

PART 1 - GENERAL

1.1 References

- .1 All Applicable OPSS guidelines and standards as may be applicable to the work including but not limited to OPSS 1010, 206 and 501.

1.2 Soil Report

- .1 St. Lawrence Testing and Inspection Co. Ltd Report No. 22C380 dated December 31, 2022 and included in Bid Documents.

1.3 Regulations

- .1 Shore and brace excavations, protect slopes and banks and perform all work in accordance with Provincial and Municipal regulations whichever is more stringent.

1.4 Tests and Inspections

- .1 Testing of materials and compaction of backfill and fill will be carried out by testing laboratory designated by Engineer. The cost of testing is by the Owner.
- .2 Do not begin backfilling or filling operations until material has been approved for use by Engineer.
- .4 Not later than 48 hours before backfilling or filling with approved material, notify Engineer so that compaction tests can be carried out by designated testing agency.
- .5 Before commencing work, conduct, with Engineer , condition survey of existing structures, trees and other plants, lawns, fencing, service poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by work.

- 1.5 Buried Services
- .1 Before commencing work verify and establish the location of all buried services on and adjacent to the site.
 - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work.
 - .3 Remove obsolete buried services within 2 m of foundations. Cap cut-offs.

- 1.6 Protection
- .1 Protect excavations from freezing.
 - .2 Keep excavations clean, free of standing water, and loose soil.
 - .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Engineer's approval.
 - .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
 - .5 Protect buried services that are required to remain undisturbed.

PART 2 - PRODUCTS

- 2.1 Materials
- .1 Granular A $\frac{3}{4}$ " minus crushed stone to OPSS 1010.
 - .2 Granular B Type II, 2" minus crushed stone to OPSS 1010.

PART 3 - EXECUTION

3.1 Clearing and Grubbing

- .1 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.
- .2 Remove stumps and tree roots below footings, slabs, and paving, and to 600 mm below finished grade elsewhere.
- .3 Dispose of cleared and grubbed material off site daily to disposal areas acceptable to authority having jurisdiction all costs by the Contractor.

3.2 Excavation

- .1 Strip topsoil over areas to be covered by new construction, over areas where grade changes are required, and so that excavated material may be stockpiled without covering topsoil. Stockpile topsoil on site for later use.
- .2 Excavate as required to carry out work, in all materials met. Do not disturb soil or rock below bearing surfaces. Notify Engineer when excavations are complete. If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work. Excavation taken below depths shown without Engineer's written authorization to be filled with fill or concrete of same strength as for footings at Contractor's expense.
- .3 Excavate for slabs and paving to subgrade levels. In addition, remove all topsoil, organic matter, debris and other loose and

harmful matter encountered at subgrade level.

3.3 Backfilling

- .1 Inspection: do not commence backfilling until fill material and spaces to be filled have been inspected and approved by Engineer.
- .2 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.
- .3 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.
- .4 Compaction/proof roll of subgrade: compact existing subgrade under walks, paving, and slabs on grade, to same compaction as specified for fill. Fill excavated areas with selected subgrade material gravel and compacted as specified for fill. Co-ordinate with Engineer before commencing.
- .5 Placing:
 - .1 Place backfill, fill and base course material in maximum 12" lifts. Add water as required to achieve specified density.
- .6 Compaction: compact each layer of material to following densities for material to ASTM D 698 and co-ordinate compaction testing requirements with Engineer:
 - .1 To underside of base courses: 95%.
 - .2 Base courses Granular B: 100%.
 - .3 Granular A: 100%.
- .7 Against foundations excavated material or imported material with no stones larger than 200 mm diameter within 600 mm of structures.

<u>3.4 Grading</u>	.1	Grade so that water will drain away from buildings, walls and paved areas, to catch basins and other disposal areas approved by the Engineer. Grade to be gradual between finished spot elevations shown on drawings.
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<u>3.5 Shortage and Surplus</u>	.1	Supply all necessary fill to meet backfilling and grading requirements and with minimum and maximum rough grade variance.
	.2	Dispose of all surplus material off site at the cost of the Contractor.

