

Part 1 General

1.1 RELATED WORK

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| .1 | Cast-in-Place Concrete: | Section 03 30 00 |
| .2 | Excavating, Trenching and Backfilling: | Section 31 23 10 |
| .3 | Aggregate Base Courses: | Section 32 11 23 |
| .4 | Asphalt Paving | Section 32 12 16 |

1.2 SOURCE APPROVAL

- .1 Source of materials to be incorporated into work or stockpiled requires approval.
- .2 Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least three (3) 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 or demonstrate that material 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 three (3) weeks in advance of proposed change to allow sampling and testing,
- .5 Acceptance of a 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 Aggregates 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.
- .3 Bear the cost of sampling and testing of aggregates which fail to meet specified requirements.

1.4 MEASUREMENT FOR PAYMENT

- .1 No measurement will be made under this Section. Include costs in items of work that require aggregates.

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 exceed five 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 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
- .4 Coarse aggregates satisfying requirements of applicable section shall be one of following:
 - .1 Crushed rock or slag.
 - .2 Gravel composed of naturally formed particles of stone.

Part 3 Execution

3.1 DEVELOPMENT OF AGGREGATE SOURCES

- .1 Source is to be supplied by Contractor.
- .2 Pits must be left in a neat and safe condition free from overhanging bands and dangerous water conditions. The pits must be left in such a condition that they comply with legislation regarding aggregate pits.

3.2 PROCESSING

- .1 Process aggregate uniformly using methods that prevent contamination, segregation, and degradation.
- .2 Blend aggregates 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 approved by Departmental Representative.

3.3 HANDLING

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

3.4 STOCKPILING

- .1 Stockpiling sites shall be level, well drained and of adequate bearing capacity with stability to support stockpiled materials.
- .2 Except where stockpiled on acceptable established areas, provide a compacted sand base not less than 300 mm in depth to prevent contamination of the aggregate or, if permitted, stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into work.
- .3 Separate aggregates by substantial dividers or 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 coarse materials.
 - .2 Max. 2 m for fine aggregate and sub-base material.
 - .3 Max. 1.5 m for other materials.
- .6 Complete each layer over entire stockpile area before beginning next layer.
- .7 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
- .8 Coning of piles or spilling of material over edges of pile will not be permitted.
- .9 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.5 STOCKPILE CLEAN-UP

- .1 Leave stockpile site in a tidy, well-drained condition, free of standing surface water.
- .2 Leave any unused aggregates in neat, compact stockpiles as directed.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

- .1 Pile Foundation General Requirements: Section 31 61 13
- .2 Steel Pipe Piles: Section 31 62 17
- .3 Metal Fabrications: Section 05 50 00

1.2 PROTECTION

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

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Division 1.
- .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.

1.4 DESIGN CRITERIA

- .1 Design templates to safely withstand following loads:
 - .1 All gravity and environmental loads to which template shall be subjected.
 - .2 Lateral loads to firmly hold pile in position when driving.
- .2 The template shall be of such a design as to enable the piles to be driven to true vertical alignment, without twist or slope, to the full required depth.

1.5 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-G40.21, Type 300W.
- .2 Welding materials: to CSA W59.
- .3 Bolts: to ASTM A325M.
- .4 Line inside surfaces of pile guides with timber or UHMWPE strips a minimum of 25 mm thick to provide protection to pile coating during driving operation. Show full details of linings and attachment on shop drawings.

Part 3 Execution

3.1 FABRICATION

- .1 Fabricate structural steel for templates in accordance with CAN/CSA-S16.1.
- .2 Welding in accordance with CSA W59.
- .3 Welding companies shall be qualified under provisions of CSA W47.1, Division 1 or 2.

3.2 REMOVAL OF TEMPLATES

- .1 Avoid any damage to piling when removing templates and leave neat appearance when removal is completed.
- .2 When instructed by Departmental Representative, remove templates from project site.

3.3 TEMPORARY SUPPORT

- .1 Pile driving templates and alignment system may be used to temporarily support piles in place against the forces of nature, providing no overstressing occurs in piles to remain in work.
- .2 Contractor is fully responsible for the integrity and stability of all piles against the forces of earthquake, ice, wind, wave, current and soil movements until completion of the entire structure.
- .3 Contractor to take precautions against any and all external forces on the structure and will engage a Professional Engineer registered in the Province of New Brunswick to conduct analysis and design as required.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This section specifies requirements for the excavating, trenching and backfilling for the wharf and yard construction, electrical and appurtenances as shown on the drawings and specified herein.

