PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 03 30 00 – Cast-in place concrete.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.
- .2 CAN/CSA-O86-01, Engineering Design in Wood.
- .3 CSA O121-M1978 (R2003), Douglas Fir Plywood.
- .4 CSA O151-04, Canadian Softwood Plywood.
- .5 CSA O153-M1980 (R2003), Poplar Plywood.
- .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

.2 Council of Forest Industries of British Columbia (COFI)

- .1 COFI, Exterior Plywood for Concrete Formwork.

1.3 SUBMITTALS

.1 When required by the Department's Designated Representative, submit shop drawings for formwork and falsework in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop drawings shall indicate method and construction schedule, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CAN/CSA-S269.3 for formwork drawings.

.3 Shop drawings shall indicate formwork design data: permissible temperature and rate of concrete placement in the formwork.

.4 Indicate erection and removal sequence of formwork/falsework as directed by the Department's Designated Representative.

.5 Submit drawings stamped and signed by professional engineer registered or licensed in New Brunswick, Canada.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Formwork materials:

Use wood and wood product formwork materials, complying with standard CAN/CSA-O86.1.

.2 Form ties:

Use removable or snap-off metal ties, fixed or adjustable length, without parts leaving holes larger than 25 mm diameter on concrete surface.

.3 Form release agent: non-toxic, biodegradable, low VOC.

.4 Form stripping agent: colorless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene.

.5 Falsework materials: comply with CSA-S269.1.

.6 Sealant: use appropriate sealant.

PART 3 - EXECUTION

3.1 FABRICATION AND ERECTION

.1 Verify lines, levels and centers before proceeding with formwork/falsework and double check dimensions as specified on drawings.

.2 Obtain Department's Designated Representative's approval for use of earth forms or framing openings in the formworks not indicated on drawings.

.3 Trim sides and bottom and remove loose earth from earth forms before pouring concrete.

.4 Fabricate and erect falsework in accordance with CSA S269.1 and with the Exterior Plywood for Concrete Formwork guide from COFI.

.5 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.

.6 Align form joints and make them watertight. Keep form joints to minimum.

.7 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.

.8 Form grove, slots, openings, drips edges, recesses, expansion and control joints complying with specifications.

.9 Build in anchors, sleeves, and other inserts required to accommodate work specified in other sections. Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.10 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

.1 Leave formwork in place for the following minimum periods of time after placing concrete.

.1 1 day for slabs poured on ground.
.2 7 days for elements poured following any other method.

.2 Remove formwork when concrete has reached 75% of its design strength or minimum period noted above, whichever comes first, and replace immediately with adequate falsework for a period of 28 days from the date of casting.

.3 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

.4 The Contractor shall remove all plastic cones from the ties and fill the holes with mortar cement in gray bags as requested by the Department's Designated Representative.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS .1 Section 03 20 00 – Cast-in-place concrete.

1.2 REFERENCES .1 American Concrete Institute (ACI)

.1 ACI 315R-04, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
.2 American National Standards Institute/American Concrete Institue (ANSI/ACI)
.3 ACI 315-99, Details and Detailing of Concrete Reinforcement.

.2 CSA International

.1 CSA-A23.1-09, Concrete Materials and Methods of Concrete Construction.
.2 CSA-A23.3-04, Design of Concrete Structures.
.3 CSA-G30.3-M1983(R1998), Cold drawn steel wire for concrete reinforcement.
.4 CSA-G30.14-M1983(R1998), Deformed steel wire for concrete reinforcement.
.5 CSA-G30.18-M98, Billet-Steel Bars for Concrete Reinforcement.
.6 CSA-G40.21-F08, Structural Quality Steel.
.7 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
.8 CSA W186-M1990(R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.

1.3 SUBMITTALS .1 Submit required shop drawings, including the location of reinforcement, in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate on shop drawings the list of required reinforcement, the quantities of reinforcement, bar bending details, size, spacing, locations of reinforcement and mechanical splices if approved by the Department's Designated Representative. Reinforcing bars shall be identified with marks to allow easy and correct placement without refering to structural drawings. Shop drawings shall also indicate size, spacing and locations of chairs, spacers and hangers. The reinforcement drawings shall be executed in accordance with the Manual of Recommended Standards published by the Institute of Reinforcing Steel in Canada or with

the ANSI / ACI 315 standard and manual No. 315 entitled Manual of Engineering and Placing drawings for Reinforced Concrete Structures published by ACI.

.3 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 All substitution of reinforcing bars with bars of different size must be authorized in writing by the Department's Designated Representative.

.2 Reinforcing steel: steel billet, grade 400W, deformed bars to CSA-G30.18, unless indicated otherwise. Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 600 g/m².

.3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.3.

.4 Chairs, bolsters, bar supports, spacers: to CSA-A23.1.

.5 Mechanical splices: subject to approval of the Department's Designated Representative.

2.2 FABRICATION

.1 Unless indicated otherwise, fabricate reinforcing steel in accordance with CSA-A23.1 and ACI 315R, with the Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada and with manual No 315R entitled Manual of Engineering and Placing Drawings for Reinforced Concrete Structures published by ACI.

.2 Obtain Department's Designated Representative's written approval for locations of reinforcement splices other than those shown on drawings.

.3 The shipped bundles of reinforcing bars must be clearly identified according to an identification code, in compliance with the list of required bars and their bending details.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide the Department's Designated Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 2 weeks prior to beginning reinforcing work.

.2 Inform the Department's Designated Representative of proposed source of material to be supplied.

PART 3 - EXECUTION

3.1FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by the Department's Designated Representative.

.2 When field bending is authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.3 REINFORCEMENT PLACING

.1 Place reinforcing steel as indicated on drawings and in accordance with CSA-A23.1.