PART 1 - GENERAL

1.1 Related
Sections

- .1 Section 03200-Concrete Reinforcement.
- .2 Section 03000-Cast-in-Place Concrete.
- .3 Section 02300-Site Work.

1.2 Measurement
Payment Procedures

- .1 Supply and installation of piles will be measured in feet of pile acceptably incorporated into work.
- .2 Consider pile tip reinforcement, splices, pile shoes/tips, pile cap reinforcement to be included in bid price.
- .3 Mobilization of equipment will be paid as a lump sum item.
- .4 Actual number and lengths of piles installed will be established by Engineer from piling records.
- .5 Unit of measurement for payment of piles will be per foot measured from tip elevation to cut-off elevation at concrete pile cap. All surplus pile material and cut-offs are property of the Contractor.
- .6 Base submitted Price on the following: 24 piles 33 foot long, 9 piles 28 foot long and 39 piles 39 foot long. Adjustments to the final price whether increase or decrease will be made in accordance with Schedule A of the Bid Form and its unit price.

1.3 References

- .1 ASTM A 252-19, Specification for Welded and Seamless Steel Pipe Piles.
- .2 CAN/CSA-G40.20-13/G40.21-13, Structural Requirements rolled/welded Structural Quality Steels.
- .3 CSA W47.1- 09, Certification of Companies for Fusion Welding of Steel Structures.
- .4 CSA W59-13, Welded Steel Construction Metal Arc Welding.
- .5 CSA W186-M1990 (R2012), Welding of Reinforcing Bars in Reinforced Concrete.
- .6 Steel Structures Painting Council (SSPC), Systems and Specifications Manual (2004 to 2007).

1.4 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01320 - Construction Progress Documentation.
- .2 Indicate: pile tip, splice details, pile cap to pile reinforcing.
- .3 Each drawing submitted shall bear the signature and stamp of qualified professional engineer registered or licensed in province of Ontario, Canada if requested.

1.5 Test Reports

- .1 Prior to fabrication, and, if requested, provide Engineer with two copies of steel

producer's certificates in accordance with ASTM A 252.

PART 2 - PRODUCTS

2.1 Materials

- .1 ERW Steel pipe: seamless, of sizes and wall thicknesses indicated, plain, beveled, flame or machine cut ends as may be required.
- .2 Pipe material to have the minimum properties in accordance with ASTM A252 Grade 3 and CAN/CSA G40.20/G40.21:
 - .1 Yield strength: 345 MPa.
 - .2 Tensile strength: 455 MPa.
 - .3 Elongation in 2i in, min %: 20 %.
 - .4 Weldable steel: to ASTM A 106 carbon equivalent less than 0.55%.
- .3 Pile tip/ point: to CAN/CSA-G40.21, Grade 300W.
- .4 Splices: to CAN/CSA-G40.21, Grade 300W.
- .5 Steel pile caps: to CAN/CSA-G40.21, Grade 300W.
- .6 Welding electrodes: to CSA W48 series.
- .7 Concrete: to Section 030000 - Cast-in-Place Concrete.
- .13 Reinforcing steel: to Section 032000 - Concrete Reinforcement, grade 400R sizes and details as indicated.

PART 3 - EXECUTION

3.1 Fabrication

- .1 Fabricate full length piles to eliminate splicing during installation wherever possible.
- .2 Full length piles may be fabricated from piling material by splicing lengths together. Use complete joint penetration groove welds splices as required.
- .3 Submit details of planned use of pile material stock to Engineer for approval prior to start of fabrication. Re-use cut-off lengths as directed by Engineer.

SPEC NOTE: Use 3.1.4 and 3.1.5 only if applicable.

- .4 Allowable tolerance on axial alignment to be as per ASTM A252.
- .5 Allowable deviation from straight line over total length of fabricated pile to be as per ASTM A252.
- .6 Install pile tip reinforcement/points, splices driving shoes as required.
- .7 Repair defective welds as approved by Engineer. Repairs to CSA W59 and CSA W59S1. Unauthorized weld repairs may be rejected.