1.2 RELATED WORK

- .1 Environmental Procedures: Section 01 35 44
- .2 Cast-in-Place Concrete: Section 03 30 00
- .3 Aggregate Materials: Section 31 05 16
- .4 Electrical: Division 26

1.3 REFERENCES

- .1 ASTM C117, Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
- .2 ASTM C136, Method for Sieve Analysis of Fine and Coarse Aggregates.
- .3 ASTM D698, Test Methods for Moisture Density Relations of Soils and Soil-Aggregate Mixtures Using 2.49 kg Rammer and 304.8 mm Drop.
- .4 ASTM D1557, Methods for Moisture Density Relations of Soils and Soil-Aggregate Mixtures Using 4.54 kg Rammer and 457 mm Drop.
- .5 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
- .6 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

1.4 PROTECTION OF EXISTING FEATURES

- .1 Existing buried utilities and structures:
 - .1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .2 Prior to commencing any excavation work, notify applicable owner or authorities having jurisdiction to establish location and state of use of buried utilities and structures. Owners or authorities having jurisdiction to clearly mark such locations to prevent disturbance during work.
 - .3 Confirm locations of buried utilities by careful test excavations.
 - .4 Maintain and protect from damage any water, sewer, gas, electric, telephone and other utilities and structures encountered.

- .5 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing. Costs for such work to be paid by the Departmental Representative.
- .6 Record location of maintained, re-routed and abandoned underground lines.
- .2 Existing structure and surface features:
 - .1 Conduct, with Departmental Representative, condition survey of existing structures, service poles, wires, paving, survey bench marks and monuments which may be affected by work.
 - .2 Protect existing structure and surface features which may be affected by work from damage while work is in progress. In the event of damage, immediately make repair to approval of Departmental Representative.

1.5 SHORING, BRACING AND UNDERPINNING

- .1 Protect existing features in compliance with Section 01 35 28 – Health and Safety Requirements and applicable local regulations.
- .2 Engage services of qualified Professional Engineer who is registered or licensed in province of New Brunswick, Canada, in which work is to be carried out to design and inspect, shoring, bracing and underpinning required for work.
- .3 Submit design and supporting data at least 5 days prior to commencing work.
- .4 Design and supporting data submitted to bear stamp and signature of qualified Professional Engineer registered or licensed in province of New Brunswick, Canada.
- .5 Professional Engineer responsible for design of temporary structures to submit proof of insurance coverage for professional liability except where Engineer is employee of contractor, in which case contractor shall submit proof that work by Professional Engineer is included in contractor's insurance coverage.

1.6 SAFETY

- .1 Construction methods and procedures employed by the Contractor in carrying out the excavation must safeguard public and private property and must be carried out in strict compliance with Section 21 of Regulation 77-1 of the Occupational Health and Safety Act of the Province of New Brunswick.

1.7 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Inform Departmental Representative at least 5 days prior to commencing work, of proposed source of fill materials and provide access for sampling.
- .3 Submit 70 kg samples of each type of fill specified.

1.8 INTERFERENCE TO NAVIGATION

- .1 Be familiar with vessel movements and fishery activities in area affected by construction operations.
- .2 Plan and execute work, in a manner that will not impede navigation, including movement of vessels at the facility.
- .3 Plan and execute work, in a manner that will not interfere with fishing operations or access to marine structures by land or water.
- .4 Departmental Representative will not be responsible for loss of time, equipment, material or any other charges related to interference with moored vessels in the harbour or other Contractor's operations.
- .5 Keep the Marine Communications and Traffic Services' Centre, Fisheries and Oceans Canada, informed of construction operations, in order that necessary Notices to Mariners may be issued.

1.9 REGULATORY REQUIREMENTS

- .1 Comply with municipal, provincial and national codes and regulations relating to project. Refer to the attachments.
- .2 Mark floating equipment with sound and light signals in accordance with Collision Regulations made pursuant to the Canada Shipping Act and Notice to Mariners.

