

1 - GENERAL

1.01 Related Sections

- .1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Section 03 10 00 - Concrete Forming and Accessories
- .3 Section 03 27 36 - Underwater Placed Concrete
- .4 Section 31 62 16.19 - Unfilled tubular Steel Pipe Piles

1.02 References

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
 - .2 CAN/CSA-A23.2-00, Methods of Test for Concrete.
 - .3 CAN/CSA-A3000-98-A5-98, Portland Cement.
 - .4 CAN/CSA-G30.18-M92(R1998), Billet-Steel Bars for Concrete Reinforcement.

1.03 Submittals

- .1 Shop Drawings
 - .1 Submit placing drawings prepared in accordance with plans to clearly show size, shape, location and all necessary details of reinforcing.
 - .2 Submit drawings showing formwork and falsework design to: CAN/CSA-A23.1.
 - .3 Drawings to bear stamp and signature of qualified professional engineer registered or licensed in Province of New Brunswick, Canada.

1.04 Waste Management and Disposal

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposals.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Ensure emptied containers are sealed and stored safely.
- .5 Use trigger operated spray nozzles for water hoses.
- .6 Designate cleaning area for tools to limit water use and runoff.

2 - PRODUCTS

2.01 Materials

- .1 Portland cement: to CAN/CSA-A3000-A5, Type 10.
- .2 Reinforcing bars: to CAN/CSA-G30.18, Grade 400W.
- .3 Water: to CAN/CSA-A23.1
- .4 Aggregates: to CAN/CSA-A23.1. Coarse aggregate to be normal density.
- .5 Air Entraining Admixture: to ASTM C 260.
- .6 Chemical admixtures: to ASTM C 494. Departmental Representative to approve accelerating or set retarding admixtures during cold weather placing.
- .7 Concrete Retarders: to ASTM C 494, low VOC, solvent free. Do not allow moisture of any kind to come in contact with the retarder film
- .8 Joint sealer/filler: grey, to CAN/CGSB-19.24, Type 1, Class B.
- .9 Sealer: proprietary poly-siloxane resin blend.
- .10 Other concrete materials: to CAN/CSA-A23.1.

2.02 Mixes

- .1 Proportion concrete in accordance with CAN/CSA-A23.1.
- .2 Minimum compressive strength at 35 MPa as specified by Departmental Representative.
- .3 Nominal maximum size of coarse aggregate: to CAN/CSA-A23.1.
- .4 Slump: to CAN/CSA-A23.1.
- .5 Air content: concrete to contain purposely entrained air in accordance with CAN/CSA-A23.1, Table 10.
- .6 Admixtures: to CAN/CSA-A23.1.
- .7 Do not use calcium chloride or compounds containing calcium chloride.
- .8 Weigh aggregates, cement, water and admixtures separately when batching. Inspect and test scales for accuracy as directed. Accuracy to be such that successive quantities can be measured to within one percent of desired amounts. Tests certificates to be submitted to Departmental Representative upon request.
- .9 Provide certification that plant, equipment and all materials to be used in concrete comply with the requirements of CSA A23.1-00.

- .10 Provide certification from independent testing and inspection company that mix proportions selected will produce concrete specified quality and can be effectively placed and finished for all work under this contract.

3 - EXECUTION

3.01 Preparation

- .1 Obtain Departmental Representative's approval before placing concrete. Provide 24 hours notice to placing concrete.
- .2 Pumping of concrete is permitted only after approval of equipment mixture.

3.02 Construction

- .1 Do concrete work in accordance with CAN/CSA-A23.1.
- .2 If allowable by Departmental Representative, pump concrete to following requirements.
- .1 Arrange equipment so that no vibrations result which might damage freshly placed concrete.
 - .2 Where concrete is conveyed and placed by mechanically applied pressure, provide suitable equipment.
 - .3 Operate pump so that concrete, without air pockets, is produced.
 - .4 When pumping is discontinued and concrete remaining in pipe line is to be used, void pipe line in a manner that prevents contamination of concrete or separation of ingredients.
- .3 Concrete will be deposited in all cases as neatly as practical, directly in its final position, and will not be caused to flow in a manner to permit or cause segregation.

