

**Part 1        General**

**1.1           RELATED SECTIONS**

- .1        Section 03 10 00 – Concrete Forming and Accessories.
- .2        Section 03 20 00 – Concrete Reinforcing

**1.2           MEASUREMENT PROCEDURES**

- .1        Cast-in-place concrete in structures where specified in the Schedule of Quantities and Prices will be measured in cubic metres in place.
- .2        Supply and installation of reinforcing steel, anchor bolts, nuts and washers and bolt grouting will not be measured but considered incidental to work.
- .3        Supply and installation of waterstops will be considered incidental to the work.
- .4        Heating of aggregates and water and providing cold weather protection will not be measured but considered incidental to the work

**1.3           REFERENCES**

- .1        American Society for Testing and Materials International (ASTM)
  - .1        ASTM C260-06, Standard Specification for Air-Entraining Admixtures for Concrete.
  - .2        ASTM C309-09, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .3        ASTM C330-04, Standard Specification for Lightweight Aggregates for Structural Concrete.
  - .4        ASTM C494/C494M-08a, Standard Specification for Chemical Admixtures for Concrete.
  - .5        ASTM C1017/C1017M-07, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
  - .6        ASTM D412-98a(2002)e1, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
  - .7        ASTM D624-00e1, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
  - .8        ASTM D1751-04(2008), Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
  - .9        ASTM D1752-04a(2008), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
  - .2 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA A283-06, Qualification Code for Concrete Testing Laboratories.
  - .3 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
    - .1 CSA-A3001-08, 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 DESIGN REQUIREMENTS**

- .1 Performance: in accordance with CSA-A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

#### **1.6 SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit WHMIS MSDS - Material Safety Data Sheets.
- .3 At least 1 weeks prior to beginning Work, submit to Departmental Representative samples of following materials proposed for use:

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- .1 5 L of curing compound.
  - .2 1 m length of each type of joint filler.
  - .3 1 m length of each type of waterstops.
  - .4 3 kg of each type of supplementary cementing material.
  - .5 10 kg of each type of blended hydraulic cement.
  - .6 5 kg of each admixture.
- .4 Submit testing results and reports for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.
  - .5 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.
  - .6 Concrete hauling time: submit for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.

## **1.7 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Site Meetings: in accordance with Section 01 31 19 – project Meetings, convene pre-installation meeting one week prior to beginning concrete works.
  - .1 Ensure key personnel, site supervisor, Departmental Representative, speciality contractor - finishing, forming concrete producer testing laboratories attend.
  - .2 Verify project requirements.
- .3 Submit to Departmental Representative, minimum 1 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.
- .4 Minimum 1 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 Finishes.
  - .6 Formwork removal.

.7 Joints.

- .5 Quality Control Plan: submit written report, as described in PART 3 - VERIFICATION, to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.
- .6 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

**1.8 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 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.
- .3 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling.
  - .2 Divert unused concrete materials from landfill to local quarry facility approved by Departmental Representative.
  - .3 Provide an appropriate area on the job site where concrete trucks can be safely washed.
  - .4 Divert unused admixtures and additive materials pigments, fibres from landfill to official hazardous material collections site as approved by the Departmental Representative.
  - .5 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.
  - .6 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 (General Use).
- .2 Blended hydraulic cement: CAN3-A362-M88.

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- .3 Water: to CSA-A23.1-09.
  - .4 Aggregates: to CAN/CSA-A23.1/A23.2-09.
  - .5 Admixtures:
    - .1 Air entraining admixture: to ASTM C260-06.
    - .2 Chemical admixture: to ASTM C494/C494M-08a, ASTM C1017. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
  - .6 Shrinkage compensating grout: premixed compound consisting of metallic or non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA-A23.1/A23.2.
    - .1 Compressive strength: 35 MPa at 28 days.
  - .7 Post-Tensioning ducts: to CSA-A23.1/A23.2.
  - .8 Curing compound: to CSA-A23.1/A23.2 white and ASTM C309, Type 1-chlorinated rubber Type 1-D with fugitive dye.
  - .9 Mechanical waterstops: labyrinth extruded PVC of sizes indicated with corner and intersecting pieces with legs not less than 500 mm long:
    - .1 Tensile strength: to ASTM D412, Die "C", minimum 8.3 MPa.
    - .2 Elongation: to ASTM D412, Die "C", minimum 250%.
    - .3 Tear resistance: to ASTM D624, Die "B", minimum 30 kN/m.
  - .10 Premoulded joint fillers:
    - .1 Bituminous impregnated fiber board: to ASTM D1751.
    - .2 Sponge rubber: to ASTM D1752, Type I.
  - .11 Weep hole tubes: plastic.
  - .12 Dovetail anchor slots: minimum 0.6 mm thick galvanized steel with insulation filled slots.
  - .13 Dampproof membrane:
    - .1 Kraft/polyethylene membrane:
      - .1 Plain polyethylene film bonded to asphalt treated creped kraft.
      - .2 Reinforced: two polyethylene films bonded each side of asphalt treated creped kraft paper, reinforced with 13 x 13 mm fibreglass scrim.
      - .3 Membrane adhesive: as recommended by membrane manufacturer.
  - .14 Dampproofing:
    - .1 Emulsified asphalt, mineral colloid type, unfilled: to CAN/CGSB-37.2.