1.10 SITE INFORMATION

- .1 Results of most recent soundings are included with the drawings. This data will be used for all calculation of quantity purposes. If the Contractor wishes to perform own survey, a written notice must be submitted to the Departmental Representative at least 7 days notice so PWGSC can verify the sounding survey before the commencement of any work.
- .2 Results of geotechnical investigations are available for inspection at: Public Works and Government Services Canada, 189 Prince William Street, Saint John, New Brunswick E2L 2B9.
- .3 Results of geotechnical investigations are made available for bidding purposes only. It should be noted that this information may differ from site condition. Take this into consideration when submitting bid.
- .4 Take necessary steps to become fully familiar with potential inclement weather and sea conditions in this area.

1.11 MEASUREMENT FOR PAYMENT

- .1 Excavation will not be measured for payment. It will be considered incidental to those items for which it is required.
- .2 Bedding material will not be measured for payment, but will be considered incidental to those items for which it is required.
- .3 Supply and placement of the 300 mm minus rockfill will be measured and paid for by the cubic metre compacted in place.
- .4 Supply and placement of the 75 mm minus sub-base will be measured and paid for by the cubic metre compacted in place.
- .5 Supply and placement of the 31.5 mm minus base will be measured and paid for by the cubic metre compacted in place.
- .6 Supply and placement of the R-250 Riprap will be measured and paid for by the tonne.
- .7 Supply and placement of the 0.1 kg to 400 kg rockfill for the containment cell will be measured and paid for by the tonne.
- .8 Supply and placement of each type of geotextile will be measured and paid for by the area, in square metres, covered by the geotextile.

Part 2 Products

2.1 MATERIALS

- .1 Rock and Gravel Aggregates – Physical Requirements
 - .1 Aggregate shall be composed of clean, hard, sound, durable, uncoated particles that do not contain friable, soluble or reactive minerals or other deleterious materials or conditions that would make the aggregate prone to decomposition or disintegration, or present any environmental hazard, from the presence of the parent material or its by-products, when exposed to the natural elements after placement in the Work.
 - .2 Aggregate shall meet the following requirements.

Properties of Rock and Gravel Aggregate

Test and Method	Aggregate Type	Value (Max.)
Micro-Deval (MTO LS – 618)	Cover Material	22%
	Aggregate Base	25%
	Aggregate Subbase and Shoulder Material	30%
Micro-Deval (MTO LS – 619)	Blending Material (Aggregate Base)	25%
	Blending Material (Aggregate Subbase and Shoulder Material)	30%
Freeze Thaw (MTO LS – 614)	All Highway Aggregates	20%
Flat & Elongated Particles @ 4:1 (MTO LS – 608)	Crushed Rock Aggregates	35%
Plasticity Index (AASHTO T89 and T90)	Aggregate Base and Blending Material	3
	Aggregate Subbase and Blending Material	5

.2 300 mm minus Rockfill

- .1** The material shall be a well graded crushed-quarried mixture and conforming to the following gradation limits

ASTM Sieve Size	% Passing
300 mm	100
200 mm	70 – 100
100 mm	
50 mm	0 - 20
25 mm	
12.5 mm	
4.75 mm	

.3 75 mm Crushed Rock Subbase.

- .1** 75 mm crushed rock subbase shall be produced by the processing of rock to conform to the grading limits as set out below, when tested in accordance with ASTM C136 and C117.

- .2 Rock shall be quarried from a source that is solid in-situ.

ASTM Sieve Size	% Passing
90.0 mm	100
75.0 mm	95 – 100
63.0 mm	85 – 100
50.0 mm	73 – 95
37.5 mm	58 – 87
31.5 mm	
25.0 mm	
19.0 mm	35 – 69
12.5 mm	
9.5 mm	25 – 54
4.75 mm	17 – 43
2.36 mm	12 – 35
1.18 mm	8 – 28
300 µm	4 – 16
75 µm	0 – 7

- .4 31.5 mm Crushed Rock Base.

- .1 31.5 mm crushed rock base shall be produced by the processing of rock to conform to the grading limits as set out below, when tested in accordance with ASTM C136 and C117.
- .2 Rock shall be quarried from a source that is solid in-situ.

ASTM Sieve Size	% Passing
90.0 mm	
75.0 mm	
63.0 mm	
50.0 mm	
37.5 mm	
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
75 µm	0 – 7

.5 R-250 Riprap

- .1 The material shall be a well graded crushed-quarried mixture and conforming to the following gradation limits:

Mass	Size (Approx. diam.)	Finer by Mass (%)
(kg)	(mm)	
750	820	100
500	710	70 – 90
250	570	40 – 55
25	260	0 - 15

- .2 Random riprap for each rock shall have both thickness and breadth greater than or equal to one-third of its length.
- .3 Random riprap shall consist of clean, hard, sound, durable rock, having a density of not less than 2.6 t/m³ and angular surfaces such that the rock interlock when placed.
- .1 Rock when tested by the Micro-Deval test method in accordance with MTO Ls – 618, shall have a Micro-Deval loss not greater than 35%.
- .2 Rock when tested by the Freeze/Thaw test method in accordance with MTO Ls – 614, shall have a Freeze/Thaw loss not greater than 15%.