3.2 Painting and Coating

- .1 N/A

3.3 Installation

- .1 See Report No. 22C380 by St. Lawrence Testing dated December 31, 2022 for all

geotechnical information applicable to this work. Prior to commencing of work submit to Engineer any and all information requested to demonstrate suitability of equipment to accomplish the work. Submit also a schedule detailing the progress of the work. Allow two weeks for this review.

- .2 Protect all adjacent structures from damage. Establish 3 benchmark elevations on adjacent buildings prior to commencing work, co-ordinate with Engineer. Any damages to adjacent buildings and property will be repaired at the Contractors cost and to the satisfaction of the Engineer.
- .3 Drive each pile to bedrock refusal. Do not over drive to damage pile. Engineer will determine bedrock refusal criteria based on driving equipment. Where an obstruction is encountered that differs unexpectedly from expected penetration resistance or tolerances notify Engineer and proceed as directed by Engineer.
4. Pile heads to be within 3" of dimensions specified on plans. Deviations from vertical to be 1 in 75. Deviations from specified cut-off level to be 1".
5. Contractor is to maintain accurate records for each pile including location of each pile, blow counts for 3 foot intervals and the number and final blows and displacement for the last 12" as refusal in bedrock. Record for each pile the final tip elevation and cut-off elevation. Provide to Engineer daily record of these records.
6. Contractor to review all previously installed piles and ensure no lifting and restrike any piles that may have lifted. Notify Engineer prior of any lifted or displace piles.
7. Leave all piled areas clear of debris and

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loose materials from piling and clean and solid to receive concrete formwork.

- .8 If approved by Engineer, splice piles in place during installation by welding. Hold members in alignment during splicing operation. Make splice by complete joint penetration groove welds to the approval of the Engineer.
- .9 Perform internal visual inspection of steel pipe, joints and base prior to placing of concrete. Ensure pipe inside is free from foreign matter.
- .10 Install concrete in accordance with Section 03300 - Cast-in-Place Concrete.
- .11 Fill steel pipe pile with concrete using methods to limit freefall and to prevent segregation. Ensure adequate vibration to completely fill cross section of pipe.
- .12 Set dowels in concrete in accordance with details as indicated. Secure until concrete is set.
- .13 Driving shoes may be installed during shop fabrication or as part of field work.

3.4 Welding

- .1 Weld in accordance with CSA W59 and CSA W59S1.
- .2 Welding certification of companies: in accordance with CSA W47.1 and CSA W47.1S1.
- .3 Welding certification of companies welding steel reinforcing bars placed in reinforced concrete: in accordance with CSA W186.

Part 1 General

1.1 SECTION INCLUDES

- .1 Formwork.
- .2 Reinforcement.
- .3 Piling

1.2 RELATED SECTIONS

- .1 Section 03 10 00 Concrete Formwork and Accessories
- .2 Section 03 20 00 Concrete Reinforcement

1.3 QUALITY ASSURANCE

- .1 Construct and erect concrete formwork in accordance with CSA A23.1, CAN/CSA-S269.3 and regulations for place of Work.
- .2 Perform concrete reinforcing work in accordance with CSA A23.1 unless specified otherwise in this section.
- .3 Perform cast-in-place concrete work in accordance with CSA A23.1/A23.2 unless specified otherwise in this section.
- .4 Conform to CSA A23.1/A23.2 in the use of admixtures.

1.4 TESTS

- .1 Provide testing of all concrete. Testing agency to be selected by the Engineer. Cost of all testing to be by Owner. Requirements to notify the Testing agency of testing requirements rests with the Contractor
- .2 Test samples in accordance with CSA A23.2.
- .3 Three (3) concrete test cylinders will be taken for every 57 cu m or less as specified by the Consultant of each class of concrete placed.
- .4 One (1) additional test cylinder will be taken during cold weather concreting, and be cured on job site under same conditions as concrete it represents.
- .5 One (1) slump test will be taken for each set of test cylinders taken.

