

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 03 20 00 - Concrete Reinforcing.
- .2 Section 03 30 00 - Cast-in-Place Concrete.

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CSA A23.1:19/A23.2:19, Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.
  - .2 CSA O86:19, Engineering Design in Wood.
  - .3 CSA O121-17, Douglas Fir Plywood.
  - .4 CSA O151-17, Canadian Softwood Plywood.
  - .5 CSA O153:19, Poplar Plywood.
  - .6 CSA S269.1-16, Falsework and Formwork.

**1.3 SHOP DRAWINGS**

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit shop drawings for formwork and falsework.
- .3 Submit drawings stamped and signed by a qualified Professional Engineer registered or licensed in the Province of Nova Scotia.
- .4 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .5 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework and formwork drawings.
- .6 Indicate sequence of erection and removal of formwork/falsework.
- .7 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.
- .8 A copy of the formwork drawings shall be kept at the Contractor's work area while temporary supporting structures are under construction or use.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Store and manage hazardous materials in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .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 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 For unexposed surfaces, use plywood and wood formwork materials to CSA O121, CSA O151, CSA O153 and CSA O86.
  - .2 For exposed to view flat surfaces use medium density overlay plywood 19 mm thick.
- .2 Form ties: 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: chemically active release agents containing compounds that react with free lime in concrete resulting in water insoluble soaps, preventing concrete from sticking to forms.

## **Part 3 Execution**

### **3.1 FABRICATION AND ERECTION**

- .1 Verify lines, levels and centres before proceeding with formwork and ensure dimensions agree with drawings.
- .2 Obtain Departmental Representative's approval for framing openings not indicated on drawings.
- .3 Use of earth forms for footings and walls is not permitted.
- .4 Fabricate and erect formwork in accordance with CSA S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA A23.1/A23.2 and as indicated below.
- .5 Formwork and all supporting or bracing members shall be designed such that they will not deflect noticeably under the weight or pressure of the concrete and other loadings incidental to construction. The maximum deflection of facing materials in concrete surfaces exposed to view shall be 1/360 of the span between supporting members.
- .6 When necessary to maintain specified tolerances, the formwork shall be cambered to compensate for anticipated deflections.
- .7 Formwork for exposed concrete must be constructed with watertight joints. To prevent leakage of paste at corners and joints in the forms and against existing concrete, use gaskets or other approved

means which will not mar the finished appearance of the concrete. Arrange form ties and plywood panels in a regular pattern. Submit shop drawings showing pattern of forms and form ties.

- .8 A form release agent shall be applied to all forms where the finished concrete surface is to be exposed. The release agent shall be non-staining.
- .9 Align form joints and make watertight.
  - .1 Keep form joints to minimum.
- .10 Use 20 mm chamfer strips on external corners and/or 20 mm fillets at interior corners and joints of all exposed concrete members unless specified otherwise.
- .11 Form reveals, chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .12 Build in anchors, sleeves and other inserts required to accommodate work specified in other sections.
  - .1 Ensure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .13 Clean formwork in accordance with CSA A23.1/A23.2 before placing concrete.
- .14 Inspect forms after each use. Damaged surfaces must be replaced or repaired so that no evidence of the damage is apparent in the finished concrete.

### **3.2 FORMWORK REMOVAL**

- .1 Leave formwork in place for following minimum periods of time after placing concrete:
  - .1 1 day for footings.
  - .2 3 days for walls.
- .2 Remove formwork when concrete has reached 75% of its design strength or minimum period noted above, whichever comes later.
- .3 Re-use formwork subject to requirements of CSA A23.1.

### **3.3 ALLOWABLE TOLERANCES**

- .1 Variations from the plumb: In the lines and surfaces of walls: - 6 mm per 3 metres, but not more than 20 mm.
- .2 Variation from the level of the grades indicated on the drawings: - 6 mm in 3 metres, but not exceed 10 mm.
- .3 Variations in the sizes and locations of sleeves, floor openings and wall openings: Plus or minus 6 mm.
- .4 Variation in the thickness of slabs and walls: Minus - 6 mm; Plus - 12 mm.
- .5 Footings: Variations in dimensions in plan: Minus - 12 mm. Plus - 50 mm. Misplacement or eccentricity: Plus or minus - 30 mm.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 03 10 00 - Concrete Forming and Accessories.
- .2 Section 03 30 00 - Cast-in-place Concrete.

**1.2 REFERENCES**

- .1 American Concrete Institute (ACI)
  - .1 ACI 315R-18, Guide to Presenting Reinforcing Steel Design Details.
- .2 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A1064/A1064M-18a, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- .3 Canadian Standards Association (CSA)
  - .1 CSA A23.1:19/A23.2:19, Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.
  - .2 CSA A23.3:19, Design of Concrete Structures.
  - .3 CSA G30.18-09 (R2019), Carbon Steel Bars for Concrete Reinforcement.
- .4 Reinforcing Steel Institute of Canada
  - .1 Reinforcing Steel Manual of Standard Practice, RSIC, Fifth Edition, 2018.