.6 0.1 kg to 400 kg rockfill.

- .1 To be blasted, quarried rock, well graded within 0.1 kg to 400 kg.
- .2 Rockfill shall not have more than 5% weighing less than 20 kg.
- .3 Silt content to be less than 1%.
- .4 Hard, angular rock free from cracks, seams and other defects which may impair durability.
- .5 Relative density, 2.65 minimum.
- .6 Absorption, 1.5 to 2.0% maximum as determined by ASTM C127 test procedure.
- .7 Durability, less than 35% abrasion Wear, ASTM C535 test procedure.
- .8 Sulphate Soundness Determination maximum 12% by ASTM C88-05.

- .7 Bedding material: well graded natural sand or crushed rock screenings to following grading requirements:

<u>ASTM Sieve Size</u>	<u>Percent Passing</u>
9.50 mm	100
4.75 mm	50-100
2.00 mm	30-90
425 µm	0-0.1

- .8 Geotextile.

- .1 The plastic yarn of the geotextile and the threads used in sewing operations 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	1.00 to 2.50
Thickness	mm			

- .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.

Part 3 Execution

3.1 STOCKPILING

- .1 Stockpile fill materials in areas designated by Departmental Representative. Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.

- .3 Stockpile excavated materials suitable for backfill in designated locations.
- .4 Separate materials containing sods, muck, frozen lumps, cinders, ashes, organic or other deleterious substances not suitable for backfill.
- .5 Dispose of unsuitable and surplus material at locations in a manner to approval of Departmental Representative.

3.2 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

- .1 Construct temporary works to depths, heights and locations as required by regulatory agencies.
- .2 During backfill operation:
 - .1 Unless otherwise indicated by Departmental Representative, remove sheeting and shoring from excavations.
 - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
 - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 450 mm above toe of sheeting.
 - .4 When sheeting is required to remain in place, cut off tops at elevations required or at such elevations directed by Departmental Representative.
- .3 Upon completion of substructure construction:
 - .1 Remove cofferdams, shoring and bracing.
 - .2 Remove excess materials from site and restore water courses to conditions indicated on drawings, or directed by Departmental Representative.

3.3 DEWATERING

- .1 Provide pumps and other equipment and materials necessary to keep excavations free of water while work is in progress.
- .2 Do not pump during placing of concrete, or for a period of at least 24 hours thereafter, unless from a pump separated from concrete work by a watertight wall or other effective means.
- .3 Dispose of water in a manner not detrimental to public health, environment, public and private property, or any portion of work completed or under construction.

3.4 TRENCHING AND EXCAVATING

- .1 Excavate to lines, grades, elevations and dimensions indicated or as directed by Departmental Representative.
- .2 Excavation must not interfere with normal 45° splay of bearing from bottom of any footing.

- .3 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of days operation.
- .4 Dispose of surplus and unsuitable excavated material off-site.
- .5 Do not obstruct flow of surface drainage or natural watercourses.
- .6 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .7 Notify Departmental Representative when soil at bottom of excavation appears unsuitable and proceed as directed by Departmental Representative.
- .8 Obtain Departmental Representative's approval of completed excavation.
- .9 Remove unsuitable material from trench bottom to extent and depth directed by Departmental Representative.
- .10 Where required due to unauthorized over-excavation, correct as follows:
 - .1 Fill under bearing surfaces and footings with concrete specified for footings.
 - .2 Fill under other areas with granular sub-base compacted to minimum of 95% of maximum dry density, ASTM D1557-78 modified Proctor Density.
- .12 Where soil at proposed elevation of bottom of footings is unsuitable for foundations, Departmental Representative may order, in writing, such changes in elevations and dimensions of work as may be necessary to ensure satisfactory bearing surfaces.
- .13 Hand trim, make firm and remove loose material and debris from excavations immediately prior to placing concrete. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.
- .14 Do not commence further work until Departmental Representative has inspected, measured and approved excavated surfaces.

