

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 03 20 00 - Concrete Reinforcing
- .2 Section 03 30 00 - Cast-in-Place Concrete
- .3 Section 22 13 18 – Drainage Waste and Vent Piping – Plastic
- .4 Section 01 74 11 - Cleaning

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1-09/A23.2-09, 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 S269.1-1975 (R2003), Falsework for Construction Purposes.
  - .7 CAN/CSA-S269.3-M92(R2003), Concrete Formwork, National Standard of Canada
- .2 Underwriters' Laboratories of Canada (ULC).

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 – Shop Drawings, Product Data, and Samples.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for recycling in accordance with 017411 Cleaning.
  - .2 Place materials defined as hazardous or toxic in designated containers.
  - .3 Divert wood materials from landfill to a recycling facility as approved by Departmental Representative.
  - .4 Divert plastic materials from landfill to a recycling facility as approved by Departmental Representative.
  - .5 Divert unused form release material from landfill to an official hazardous material collections site as approved by the Departmental Representative.

**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 and CAN/CSA-O86.
  - .2 For concrete exposed to view use smooth, square edged plywood panels to clause 6.5 CSA-A23.1.
  - .3 Use sealed formwork to eliminate contamination of river with fresh concrete.
- .2 Form ties:
  - .1 Use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
- .3 Form liner:
  - .1 Plywood: medium density overlay, Douglas Fir to CSA O121, sanded grade, square edge, 17 mm thick.
- .4 Form release agent: non-toxic, biodegradable, low VOC.
- .5 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene.
- .6 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 Obtain Departmental Representative's approval for use of earth forms and framing openings not indicated on drawings.
  - .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
  - .4 Fabricate and erect falsework in accordance with CSA S269.1 and WorkSafe BC regulations.
  - .5 Do not place shores and mud sills on frozen ground.
  - .6 Provide site drainage to prevent washout of soil supporting mud sills and shores.
  - .7 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.
  - .8 Align form joints and make watertight.
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- .1 Keep form joints to minimum..
- .9 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .10 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.
- .11 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

**3.2 REMOVAL AND RESHORING**

- .1 Leave formwork in place for following periods of time after placing concrete.
  - .1 As directed by shoring engineer retained by the contractor, but minimum 3 days.
- .2 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 03 10 00 – Concrete Forming and Accessories.
- .2 Section 03 30 00 – Cast-in-Place Concrete Short Form.
- .3 Section 01 74 11- Cleaning

**1.2 REFERENCES**

- .1 ASTM International
- .1 ASTM A496/A496M-07, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
- .2 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 CAN/CSA-A23.3-09, Precast Concrete – Materials and Construction
  - .4 CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
  - .5 CSA-G40.20/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .6 CSA W186-M1990 (R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .3 Reinforcing Steel Institute of Canada (RSIC)
  - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

**1.3 QUALITY ASSURANCE**

- .1 Submit in accordance with 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

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 10 - Product Requirements and with manufacturer's written instructions.
  - .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:
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- .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.
- .4 Develop Waste Reduction Workplan related to Work of this Section.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Materials and products in accordance with Division 1 - Sustainability.
- .2 Do verification requirements in accordance with Division 1 - Sustainability.

**Part 3 Execution**

**3.1 FIELD BENDING**

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

**3.2 PLACING REINFORCEMENT**

- .1 Place reinforcing steel as indicated on placing drawings in accordance with CSA-A23.1/A23.2.
- .2 Reinforcing to be free of grease, scale and other coatings, unless noted otherwise on structural drawings.
- .3 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.

**3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 017411 -Cleaning.

**END OF SECTION**

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**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 03 10 00 – Concrete Forming and Accessories
- .2 Section 03 20 00 – Concrete Reinforcing
- .3 Section 01 74 11 - Cleaning

**1.2 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-19.24-M90, Multicomponent, Chemical-Curing Sealing Compound.
- .2 CSA International
  - .1 CSA-A23.1/A23.2-2009, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 – Shop Drawings, Product Data, and Samples.
- .2 At least 4 weeks prior to beginning Work, inform Departmental Representative of source of fly ash.
  - .1 Do not change source of fly ash without written approval of Departmental Representative.
- .3 Provide testing reports for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.

**1.4 QUALITY ASSURANCE**

- .1 Provide to Departmental Representative, 4 weeks minimum prior to starting concrete work, valid and recognized certificate from plant delivering concrete.
  - .1 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements.

**1.5 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 the Departmental Representative.
- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.
- .3 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials in accordance with Section 017411 Cleaning.

