

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 30 00 – Administrative Requirements.
- .2 Section 03 20 00 – Concrete Reinforcing.
- .3 Section 03 30 00 – Cast-In-Place Concrete.

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 S269.1-1975(R2003), Falsework for Construction Purposes.
 - .4 CAN/CSA-S269.3-M92(R2003), Concrete Formwork, National Standard of Canada
- .2 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .3 NB Power
 - .1 Standard Construction Practices – General, Section 2U (2012)

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 30 00 – Administrative Requirements.
- .2 Submit shop drawings for formwork and falsework.
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of New Brunswick, Canada, in accordance with the New Brunswick Occupational Health and Safety Act.
- .3 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 30 00 – Administrative Requirements.
- .4 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.
- .5 Indicate sequence of erection and removal of formwork/falsework.

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 and CSA-A23.1/A23.2.
 - .2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.
- .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.
 - .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.
- .3 Form release agent: non-toxic, biodegradable, chemically active release agent containing compounds that react with free lime in concrete resulting in water insoluble soaps.
- .4 Falsework materials: to CSA-S269.1.
- .5 Sealant: to Section 07 92 00 - Joint Sealants.

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 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .3 Fabricate and erect falsework in accordance with CSA S269.1.
- .4 Refer to architectural drawings for concrete members requiring architectural exposed finishes.
- .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 For concrete encased electrical conduits, fabricate and erect formwork in accordance with NB Power Standard Construction Practices, Section 2U.

- .9 Align form joints and make watertight.
 - .1 Keep form joints to minimum.
- .10 Use 19 mm chamfer strips on external corners where indicated on drawings.
- .11 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .12 Construct forms for architectural concrete, and place ties and/or as directed.
 - .1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .13 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.
- .14 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 1 day for footings.
 - .2 2 days for walls and piers.
 - .3 Under no circumstances will removal of formwork be accepted until criteria at item 2 is satisfied.
- .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 SECTIONS

- .1 Section 01 30 00 – Administrative Requirements.
- .2 Section 03 10 00 – Concrete Forming and Accessories.
- .3 Section 03 30 00 – Cast-In-Place Concrete.
- .4 Section 03 35 00 – Concrete Finishing.

1.2 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 SP-66-04, ACI Detailing Manual 2004.
 - .1 ACI 315-99, Details and Detailing of Concrete Reinforcement.
 - .2 ACI 315R-04, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A143/A143M-03, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
 - .2 ASTM A185/A185M-05a, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .3 ASTM A497/A497M-05a, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
 - .4 ASTM A775/A775M-04a, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .3 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-A23.3-04, Design of Concrete Structures.
 - .3 CAN/CSA-G30.18-M92(R2002), Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada.
- .4 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 30 00 – Administrative Requirements.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315.

- .3 Submit drawings, stamped and signed by professional engineer licensed in Province of New Brunswick, Canada.
- .4 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315.
- .5 Submit shop drawings including placing of reinforcement and indicate:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings and locations of reinforcement with identifying code marks to permit correct placement without reference to structural drawings.
 - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
- .6 Detail lap lengths and bar development lengths to CSA-A23.3, but not less than:
 - .1 400 mm for 10M.
 - .2 600 mm for 15M.
 - .3 700 mm for 20M.
 - .4 1100 mm for 25M.
- .7 Quality Assurance: as described in PART 2 – SOURCE QUALITY CONTROL.
 - .1 Upon request, submit in writing to Engineer proposed source of reinforcement material to be supplied.

Part 2 Products

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Engineer.
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.
- .3 Cold-drawn annealed steel wire ties: to ASTM A497/A497M.
- .4 Deformed steel wire for concrete reinforcement: to ASTM A497/A497M.
- .5 Welded steel wire fabric: to ASTM A185/A185M.
 - .1 Provide in flat sheets only.
- .6 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .7 Plain round bars (where applicable): to CSA-G40.20/G40.21-300W.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 ACI 315 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain Engineer's approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, inform Engineer 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 Engineer.
- .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 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 Engineer's approval of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 30 00 – Administrative Requirements
- .2 Section 03 10 00 – Concrete Forming and Accessories.
- .3 Section 03 20 00 – Concrete Reinforcing.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C260-01, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-03, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M-05, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM D1751-04, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - .5 ASTM C1107-02, Standard Specification for Packaged Dry, Hydraulic-cement Grout (Non-Shrink).
- .2 Canadian Standards Association (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 A283-00(R2003), Qualification Code for Concrete Testing Laboratories.
 - .3 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.
- .3 NB Power Standard Construction Practices – General, Section 2U

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 30 00 – Administrative Requirements.
- .2 Concrete pours: submit 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.

1.4 QUALITY ASSURANCE

- .1 Submit to Engineer prior to starting concrete work, valid and recognized certificate from plant delivering concrete.

