip area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.
 - .4 When excavation is completed dress sides of excavation to nominal 1.5:1 slope, and 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 neat condition.
 - .6 Provide silt fence or other means to prevent contamination of existing watercourse or natural wetland features.
 - .2 Processing:
 - .1 Process aggregates uniformly using methods that prevent contamination, segregation, and degradation.
 - .2 Blend aggregates, as required, including reclaimed materials that meet physical requirements of specification is permitted in order to satisfy gradation requirements for material and, percentage of crushed particles, or particle shapes specified.
 - .1 Use methods and equipment approved in writing by *Departmental Representative*.
 - .3 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate gradation.
 - .4 Where necessary, screen, crush, wash, classify and process aggregates with suitable equipment to meet requirements.
 - .1 Use only equipment approved in writing by *Departmental Representative*.
 - .5 Stockpiling:
 - .1 Stockpile aggregates on site in locations as indicated unless directed otherwise by *Departmental Representative*. Do not stockpile on completed pavement surfaces.
 - .2 Stockpile aggregates in sufficient quantities to meet project schedules.
 - .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
 - .4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.
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- .5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
- .6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by *Departmental Representative* within 48 hours of rejection.
- .7 Stockpile materials in uniform layers of thickness as follows:
 - .1 Maximum 1.5 m for coarse aggregate and base course materials.
 - .2 Maximum 1.5 m for fine aggregate and sub-base materials.
 - .3 Maximum 1.5 m for other materials.
- .8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
- .9 Do not cone piles or spill material over edges of piles.
- .10 Do not use conveying stackers.
- .11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.3 **Cleaning**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.
- .4 Waste Management: separate waste materials in accordance with Section 01 74 21 – Construction and Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- .5 For temporary or permanent abandonment of aggregate source, restore source to condition meeting requirements of authority having jurisdiction.
- .6 Restrict public access to temporary or permanently abandoned stockpiles by means acceptable to *Departmental Representative*.

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 Submission and Shop Drawing requirements.
- .3 Section 31 61 13 – Pile Foundations – General.
- .4 Section 31 62 18 – Steel H-Piles.
- .5 Section 31 63 26 – Berlin Wall Construction.

1.2 References

- .1 ASTM A252/A252M-19, Standard Specification for Welded and Seamless Steel Pipe Piles.
- .2 ASTM A307-21, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength.
- .3 ASTM F3125/F3125M-21, Standard Specification for High Strength Structural Bolts, 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 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 W47.1:19, 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 and Shop Drawings.
- .2 Indicate the following items:
 - .1 Material
 - .2 Anchorage, field control and alignment methods
 - .3 Design parameters
 - .4 Tolerance for driving pile
 - .5 Removable members
 - .6 Alternatives

1.4 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 during installation.
 - .3 All weather-related loads that may be applied during installation activities.
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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 CSA G40.21, 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.

3.3 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 Reference Standards

- .1 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)).
- .2 AASHTO T99-21, 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 ASTM C127-15, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
- .4 AASHTO T-85 (2021), Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate.
- .5 ASTM C136-19, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .6 ASTM C117-17, Standard Test Method for Materials Finer than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing.

1.2 Related Work

- .1 Refer to other Specification Sections for related information
- .2 Refer to Section 01 33 00 for Submission and Shop Drawing requirements
- .3 Section 02 41 13 – Selective Site Demolition
- .4 Section 02 41 16 – Sitework, Demolition and Removal
- .5 Section 31 61 13 – Pile Foundations – General
- .6 Section 31 63 26 – Berlin Wall Construction
- .7 Section 35 31 23.13 – Rock Protection

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 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 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:
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- .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 incidental to work involved in other sections of this specification.