3.03 Inserts

- .1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, waterstops, joint fillers and other inserts required to be built-in. Sleeves and openings greater than 100 mm x 100 mm not indicated, must be approved by Departmental Representative.

3.04 Finishes

- .1 Concrete deck, guard:
 - .1 Screed to plane surfaces and use wood floats.
 - .2 Provide round edges and joint spacings using standard tools.
 - .3 Trowel smooth and provide lightly brushed non-slip finish.

3.05 Control Joints

- .1 Cut control joints in slabs on grade and cope walls at locations indicated, in accordance with CAN/CSA-A23.1 and install specified joint sealer/filler.

3.06 Curing

- .1 Cure and protect concrete in accordance with CAN/CSA-A23.1.
 - .1 Do not use curing compounds where bond is required by subsequent topping or coating.

3.07 Sealing

- .1 Following curing, apply poly-siloxane resin blend sealer at 4 m²/L.

3.08 Site Tolerances

- .1 Concrete deck slab finishing tolerance in accordance with CAN/CSA-A23.1.

3.09 Field Quality Control

- .1 Concrete testing: to CAN/CSA-A23.2 by testing laboratory designated and paid for by Departmental Representative.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 03 30 00 - Cast-in-Place Concrete.

1.02 PRICE AND PAYMENT PROCEDURES

- .1 Measurement and Payment:
 - .1 No measurement will be made under this Section.

1.03 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 SP-66-04, ACI Detailing Manual 2004.
- .2 ASTM International
 - .1 ASTM A 82/A 82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - .2 ASTM A 143/A 143M-07, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
 - .3 ASTM A 185/A 185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .4 ASTM A 775/A 775M-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 CAN/CSA-A23.3-04(R2010), 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.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and SP-66.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or

licensed in Province of New Brunswick, 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, 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 CAN/CSA-A23.3, unless otherwise indicated.

1.05 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, provide Departmental Representative with certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.
 - .2 Upon request submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

1.06 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labeled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

2 PRODUCTS

2.01 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Reinforcing steel: billet steel, grade 300, deformed bars to CSA-G30.18, unless indicated otherwise.
- .3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.
- .4 Cold-drawn annealed steel wire ties: to ASTM A 82/A 82M.
- .5 Deformed steel wire for concrete reinforcement: to ASTM A 82/A 82M.

- .6 Welded steel wire fabric: to ASTM A 185/A 185M.
 - .1 Provide in flat sheets only.
- .7 Welded deformed steel wire fabric: to ASTM A 82/A 82M.
 - .1 Provide in flat sheets only.
- .8 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .9 Mechanical splices: subject to approval of Departmental Representative.
- .10 Plain round bars: to CSA-G40.20/G40.21.

2.02 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
 - .1 SP-66 unless indicated otherwise.
- .2 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
 - .1 Ship epoxy coated bars in accordance with ASTM A 775A/A 775M.

2.03 SOURCE QUALITY CONTROL

- .1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.
- .2 Upon request inform Departmental Representative of proposed source of material to be supplied.

3 EXECUTION

3.01 FIELD BENDING

- .1 Do not field bend or field weld reinforcement.

3.02 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, obtain Departmental Representative's of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.

3.03 FIELD TOUCH-UP

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

3.04 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.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 03 20 00 - Concrete Reinforcing
- .2 Section 03 37 26 - Underwater Placed Concrete
- .3 Section 31 63 19.13 - Rock Sockets for Piles
- .4 Section 31 62 16.19 - Unfilled Tubular Steel Piles

1.02 Measurement For Payment

- .1 Measurement and Payment:
 - .1 Supply and installation of Cast-in-Place Concrete, grout, anchor bolts, nuts and washers and bolt grouting for socketing of Pipe Piles will not be measured under this section, but will be included in section 31 63 19 Bored and Socketed Piles.
 - .2 Concrete and all associated work for construction of the Gangway landing will be measured for payment as a lump sum.