**Part 2 Products**

**2.1 DESIGN CRITERIA**

- .1 Alternative 1 – Performance: to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS

**2.2 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.

**2.3 MATERIALS**

- .1 Cement: to CSA A3001, Type GU.
- .2 Supplementary cementing materials: with minimum 15% fly ash replacement, by mass of total cementitious materials to CSA A3001.
- .3 Water: To clause 4.2.2 and to table 9 limits for chlorides and alkalis CSA A23.1/A23.2.
- .4 Aggregate: normal density fine and coarse aggregate to clause 4.2.3 including clause 4.2.3.5 on deleterious reactions.
- .5 Other concrete materials: to CSA A23.1/A23.2.

**2.4 MIXES**

- .1 Alternative 1 - Performance Method for specifying concrete: to meet Departmental Representative performance criteria to CSA A23.1/A23.2.
  - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 - VERIFICATION.
  - .2 Provide concrete mix to meet following hard state requirements:
    - Footings:
      - .1 Durability and class of exposure: F-2.
      - .2 Supplementary cementing materials: as per CAN/CSA A3001.
      - .3 Entrainment air of 5-8%.
      - .4 Maximum water / cement ratio of 0.55.
      - .5 Compressive strength at 28days: 25MPa minimum.
      - .6 Intended application: footings.
      - .7 Aggregate size 20 mm maximum.

- .8 Curing type 1- curing for 3 days  $\geq 10^{\circ}\text{C}$  as per table 20 of CSA A23.1

Exterior slab-on-grade:

- .1 Durability and class of exposure: C-1.
  - .2 Supplementary cementing materials: as per CAN/CSA A3001.
  - .3 Entrainment air of 4-7%.
  - .4 Maximum water / cement ratio of 0.4.
  - .5 Compressive strength at 28days: 35MPa minimum.
  - .6 Intended application: footings.
  - .7 Aggregate size 20 mm maximum.
  - .8 Curing type 2 - curing for 7 days  $\geq 10^{\circ}\text{C}$  as per table 20 of CSA A23.1
- .3 Concrete supplier's certification.
  - .4 Provide quality management plan to ensure verification of concrete quality to specified performance.

**Part 3 Execution**

**3.1 PREPARATION**

- .1 Provide Departmental Representative 24 hours' notice before each concrete pour.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 During concreting operations:
  - .1 Development of cold joints not allowed.
- .4 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.

**3.2 INSTALLATION / APPLICATION**

- .1 Do cast-in-place concrete work in accordance with CSA A23.1/A23.2.
- .2 Protect concrete: for hot weather conditions when air temperature is  $27^{\circ}\text{C}$  or higher as per clause 7.4.2.4. Protect concrete for cold weather conditions when air temperature is  $5^{\circ}\text{C}$  or lower (or likely to fall below  $5^{\circ}\text{C}$  within 24 hours of placing) as per clause 7.4.2.5.
- .3 Provide minimum concrete cover: over principal reinforcing steel unless noted otherwise on the structural drawings: 75mm for elements cast against earth, 40mm for formed elements.
- .4 Horizontal wall reinforcing shall be continuous around corners and hooked at wall. Lap lengths are as follows:

<u>bar size</u>	<u>vertical lap</u>	<u>horizontal lap</u>
15M	600mm [24"]	800mm [32"]
20M	750mm [30"]	1000mm[40"]

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

**3.3 FINISHES**

- .1 Formed surfaces exposed to view: smooth-form finish in accordance with CSA A23.1/A23.2.
- .2 Pavements, walks, curbs and exposed site concrete:
  - .1 Screed to plane surfaces and use aluminum floats.
  - .2 Provide round edges and joint spacing using standard tools.
  - .3 Trowel smooth to provide lightly brushed non-slip finish.

**3.4 FIELD QUALITY CONTROL**

- .1 Concrete testing: to CSA A23.1/A23.2 by testing laboratory designated and paid for by Departmental Representative. Compression tests (sample taken at each pour) are required.
- .2 Notify Departmental Representative for field review of reinforcing before pour.

**3.5 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Use trigger operated spray nozzles for water hoses.
- .3 Designate cleaning area for tools to limit water use and runoff.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 11 - Cleaning.
  - .1 Divert unused concrete materials from landfill to local facility after receipt of written approval from Departmental Representative.
  - .2 Provide appropriate area on job site where concrete trucks and be safely washed.
  - .3 Divert admixtures and additive materials from landfill to approved official hazardous material collections site after receipt of written approval from Departmental Representative.
  - .4 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

**END OF SECTION**

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