

PART 1 - GENERAL

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| <u>1.1 RELATED
SECTIONS</u> | .1 | Section 03 20 00 - Concrete Reinforcing. |
| | .2 | Section 03 30 00 - Cast-in-Place Concrete. |
| <u>1.2 REFERENCES</u> | .1 | Canadian Standards Association (CSA International) (latest editions):
.1 CSA-A23.1-04/A23.2-04, 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 |
| <u>1.3 SUBMITTALS</u> | .1 | Submittals in accordance with Section 01 33 00 - Submittal Procedures. |
| | .2 | Submit shop drawings for formwork and falsework. |
| <u>1.4 WASTE MANAGEMENT AND DISPOSAL</u> | .1 | Separate and recycle waste materials in accordance with Section 01 74 21 - Construction / Demolition Waste Management and Disposal and the Waste Reduction Workplan. |
| <u>1.5 MEASUREMENT PROCEDURES</u> | .1 | No measurement will be made under this section. Include Concrete Forming and Accessories costs in items of concrete work in Section 03 30 00 - Cast-in-Place Concrete. |

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 and CAN/CSA-086.
- .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 release agent: non-toxic, biodegradable, low VOC,.
- .4 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 70 and 110s Saybolt Universal 15 to 24 mm² /s at 40 degrees C, flashpoint minimum 150 degrees C, open cup.
- .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 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.
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3.1 FABRICATION AND .6
ERECTION
(Cont'd)

- .6 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .7 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .8 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.
- .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 Seven (7) days for all concrete.
- .2 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

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|---------------------------------------|----|---|
| <u>1.1 RELATED
SECTIONS</u> | .1 | Section 03 10 00 - Concrete Forming and Accessories. |
| | .2 | Section 03 30 00 - Cast-in-Place Concrete. |
| <u>1.2 MEASUREMENT
PROCEDURES</u> | .1 | No measurement will be made under this Section. Include reinforcement costs in items of concrete work in Section 03 30 00 - Cast-In-Place Concrete. |
| <u>1.3 REFERENCES</u> | .1 | Canadian Standards Association (CSA International) (latest editions):
.1 CSA-A23.1-04/A23.2-04, 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 CSA-G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.5 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.
.6 CSA W186-M1990(R2002), Welding of Reinforcing Bars in Reinforced Concrete Construction. |
| | .2 | Reinforcing Steel Institute of Canada (RSIC)
.1 RSIC-2004, Reinforcing Steel Manual of Standard Practice. |
| <u>1.4 SUBMITTALS</u> | .1 | Submittals in accordance with Section 01 33 00 - Submittal Procedures. |
| | .2 | Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice. |

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1.4 SUBMITTALS
(Cont'd)

- .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 Departmental Representative, 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.
- .5 Quality Assurance: 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 Departmental Representative with certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.

1.5 DELIVERY,
STORAGE AND
HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials in accordance with Section 01 74 21 - Construction / Demolition Waste Management and Disposal.
 - .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 CSA G30.3.

- 2.1 MATERIALS
(Cont'd)
- .5 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 Departmental Representative'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, provide Departmental Representative 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 Departmental Representative of proposed source of material to be supplied.

PART 3 - EXECUTION

- 3.1 FIELD BENDING
- .1 Do not field bend/field weld reinforcement.
- .2 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 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
- .3 Ensure cover to reinforcement is maintained during concrete pour.

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Section 03 10 00 - Concrete Forming & Accessories
- .2 Section 03 20 00 - Concrete Reinforcing
- .3 Section 03 41 00 - Precast Structural Concrete
- .4 Section 05 50 00 - Metal Fabrications

1.2 MEASUREMENT
PROCEDURES

- .1 Concrete Wall Cap:
 - .1 Measure cast-in-place concrete for new wall cap in cubic metres calculated from neat dimensions indicated on Department Drawings.
 - .2 Concrete placed beyond dimensions indicated will not be measured.
- .2 Tremie Concrete (Behind Berlin Wall):
 - .1 To be measured in cubic metres calculated from neat dimensions indicated or authorized in writing by Engineer.
- .3 No deductions will be made for volume of concrete displaced by reinforcing steel, structural steel, or piles.
- .4 No deductions will be made for volume of concrete less than 0.1 m² in cross sectional area displaced by individual drainage openings.
- .5 Heating of water and aggregates and providing cold weather protection will not be measured but considered incidental to the work.
- .6 Cooling of concrete and providing hot weather protection will not be measured but considered incidental to the work.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International) (latest editions):
 - .1 CSA-A23.1/A23.2-2004, 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.