3.5 PLACING GENERAL

- .1 Place material after previously placed materials have been inspected and approved by the Departmental Representative.
- .2 Construct material layers to depth and grade in areas as indicated.
- .3 Ensure no frozen material is placed.
- .4 Place material only on clean unfrozen surface, free from snow or ice.
- .5 Place materials using methods which do not lead to segregation or degradation.

- .6 Place material to full width in uniform layers not exceeding 150 mm compacted thickness for aggregates and 500 mm for rockfill. The Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
- .7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .8 Remove and replace portion of layer in which material has become segregated during spreading.
- .9 Contractor shall clear work area of driftwood, debris, snow, ice and other objectionable materials before placing any rock materials.
- .10 Sequence construction operations such that sufficient riprap, armour and filter stone is placed to protect the core at all times.
- .11 The Contractor is to provide cross sections to the Departmental Representative at 10 metre stations to show that lines and grades have been achieved as shown on the drawings, measurement for payment for this will be included in the cost of the supply and installing the above item.

3.6 COMPACTION

- .1 Compaction equipment to be capable of obtaining required material densities.
- .2 Compact graded rockfill, subbase and base material to density of not less than 95% standard dry density in accordance with ASTM D698.
- .3 Shape and roll alternately to obtain smooth, even and uniformly compacted material.
- .4 Apply water as necessary during compaction to obtain specified density.
- .5 In areas not accessible to rolling equipment compact to specified density with mechanical tampers approved by the Owner's Representative.
- .6 Correct surface irregularities by loosening and addition or removing material until surface is within specified tolerance.

3.7 BACKFILLING AROUND CONCRETE ANCHOR BLOCKS

- .1 Place anchor blocks in position and brace to stabilize.
- .2 Backfill on each side of the anchor blocks simultaneously in compacted lifts with 75 mm minus subbase material.
- .3 Compact fill to a minimum of 95% of Modified Proctor Density to ASTM D1557.
- .4 Backfill anchor blocks prior to backfilling wharf.

3.8 BACKFILLING AROUND SERVICES

- .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 or 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 surrounding material as specified elsewhere.
 - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing.
 - .3 Place layers simultaneously on both sides of installation work to equalize loading.
 - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
 - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval has been obtained from Departmental Representative.
 - .2 If approved by Departmental Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Departmental Representative.
 - .5 Place material by hand under, around and over installations in 100 mm lifts until 300 mm of cover is provided. Dumping material directly on installations will not be permitted. Compact to 95% of maximum dry density ASTM D1557-78, Modified Proctor Density.
- .5 Shoring, sheeting and bracing:
 - .1 Unless otherwise indicated or direct by Departmental Representative, remove sheeting and shoring from trench during backfilling operations.
 - .2 Do not remove bracing until backfilling has reached level of bracing.
 - .3 Pull sheeting to 150 mm increments until clear of installations, simultaneously placing and compacting backfill to fill voids left by pulled sheeting.
 - .4 Pull sheeting thereafter in increments that will ensure backfill is maintained at an elevation of at least 450 mm above toe of sheeting.
 - .5 When sheeting is to remain in place cut off tops at elevations indicated or directed.
 - .6 Place backfill materials in uniform layers not exceeding 300 mm in thickness to subgrade elevation or top of trench. Compact each layer before placing succeeding layer.
 - .7 Compact common backfill materials to a density not less than 95% of maximum dry density ASTM D1557-78 Modified Proctor Density.
 - .8 Compact granular backfill material to a density not less than 95% of maximum dry density ASTM D1557-78 Modified Proctor Density.
 - .9 Compact using approved mechanical tamping devices, or by hand tamping to achieve specified compaction.

3.9 GEOTEXTILE

- .1 The areas to be covered with geotextile shall be prepared by shaping the ground to present a uniform and regular surface free from bumps and depressions.
 - .1 Geotextile shall not be placed on stumps, brush, limbs, ice or other material that may tear or puncture the fabric.
 - .2 The geotextile shall be placed so as to create a surface that is smooth and free of tension stress, folds, wrinkles and creases.
 - .3 The manufacturer's installation procedures shall be the standard of installation that shall be applied except as follows:
 - .1 where more than one width of fabric is used, the fabric shall be joined by sewing or by an overlap of at least 500 mm and all overlap joints shall be securely held in place.
 - .4 In no case shall Equipment travel on uncovered fabric.
 - .5 The Contractor shall immediately repair damaged geotextile.
 - .1 The damaged area shall be covered with a patch of the same fabric type extending a minimum of one metre beyond the perimeter of the damaged area.