1.03 REFERENCES

- .1 Abbreviations and Acronyms:
 - .1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.
 - .1 Type GU, GUb and GUL - General use cement.
 - .2 Type MS and MSb - Moderate sulphate-resistant cement.
 - .3 Type MH, MHb and MHL - Moderate heat of hydration cement.
 - .4 Type HE, HEb and HEL - High early-strength cement.
 - .5 Type LH, LHb and LHL - Low heat of hydration cement.
 - .6 Type HS and HSb - High sulphate-resistant cement.
 - .2 Fly ash:
 - .1 Type F - with CaO content less than 15%.
 - .2 Type CI - with CaO content ranging from 15 to 20%.
 - .3 Type CH - with CaO greater than 20%.
 - .3 GGBFS - Ground, granulated blast-furnace slag.
- .2 Reference Standards:
 - .1 ASTM International
 - .1 ASTM C 260/C 260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C 309-07, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C 494/C 494M-10a, Standard Specification for Chemical Admixtures for Concrete.

- .4 ASTM C 1017/C 1017M-07, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
- .5 ASTM D 412-06ae2, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
- .6 ASTM D 624-00(2007), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
- .7 ASTM D 1751-04(2008), Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- .8 ASTM D 1752-04a(2008), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
 - .2 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
 - .2 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .4 CSA International
 - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A283-06, Qualification Code for Concrete Testing Laboratories.
 - .3 CSA A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide testing results and reports for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.
- .3 Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.
- .6 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements, 01 35 43 - Environmental Procedures.

1.05 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Provide Departmental Representative, minimum 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.
 - .1 Provide test data and certification by qualified independent inspection

and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.

- .3 Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by Departmental Representative on following items:
 - .1 Falsework erection.
 - .2 Hot weather concrete.
 - .3 Cold weather concrete.
 - .4 Curing.
 - .5 Finishes.
 - .6 Formwork removal.
 - .7 Joints.

1.06 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
 - .1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
 - .1 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by Departmental Representative.
 - .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

2 PRODUCTS

2.01 DESIGN CRITERIA

- .1 Alternative 1 - Performance: to CSA A23.1/A23.2.

2.02 PERFORMANCE CRITERIA

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

2.03 MATERIALS

- .1 Blended hydraulic cement: Type GUb to CSA A3001.
- .3 Portland-limestone cement: Type GUL to CSA A23.1.
- .4 Supplementary cementing materials to CSA A3001.
- .5 Water: to CSA A23.1.
- .6 Aggregates: to CSA A23.1/A23.2.
- .7 Admixtures:
 - .1 Air entraining admixture: to ASTM C 260.

- .2 Chemical admixture: to ASTM C 494/ ASTM C 1017. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .8 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.
 - .1 Compressive strength: 35 MPa at 28 days.
 - .2 Net shrinkage at 28 days: maximum 0.5 %.
- .9 Non premixed dry pack grout: composition of non metallic aggregate Portland cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 35 MPa at 28 days.
- .10 Post-Tensioning Ducts: to CSA A23.1/A23.2.
- .11 Curing compound: to CSA A23.1/A23.2 white and ASTM C 309.

2.04 MIXES

- .1 The contractor shall be responsible for the concrete mix design.
- .2 It shall be the responsibility of the contractor to ensure that the mixture proportions shall be properly batched, mixed, placed and cured such that the concrete conforms to the specification.
- .3 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Alternative 1, to give following properties:
 - .1 Cement: GUb-F/SF.
 - .2 Minimum compressive strength at 28 days: 35 MPa.
 - .3 Minimum cement content: 400 kg/m³ of concrete.
 - .4 Maximum water/cement ratio: 0.40.
 - .5 Class of exposure: C-1.
 - .6 Nominal size of coarse aggregate: 20 mm.
 - .7 Slump at time and point of discharge: 50 to 100 mm.
 - .8 Air content: 5 to 8%.