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1.3 REFERENCES
(Cont'd)

- .1 (Cont'd)
 - .3 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.

1.4 ACRONYMS AND TYPES

- .1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).
 - .1 Type GU or GUb - General use cement.
 - .2 Type MS or MSb - Moderate sulphate-resistant cement.
 - .3 Type MH or MHb - Moderate heat of hydration cement.
 - .4 Type HE or Heb - High early-strength cement.
 - .5 Type LH or LHb - Low heat of hydration cement.
 - .6 Type HS or HSb - High sulphate-resistant cement.
- .2 Fly ash:
 - .1 Type F - with CaO content less than 8%.
 - .2 Type CI - with CaO content ranging from 8 to 20%.
 - .3 Type CH - with CaO greater than 20%.
- .3 GGBFS - Ground, granulated blast-furnace slag.

1.5 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Minimum 4 weeks prior to starting concrete work, submit to Engineer manufacturer's test data and certification by qualified independent inspection and testing laboratory that following materials will meet specified requirements:
 - .1 Portland Cement;
 - .2 Blended Hydraulic Cement;
 - .3 Supplementary Cementing Materials;
 - .4 Admixtures;
 - .5 Aggregates;
 - .6 Water.
- .3 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CAN/CSA-A23.1.

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1.5 SUBMITTALS
(Cont'd)

- .4 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CAN/CSA-A23.1.

1.6 QUALITY
ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Submit to Departmental Representative minimum 4 weeks 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.
- .3 Minimum 4 weeks prior to starting concrete work, submit 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 Formwork removal.
 - .6 Joints.
- .4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

1.7 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 Departmental Representative, laboratory 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.

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1.7 DELIVERY,
STORAGE AND
HANDLING
(Cont'd)

- .3 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Provide an appropriate area on the job site where concrete trucks can be safely washed.
 - .3 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.
 - .4 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, Type GU.
- .2 Water: to CSA-A23.1.
- .3 Aggregates: to CAN/CSA-A23.1/A23.2. Coarse aggregates to be normal density.
- .4 Admixtures:
 - .1 Air entraining admixture: to ASTM C260.
 - .2 Chemical admixture: to ASTM C 494 ASTM C1017. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .5 Premoulded joint fillers:
 - .1 Bituminous impregnated fiber board: to ASTM D1751.

2.2 MIXES

- .1 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Alternative 1 to give the following properties for concrete:
 - .1 Concrete Wall Cap:
 - .1 Cement:
 - .1 Type Gu.

2.2 MIXES
(Cont'd)

- .1 (Cont'd)
 - .1 Concrete Wall Cap: (Cont'd)
 - .2 Minimum compressive strength at 28 days: 35 MPa.
 - .3 Minimum Cement Content: 385 kg/m³ of concrete.
 - .4 Class of Exposure: C1.
 - .5 Nominal size of coarse aggregate: 5-20 mm.
 - .6 Slump at time and point of discharge: 50 to 100 mm.
 - .7 Air content: 5 to 8%.
 - .2 Tremie Concrete:
 - .1 Cement:
 - .1 Type Gu.
 - .2 Minimum compressive strength at 28 days: 15 MPa.
 - .3 Minimum Cement Content: 385 kg/m³ of concrete.
 - .4 Class of Exposure: C1.
 - .5 Nominal size of coarse aggregate: 5-20 mm.
 - .6 Slump at time and point of discharge: 50 to 100 mm.
 - .7 Air content: 5 to 8%.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Obtain Departmental Representative's approval before placing concrete.
 - .1 Provide 24 hours notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 Pumping of concrete is permitted only after approval of equipment and mix.
- .4 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .5 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .6 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

