

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA-O86S1, Supplement No. 1 to CAN/CSA-O86-2014, Engineering Design in Wood.
  - .3 CSA O121, Douglas Fir Plywood.
  - .4 CSA O151, Canadian Softwood Plywood.
  - .5 CSA O153, Poplar Plywood.
  - .6 CAN/CSA-O325.0, Construction Sheathing.
  - .7 CSA O437 Series, Standards for OSB and Waferboard.
  - .8 CSA S269.1, Falsework for Construction Purposes.
  - .9 CAN/CSA-S269.3, Concrete Formwork, National Standard of Canada
- .2 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S701, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 43 - Environmental Procedures and Section 01 35 29.06 - Health and Safety Requirements.
- .3 Co-ordinate submittal requirements and provide submittals required.
- .4 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.
- .5 The design and inspection of the formwork and falsework is the responsibility of the Contractor.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Store and manage hazardous materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Waste Management and Disposal: in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Formwork materials:
  - .1 Wood and wood product formwork materials to CSA-O121 and CAN/CSA-S269.3.
- .2 Form ties:
  - .1 Use snap ties complete with plastic cones and light grey concrete plugs.
- .3 Form release agent: non-toxic, biodegradable, low VOC.
- .4 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 falsework in accordance with CSA S269.1.
- .3 Do not place shores and mud sills on frozen ground.
- .4 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.
- .5 Align form joints and make watertight.
  - .1 Keep form joints to minimum.
- .6 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .7 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.
- .8 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.
- .9 Obtain Departmental Representative's approval before framing openings not indicated.

**3.2 REMOVAL AND RESHORING**

- .1 Remove formwork when concrete has reached 70% of its design strength or minimum 3 days, whichever comes later, and replace immediately with adequate re-shoring.
- .2 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

**3.3 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American Concrete Institute (ACI)
  - .1 SP-66, ACI Detailing Manual.
- .2 ASTM International
  - .1 ASTM A82/A82M, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
  - .2 ASTM A143/A143M, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
  - .3 ASTM A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
  - .4 ASTM A775/A775M, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .3 CSA International
  - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2 CAN/CSA-A23.3, Design of Concrete Structures.
  - .3 CSA-G30.18, Carbon Steel Bars for Concrete Reinforcement.
  - .4 CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .5 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .6 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .4 Reinforcing Steel Institute of Canada (RSIC)
  - .1 RSIC, Reinforcing Steel Manual of Standard Practice.

**1.2 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 SP-66.
- .3 Shop Drawings:
  - .1 Submit drawings.
    - .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 Departmental Representative, with

identifying code marks to permit correct placement without reference to structural drawings.

- .2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.
  - .1 Provide type B unless otherwise indicated.

### **1.3 QUALITY ASSURANCE**

- .1 Submit in accordance with 01 45 00 - Quality Control
  - .1 Mill Test Report: upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, minimum 2 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 a manner to prevent damage and contamination.
- .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 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 Departmental Representative.
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CSA-G30.18, unless indicated otherwise.
- .3 Cold-drawn annealed steel wire ties: to CSA-G30.3.
- .4 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .5 Mechanical splices: subject to approval of Departmental Representative.
- .6 Plain round bars: to CSA-G40.20/G40.21.

### **2.2 FABRICATION**

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .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.

### **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 reviewed placing drawings in accordance with CSA-A23.1/A23.2.
- .2 Use plain round bars as slip dowels in concrete.
- .3 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement. Provide a minimum of 72 hours' notice prior to placing of concrete.
- .4 Ensure cover to reinforcement is maintained during concrete pour.
- .5 Do not use bury bars unless authorized in writing by Departmental Representative.
- .6 Protect projecting dowels from damage and cold bending.

#### **3.3 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Reference Standards:
  - .1 ASTM International
    - .1 ASTM C260/C260M, Standard Specification for Air-Entraining Admixtures for Concrete.
    - .2 ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
    - .3 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete.
    - .4 ASTM C1017/C1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
    - .5 ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
    - .6 ASTM D624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
  - .2 CSA International
    - .1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
    - .2 CSA A283, Qualification Code for Concrete Testing Laboratories.
    - .3 CSA A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide testing and inspection 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 pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in Section 3.3 - FIELD QUALITY CONTROL.
- .4 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.
- .5 Submit proposed mix design stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada to Departmental Representative for review 2 weeks prior to placing concrete.

**1.3 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with 01 45 00 - Quality Control

- .2 Provide Departmental Representative, minimum 2 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 2 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.
- .4 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

#### **1.4 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:
  - .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.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Portland Cement: to CSA A3001
- .2 Water: to CSA A23.1.
- .3 Aggregates: to CSA A23.1/A23.2.
- .4 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: 40 MPa at 28 days.
  - .2 Net shrinkage at 28 days: maximum 0.2%.

## 2.2 MIXES

- .1 Proportion normal density concrete in accordance with CAN/CSA A23.1 unless noted otherwise.
- .2 Mix designs for the performance and properties as per following table:

Component	Exposure Class	Cement type	Comp. Strength MPa/days	Air Content %	Nominal Max Aggregate Size mm	Water / Cement Ratio, max	Flyash %
Exterior concrete pad	F-1	HS	30/28	5-8	20	0.45	<25
Interior concrete pad	N	Gu	25/28	1-3	20	0.45	

## Part 3 Execution

### 3.1 PREPARATION

- .1 Obtain Departmental Representative's written approval before placing concrete.
  - .1 Provide 72 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.
- .7 Protect previous Work from staining.
- .8 Clean and remove stains prior to application for concrete finishes.
- .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .10 Do not place load upon new concrete until authorized by Departmental 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 concrete, 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 300 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.
- .3 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.
- .4 Finishing and curing:
  - .1 Finish concrete to CSA A23.1/A23.2.
  - .2 Use procedures as reviewed by Departmental Representative to remove excess bleed water. Ensure surface is not damaged.
  - .3 Use curing compounds compatible with applied finish on concrete surfaces.
  - .4 Formed surfaces exposed to view: sack rubbed finish to CAN/CSA A23.1.
  - .5 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.
  - .6 Roughen top of equipment bases to provide bond for grout.

### **3.3 FIELD QUALITY CONTROL**

- .1 Site tests: conduct tests as follows in accordance with 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .1 Concrete pours.
  - .2 Slump.
  - .3 Air content.
  - .4 Compressive strength at 7, 28 and 56 days minimum.
  - .5 Air and concrete temperature.
- .2 Take concrete samples for testing in accordance with CSA A23.2. One (1) strength test shall consist of test cylinders for each 50 m<sup>3</sup> of concrete, or portions of each mix type of concrete or each separate type of structural element in any one (1)-day's pour. For concrete with specified twenty-eight (28) day strength, strength test shall consist of minimum three (3) test cylinders. Test first cylinder at seven (7) days and remaining two (2) at twenty-eight (28) days.
- .3 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Contractor for review to CSA A23.1/A23.2.
- .4 Ensure testing laboratory is certified to CSA A283.
- .5 Pay for costs of tests as specified in 01 45 00 - Quality Control

- .6 Take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .7 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

### **3.4 CLEANING**

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

**END OF SECTION**