3 EXECUTION

3.01 PREPARATION

- .1 Obtain Departmental Representative's written approval before placing concrete.
 - .1 Provide 24 hours minimum notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of

re-handling, and without damage to existing structure or Work.

- .4 Pumping of concrete is permitted only after approval of equipment and mix.
- .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather .
- .7 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .8 Do not place load upon new concrete until authorized by Departmental Representative.

3.02 INSTALLATION/ APPLICATION

- .1 Do cast-in-place concrete work to CSA A23.1/A23.2.
- .2 Sleeves and inserts:
 - .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Departmental Representative.
 - .2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
 - .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Departmental Representative.
 - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Departmental Representative before placing of concrete.
 - .5 Confirm locations and sizes of sleeves and openings shown on drawings.
 - .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Anchor bolts:
 - .1 Set anchor bolts to templates in co-ordination with appropriate trade prior to placing concrete.
 - .2 Grout anchor bolts in preformed holes or holes drilled after concrete has set only after receipt of written approval from Departmental Representative.
 - .1 Formed holes: 100 mm minimum diameter.
 - .2 Drilled holes: 25 mm minimum diameter larger than bolts used or to manufacturers' recommendations.
 - .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
 - .4 Set bolts and fill holes with shrinkage compensating grout or epoxy grout.
 - .5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .4 Finishing and curing:
 - .1 Finish concrete to CSA A23.1/A23.2.
 - .2 Use procedures as reviewed by Departmental Representative or those noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.

- .3 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.
- .4 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.

3.03 SURFACE TOLERANCE

- .1 Concrete tolerance to CSA A23.1 Straightedge Method.

3.04 FIELD QUALITY CONTROL

- .1 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control.
 - .1 Concrete pours.
 - .2 Slump.
 - .3 Air content.
 - .4 Compressive strength at 7 and 28 days.
 - .5 Air and concrete temperature.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.2.
 - .1 Ensure testing laboratory is certified to CSA A283.
- .3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Departmental Representative.
- .4 Departmental Representative will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
- .5 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .6 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.
- .7 Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

3.05 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 03 30 00 - Cast-in-Place Concrete.
- .2 Section 31 63 19 - Bored and Socketed Piles
- .3 Section 31 62 16.19 - Unfilled Tubular Piles

1.02 REFERENCES

- .1 Definitions:
 - .1 Tremie concrete: concrete placed underwater through tube called tremie pipe.
 - .2 Tremie pipe: pipe has hopper at upper end and may be open ended or may have foot valve, plug or travelling plug to control flow of concrete. Pipe has diameter of 200 mm minimum, constructed from sections with flange couplings fitted with gaskets.
 - .1 Concrete is placed in hopper and sufficient head of concrete is maintained in tremie pipe to provide desired rate of flow.
 - .3 Pumped concrete method: method of placing concrete underwater uses concrete pump with discharge line used in similar manner to tremie pipe.
 - .4 Bottom-dump bucket method: method of placing concrete underwater requires use of bucket designed to discharge from bottom after it has contacted foundation or surface of previously placed concrete.
 - .5 Bagged concrete method: method of placing underwater concrete consists of diver placing bags partially filled with dry concrete mix.
- .2 Reference Standards:
 - .1 American Concrete Institute (ACI)
 - .1 ACI 304R-00, Guide for Measuring, Mixing, Transporting and Placing Concrete.
 - .2 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations (including Addendum 2007).
 - .2 LEED Canada-NC-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations 2009.
 - .3 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Commercial Interiors.
 - .4 LEED Canada-EB: O&M-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Existing Buildings: Operations and Maintenance 2009.
 - .3 CSA International
 - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

1.03 ADMINISTRATIVE REQUIREMENTS

- .1 Concrete pre-placement meeting; conduct pre-placement meeting 2 weeks minimum before tremie operation.
 - .1 Ensure meeting includes as minimum attendees as follows:
 - .1 General contractor.
 - .2 Ready-mix concrete supplier.
 - .3 Admixture supplier.
 - .4 Placing/formwork sub-contractor.
 - .5 Reinforcing sub-contractor.
 - .6 Testing agency representative.
 - .7 Structural engineer.
 - .8 Owners representative.
 - .2 Distribute minutes to attendees including copies of concrete mix designs, aggregate physical properties, placing schedule, rate of delivery, testing program, and, contingency plan for delay and breakdown.

