

PART 1 - GENERAL

- 1.1 Related Sections .1 Section 03 30 00 - Cast-in-Place Concrete.
- 1.2 Measurement Procedures .1 No measurement will be made under this section. Include costs in items of concrete work for which reinforcement is required.
- 1.3 References .1 Canadian Standards Association (CSA)  
.1 CAN/CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction.  
.2 CAN/CSA A23.3-14, Design of concrete structure.  
.3 CAN/CSA-G30.18-09, Billet-Steel Bars for Concrete Reinforcement.  
.4 CSA W186-M1990 (R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.  
.5 ASTM A82-07, Standard specification for Steel Wire, Plain, for Concrete Reinforcement.

PART 2 - PRODUCTS

- 2.1 Materials .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Reinforcing steel: billet steel, having a yield stress of 400 MPa, deformed bars to CAN/CSA-G30.18-09, unless indicated otherwise.
- .3 Cold-drawn annealed steel wire ties: to ASTM A82.
- .4 Chairs, bolsters, bar supports, spacers: to CAN/CSA-A23.1.
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- 2.2 Fabrication
- .1 Fabricate reinforcing steel in accordance with CAN/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 or tack weld reinforcement. Heating shall not be used as an aid in bending steel.
- 3.2 Placing Reinforcement
- .1 Place reinforcing steel as indicated on reviewed shop drawings and in accordance with CAN/CSA-A23.1.
  - .2 Prior to placing concrete, obtain Departmental Representative's review of reinforcing material and placement.
  - .3 Ensure cover to reinforcement is maintained during concrete pour.
  - .4 Reinforcing steel shall be free of oil, dirt, mill scale, loose or excessive rust or other coating that would reduce bond to concrete.
  - .5 Bar support shall be made of plastic or stainless steel.
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3.2 Placing Reinforcement (Cont'd) .6 Reinforcement shall be accurately position, secured and supported, using bar supports and side form spacers to ensure proper concrete cover and spacing.

.7 Bars shall be fastened together at all intersections except where the spacing is less than 300mm in each direction in which case fastening at alternate intersections of each bar with other bar shall be permitted.

3.3 Splicing .1 Where splicing of rebar is allow, the minimum splice length will be 40 times the rebar size diameter.

.2 Welding or splicing shorter bars as a substitute for supplying bars of the specified lengths shall not be permitted.

3.4 Support of Reinforcement .1 Bar support shall be made of plastic.

.2 Commercially available precast concrete bar supports may be used that are in contact with soil only.

.1 Precast bar supports shall be made of concrete with a quality at least equal to that specified for the member into which the bar supports are integrated.

.2 Bar supports in contact with the soil shall have a base area of less than 16 cm<sup>2</sup>.

PART 1 - GENERAL

- 1.1 Related Sections
- .1 Section 03 20 00 - Concrete Reinforcing.
  - .2 Section 03 37 26 - Underwater Placed Concrete.
  - .3 Section 05 50 00 - Metal Fabrications.
- 1.2 Measurement Procedures
- .1 Concrete Deck (Wharf): cast-in-place reinforced concrete deck (300mm thick) for the wharf including the hoist foundation to be measured in square metres (m<sup>2</sup>) calculated from neat dimensions indicated or authorized in writing by the Departmental Representative. Measurements to be made on the surface area of the deck to the inside face of the concrete beam. Construction/control joints as shown, supply and install reinforced concrete for the hoist foundation and light pole concrete bases as shown will be considered incidental to this item.
  - .2 Concrete Beam; cast in place reinforced concrete beam along the top of H-piles to be measured in cubic metres (m<sup>3</sup>) calculated from neat dimensions indicated or authorized in writing by Departmental Representative. No deductions will be made for scuppers within the beam. Construction/control joints as shown will be considered incidental to this item.
  - .3 Refer to section 31 63 26.16 - 'Berlin Wall Construction' for other concrete work measurement.
  - .4 Formwork and falsework will not be measured but considered incidental to the work.
  - .5 No deductions will be made for volume of concrete displaced by reinforcing steel.
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- 1.2 Measurement Procedures (Cont'd)
- .6 Heating of water and aggregates and providing cold weather protection will not be measured but considered incidental to work.
  - .7 Cooling of concrete and providing hot weather protection will not be measured but considered incidental to work.
  - .8 Concrete used in the casting of concrete cylinders for testing and other miscellaneous concrete fill-in of voids and corner H-piles as shown will not be measured for payment but will be considered incidental to the work.
  - .9 Supply and installation of concrete additives as recommended by the supplier will not be measured but considered incidental to work.
  - .10 Reinforcing steel will not be measured but considered incidental to the work.
- 1.3 References
- .1 Canadian Standards Association (CSA)
    - .1 CSA-A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
    - .2 CSA A283-00 (R2011), Qualification Code for Concrete Testing Laboratories.
    - .3 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
  - .2 American Society for Testing and Materials (ASTM)
    - .1 ASTM C260/C260M 10a, Specification for Air-Entraining Admixtures for Concrete.
    - .2 ASTM C494/C494M 11, Standard Specification for Chemical Admixtures for Concrete.
- 1.4 Formwork
- .1 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.
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- 1.5 Certificates
- .1 Submit certificates in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 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:
    - .1 Portland cement.
    - .2 Blended hydraulic cement.
    - .3 Supplementary cementing materials.
    - .4 Admixtures.
    - .5 Aggregates.
    - .6 Water.
  - .3 Provide mix design and 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.
  - .4 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CAN/CSA-A23.1.
- 1.6 Waste Management and Disposal
- .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)
  - .2 Use trigger operated spray nozzles for water hoses.
  - .3 Designate a cleaning area for tools to limit water use 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.
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1.6 Waste Management and Disposal (Cont'd) .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 CAN/CSA-A3001.