- .15 Polyethylene film: To thickness specified and to CAN/CGSB-51.34.

## **2.2 MIXES**

- .1 Performance Method for specifying concrete: to meet Departmental Representative performance criteria in accordance with CAN/CSA-A23.1/A23.2.
  - .1 Ensure concrete supplier is certified by the Atlantic Provinces Ready Mixed Concrete Association and meets performance criteria as established below.
  - .2 Provide concrete mix to meet following plastic state requirements:
    - .1 Workability: free of surface blemishes, loss of mortar and segregation.
  - .3 Provide concrete mix to meet following hard state requirements:
    - .1 Durability and class of exposure: F-1.
    - .2 Minimum compressive strength at 28 day age: 35 MPa.
    - .3 Volume stability: acceptable volume change range due to shrinkage, creep and freeze thaw cycle.
    - .4 Surface texture: non-skid finish.
    - .5 Admixture: air- entraining chemical to ASTM C494/C494M
    - .6 Maximum W/CM ratio: .50
    - .7 Air Content: 4% to 7%.
    - .8 Slump at discharge 60 to 100mm.
  - .4 Provide quality management plan to ensure verification of concrete quality to specified performance.
  - .5 Concrete supplier's certification.

## **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 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.

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- .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
  - .6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing.
  - .7 Protect previous Work from staining.
  - .8 Clean and remove stains prior to application for concrete finishes.
  - .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
  - .10 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.
    - .1 Place steel dowels and pack solidly with shrinkage compensating grout to anchor and hold dowels in positions as indicated.
  - .11 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/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 Departmental Representative.
  - .2 Where approved by Departmental Representative, 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 Departmental Representative.
  - .4 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.
  - .5 Check locations and sizes of sleeves and openings shown on drawings.
- .3 Drainage holes and weep holes:
  - .1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.
  - .2 Install weep hole tubes and drains as indicated.
- .4 Finishing and curing:
  - .1 Finish concrete in accordance with CSA-A23.1/A23.2.

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- .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. Applied finish on concrete: Provide written declaration that compounds used are compatible.
  - .4 Concrete floor to have finish hardness in accordance with CSA-A23.1/A23.2.
  - .5 Provide float or swirl-trowelled finish unless otherwise indicated.
  - .6 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.
- .5 Waterstops:
- .1 Install waterstops to provide continuous water seal.
  - .2 Do not distort or pierce waterstop in way as to hamper performance.
  - .3 Do not displace reinforcement when installing waterstops.
  - .4 Use equipment to manufacturer's requirements to field splice waterstops.
  - .5 Tie waterstops rigidly in place.
  - .6 Use only straight heat sealed butt joints in field.
  - .7 Use factory welded corners and intersections unless otherwise approved by Departmental Representative.
- .6 Joint fillers:
- .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative.
  - .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, expansion joints as indicated.
  - .4 Install joint filler.

### **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 Departmental Representative for review in accordance with CSA-A23.1/A23.2.
- .2 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Departmental Representative.



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- .3 Departmental Representative will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
  - .4 Testing laboratory will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
  - .5 Non-Destructive Methods for Testing Concrete: in accordance with CSA-A23.1/A23.2.
  - .6 Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

### **3.5 VERIFICATION**

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established in PART 2 - Products, by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

## **Part 4 Measurement and Basis for Payment**

### **4.1 Measurement for Payment**

- .1 The measurement of payment for cast-in-place concrete will be based on theoretical volume (cubic metres) of concrete based on the contract drawings which will include supply and installation of all formwork, reinforcement and concrete.

### **4.2 Basis for Payment**

- .1 Costs will be deemed to be included in the unit and lump sum prices quoted in the Schedule of Quantities and Prices for concrete work.