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- 3.1 PREPARATION .7 Do not place load upon new concrete until
(Cont'd)
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- 3.2 CONSTRUCTION .1 Do cast-in-place concrete work in accordance
with CSA-A23.1/A23.2.
- .2 Sleeves and inserts:
.1 Where approved by Departmental
Representative, set sleeves, ties, pipe
hangers and other inserts and openings as
indicated or specified elsewhere.
.2 Sleeves and openings greater than 100 x
100 mm not indicated, must be reviewed by
Departmental Representative.
.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.
.4 Check locations and sizes of sleeves and
openings shown on drawings.
- .3 Finishing and curing:
.1 Finish concrete in accordance with
CSA-A23.1/A23.2.
.2 Use procedures as reviewed by
Departmental Representative or those noted in
CSA-A23.1/A23.2 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.
- 3.3 SURFACE .1 Concrete tolerance in accordance with
TOLERANCE
- 3.4 FIELD QUALITY .1 Site tests: conduct following test in
CONTROL accordance with Section 01 45 00 - Quality
Control and submit report as described in PART
1 - SUBMITTALS.
.1 Concrete pours.
.2 Slump tests.
- .2 Inspection and testing of concrete and
concrete materials will be carried out by
testing laboratory designated by Departmental
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- 3.4 FIELD QUALITY .2 (Cont'd)
CONTROL
(Cont'd)
- .1 Ensure testing laboratory is certified
in accordance with CSA A283.
- .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.
- .4 Non-Destructive Methods for Testing Concrete:
in accordance with CSA-A23.1/A23.2.
- .5 Inspection or testing by Departmental
Representative will not augment or replace
Contractor quality control nor relieve
Contractor of his contractual responsibility.

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 45 00 - Quality Control
- .3 Section 01 74 21 - Construction/Demolition
Waste Management and Disposal
- .4 Section 03 30 00 - Cast-in-Place Concrete

1.2 REFERENCES

- .1 Canadian Standards Association (CSA
International):
 - .1 CAN/CSA-A5-93, Portland Cement.
 - .2 CAN/CSA-A23.1-94, Concrete Materials and
Methods of Concrete Construction.
 - .3 CAN/CSA-A23.4-94, Precast Concrete -
Material and Construction.
 - .4 CAN/CSA-A23.2-00, Methods of Test for
Concrete.
 - .5 CAN3-A266.1-M78, Air-Entraining
Admixtures for Concrete.
 - .6 CAN3-A266.2-M78, Chemical Admixtures for
Concrete.
 - .7 CAN3-A266.4-M78, Guidelines for the use
of Admixtures in Concrete.
 - .8 CSA-G30.18-M92 (R1998), Billet Steel
Bars for Concrete Reinforcement.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with
Section 01 33 00 - Submittal Procedures, and
in accordance with CAN3-A23.3 and CAN3-A23.4.
- .2 Include the following items:
 - .1 Design calculations for items designed
by manufacturer.
 - .2 Details of reinforcement and their
connections.
 - .3 Methods of handling and erection.
 - .4 Openings, sleeves, inserts and related
reinforcement.
 - .5 Storage facility.

1.4 WASTE MANAGEMENT.1
AND DISPOSAL

Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.5 MEASUREMENT
PROCEDURES

.1 Precast Drop Panels - Reinforced precast drop panels will be measured in cubic metres (m3) calculated from neat dimensions indicated or authorized in writing by Engineer.

.2 Precast elements units will include cost, supply, delivery, storage, erection, hardware for handling, removal and patching of erection devices.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 To Section 03 30 00 - Cast-in-Place Concrete.

2.2 CONCRETE MIXES

.1 Proportion structural normal density concrete in accordance with CAN/CSA-A23.1-00, Alternative 1 to give the following properties for concrete.

.2 Precast Panels:

.1 Cement: Type 10, Portland Cement.

.2 Minimum compressive strength at 28 days: 35 MPa.

.3 Class of exposure: C-1.

.4 Nominal size of coarse aggregate: 20mm.

.5 Slump at point and time of discharge: 50mm to 100mm.

.6 Air Content: 5 - 8%.

.7 Density of air-drying concrete will be in range of 2240 to 2400 kg/m3.

.8 Minimum cement content: 385 kg/m3.

.9 Maximum water/cement ratio: 0.4.

PART 3 - EXECUTION

- 3.1 ERECTION .1 Do precast concrete work in accordance with CAN3-A23.4.
- .2 Erect precast elements within 10mm as shown on drawings.
- .3 Replace or repair damaged precast elements to satisfaction of Engineer at no additional cost.
- 3.2 CLEANING .1 After erection, clean precast elements to satisfaction of Engineer.