3.10 RIPRAP

- .1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Departmental Representative.
- .2 The Contractor shall clear the Work Area of all driftwood, debris, snow, ice, and other objectionable materials.
- .3 Control of the gradation shall be by visual examination.
 - .1 Differences in opinion between the Departmental Representative and the Contractor shall be resolved by testing in accordance with ASTM D5519.
 - .2 The Contractor shall provide the Equipment, a sorting site and the labour required to undertake the testing required.
- .4 The Contractor shall place riprap material such that the underlying materials and abutting Structures are not damaged.
 - .1 The contractor shall be responsible, at his/her own expense to repair any such damage to the Work.
- .5 The Contractor shall tamp riprap mixed during placement.

3.11 ROCK MATERIAL WASHED OUT OF WORK

- .1 Should during the progress of the Work, any rock material be washed out of the Work, or through neglect or carelessness of the Contractor or their employees or from any other cause, be dumped into the water near the Work or anywhere within the harbour or channel so as to interfere in the opinion of the Departmental Representative with actual depths of water and/or impede navigation, it will be removed by the Contractor when ordered to do so by the Departmental Representative. Any material washed out of the Work or displaced beyond the contract limits will be replaced by the Contractor at no cost to Canada.

3.12 TOLERANCES

- .1 Note: These tolerances are not to be considered pay limits but are specified to ensure Contractor keeps within acceptable lines and grades.
- .2 Completed component layers to be within the following tolerances of lines and grades indicated:
 - .1 Rock fill: +/-100 mm
 - .2 Riprap: +/-100 mm
 - .3 Base/Sub-base: +/-25 mm

END OF SECTION

Part 1 General

1.1 RELATED WORK

- .1 Environmental Procedures: Section 01 35 43
- .2 Pile Driving Templates: Section 31 09 16
- .3 Steel Pipe Piles: Section 31 62 17
- .4 Metal Fabrications: Section 05 50 00

1.2 PROTECTION

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

1.3 SCHEDULING OF WORK

- .1 Submit schedule of planned sequence of driving to Departmental Representative at time of submitting construction schedule.

1.4 MEASUREMENT FOR PAYMENT

- .1 All work included in this section shall be covered by pay items in Sections 31 62 17 – Steel Pipe Piles.

Part 2 Products

2.1 MATERIALS

- .1 For material requirements refer to Section 31 62 17 – Steel Pipe Piles and Section 05 50 00 – Metal Fabrications.

Part 3 Execution

3.1 PILE DRIVING EQUIPMENT REQUIREMENTS

- .1 Equipment information: prior to commencement of pile installation operation, submit to Departmental Representative for review, details and the driving analysis of the 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. For non-impact methods of installation such as auguring, jacking, vibratory hammers or other means, give full details of characteristics necessary to evaluate performance.

.2 Hammer:

- .1 Select and size hammer to drive the steel pipe piling to the required depth without damage to piling sections.

.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 approved means, to ensure support to pile while being driven.
- .2 Length: Provide length of leads such that use of a follower is unnecessary. Drive battered piles using inclined leads.
- .3 Swing leads: Requires written approval. Firmly guy top and bottom to hold pile in position during driving operation.

3.2 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 and length, location of pile in pile group, location or designation of pile group.
- .4 Sequence of driving piles in group.
- .5 Number of blows per 25 mm for last 300 mm.
- .6 Final tip and cut-off elevations.
- .7 Other pertinent information such as interruption of continuous driving, pile damage.
- .8 Record elevation taken on adjacent piles during driving of each pile.

.2 Provide Departmental Representative with three copies of records.

3.3 DRIVING

- .1 Use driving caps to protect piles.
- .2 Hold piles securely and accurately in position while driving.
- .3 Deliver hammer blows in direct axis of pile.
- .4 Reinforce pile heads if necessary.
- .5 Installation of each pile will be subject to approval of Departmental Representative. Departmental Representative will be sole judge of acceptability of each pile with respect to depth of penetration or other criteria. Departmental Representative to approve final driving of all piles prior to removal of pile driving rig from site.
- .6 Cut off piles neatly and squarely at elevations indicated. Provide sufficient length above cut-off elevation so that part damaged during driving is cut off.

- .7 Remove cut-off lengths from site on completion of work.