1.04 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for concrete and include product characteristics, performance criteria, physical size, finish and limitations.

1.05 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labeled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect concrete from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

2 PRODUCTS

2.01 MATERIALS

- .1 Concrete materials: to Section 03 30 00 - Cast-in-Place Concrete.

2.02 CONCRETE MIXES

- .1 Use type 50 cement.
- .2 Minimum compressive strength at 28 days: 35 MPa.

- .3 Class of exposure: C-XL.
- .4 Maximum water cement ratio by mass: 0.45.
- .5 Nominal size of coarse aggregate: 20 mm.
- .6 Cement content for mixtures: 385 kg/m² minimum.
- .7 Slump at point and time of submergence: 100 to 125 mm.
- .8 Admixtures: as approved in writing by Departmental Representative. Use admixtures to correct deficiencies in mix or to improve placement of concrete.
 - .1 Departmental Representative may withdraw prior approval of admixture if conditions encountered during course of work indicate unsatisfactory results.
 - .2 Do not use calcium chloride or materials containing calcium chloride.
 - .3 Submit admixtures to produce self consolidating concrete to Departmental Representative for review.

3 EXECUTION

3.01 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for concrete placement installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.02 PREPARATION

- .1 Where concrete must bond to existing surfaces, clean surfaces before starting concrete placement.
 - .1 Use water jets, mechanical scrapers or other means, and when quantities of mud or rock cuttings are present, remove by air lift.

3.03 INSTALLATION

- .1 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete and Section 03 20 00 - Concrete Reinforcing and to CSA A23.1/A23.2. Testing for concrete to CSA A23.1/A23.2.
- .2 Where concrete placement extends above water surface, protect concrete from direct contact with air at temperature below 5 degrees C for 7 days.
- .3 Place concrete in one continuous operation to full depth required.
 - .1 Supply complete equipment for every phase of operation.
 - .2 Provide sufficient supply of concrete to complete pour without interruption.

- .4 Tremie method:
 - .1 Provide water-tight tremie pipe sized to allow free flow of concrete. Diameter of tremie pipe to be minimum 200 mm and minimum eight times maximum size of coarse aggregate.
 - .2 Provide hopper at top of tremie pipe and means to raise and lower tremie pipe.
 - .3 Provide plug or foot valve at bottom of tremie pipe to permit filling pipe with concrete initially.
 - .4 Provide minimum of one tremie pipe for every 30 m² of plan area and to maximum spacing of 6 m centre to centre. Do not move tremie pipes laterally through concrete.
 - .5 Start placement with tremie pipe full of concrete. Keep bottom of pipe buried minimum 900 mm in freshly placed concrete.
 - .6 If seal is lost, allowing water to enter pipe, withdraw pipe immediately. Refill pipe, and continue placing as specified.
 - .7 If tremie operation is interrupted so that horizontal construction joint has to be made, cut surface laitance by jetting, within 24 to 36 hours and remove loose material by pumping or air lifting before placing next lift.
- .5 Pumped concrete method:
 - .1 Follow procedures as for tremie method in placing concrete using discharge line from concrete pump as tremie pipe.
 - .2 Pump discharge line diameter: 125 mm minimum.
- .6 Bottom-dump bucket method:
 - .1 Fill bucket with concrete, cover top surface and lower slowly through the pipe pile.
 - .2 Discharge concrete only when bucket is in contact with surface on which concrete is to be deposited.
 - .3 Withdraw bucket until it is above concrete to maintain still water at point of discharge to approval of Departmental Representative.

3.04 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 Waste Management: in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION