

PART 1 - GENERAL

<u>1.1 Related Sections</u>	.1	Section 03 30 00 Cast-in-Place Concrete.
<u>1.2 Description</u>	.1	This section specifies the materials for forms, form ties and release agents as well as their fabrication, erection, removal and restoring.
<u>1.3 Measurement Procedures</u>	.1	No measurement will be made under this section. Include costs in items of concrete work for which formwork is required.
<u>1.4 References</u>	.1	Canadian Standards Association (CSA International)
	.1	CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
	.2	CAN/CSA-O86-09, Engineering Design in Wood.
	.3	CSA O121-08, Douglas Fir Plywood.
	.4	CSA O151-09, Canadian Softwood Plywood.
	.5	CSA O153-M1980(R2008), Poplar Plywood.
	.6	CSA S269.1-1975(R2008), Falsework for Construction Purposes.
	.7	CAN/CSA-S269.3-M92(R2008), Concrete Formwork, National Standard of Canada
<u>1.5 Submittals</u>	.1	Submittals in accordance with Section 01 33 00 Submittal Procedures.
	.2	Submit shop drawings for formwork and falsework.
	.1	Submit drawings stamped and signed by professional engineer registered or licensed in the Province of New Brunswick.
	.3	Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, anchorages, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings Comply with CAN/CSA-S269.3 for formwork drawings.

- .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 as directed by Departmental Representative.
- 1.6 Delivery, Storage and Handling
  - .1 Store and manage hazardous materials in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
  - .2 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 Place materials defined as hazardous or toxic in designated containers.
    - .3 Divert wood materials from landfill to a recycling facility.
    - .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.

## PART 2 - PRODUCTS

- 2.1 Materials
  - .1 Formwork materials:
    - .1 Formwork materials to be to CAN/A23.1/A23.2.
    - .2 Wood and wood product formwork materials to be to CSA-O121, CSA-O86 and CSA-O153.
  - .2 Form ties:
    - .1 Use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia. in concrete surface.
  - .3 Form release agent: non-toxic, biodegradable.
  - .4 Form stripping agent: colourless mineral oil, non-toxic,

and 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 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 Build in anchors, sleeves, and other inserts required to accommodate work specified in other sections.
- .6 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

#### 3.2 Formwork Removal

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
  - .1 7 days for pile cap beams and fill containment wall.
  - .2 14 days for deck slab and edge beam.
- .2 Remove formwork when concrete has reached 75% of its design strength or minimum period noted above, whichever comes later.
- .3 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

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END OF SECTION

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## PART 1 - GENERAL

<u>1.1 Related Sections</u>	.1	Section 03 10 00 Concrete Forming and Accessories.
	.2	Section 03 30 00 Cast-in-Place Concrete.
	.3	Section 05 50 00 Metal Fabrications.
	.4	Section 31 62 19 Timber Piles.
<u>1.2 Description</u>	.1	This section specifies concrete reinforcing materials, their fabrication and placing.
<u>1.3 Measurement Procedures</u>	.1	No measurement will be made under this section. Include costs in items of concrete work for which reinforcement is required.
<u>1.4 References</u>	.1	American Society for Testing and Materials International (ASTM).
	.1	ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
	.2	Canadian Standards Association (CSA)
	.1	CSA-A23.1-09, Concrete Materials and Methods of Concrete Construction/Methods and Standard Practices for Concrete.
	.2	CSA-A23.3-04 (R2010), Design of Concrete Structures.
	.3	CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
<u>1.5 Shop Drawings</u>	.1	Submit shop drawings including placing of reinforcement in accordance with Section 01 33 00 Submittal Procedures.
	.2	Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, and locations of reinforcement with identifying code marks to permit correct placement without reference to structural drawings. Prepare reinforcement drawings in

accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada.

- .3 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated. Provide Class B tension lap splices unless otherwise indicated.
- .4 Each shop drawing submitted to bear the stamp and signature of a qualified Professional Engineer registered in the Province of New Brunswick.

## PART 2 - PRODUCTS

### 2.1 Materials

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Reinforcing steel: carbon steel, having a yield stress of 400 MPa, deformed bars to CSA-G30.18, unless indicated otherwise.
- .3 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.
- .4 Chairs, bolsters, bar supports, spacers: to CSA-A23.1.

### 2.2 Fabrication

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1 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.

## PART 3 - EXECUTION

### 3.1 Field Bending

- .1 Do not field bend or field weld reinforcement.

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| 3.2 <u>Placing<br/>Reinforcement</u> | .1 | Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA-A23.1.             |
|                                      | .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.   |

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END OF SECTION

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PART 1 - GENERAL

<u>1.1 Related Sections</u>	.1	Section 03 10 00 Concrete Forming and Accessories.
	.2	Section 03 20 00 Concrete Reinforcing.
	.3	Section 03 37 26 Underwater Placed Concrete.
	.4	Section 05 50 00 Metal Fabrications.
<u>1.2 Description</u>	.1	This section specifies the materials, mixes, accessories, preparations, construction and verification for cast-in-place concrete.
<u>1.3 Measurement Procedures</u>	.1	<u>Cast-In-Place Concrete</u> : The cast-in-place reinforced concrete pile cap beams and fill containment wall will be measured for payment in cubic metres, (M <sup>3</sup> ), calculated from theoretical neat dimensions indicated on plans or as authorized in writing by Departmental Representative. This includes all joint sealants, fillers, and dowels. Concrete placed beyond dimensions indicated will not be measured.
	.2	<u>Concrete Deck</u> : The cast-in-place reinforced concrete deck including the edge beam, will be measured for payment in square metres, (M <sup>2</sup> ), calculated from theoretical neat dimensions indicated on plans or as authorized in writing by Departmental Representative. Measurements to be made on the surface area of the deck. Construction joints as shown will be considered incidental to this item.
	.3	Reinforcing steel to be incidental to the work and will not be measured separately.
	.4	Formwork and falsework to be incidental to the work and will not be measured separately.
	.5	No deductions will be made for volume of concrete displaced by reinforcing steel.
	.6	Heating of water and aggregates and cold weather

protection to be incidental to the work and will not be measured separately.

.7 Cooling of concrete and providing hot weather protection to be incidental to the work and will not be measured separately.

.8 Supply and installation of concrete additives as recommended by the concrete supplier to be incidental to the work and will not be measured separately.

#### 1.4 References

- .1 American Society for Testing and Materials International (ASTM)
- .1 ASTM A775/A775M-07b, Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
  - .2 ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
  - .3 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .4 ASTM C494/C494M-13, Standard Specification for Chemical Admixtures for Concrete.
  - .5 ASTM C881/C881M-10, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
  - .6 ASTM D1751-04(2008), Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
- .2 Canadian Standards Association (CSA)
- .1 CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2 CSA A283-06 (R2011), Qualification Code for Concrete Testing Laboratories.
  - .3 CSA-A3000-08, Cementitious Materials Compendium.



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| <u>1.5     Certificates</u>                  | <ul style="list-style-type: none"><li>.1     Submit certificates in accordance with Section 01 33 00 Submittal Procedures.</li><li>.2     Provide certification indicating the concrete supplier is certified in accordance with the Atlantic Provinces Ready Mix Concrete Association Program or equivalent.<ul style="list-style-type: none"><li>.1     Only concrete supplied from such certified plants shall be acceptable to the Departmental Representative.</li><li>.2     Plant certification shall be maintained for the duration of the fabrication and erection until the warranty period expires.</li></ul></li><li>.3     Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1.</li><li>.4     Provide mix design in compliance with CSA-A23.1 to provide concrete of quality, yield and strength as specified under 2.2 Mix Design. Mix design to be prepared by and stamped by an engineer licensed to practice in the Province of New Brunswick.</li><li>.5     Prior to starting concrete work, submit to Departmental Representative manufacturer's test data and certification by qualified independent inspection and testing laboratory that following materials will meet specified requirements:<ul style="list-style-type: none"><li>.1     Portland cement.</li><li>.2     Blended hydraulic cement.</li><li>.3     Supplementary cementing materials.</li><li>.4     Admixtures.</li><li>.5     Aggregates.</li><li>.6     Water.</li></ul></li></ul> |
| <u>1.6     Waste Management and Disposal</u> | <ul style="list-style-type: none"><li>.1     Designate a cleaning area for concrete trucks off site, at a company owned site for such a purpose meeting all federal and provincial requirements.</li><li>.2     Use trigger operated spray nozzles for water hoses.</li><li>.3     Designate a cleaning area for tools to limit water use</li></ul>   |

and runoff.

- .4 Carefully coordinate the specified concrete work with weather conditions.
- .5 Prevent plasticizers, water-reducing agents and air-entraining agents from entering drinking water supplies or waterways. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, noncombustible material and remove for disposal.
- .6 Choose least harmful, appropriate cleaning method which will perform adequately.

## PART 2 - PRODUCTS

### 2.1 Materials

- .1 Blended hydraulic cement: Type GUb-F/SF to CSA-A3001.
- .2 Supplementary cementing materials: to CSA-A3001.
- .3 Water: to CSA-A23.1.
- .4 Aggregates: to CSA-A23.1/A23.2. Coarse aggregates to be normal density.
- .5 Air entraining admixture: to ASTM C260.
- .6 Chemical admixtures: to ASTM C494/C494M. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .7 Concrete retarders: to ASTM C494/C494M water based, low VOC, solvent free. Do not allow moisture of any kind to come in contact with the retarder film.
- .8 Curing Compound:
  - .1 To CSA-A23.1, and ASTM C309.
  - .2 Acceptable Products:
    - .1 Kure-N-Seal WB by BASF Building Systems.

- .2 Florseal WB 18 by Sika Canada.
- .3 1100 Cure by W.R. Meadows.
- .9 Isolation/Control Joint Filler:
  - .1 Polyethylene closed-cell foam filler. To be Deck-O-Foam by W.R. Meadows, or approved alternate.
- .10 Joint Sealer for horizontal joints:
  - .1 Sikaflex 2C NS/SL supplied by Sika Canada, or approved alternate.
- .11 Joint Sealer for vertical joints:
  - .1 Sikaflex 2C NS as supplied by Sika Canada, or approved alternate.
- .12 Anchorage Adhesive (Above Water): to ASTM C881/C881M, Type IV, Grade 3, Class A, B, and C.
  - .1 Acceptable Products:
    - .1 Epcon Acrylic 7 by ITW Ramset/Red Head.
    - .2 HIT HY200 Injection Adhesive System by HILTI.
    - .3 Acrylic-Tie Anchoring System by Simpson Strong-Tie.
    - .4 Alternate Materials: Approved by addendum in accordance with Instructions to Tenderers.
- .13 Refer to Section 05 50 00 for metal fabricated assemblies to be installed in concrete items.

## 2.2 Mix Design

- .1 The contractor shall be responsible for the concrete mix design.
- .2 It shall be the responsibility of the Contractor to ensure that the mixture proportions shall be properly batched, mixed, placed and cured such that the concrete conforms to the specifications.
- .3 Proportion normal density concrete in accordance with CSA-A23.1, Alternative 1, to give following properties:

- .1 Cement: GUb-F/SF.
- .2 Minimum compressive strength at 28 days: 35 MPa.
- .3 Minimum cement content: 400 kg/m<sup>3</sup> of concrete.
- .4 Maximum water/cement ratio: 0.40.
- .5 Class of exposure: C-1.
- .6 Nominal size of coarse aggregate: 20 mm.
- .7 Slump at time and point of discharge: 50 to 100 mm.
- .8 Air content: 5 to 8 %.

### PART 3 - EXECUTION

#### 3.1 Preparation

- .1 Inform Department Representative before placing concrete. Provide 24 hours notice prior to placing of concrete.
- .2 Pumping of concrete is permitted only after review of equipment and mix.
- .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .4 Prior to placing of concrete advise Departmental Representative of proposed method for protection of concrete during placing and curing in adverse weather.
- .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.

#### 3.2 Construction

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

#### 3.3 Preparation of Horizontal Pour Joints

- .1 Remove all laitance, dirt, dust, debris, adhesives, grease, or other substances that would interfere with the bond between the existing base course concrete and the new concrete.

- .2 The surface of the base course concrete shall be roughened to a 6 mm profile, using high pressure water blasting, or other approved methods.
- .3 Remove all loose materials from the prepared surface.
- .4 The surface of the base concrete shall be kept continuously moist for at least one hour prior to placement of the new concrete. Excess water shall be removed, the surface cleaned and flushed with fresh water and permitted to become saturated surface-dry before the placement of the new concrete.

#### 3.4 Finishing

- .1 Only ACI (American Concrete Institute) certified or other pre-approved concrete finishers are to be utilized in finishing all concrete works.
- .2 Finish concrete in accordance with CSA-A23.1.
  - .1 Float surfaces with wood or metal floats or power finishing machines and bring surfaces to true grade or dimensions.
  - .2 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible.
- .3 Broom finish surface of deck with coarse bristle obtaining a coarse textured finish with a non-slip finish. All brush strokes to be in the direction perpendicular to traffic (parallel to pile cap beams). Surface finish to be as approved by Departmental Representative prior to placement.
- .4 All formed surfaces to be smooth form finish.

#### 3.5 Site Tolerance

- .1 Concrete tolerance in accordance with CSA-A23.1.
  - .1 Deck slab surface to be to Table 22 Class B, non-slip, straight edge, value  $\pm 6$  mm.

#### 3.6 Field Quality Control

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Departmental Representative in accordance with CSA-A23.1 and Section 01 45 00

Testing and Quality Control.

- .2 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .3 Non-destructive Methods for Testing Concrete shall be in accordance with CSA-A23.2.

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END OF SECTION

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PART 1 - GENERAL

<u>1.1 Related Sections</u>	.1	Section 01 74 21 Construction/Demolition Waste Management And Disposal.
	.2	Section 03 30 00 Cast-in-Place Concrete.
	.3	Section 31 63 19 Rock Sockets for piles.
<u>1.2 Description</u>	.1	This section specifies the requirements for the underwater placed concrete used to embed the bottoms of the treated timber bearing and batter piles into the rock sockets.
<u>1.3 Measurement Procedures</u>	.1	There will be no measurement for payment under this section. Work under this section will be included in pay items in Section 31 62 19 Timber Piles for the treated timber bearing and batter piles.
<u>1.4 References</u>	.1	Canadian Standards Association (CSA International)
	.1	CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Methods for Concrete.
<u>1.5 Definitions</u>	.1	Tremie concrete is concrete placed underwater through a tube called a tremie pipe.
	.1	Tremie pipe has a hopper at upper end and may be open ended or may have foot valve, plug or travelling plug to control flow of concrete.
	.2	Concrete is placed in a hopper and a sufficient head of concrete is maintained in tremie pipe to provide desired rate of flow.
	.2	Pumped concrete method of placing concrete underwater uses a concrete pump with a discharge line used in a similar manner to a tremie pipe.
<u>1.6 Certification</u>	.1	Provide certificates in accordance with Section 03 30 00, articles 1.4.1, 1.4.2, 1.4.3, 1.4.4 and 1.4.5.
<u>1.7 Waste Management and Disposal</u>	.1	Separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/

Demolition Waste Management and Disposal.

- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Divert unused concrete materials from landfill to local quarry or facility approved by Departmental Representative.
- .4 Divert chemical additive materials from landfill to official hazardous material collections site approved by Departmental Representative.
- .5 Do not dispose of unused chemical additive materials into sewer systems, into lakes, streams, onto ground or in any other location where it will pose health or environmental hazard.

PART 2 - PRODUCTS

2.1 Materials

- .1 Concrete materials: to Section 03 30 00 Cast-in-Place Concrete and as specified herein.

2.2 Concrete Mix

- .1 Use Type GUb-F/SF Portland cement (General purpose cement with fly ash and silica fume) in the concrete mix design to satisfy the following criteria:
  - .1 Minimum compressive strength at 28 days: 35 MPa.
  - .2 Class of exposure: C1.
  - .3 Maximum water-cement ratio by mass: 0.40.
  - .4 Minimum cement content: 400 kg/m<sup>3</sup>.
  - .5 Nominal size of coarse aggregate: 20 mm.
  - .6 Fine aggregate content: 42 to 45 % of total aggregate mass.
  - .7 Slump at point and time of discharge: 150 mm to 170 mm.
  - .8 Air content at discharge: 6 to 9%.

PART 3 - EXECUTION

3.1 Installation

- .1 Do concrete work in accordance with Section 03 30 00 Cast-in-Place Concrete and as specified herein.



- .2 Place concrete in one continuous operation to full depth required.
    - .1 Supply complete equipment for every phase of operation.
    - .2 Provide sufficient supply of concrete to complete pour without interruption.
    - .3 Placement to be by one of the two methods describe in cl. 3.1.3 and 3.1.4.
  - .3 Tremie method.
    - .1 Provide water-tight tremie pipe sized to allow free flow of concrete. Diameter of tremie pipe to be minimum 125 mm.
    - .2 Provide hopper at top of tremie pipe and means to raise and lower tremie pipe.
    - .3 Provide plug or foot valve at bottom of tremie pipe to permit filling pipe with concrete initially.
    - .4 Start placement with tremie pipe full of concrete. Keep bottom of pipe buried minimum 300 mm in freshly placed concrete. Control rate of flow by varying depth of pipe bottom in concrete.
    - .5 If seal is lost, allowing water to enter pipe, withdraw pipe immediately. Refill pipe, and continue placing as specified.
    - .6 Do not vibrate, disturb or puddle concrete after placement.
  - .4 Pumped concrete method.
    - .1 Follow procedures as for tremie method in placing concrete using discharge line from concrete pump as tremie pipe.
    - .2 Pump discharge line to have minimum diameter of 125 mm.
- 3.2 Environmental Requirements
- .1 Surplus concrete shall not be dumped at sea but recuperated and disposed of off site. Any cleaning of tremie pipes and other equipment on site shall be carried out in a manner that the run off water will be filtered before entry to sea.