3.4 DRIVING TOLERANCES

- .1 Pile heads to be within 75 mm of locations indicated.
- .2 Piles not to be more than 1% of length out of alignment.

3.5 DAMAGED OR DEFECTIVE PILES

- .1 Departmental Representative will be sole judge in designating defective piles and will have authority to reject piles in place.
- .2 Pull out rejected piles and replace with new piles.
- .3 No extra compensation will be made for removing and replacing or other work made necessary through rejection of a defective pile.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This section specifies the requirements for steel pipe piles for the new wharf.

1.2 RELATED WORK

- .1 Pile Foundations General Requirements: Section 31 61 13
- .2 Pile Driving Templates: Section 31 09 16
- .3 Cast-in-Place Concrete: Section 03 30 00
- .4 Metal Fabrications: Section 05 50 00

1.3 TEST REPORTS

- .1 Prior to fabrication, provide Departmental Representative with two copies of steel producer's certificates in accordance with ASTM A252.
- .2 One charpy V-notch test required per heat and results reported to Departmental Representative by manufacturer.

1.4 MEASUREMENT FOR PAYMENT

- .1 Supply of Steel Pipe Piles: Supply of each size of steel pipe piles will be measured in metres delivered to site in lengths indicated or approved by Departmental Representative. A maximum allowance of 300 mm cutoff is included.
- .2 Installation of Steel Pipe Piles will be measured by one of the two following methods:
 - .1 Driven Pipe Piles will be measured in metres for lengths acceptably incorporated into work. Installed length will include length from pipe pile cut-off at pile cap to the pile tip after final driving. The price per metre will also include the supply and placing of cast-in-place concrete and concrete reinforcement in the pile.
 - .2 Drilled in Pipe Piles will be measured in metres for lengths acceptably incorporated into work. Installed length will include length from pipe pile cut-off at pile cap to bottom of the rock socket. The price per metre will also include the supply and placing of cast-in-place concrete and concrete reinforcement in the pile and the rock socket.
- .3 Rock Sockets will not be measured for payment but will be included in the cost of installation of the piles.
- .4 Any pile redriving and pile tip or pile splices will be considered incidental to work and will not be measured separately.

- .5 Pile shoes, anodes and epoxy coating system will not be measured for payment but will be considered as incidental to Part 1.4.1.
- .6 Actual number and lengths of piles installed will be established by Departmental Representative from piling 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 Steel piles: straight steel pipe of sizes and wall thicknesses indicated, to ASTM A252, Grade 3 ($F_y = 310$ MPa), with machine cut ends to API-5L.
- .2 Pipe material to have following minimum tensile properties:
 - .1 Yield strength: 310 MPa.
 - .2 Tensile strength: 455 MPa.
- .3 Pipe chemical composition: to ASTM A252.
- .4 Pipe allowable tolerances:
 - .1 Deviation from straight line, specified diameter, wall thickness and out-of-roundness of body of pipe and at pipe ends to conform to API 5L. Pipe to be checked for deviations before leaving mill.
- .5 All steel pipe piles to be prepared and coated full length with a minimum of 0.305 mm thick fusion bonded epoxy coating as per the manufacturer's recommendations. The coating shall be Scotchkote #206n or #6233 Fusion Bonded Epoxy coating as manufactured by 3M company, Electro-Products Division, St. Paul, MN or approved equal. Approved Canadian applicators are Shaw Pipe Protection (905) 383-5714 or Pipe Coating Systems (403) 955-2398.
- .6 Pile driving shoes: Cast steel to ASTM A148 90/60 – heat treated. Open-end cutting shoes, outside flanges Standard of Quality 0-14000 by Associated Pile and Fitting Corp.
- .7 Concrete: to Section 03 30 00.
- .8 Anodes: sacrificial anodes to be Renode II Anode No. RM37FM as manufactured by Reynolds Metal Co. or approved equal.
- .9 Reinforcing steel: to Section 03 20 00 sizes and details as indicated.
- .10 Welding electrodes to CSA W59.

2.2 FABRICATION

- .1 Fabricate full length piles to eliminate splicing during installation. Splicing during installation shall not be done without the written permission from the Departmental Representative.
- .2 Unless otherwise approved by Departmental Representative, only one splice per pile for lengths over 15 m will be permitted using a complete joint penetration groove weld. NO splice will be permitted within 2.0 metres above and 1 metre below L.N.T. Contractor must submit and detail splices on shop drawings including location of proposed welds on each pipe pile. Piles to a length of 15 m will be in one piece with no splices.
- .3 Allowable tolerance on axial alignment to be 0.25% as measured by a 3 m straight edge.
- .4 Allowable deviation from straight line over total length of fabricated pile to be not more than 0.2% of total pile length.
- .5 Install driving shoes as indicated on all pipe piles.