Part 2 Products

2.1 ACCEPTABLE SUPPLIERS - READY MIX

- .1 On-site or transit mixed concrete is not acceptable.

- .2 Maximum time between charging mixer truck and complete discharge is 1 ½ hours.

2.2 WOOD FORM MATERIALS

- .1 Plywood: CSA O121, Douglas Fir or Spruce species; select sheathing grade.
- .2 Lumber: KD SPF species; #2 and Btr., grade; with grade stamp clearly visible.

2.3 FORMWORK ACCESSORIES

- .1 Form Ties: Snap-off metal type of fixed length.
- .2 Fillets for Chamfered Corners: To be wood minimum ¾" x ¾".

2.4 REINFORCEMENT

- .1 Reinforcing Steel: CAN/CSA-G30.18, billet steel, Grade 400R regular bars, unfinished or epoxy coated as required
- .2 Welded Steel Wire Reinforcement, Plain: ASTM A185, in flat sheets.
- .3 Chairs, Bolsters, Bar Supports, Spacers: Size and shaped for strength and support of reinforcing during construction conditions. Plastic only.

2.5 CONCRETE MATERIALS

- .1 Cement: CAN/CSA A3001, Normal Type 10.
- .2 Fine and Coarse Aggregates: CSA A23.1/A23.2.
- .3 Water: Clean, and free from injurious material.

2.6 ADMIXTURES

- .1 Air Entrainment: ASTM C260.
- .2 All other admixtures must be approved by the Consultant prior to use.

2.7 CONCRETE ACCESSORIES

- .1 N/A.

2.8 REINFORCEMENT FABRICATION

- .1 Fabricate concrete reinforcing in accordance with CSA A23.1/A23.2.
- .2 Contractor to supply three sets of fabrication and placing drawings of the reinforcing to the Consultant for review prior to fabrication. Allow 5 days for the review.
- .3 Locate reinforcing splices at point of minimum stress.
- .4 Weld reinforcing bars in accordance with CSA W186.

2.9 CONCRETE MIXES

- .1 Mix concrete in accordance with CSA A23.1/A23.2.
- .2 All concrete to be class C1 concrete of the following strength:
 - .1 Compressive Strength 26 MPa at seven (7) days.
 - .2 Compressive strength 35 MPa at twenty-eight (28) days.
 - .3 Add air entraining agent to concrete to entrain air as indicated in CSA A23.1/A23.2.
- .3 Use accelerating admixtures in cold weather or set-retarding admixtures during hot weather only when accepted by the Consultant. Calcium chloride may not be used.
- .4 Add air entraining agent to concrete mix for concrete work exposed to exterior.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that site conditions are ready to receive work.
- .2 Beginning of installation means acceptance of site conditions.

3.2 FORMWORK ERECTION

- .1 Construct formwork, shoring and bracing to meet design and code requirements.
- .2 Align joints and make watertight. Keep form joints to a minimum.
- .3 When using earth forms, hand trim sides and bottoms, and remove loose dirt prior to placing concrete.
- .4 Provide bracing to ensure stability of formwork. Shore or strengthen previously constructed formwork liable to be over stressed by construction loads.
- .5 Provide chamfer strips on external corners.
- .6 Apply form release agent prior to placing reinforcing steel, anchoring devices, and embedded items.
- .7 Provide formed openings where required for pipes, conduits, sleeves, and other work to be embedded in and passing through concrete members.
- .8 Place items which will be cast directly into concrete.
- .9 Coordinate work of other sections involved in forming and setting openings, slots, chases, sleeves, bolts, anchors, and other inserts.
- .10 Install waterstops continuous without displacing reinforcement. Water stops to be Heat seal joints and watertight].

- .11 Place formed construction in pattern pouring sequence and in accordance with plans. Set top screed to required elevations.

3.3 FORMWORK CLEANING

- .1 Clean forms as erection proceeds, to remove foreign matter.
- .2 During cold weather, remove ice and snow from within forms.