Part 2 PRODUCTS

2.1 Materials

- .1 Refer to Section 35 31 23.13 – Rock Protection for material requirements for breakwater rehabilitation.
- .2 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 (AASHTO T85).
 - .1 Gradation to meet NBOT ‘R5’ Random Rip-Rap limits as follows:

ASTM SIEVE SIZE	% PASSING BY MASS
220 mm	100
190 mm	70 – 90
150 mm	40 – 55
70 mm	0 – 15

- .2 Gradation to meet NBOT ‘R25’ Random Rip-Rap limits as follows:

ASTM SIEVE SIZE	% PASSING BY MASS
380 mm	100
330 mm	70 – 90
260 mm	40 – 55
120 mm	0 – 15

- .3 Granular Base and Sub-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 (AASHTO T85).
- .1 Gradation to be within the following limits when tested to ASTM C136 and ASTM C117 and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart.
- .1 Gradation – Granular Base (Type 1):

ASTM SIEVE SIZE	% PASSING BY MASS
31.5 mm	95 – 100
25.0 mm	81 – 100
19.0 mm	66 – 90
12.5 mm	50 – 77
9.5 mm	41 – 70
4.75 mm	27 – 54
2.36 mm	17 – 43
1.18 mm	11 – 32
300 µm	4 – 19
74 µm	0 – 8

- .2 Gradation – Granular Sub-Base (Type 2):

ASTM SIEVE SIZE	% PASSING BY MASS
75.0 mm	100
0.425 mm	30 max
0.075 mm	8 max

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 Remove all other obstructions encountered during excavation in accordance with Sections 02 41 13 - Selective Site Demolition and 02 41 16 - Sitework, Demolition and Removal.
- .3 Excavation must not interfere with bearing capacity of adjacent foundations.
- .4 Dispose of surplus and unsuitable excavated material in approved location off site.
- .5 Do not obstruct flow of surface drainage or natural watercourses.
- .6 Stockpile suitable excavated materials required for backfill in approved location.
- .7 Dispose of surplus and unsuitable excavated material off site.
- .8 Obtain *Departmental Representative's* approval of completed excavation.

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.

3.7 Compaction

- .1 Compact common backfill materials:
 - .1 In non-pavement areas, compact to a density at least equal to density of adjacent, undisturbed soil.
 - .2 In pavement areas, compact to 100% standard proctor maximum dry density.
- .2 Compact granular backfill materials to 100% standard proctor maximum dry density.
- .3 Compact using approved mechanical tamping devices, or by hand tamping to achieve specified compaction.

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 Submission and Shop Drawing requirements.
- .3 Section 01 74 21 – Construction and Demolition Waste Management and Disposal
- .4 Section 31 23 10 – Excavating and Backfilling.
- .5 Section 31 63 26 – Berlin Wall Construction.
- .6 Section 35 31 23.13 – Rock Protection.

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 Samples

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to *Departmental Representative* the following samples at least 2 weeks prior to commencing work.
 - .1 Minimum length of 1 m of roll width of geotextile.

1.4 Mill Certifications

- .1 Submit to *Departmental Representative* a copy of mill test data and certificate at least 2 weeks prior to start of work.

1.5 Delivery and Storage

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

1.6 Waste Management and Disposal

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction and Demolition Waste Management and Disposal.
 - .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
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- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, and packaging material, in appropriate on-site bins, for recycling in accordance with Waste Management Plan.
- .4 Fold up metal banding, flatten and place in designated area for recycling

Part 2 PRODUCTS

2.1 Materials

- .1 The plastic yarn of the geotextile and the threads used in sewing operation shall consist of a long chain synthetic polymer composed of at least 85% by mass of propylene, ethylene, ester, amide or vinylidene-chloride, and shall contain stabilizers or inhibitors added to the base plastic to make the filaments resistant to deterioration by ultraviolet and heat exposure.
- .2 Geotextile shall be a pervious sheet of non-woven plastic yarn.
- .3 The material shall be handled and protected as per the manufacturer's instructions and recommendations until incorporated in the Work.
- .4 The geotextile shall conform the following requirements:

Property	Unit	ASTM	Type	
			N2	N3
Min. tearing Strength (Trapezoid Method)	N	D4533	250	310
Min. Grab Tensile Strength (Both Directions)	N	D4632	600	790
Min. Elongation at Break	%	D4632	50	50
Apparent Opening Size	µm	D4751	50 to 250	50 to 250
Permittivity	Sec ⁻¹	D4491	1.25 to 2.75	1.0 o 2.50

- .5 Thread for the seams shall be equal to or better than the geotextile in resistance to chemical and biological degradation and both factory and field sewn or sealed seams shall have a grab tensile strength equal to 90% of that of the geotextile.
- .6 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 Installation

- .1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position with securing pins and washers.
- .2 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.
- .3 Place geotextile material smooth and free of tension stress, folds, wrinkles, and creases.
- .4 Overlap each successive strip of geotextile 600 mm over previously laid strip.
- .5 Pin successive strips of geotextile with securing pins at 600 mm interval at midpoint of lap.

- .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 hours of placement.
- .8 Replace damaged or deteriorated geotextile to approval of *Departmental Representative*.
- .9 Place and compact soil layers in accordance with Section 31 23 10 – Excavating and Trenching.

3.2 Cleaning

- .1 Remove construction debris from Project site and dispose of debris in an environmentally responsible and legal manner.

3.3 Protection

- .1 Vehicular traffic not permitted directly on geotextile.

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 Submission and Shop Drawing requirements.
- .3 Section 31 09 18 – Pile Driving Templates.
- .4 Section 31 62 18 – Steel H-Piles.
- .5 Section 31 63 26 – Berlin Wall Construction.

1.2 Submissions

- .1 Methodology:
 - .1 Provide methodology including type of pile installation equipment to carry out the work.
 - .2 Provide submissions in accordance with Section 01 33 00 – Submissions and Shop Drawings.

1.3 Existing Sub-Surface Conditions

- .1 Sub-surface investigation reports may be available for viewing at the *Departmental Representative's* office and at the offices of Public Works and Government Services Canada, 1045 Main Street, 1st Floor, Lobby C Unit 108, Moncton, New Brunswick.
- .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 installation 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*.

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 Provide equipment of sufficient capacity to handle full length piles without cutting and splicing.
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- .3 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 New Brunswick, Canada.
- .4 Welding materials: to CSA W48.1

Part 3 EXECUTION

3.1 Preparation

- .1 Ensure that conditions at pile locations are adequate to support pile installation operation. Make provision for access and support of piling equipment during performance of work.

3.2 Installation

- .1 The steel H-piles are to be installed true and plumb along the baseline as shown on the drawings. H-piles shall be installed by pre-drilling into bedrock.
- .2 Pre-drill a 650 mm diameter socket by the full socket length (3.9 m) into bedrock to achieve satisfactory plumpness and the depth as shown on the drawings.
- .3 All piles are to be installed to a minimum of 3.6 meters into socket as shown on the drawings. The elevations vary depending on the exact location of bedrock.
- .4 Deviations from vertical in any direction shall not exceed 1 to 50 for all piles.
- .5 Hold piles securely and accurately in position during installation.
- .6 Cut off piles neatly and squarely at elevations indicated.
- .7 Remove cut-off lengths from site on completion of work.

3.3 Field Measurement

- .1 Maintain accurate records of driving for each pile, including:
 - .1 Pile size, length, and location.
 - .2 Final tip and cut-off elevations.
 - .3 Other pertinent information such as interruption of continuous driving, pile damage.
 - .4 Record elevation taken on adjacent piles during driving of each pile.
 - .5 All measurements, observations and calculations associated with pile driving analyzer and wave equation analysis.
- .2 Provide *Departmental Representative* with three copies of records.

3.4 Obstructions

- .1 Where obstruction is encountered that causes sudden and unexpected change in penetration resistance or deviation from specified tolerances, advise Department 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.

3.5 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.

3.6 Protection

- .1 Protect adjacent structures, services, and work of other section from hazards due to pile installation operations.
- .2 Arrange sequencing of pile installation 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 Submission and Shop Drawing requirements.
- .3 Section 31 09 18 – Pile Driving Templates
- .4 Section 31 61 13 – Pile Foundations – General.
- .5 Section 31 63 26 – Berlin Wall Construction.