- .1 When plant does not hold valid certification, provide test data and certification by qualified independent inspection and testing laboratory that materials used in concrete mixture will meet specified requirements.
- .2 Prior to starting concrete work, submit proposed execution and quality control procedures for review by Engineer on following items:
 - .1 Curing.
 - .2 Finishes.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.
 - .1 Modifications to maximum time limit must be agreed to Engineer laboratory representative and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by Engineer.
- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.
- .3 Waste Management and Disposal:
 - .1 Divert unused concrete materials from landfill to local quarry and/or facility approved by Authority having jurisdiction.
 - .2 Provide an appropriate area on the job site where concrete trucks can be safely washed.
 - .3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by the Authority having jurisdiction.
 - .4 Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
 - .5 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal. Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

Part 2 Products

2.1 MATERIALS

- .1 Cement: to CAN/CSA-A3001.
- .2 Supplementary cementing materials: CAN/CSA-A3001.
- .3 Water: to CSA-A23.1.
- .4 Aggregates: to CAN/CSA-A23.1/A23.2. Coarse aggregates to be normal density.
- .5 Admixtures:

- .1 Air entraining admixture: to ASTM C260.
- .2 Chemical admixture: to ASTM C494 Engineer to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .6 Shrinkage compensating grout: premixed compound consisting of cement, based mineral aggregate, water reducing and plasticizing agents to CSA-A23.1/A23.2.
 - .1 Compressive strength: 50 MPa at 28 days.
- .7 Curing compound: to CSA-A23.1/A23.2 white and ASTM C309, Type 1-chlorinated rubber. Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration to Architect that compounds use are compatible.
- .8 Mechanical waterstops: ribbed extruded PVC of sizes indicated with pre-welded with legs not less than 300 mm.
- .9 Premoulded joint fillers:
 - .1 Bituminous impregnated fiber board: to ASTM D1751.
- .10 Thermal and Moisture Protection: to Division 7.

2.2 MIXES

- .1 Proportion normal density concrete in accordance with CAN/CSA-A23.1/A23.2, to give following properties:
 - .1 For all interior concrete slabs not exposed to freezing and thawing (slabs on grade):
 - .1 Cement: Type GU - General Use Hydraulic Cement.
 - .2 Maximum water/cementing materials ratio: 0.55.
 - .3 20 mm nominal size coarse aggregate.
 - .4 Minimum compressive strength at 28 days: 25 MPa.
 - .5 Class of exposure: N
 - .6 Chemical admixtures in accordance with ASTM C494.
 - .7 Slump at time and point of discharge 80 mm \pm 30 mm.
 - .2 For exterior concrete (wall support):
 - .1 Cement: Type GU - General Use Hydraulic Cement.
 - .2 Maximum water/cementing materials ratio: 0.55.
 - .3 20 mm nominal size coarse aggregate.
 - .4 Minimum compressive strength at 28 days: 25 MPa.
 - .5 Class of exposure: F-2.
 - .6 Air content 4% to 7%
 - .7 Chemical admixtures in accordance with ASTM C494.
 - .8 Slump at time and point of discharge 80 mm \pm 30 mm.

- .2 Do not change concrete mix without prior approval of Engineer. Should change in material source be proposed, new mix design to be approved by Engineer.

Part 3 Execution

3.1 PREPARATION

- .1 Obtain Engineer's approval before placing concrete.
 - .1 Provide 24 hour 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 by Engineer.
- .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .6 Prior to placing of concrete obtain Engineer's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .7 Prior to placing of concrete for concrete encased conduits, obtain approval from NB Power for placement of conduits.
- .8 Protect previous Work from staining.
- .9 Clean and remove stains prior to application for concrete finishes.
- .10 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .11 In locations where new concrete is dowelled to existing work, drill holes in existing concrete (where applicable).
 - .1 Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.
- .12 Do not place load upon new concrete until authorized by Engineer.

3.2 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with 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 Engineer.

- .2 Where approved by Engineer, 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 Engineer.
- .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Engineer before placing of concrete.
- .5 Check 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 Embedded items:
 - .1 Set anchor bolts and column bases footings of appropriate trade prior to placing concrete.
- .4 Finishing and curing:
 - .1 Unless noted otherwise, finish, cure and protect concrete in accordance with CAN/CSA-A23.1/A23.2.
 - .2 Curing and protection of concrete during cold weather (when temperature is at or below 5°C or when there is a probability of temperature falling below 5°C within 24 hours of placing) should go on until concrete cylinders stored on site have reached a compressive strength of 30 MPa.
 - .3 Interior floor slabs to be left exposed, to receive epoxy, carpet, sheet vinyl or other covering requiring a smooth surface: initial finishing operations followed by final finishing comprising mechanical floating and steel trowelling as specified in CAN/CSA-A23.1/A23.2 to produce hard, smooth, dense trowelled surface free from blemishes.
 - .4 Floor slabs to receive mortar bed for ceramic or quarry tile: screed to correct grade to provide broomed texture.
 - .5 Exterior structural slab, sidewalk and equipment pads: initial finishing operations followed by a broom finish to produce a non-slip texture. Edges to be rounded.
 - .6 Use procedures as reviewed by Engineer or those noted in CSA-A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
 - .7 Use curing compounds compatible with applied finish on concrete surfaces. Applied finish on concrete: in accordance with manufacturer's instructions. Provide written declaration that compounds used are compatible.
 - .8 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.
- .5 Joint fillers:
 - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Engineer.
 - .2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 - .3 Locate and form isolation, construction and expansion joints as indicated.
 - .4 Install joint filler.

- .5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

3.3 SURFACE TOLERANCE

- .1 Concrete tolerance in accordance with CSA-A23.1/A23.2.

3.4 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Engineer for review in accordance with CSA-A23.1/A23.2.
 - .1 Ensure testing laboratory is certified in accordance with CSA A283.
- .2 Non-Destructive Methods for Testing Concrete: in accordance with CSA-A23.1/A23.2.
- .3 Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

END OF SECTION