3.4 REINFORCING PLACEMENT

- .1 Place reinforcing supported and secured against displacement.
- .2 Before placing concrete, ensure reinforcing is clean and free of foreign coatings which would reduce bond to concrete.

3.5 PLACING CONCRETE

- .1 Place concrete in accordance with CSA A23.1/A23.2.
- .2 Maintain records of poured concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.
- .3 Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Apply bonding agent in accordance with manufacturer's recommendations.
- .4 Pour concrete continuously between predetermined construction and control joints.
- .5 Saw cut joints within 24 hours after finishing. Use 5 mm, 3/16 inch thick blade, cutting into slab 1/4 of its thickness.
- .6 In locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels and pack solidly with non-shrink grout.
- .7 Conform to CSA A23.1/A23.2 when concreting during hot weather.
- .8 Conform to CSA A23.1/A23.2 when concreting during cold weather.
- .9 Maintain concrete cover around reinforcing as per the structural drawings.
- .10 Install vapour retarder under interior slabs on grade. Lap joints minimum 6 inches and seal.
- .11 Separate slabs-on-grade from vertical surfaces with a 3/4" inch thick joint filler. Extend joint filler from bottom of slab to within 1/4 inch of finished slab surface.

3.6 FORM REMOVAL

- .1 Do not remove forms, [shores,] and bracing until concrete has gained sufficient strength to support its own weight, and construction and design loads which are liable to be imposed upon it.

- .2 Remove formwork progressively and in accordance with code requirements.
- .3 Store removed forms, for exposed architectural concrete, in manner that surfaces to be in contact with fresh concrete will not be damaged.
- .4 Restore structural members where required due to design requirements or construction conditions and as required to permit progressive construction.
- .5 Remove forms not directly supporting weight of concrete as soon as stripping operations will not damage concrete.

3.7 PATCHING

- .1 Patch imperfections as directed by Consultant.

3.8 DEFECTIVE CONCRETE

- .1 Modify or replace concrete not conforming to required lines, details and elevations.
- .2 Repair or replace concrete with excessive honeycombing and other defects.

3.9 CONCRETE FINISHING

- .1 Provide new concrete surfaces to be left exposed to match adjacent concrete finish.

3.10 CURING AND PROTECTION

- .1 Beginning immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, or mechanical injury for a minimum seven (7), days after placing

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 03 00 00 Cast in Place Concrete.
- .2 03 20 00 Concrete Reinforcing.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-O86S1-05, Supplement No. 1 to CAN/CSA-O86-01, Engineering Design in Wood.
 - .3 CSA O121-M1978(R2003), Douglas Fir Plywood.
 - .4 CSA O151-04, Canadian Softwood Plywood.
 - .5 CAN/CSA-O325.0-92(R2003), Construction Sheathing.
 - .6 CSA O437 Series-93(R2006), Standards for OSB and Waferboard.
 - .7 CSA S269.1-1975(R2003), Falsework for Construction Purposes.
 - .8 CAN/CSA-S269.3-M92(R2003), Concrete Formwork, National Standard of Canada

1.3 SUBMITTALS

- .1 Submit shop drawings for all formwork and falsework bearing the seal of a Licensed Ontario Professional Engineer to Consultant for review prior to commencing Work. Allow 5 day for review.
- .2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.
- .3 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.
- .4 Indicate sequence of erection and removal of formwork/falsework.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal: Dispose of all wastes off site.

Part 2 Products

2.1 MATERIALS

- .1 Formwork materials:

- .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121.
- .2 Form ties:
 - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
 - .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs. Repair all holes, do not leave ties project past wall face.
 - .3 Contractor shall seek approval of Consultant before drilling any holes into Bin Walls to attach formwork.
- .3 Form release agent: biodegradable..
- .4 Form stripping agent: colourless mineral oil, biodegradable, low VOC, free of kerosene.
- .5 Falsework materials: to CSA-S269.1.