1.2 Measurement Procedures

- .1 Supply and installation of H-piles will be measured in accordance with Section 01 29 00.
- .2 Consider pile shows as incidental to installation of piles.
- .3 Mobilization of equipment will be considered incidental to installation of piles.
- .4 Actual number and lengths of piles installed will be established by *Departmental Representative* from piling records.
- .5 Adjustments in contract price due to changes in number and lengths of piles will be based on unit prices established in Contract.

1.3 References

- .1 CSA W47.1:19, 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 (R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.

1.4 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submissions and Shop Drawings.
- .2 Each drawing submitted shall bear the signature and stamp of qualified Professional Engineer registered or licensed in the Province of New Brunswick, Canada.

1.5 Test Reports

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

1.6 Existing Sub-Surface Conditions

- .1 Sub-surface investigation reports are available for viewing at the *Departmental Representative's* office and at the offices of Public Works and Government Services Canada, Unit 100, 4th Floor, 1045 Main Street Moncton, NB. Relevant borehole logs are included on the drawings.
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- .2 Notify the *Departmental Representative* immediately if subsurface conditions at site differ from these indicated.

1.7 Measurement for Payment

- .1 Supply of steel H-Piles will be measured in accordance with Section 01 29 00.
- .2 Installation of steel H-Piles will be measured in accordance with Section 01 29 00.
- .3 Mobilization of equipment will be considered incidental to installation of piles.
- .4 Base tender on number and lengths of piles indicated on the plan.
- .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 lengths of piles will be based on unit prices established in Contract.

1.8 Waste Management and Disposal

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction and 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.

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 Welding: 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.

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 and 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 03 37 26 – Underwater Concreting.
- .7 Section 05 50 00 – Metal Fabrications.
- .8 Section 31 23 10 – Excavating and Backfilling.
- .9 Section 31 61 13 – Pile Foundations – General.
- .10 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 – Submissions and Shop Drawings.

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 – Steel H-Piles.

2.2 Steel Angles, Tie Rods, and Miscellaneous Steel

- .1 The supply of steel angles, tie rods, and all miscellaneous steel required as shown on the drawings, shall meet the requirements of Section 05 50 00 – Metal Fabrications.

2.3 Concrete Panels and Anchor Wall/Blocks

- .1 The supply of concrete panels and anchor wall/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.

2.4 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, steel angles, tie rods, tie rod connection bracket, concrete panels and anchor wall/blocks for the construction of the Berlin Wall shall be carried out in accordance with their applicable sections.

3.2 H-Pile Installation

- .1 Refer to section 31 61 13 – Pile Foundations – General for installation requirements.
- .2 The steel H-piles for Berlin Wall shall be installed true and plumb along the baseline as shown on the drawings.
- .3 Hold piles securely and accurately in position during installation.
- .4 Cut off piles squarely at required elevation.
- .5 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 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 tie rod installation and backfilling operations.
- .3 Concrete panels shall be installed with temporary shims to prevent movement of panel until the backfilling operations are complete.
- .4 Concrete panel bearing on flange of H-pile shall be minimum 80 mm.

3.4 Tie Rod Installation

- .1 All H-piles must be driven and approved by *Departmental Representative*.
- .2 Concrete anchor blocks shall be in place and approved by *Departmental Representative*.
- .3 Weld tie rod connection brackets to all H-piles.
- .4 Install new tie rods and connect to anchor wall/blocks.
- .5 Tighten tie rod nuts at concrete anchor blocks against bearing plate so that there is no sag in tie rods. *Departmental* 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 existing cribwork structure/bedrock and bottom of Berlin Wall 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.
- .8 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.
- .9 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
- .10 Place backfill material in uniform layers simultaneously on sides of the anchor blocks so loading is equivalent.
- .11 Refer to Section 31 23 10 – Excavating and Backfilling for installation requirements for granular base and granular sub-base material.

END OF SECTION