.2 Prior to pour concrete, obtain Department's Designated Representative's approval for reinforcing material and placement.

.3 Ensure constant reinforcement cover during concrete pours.

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 03 10 00 – Concrete forming and accessories

.2 Section 03 20 00 – Concrete reinforcing

1.2 REFERENCES

.1 ASTM International

- .1 ASTM C 109/C109M-99, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50 mm Cube Specimens)
- .2 ASTM C 260-00, Standard Specification for Air-Entraining Admixtures for Concrete.
- .3 ASTM C 309-98, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- .4 ASTM C 494-99, standard Specification for Chemical Admixtures for Concrete.
- .5 ASTM C 827-95a, Test Method for change in Height at Early Ages of cylindrical Specimens from Cementitious Mixtures.
- .6 ASTM C 939-94a, Test Method for Flow of Grout for Preplaced-Aggregate Concrete.

.2 CSA International

- .1 CSA-,A-3001, Portland cement
- .2 CSA A23.1-2004, Concrete Materials and Methods of Concrete Construction/
- .3 CSA A23.2-2004, Methods of Test and Standard Practices for Concrete.
- .4 CSA A23.5-M86 (R1998), Supplementary Cementing Materials.
- .5 CSA A363-M88, Cementitious Hydraulic Slag.

1.3 SAMPLES

.1 Submit samples required in accordance to Section 01 33 00 – Submittal Procedures.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 At least 4 weeks prior to beginning Work, provide test data and certification by qualified independent inspection and testing laboratory certifying that material tested below comply with specified requirements:

.1 Portland cement.
.2 Supplementary cementing materials.
.3 Grout.
.4 Admixtures.
.5 Aggregates.
.6 Water.
.7 Sealant.

.3 Two weeks prior to beginning Work, supply the chosen concrete mix, which will produce concrete with the specified quality, resistance and performance and in compliance with the requirements of CSA-A23.1 standard.

.4 Supply a certificate attesting that the mixing plant and the material used for the manufacture of concrete meet the requirements of CSA-A23.1 standard.

1.5 QUALITY ASSURANCE

.1 Minimum 3 weeks prior to starting concrete work, provide proposed quality control procedures, in compliance with Section 01 45 00 – Quality Control, for review by the Department's Designated Representative on following items:

.1 Falsework erection.
.2 Hot weather concrete.
.3 Cold weather concrete.
.4 Curing.
.5 Finishes.
.6 Formwork removal.
.7 Joints.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Cement: to CSA A3001, Type 1.

.2 Supplementary cementing materials: to CSA A23.5.

.3 Cementitious Hydraulic Slag: to CSA-A363.

.4 Water: to CSA A23.1.

.5 Aggregates: to CSA A23.1. Coarse aggregates shall be of average density.

.6 Air entraining admixture: to ASTM C 260.

.7 Chemical admixture: to ASTM C 494. Department's Designated Representative is to approve accelerating or set retarding admixtures during cold and hot weather placing.

.8 Corrosion-inhibiting admixture: to ASTM C 494, water-based, low VOC content. The retarder film shall at no time be exposed to moisture.

.9 Shrinkage compensating grout: premixed compound with non-metallic aggregate, Portland cement, water reducing and plasticizing agents.

.1 Compressive strength: 40MPa at 28 days.

.10 Curing compound: to CSA A23.1 and ASTM C 309.

2.2 MIXES

.1 The 35 MPa concrete shall be prepared according to standard CAN/CSA-A23.1 and from a mixture having the following characteristics for:

.1 Cement Type 50:

.1 Ternary cement of type GUb-F/SF (fly ash and silica fume) shall not exceed 30% of the total mass of the binder.

.2 Minimum compression resistance after 28 days: 35 MPa.
.3 Exposition class: C1.
.4 Nominal size of coarse aggregates: 5-28mm.
.5 Slump at time and at point of discharge: 80 ± 30 mm.
.6 Air content: 5 to 8%
.7 Chemical admixtures: increasing water-reducing resistance, retarders, accelerators, resistance enhancers, air-entrainment, super plasticizers, in accordance with ASTM C 494 standard. (It is prohibited to use calcium chloride or material containing it.)
.8 Maximum water/cement ratio: 0.40.
.9 Minimum quantity of cement: 350 kg/m^3.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Obtain Department's Designated Representative's written approval before placing concrete. Provide 24 hours minimum notice prior to placing of concrete.

.2 Pumping of concrete will not be permitted after approval of equipment and mix.

.3 Ensure reinforcement and inserts are not disturbed during concrete placement.

.4 Prior to placing of concrete obtain Department's Designated Representative's approval of proposed method for protection of concrete during placing and curing.

.5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.6 Do not place load upon new concrete until authorized by the Department's Designated Representative.

3.2 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 the Department's Designated Representative.

.2 Where approved by the Department's Designated Representative set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.

.3 Confirm locations and sizes of sleeves and openings shown on drawings.

.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 Department's Designated Representative.

.3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.

.4 Drainage holes and weep holes:

.1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.

.5 Finishing

.1 Finish concrete surfaces to CSA A23.1.

.6 Joint filler:

.1 Provide filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by the Department's Designated Representative .When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.2 Locate and form construction joints as indicated. Install joint filler.

.7 Take all necessary measures to avoid concrete losses in marine environments.

3.3 FIELD QUALITY CONTROL

.1 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by the Department's Designated Representative for review in compliance with CSA A23.1 and Section 01 45 00 – Quality Control.

.2 The Department's Designated Representative will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.

.3 The Department's Designated Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they are extracted from.

.4 Non-Destructive Methods for Testing Concrete: to CSA A23.2.

.5 Inspection or testing executed by the Department's Designated Representative cannot replace nor complete the quality control performed by the Contractor, nor relieve the Contractor from his contractual responsibility.