.2 Supplementary cementing materials: to CAN/CSA-A3001.

.3 Water: to CAN/CSA-A23.1.

.4 Aggregates: to CAN/CSA-A23.1. Coarse aggregates to be normal density.

.5 Air entraining admixture: to ASTM C 260.

.6 Chemical admixtures: to ASTM C 494/C 494M. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.

.7 Concrete retarders: to ASTM C 494/C 494M water based,, low VOC, solvent free. Do not allow moisture of any kind to come in contact with the retarder film.

.8 Above materials to be used for all concrete work specified in the project except for underwater placed concrete of H-pile anchoring, see section 03 37 26.

2.2 Mixes .1 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Alternative 1.

.1 Portland 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: 0.4

.5 Class of exposure: C1.

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- 2.2 Mixes .1 (Cont'd)
- (Cont'd) .6 Nominal size of coarse aggregate: 5-20 mm.
- .7 Slump at time and point of discharge: 50 to 100 mm.
- .8 Air content: 5 to 8 %.
- .2 Above mix to be used for all concrete work specified in the project except for underwater placed concrete of H-pile anchoring, see section 03 37 26.

### PART 3 - EXECUTION

- 3.1 Preparation .1 Obtain Departmental Representative's approval before placing concrete. Provide 24 hours 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 inform Departmental Representative's approval 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 CAN/CSA-A23.1.

- 3.3 Finishing .1 Finish concrete in accordance with CAN/CSA-A23.1.
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- 3.3 Finishing                    .1    (Cont'd)
- (Cont'd)
- .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.
- .2    Broom finish deck surface with coarse bristle obtaining a coarse textured finish with a non-slip finish. All brush strokes to be in the direction perpendicular to traffic.
- .3    Exposed concrete panels to have smooth finish.
- 3.4 Site Tolerance            .1    Concrete tolerance in accordance with CAN/CSA-A23.1.
- 3.5 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 CAN/CSA-A23.1/A23.2 and Section 01 45 00.
- .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 CAN/CSA-A23.2.
- 3.6 Formwork Removal                .1    Leave the formwork in place for the following minimum time after placing concrete provided the air temperature surrounding the concrete is above 10 degree Celsius.
- .1    2 days for vertical surfaces.
- .2    7 days for beam and slab or 70% of design strength.
- .3    7 days for concrete anchor blocks.

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
- .1 Materials and installation for concrete underwater by tremie or pumped concrete method if contractor choose this method.
- 1.2 RELATED SECTIONS
- .1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Section 03 20 00 - Concrete Reinforcing.
- .3 Section 03 30 00 - Structural Concrete.
- .4 Section 31 62 16.16 - Steel H-Pile.
- 1.3 MEASUREMENT PROCEDURES
- .1 The supply and placement of underwater concrete will not be measured separately for Payment. Cost of doing this work shall be considered incidental to Section 31 62 16.16 - Steel H-Pile.
- 1.4 REFERENCES
- .1 Canadian Standards Association (CSA International)
- .1 CAN/CSA-A23.1/A23.2-14 , Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
- 1.5 DEFINITIONS
- .1 Tremie concrete is placed underwater through tube called 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 hopper and sufficient head of concrete is maintained in tremie pipe to provide desired rate of flow.
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1.5 DEFINITIONS  
(Cont'd)

.2 Pumped concrete method of placing concrete underwater uses concrete pump with discharge line used in similar manner to a tremie pipe.

1.6 WASTE  
MANAGEMENT AND  
DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 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 the Departmental Representative.

.4 Divert chemical additive materials from landfill to official hazardous material collections site approved by the 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.

2.2 MIXES

.1 GUB-F-SF Portland cement (General use cement with fly ash and silica fume).

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

.3 Class of exposure: C1.

.4 Maximum water cement ratio by mass: 0.40.

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- 2.2 MIXES  
(Cont'd)
- .5 Minimum cement content: 400 kg/m<sup>3</sup>.
  - .6 Nominal size of coarse aggregate: 20 mm.
  - .7 Fine aggregate content: 42 to 45 % of total aggregate mass.
  - .8 Slump at point and time of submergence discharge: 170 mm ± 40 mm.
  - .9 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 Section 03 20 00 - Concrete Reinforcement and to CAN/CSA-A23.1/A23.2. Testing for concrete to CAN/CSA-A23.1/A23.2, except where specified otherwise.
  - .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.

- 3.2 TREMIE CONCRETE
- .1 Provide water-tight tremie pipe sized to allow free flow of concrete. Diameter of tremie pipe to be minimum 200 mm and minimum eight times maximum size of coarse aggregate.
  - .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.
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- 3.2 TREMIE CONCRETE (Cont'd)
- .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.
- 3.3 PUMPED CONCRETE
- .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.