Part 3 Execution

3.1 FABRICATION AND ERECTION

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .3 Align form joints and make watertight.
 - .1 Keep form joints to minimum.
- .4 Construct forms for architectural concrete, and place ties [as indicated] [and] [as directed].
 - .1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .5 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.
 - .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .6 Line forms for following surfaces:
- .7 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

- .1 Remove formwork when concrete has reached 75 % of its design strength.

- .2 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 03 10 00 Concrete Form Work.
- .2 Section 03 00 00 Cast In Place Concrete.

1.2 PRICE AND PAYMENT PROCEDURES

- .1 No measurement will be made under this Section.

1.3 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 SP-66-04, ACI Detailing Manual 2004.
 - .1 ACI 315-99, Details and Detailing of Concrete Reinforcement.
 - .2 ACI 315R-04, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
- .2 ASTM International
 - .1 ASTM A82/A82M-[07], Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - .2 ASTM A185/A185M-[07], Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .3 ASTM A775/A775M-[07b], Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .3 CSA International
 - .1 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CSA-A23.3-04, Design of Concrete Structures.
 - .3 CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA-G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .6 CSA W186-M1990(R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .4 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit three sets of reinforcing fabrication and placing drawings to the Consultant for their review. Allow 5 days to review from the Consultants received Date.

- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario Canada.
 - .1 Indicate placing of reinforcement and:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Consultant, with identifying code marks to permit correct placement without reference to structural drawings.
 - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
 - .2 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.

1.5 QUALITY ASSURANCE

- .1 Submit in accordance with Section [01 45 00 - Quality Control] and as described in PART 2 - SOURCE QUALITY CONTROL.
 - .1 Mill Test Report: Upon request of Consultant, provide Consultant with certified copy of mill test report of reinforcing steel.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and in accordance to accepted Industry practice.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground and in a dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by the Consultant.
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CSA-G30.18, unless indicated otherwise.
- .3 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.

- .4 Deformed steel wire for concrete reinforcement: to ASTM A82/A82M.
 - .1 Provide in flat sheets only.
- .5 Welded deformed steel wire fabric: to [ASTM A82/A82M].
 - .1 [Provide in flat sheets only].
- .6 Epoxy Coating of non-prestressed reinforcement: to ASTM A775/A775M.
- .7 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610 g/m².
 - .1 Protect galvanized reinforcing steel with chromate treatment to prevent reaction with Portland cement paste.
 - .2 If chromate treatment is carried out immediately after galvanizing, soak steel in aqueous solution containing minimum 0.2% by weight sodium dichromate or 0.2% chromic acid.
 - .1 Temperature of solution equal to or greater than 32 degrees and galvanized steels immersed for minimum 20 seconds.
 - .3 If galvanized steels are at ambient temperature, add sulphuric acid as bonding agent at concentration of 0.5% to 1%.
 - .1 In this case, no restriction applies to temperature of solution.
 - .4 Chromate solution sold for this purpose may replace solution described above, provided it is of equivalent effectiveness.
 - .1 Provide product description as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .8 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .9 Mechanical splices: subject to approval of Consultant.
- .10 Plain round bars: to CSA-G40.20/G40.21.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2, ACI 315 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain Consultant's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Consultant, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
- .5 Upon request, provide Consultant with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, prior to beginning reinforcing work].
- .6 Upon request inform Consultant of proposed source of material to be supplied.

Part 3 Execution

3.1 PREPARATION

- .1 Galvanizing to include chromate treatment.
 - .1 Duration of treatment to be 1 hour per 25 mm of bar diameter.
- .2 Conduct bending tests to verify galvanized bar fragility in accordance with ASTM A143/A143M.

3.2 FIELD BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Consultant.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

3.3 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.
- .2 Use plain round bars as slip dowels in concrete.
 - .1 Paint portion of dowel intended to move within hardened concrete with [one coat of asphalt paint].
 - .2 When paint is dry, apply thick even film of mineral lubricating grease.
- .3 Prior to placing concrete, Consultant's] approval of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.
- .5 Protect epoxy and paint coated portions of bars with covering during transportation and handling.

3.4 FIELD TOUCH-UP

- .1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

3.5 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 from site.

END OF SECTION