

PART 1 - GENERAL

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| <u>1.1 RELATED SECTIONS</u> | .1 | Section 01 33 00 - Submittal Procedures. |
| | .2 | Section 03 20 00 - Concrete Reinforcing. |
| | .3 | Section 03 30 00 - Cast-in-Place Concrete. |
| <u>1.2 REFERENCES</u> | .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-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 | CSA O153-M1980(R2003), Poplar Plywood. |
| | .6 | CAN/CSA-O325.0-92(R2003), 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 |
| | .2 | Underwriters' Laboratories of Canada (ULC) |
| | .1 | CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering. |
| <u>1.3 SUBMITTALS</u> | .1 | Submittals in accordance with Section 01 33 00 - Submittal Procedures. |
| <u>1.4 DELIVERY, STORAGE AND HANDLING</u> | .1 | Store and manage hazardous materials in accordance with Health and Safety/Environmental Protection Plans. |
| | .2 | Waste Management and Disposal: |
| | .1 | Separate waste materials for reuse and recycling. |
| | .2 | Place materials defined as hazardous or toxic in designated containers. |
| | .3 | Divert wood materials from landfill for reuse. |
| | .4 | Divert plastic materials from landfill |

- to a recycling facility.
- .5 Divert unused form release material from landfill to an official hazardous material collections site if not retained by Contractor for future work.

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-0121.
- .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 liner:
- .1 Plywood: high density overlay Douglas Fir to CSA 0121 square edge.
- .4 Form release agent: non-toxic, biodegradable, and low VOC.
- .5 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 15 to 24 mm²/s at 40 degrees C, flashpoint minimum 150 degrees C, open cup.
- .6 Falsework materials: to CSA-S269.1.

PART 3 - EXECUTION

3.1 FABRICATON 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 Provide Site drainage to prevent washout of soil supporting mud sills and shores.
- .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 watertight.
 - .1 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 chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .9 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.
- .10 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHAPING

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
 - .1 7 days for walls.
- .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 Space reshoring in each principal direction at not more than 3000 mm apart.
- .5 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

PART 1 - GENERAL1.1 RELATED
SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 03 10 00 - Concrete Forming and Accessories.
- .3 Section 03 30 00 - Cast-in-Place Concrete.

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.
- .3 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-A23.3-14, Design of Concrete Structures.
 - .3 CAN/CSA-G30.18-M92(R2002), Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada.
 - .4 CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CSA W186-M1990(R2002), Welding of Reinforcing Bars in Reinforced Concrete Construction.

- .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 33 00 - Submittal Procedures.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
- .3 Submit Shop Drawings including placing of reinforcement and indicate:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Consultant, with identifying code marks to permit correct placement without reference to structural Drawings.
 - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
- .4 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.
 - .1 Provide Type C tension lap splices unless otherwise indicated.
- .5 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
 - .1 Mill Test Report: provide Consultant with certified copy of mill test report of reinforcing steel, minimum 2 weeks prior to beginning reinforcing work.
 - .2 Submit in writing to Consultant proposed source of reinforcement material to be supplied.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials in accordance with Health and Safety/Environmental Protection Plans.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for possible reuse and/or recycling.
 - .2 Place materials defined as hazardous

or toxic in designated containers.

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 CAN/CSA-G30.18, unless indicated otherwise.
- .3 Reinforcing steel: weldable low alloy steel deformed bars to CAN/CSA-G30.18.
- .4 Cold-drawn annealed steel wire ties: 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: to CSA-G40.20

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 Departmental Representative's 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.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Ensure that rebar/mesh is free of mud or substances which will prevent the bonding of concrete to the rebar/mesh unless noted otherwise.

3.2 FIELD BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.

3.3 PLACING REINFORCEMENT

- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.
- .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 Owner's Representative approval of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.

PART 1 - GENERAL1.1 RELATED
SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 03 10 00 - Concrete Forming and Accessories.
- .3 Section 03 20 00 - Concrete Reinforcement.

1.2 REFERENCES

- .1 ANSI/ACI 117-81, Tolerances for Concrete Construction and Materials.
- .2 ASTM C309-89, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- .3 CAN/CSA-A23.1-14, Concrete Materials and Methods of Concrete Construction.
- .4 CAN/CSA-A23.2-14, Methods of Test for Concrete.
- .5 CAN/CSA-A3000-13, Cementitious Materials Compendium.
- .7 CSA-A283-06(R2011), Qualification Code for Concrete Testing Laboratories.
- .8 ASTM C260, Air-Entraining Admixtures for Concrete.
- .9 ASTM C494, Chemical Admixtures for Concrete.

1.3 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

1.4 CERTIFICATES

- .1 Store and manage hazardous materials in accordance with Health and Safety/Environmental Protection Plans.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for possible reuse and/or recycling.
 - .2 Place materials defined as hazardous or toxic in designated containers.

1.5 CONSTRUCTION

- .1 Submit proposed quality control procedures

QUALITY CONTROL

for Departmental Representative's approval.

.1 Cold Weather Protection.

.2 Curing Methods.

PART 2 - PRODUCTS2.1 MATERIALS

.1 Portland cement: to CSA-A3001, Type HS, High sulfate-resistant hydraulic cement.

.2 Supplementary cementing materials: Shall not be used for high sulfate-resistant concrete.

.3 Aggregates: to CSA-A23.1/A23.2. Coarse aggregates to be normal density.

.4 Air entraining admixture: to ASTM C260.

.5 Chemical admixtures: to ASTM C494. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.

2.2 CONCRETE MIXES

.1 Proportion normal density, high sulfate-resistant concrete in accordance with CSA-A23.1, to give following properties for all concrete:

.1 Minimum compressive strength at 56 days: 30 Mpa.

.2 Maximum W/C Ratio: 0.5

.3 Class of exposure: S-3.

.4 Nominal size of coarse aggregate: 19 mm.

.5 Slump at time and point of discharge: 80 mm maximum

.6 Air content: 5 to 8%.

.7 Chemical admixtures: in accordance with ASTM C494.

.8 Curing: Type 2: 7 d total at $\geq 10^{\circ}\text{C}$ and for the time necessary to attain 70% of the specified strength.PART 3 - EXECUTION3.1 GENERAL

.1 Do cast-in-place concrete work in accordance with CAN/CSA-A23.1.

3.2 WORKMANSHIP

.1 Obtain Departmental Representative's approval before placing concrete. Provide 24 hr notice prior to placing of concrete.

- .2 Pumping of concrete is permitted only after approval of equipment and mix.
- .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .4 Prior to placing of concrete obtain Departmental 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 Departmental Representative.

3.3 INSERTS/EMBEDDED ITEMS

- .1 No sleeves, ducts, pipes or other openings shall 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 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Departmental Representative before placing of concrete.

3.4 SURFACE TOLERANCE

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

3.5 FINISHING

- .1 Finish concrete in accordance with CSA-A23.1.
- .2 Use procedures acceptable to Departmental Representative to remove excess bleed water. Ensure surface is not damaged.
- .3 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.

3.6 FIELD QUALITY
CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Owner in accordance with CSA-A23.1.
- .2 Owner will pay for costs of tests.
- .3 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.