

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 03 30 00 Cast-In-Place Concrete
- .2 03 20 00 Concrete Reinforcing

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-O86-14, Engineering Design in Wood.
 - .3 CSA O121-08(R2013), Douglas Fir Plywood.
 - .4 CSA O151-09(R2014), Canadian Softwood Plywood.
 - .5 CSA O153-13, Poplar Plywood.
 - .6 CAN/CSA-O325-07(R2012), Construction Sheathing.
 - .7 CSA O437 Series-93(R2006), Standards for OSB and Waferboard.
 - .8 CSA S269.1-1975(R2003), Falsework for Construction Purposes.
 - .9 CAN/CSA-S269.3-M92(R2003), Concrete Formwork, National Standard of Canada

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate sequence of erection and removal of formwork/falsework as directed by Contract Administrator.

Part 2 Products

2.1 MATERIALS

- .1 Formwork materials:
 - .1 For concrete without special architectural features, use wood and wood product formwork materials to CAN/CSA-O86.
- .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.
- .3 Form liner:
 - .1 Plywood: Canadian Softwood Plywood to CSA O151, No. 2 grade, 19 mm thick.
- .4 Form release agent: non-toxic, biodegradable.
- .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 falsework in accordance with CSA S269.1.
- .3 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.
- .4 Align form joints and make watertight.
 - .1 Keep form joints to minimum.
- .5 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .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 Line forms for following surfaces:
 - .1 Secure lining taut to formwork to prevent folds.
 - .2 Pull down lining over edges of formwork panels.
 - .3 Ensure lining is new and not reused material.
 - .4 Ensure lining is dry and free of oil when concrete is poured.
 - .5 Application of form release agents on formwork surface is prohibited where drainage lining is used.
 - .6 If concrete surfaces require cleaning after form removal, use only pressurized water stream so as not to alter concrete's smooth finish.
- .9 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 minimum periods of time after placing concrete.
 - .1 7 days for equipment housekeeping pads.
- .2 Remove formwork when concrete has reached 70% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.
- .3 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.
- .4 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 03 30 00 Cast-In-Place Concrete

1.2 PRICE AND PAYMENT PROCEDURES

- .1 Measurement and Payment:
 - .1 No measurement will be made under this Section.
 - .1 Include reinforcement costs in items of concrete Work in Section 03 30 00 - Cast-In-Place Concrete.

1.3 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 SP-66-04, ACI Detailing Manual 2004.
- .2 ASTM International
 - .1 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - .2 ASTM A143/A143M-07, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
 - .3 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .4 ASTM A775/A775M-07b, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .3 CSA International
 - .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA-A23.3-14, Design of Concrete Structures.
 - .3 CSA-G30.18-09 (R2014), Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .4 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.4 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 stamped and signed by professional engineer registered or licensed in Province of Manitoba, 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 Contract Administrator, 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.

1.5 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, provide Contract Administrator 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 Contract Administrator proposed source of reinforcement material to be supplied.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance 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:
- .1 Store materials indoors, in 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 Contract Administrator.
- .2 Reinforcing steel: billet steel, grade 400, 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 A82/A82M.
- .5 Deformed steel wire for concrete reinforcement: to ASTM A82/A82M.
- .6 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

2.2 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.
 - .2 Obtain Contract Administrator written approval for locations of reinforcement splices other than those shown on placing drawings.
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- .3 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Contract Administrator 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 Contract Administrator of proposed source of material to be supplied.

Part 3 Execution

3.1 FIELD BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Contract Administrator.
- .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 Prior to placing concrete, obtain Contract Administrator approval of reinforcing material and placement.
- .3 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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 03 10 00 Concrete Forming and Accessories
- .2 03 20 00 Concrete Reinforcing

1.2 PRICE AND PAYMENT PROCEDURES

- .1 Measurement and Payment:
 - .1 Cast-in-place concrete will not be measured but will be paid for as a fixed price item.
 - .2 Supply and installation of anchor bolts, nuts and washers and bolt grouting will not be measured but considered incidental to Work.

1.3 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 C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M-10a, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM C1017/C1017M-13e1, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .2 CSA International
 - .1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A283-06 (R2016), Qualification Code for Concrete Testing Laboratories.
 - .3 CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide testing results for review by Contract Administrator 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 PART 3 - FIELD QUALITY CONTROL.
- .4 Concrete hauling time: provide for review by Contract Administrator deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to Site of Work and discharged after batching.

1.5 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Provide Contract Administrator, 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 Quality Control Plan: provide written report to Contract Administrator verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.6 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 Contract Administrator and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by Contract Administrator.
 - .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

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 Contract Administrator and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

2.3 MATERIALS

- .1 Portland Cement: to CSA A3001, Type GU.
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- .2 [Blended] hydraulic cement: Type GUB to CSA A3001.
- .3 Supplementary cementing materials: with minimum 20% Type F fly ash replacement, by mass of total cementitious materials to CSA A3001.
- .4 Water: to CSA A23.1.
- .5 Aggregates: to CSA A23.1/A23.2.
- .6 Admixtures:
 - .1 Air entraining admixture: to ASTM C260.
 - .2 Chemical admixture: to ASTM C494 and ASTM C1017. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .7 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 %.

2.4 MIXES

- .1 Alternative 1 - Performance Method for specifying concrete: to meet Contract Administrator performance criteria to CSA A23.1/A23.2.
 - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.
 - .2 Provide concrete mix to meet following hard state requirements:
 - .1 As specified on drawings.
 - .3 Provide quality management plan to ensure verification of concrete quality to specified performance.
 - .4 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

Part 3 Execution

3.1 PREPARATION

- .1 Obtain Contract Administrator 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 Protect previous Work from staining.
- .7 Clean and remove stains prior to application for concrete finishes.

- .8 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .9 In locations where new concrete is dowelled to existing Work, drill holes in existing concrete.
 - .1 Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout as indicated on drawings to anchor and hold dowels in positions as indicated.
- .10 Do not place load upon new concrete until authorized by Contract Administrator.

3.2 INSTALLATION/APPLICATION

- .1 Do cast-in-place concrete Work to CSA A23.1/A23.2.
- .2 Sleeves and inserts:
 - .1 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Contract Administrator.
 - .2 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 Contract Administrator.
 - .3 Protect anchor bolt holes from water accumulations.
 - .4 Set bolts and fill holes with epoxy grout as indicated on drawing.
- .4 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.
- .5 Finishing and curing:
 - .1 Finish concrete to CSA A23.1/A23.2.
 - .2 Use procedures as noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
 - .3 Finish concrete floor to CSA A23.1/A23.2. Class A.
 - .4 Provide swirl-trowelled finish unless otherwise indicated.

3.3 FIELD QUALITY CONTROL

- .1 Site tests: conduct tests as follows in accordance with Section [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 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 Contract Administrator for review to CSA A23.1/A23.2.
 - .1 Ensure testing laboratory is certified to CSA A283.

- .3 Contract Administrator will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
- .4 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.
- .5 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

3.4 CLEANING

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

END OF SECTION