Part 3 Execution

3.1 GENERAL INSTALLATION

- .1 Install piling in accordance with Section 31 61 13 and this section.
- .2 If approved by Departmental Representative, splice piles in place during installation by welding. To prevent distortion, tack opposite points first and then weld opposite sections. Hold members in alignment during splicing operation. Make splice by complete joint penetration groove welds as indicated on shop drawings.
- .3 Perform internal visual inspection of steel pipe, joints and base prior to placing of concrete. Ensure pipe inside is free from foreign matter.
- .4 Assemble and install reinforcement cages as indicated.
- .5 Install concrete in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .6 Fill steel pipe pile and rock socket as applicable with concrete using methods to limit freefall and to prevent segregation. Ensure adequate vibration to completely fill cross section of pipe.
- .7 Set dowels in concrete in accordance with details as indicated. Secure until concrete is set.
- .8 Install pile caps as indicated.
- .9 Driving shoes may be installed during shop fabrication or as part of field work.

- .10 Touch up scratched surfaces with two applications of epoxy, as per manufacturer's recommendations.
- .11 Install pipe pile cathodic protection (anodes) at elevation ± 1.0 metre above L.N.T. on all steel pipe piles. Weld 13 mm diameter threaded stud to pipe pile as required for installation of anode. Touch up epoxy coating as per manufacturer's recommendations.

3.2 ROCK SOCKETS

- .1 The pipe piles with rock sockets shall be driven open ended until they are firmly seated into sound bedrock. The Contractor shall note that it may be necessary to retap the pipe pile casing to reseal it to the bedrock during the construction of the pipe pile rock socket described below.
- .2 Rock sockets shall be a minimum of 2.1 metres long as measured from the final bottom elevation of the pipe pile to the bottom elevation of the bottom of the rock socket, as shown on the Contract Drawings.
- .3 Upon completion of drilling operations the Contractor shall thoroughly clean the rock sockets to remove all soil, rock cuttings, mud, etc. so that a minimum of 50% of the base of each socket shall have less than 15 mm of sediment or debris, and the maximum depth of sediment or debris at any place at the base of the socket does not exceed 30 mm at the time of placement of the concrete.
- .4 The Contractor shall inform the Departmental Representative when the rock sockets are complete and ready for inspection and allow the Departmental Representative sufficient time to complete their inspections prior to proceeding with the remaining Work.

3.3 INSTALLATION OF PIPE PILES

- .1 The 26 piles on Lines B and C are to be drilled in and a rock socket as described in section 3.2 shall be formed in the rock. The pile and rock socket are to be filled with reinforced concrete as described in section 3.1 and 3.2.
- .2 The contractor is given the option of either installing the remaining 13 pipe piles on Line A by driving them open ended and installing a rock socket into the bedrock as described in section 3.2 or driving the piling to refusal as described below in section 3.4.

3.4 PILE DRIVING

- .1 Piles may be driven open or closed ended.
- .2 Piles may be driven with a H Pile "Stinger" at the tip. The maximum length of stinger is 1.5 metres. The cross sectional steel area of the stinger is to match or exceed the cross sectional steel area of the pipe pile.
- .3 The piles may be driven with any type of hammer approved by the Departmental Representative, however, they will be finalized with an external hammer acting at the top of the pile with a minimum energy of 140,000 Joules.

- .4 Piles driven open ended shall be cleaned out as specified for piles with rock sockets.
- .5 Reinforcing steel and concrete will be installed in piles driven both open and close ended as specified in section 3.1.
- .6 The Contractor shall be responsible for selecting the method of installation of the 13 piles on Line A. If the Contractor is not able to install the piles as specified by the method selected, the Contractor shall use another method to install the piles at no additional costs.

3.5 WELDING

- .1 Weld in accordance with CSA W59 and CSA W59S1.
- .2 Welding certification of companies: in accordance with CSA W47.1, Division 1 or 2.
- .3 Welding certification of companies welding steel reinforcing bars placed in reinforced concrete: in accordance with CSA W186.

END OF SECTION