**1.3 SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Prepare reinforcement drawings in accordance with the Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .3 Submit shop drawings including placing of reinforcement and indicate:
  - .1 Bar bending details.
  - .2 Lists.
  - .3 Quantities of reinforcement.
  - .4 Sizes, spacings and locations of reinforcement, 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 Class “B” tension lap splices unless otherwise indicated.
- .5 Quality Assurance: in accordance with Section 01 45 00 - Quality Control and as described in PART 2 - 2.3 SOURCE QUALITY CONTROL.

- .1 Mill Test Report: Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, minimum 2 weeks prior to beginning reinforcing work.
- .2 Upon request, submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.
- .6 Each shop drawing submitted to bear the stamp and signature of a qualified Professional Engineer registered in the Province of Nova Scotia.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Store and manage hazardous materials in accordance with Section 01 35 29.06 - Health and Safety Requirements..
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling.
  - .2 Place materials defined as hazardous or toxic in designated containers.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Reinforcing steel: carbon steel, grade 400W, deformed bars to CSA G30.18, unless indicated otherwise.
- .2 Cold-drawn annealed steel wire ties: to ASTM A1064/A1064M.
- .3 Chairs, bolsters, bar supports, spacers: to CSA A23.1/A23.2. Non-metallic where within 40 mm of exposed concrete surfaces.

#### **2.2 FABRICATION**

- .1 Fabricate reinforcing steel in accordance with CSA A23.1/A23.2, ACI 315, and the Manual of Standard Practice by the Reinforcing Steel Institute of Canada, unless indicated otherwise.
- .2 Obtain Departmental Representative's approval for locations of reinforcement splices other than those shown on drawings.
- .3 Welding of reinforcement will not be permitted.
- .4 Ship bundles of bar reinforcement, clearly identified, in accordance with bar bending details and lists.

#### **2.3 SOURCE QUALITY CONTROL**

- .1 Provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 2 weeks prior to commencing reinforcing work.
- .2 Upon request, inform Departmental Representative of proposed source of materials to be supplied.

**Part 3 Execution**

**3.1 ON-SITE STORAGE AND HANDLING**

- .1 Reinforcing steel shall be handled and stored in such a manner to keep it free of dirt, mud and water.
- .2 Reinforcing steel shall be off-loaded from the truck directly onto purpose made storage racks and covered with tarp.
- .3 Clean reinforcing steel of excess rust and previously deposited concrete prior to placing concrete.

**3.2 FIELD BENDING**

- .1 Do not field bend reinforcement except where indicated or authorized by Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- .3 Replace bars which develop cracks or splits.

**3.3 PLACING REINFORCEMENT**

- .1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA A23.1/A23.2.
- .2 Install, support and space reinforcement in alignment to position and clearances indicated and secure to supports.
- .3 Unless otherwise indicated, provide the following cover for reinforcing:
  - 75 mm - Where concrete is cast against earth.
  - 50 mm - 20M bars or larger.
  - 50 mm - Slabs-on-grade.
  - 40 mm - 15M bars or smaller.
- .4 Ensure cover to reinforcement is maintained during concrete pour.
- .5 Prior to placing concrete, obtain Departmental Representative's approval, in writing, of reinforcing material and placement. Use of approved chairs to support reinforcement in slabs is mandatory.
- .6 Remove and replace reinforcement which is visibly damaged or cracked.
- .7 Do not cut reinforcement, either before or after concrete is placed, to permit incorporation of other work.
- .8 Do not relocate reinforcement without approval.
- .9 Clean reinforcement before placing concrete.
- .10 All wall dowels shall be set in footing forms prior to placing concrete and held in place by approved means so that each dowel is maintained in its correct position. Dowels shall not be inserted in freshly placed concrete.

- .11 The Departmental Representative shall be notified when the reinforcing steel is in place and in sufficient time to permit an inspection of same prior to concrete placement. Minimum 24-hour notification required.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 03 10 00 – Concrete Forming and Accessories.
- .2 Section 03 20 00 – Concrete Reinforcing.
- .3 Section 07 92 00 – Joint Sealants.
- .4 Section 09 67 00 – Fluid-Applied Flooring.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C260-10a (2016), Standard Specification for Air-Entraining Admixtures for Concrete.
  - .2 ASTM C309-19, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .3 ASTM C494/C494M-19, Standard Specification for Chemical Admixtures for Concrete.
  - .4 ASTM C1017/C1017M-13e1, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
  - .5 ASTM D1751-18, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
  - .6 ASTM D3575-20, Standard Test Methods for Flexible Cellular Materials made from Olefin Polymers.
  - .7 ASTM E1745-17, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
- .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.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA A23.1:19/A23.2:19, Concrete Materials and Methods of Concrete Construction / Test Methods and Standard Practices for Concrete.
  - .2 CSA A283:19, Qualification Code for Concrete Testing Laboratories.
  - .3 CSA A3000-18, Cementitious Materials Compendium.
    - .1 CSA A3001-18, Cementitious Materials for Use in Concrete.

**1.3 DESIGN REQUIREMENTS**

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

#### **1.4 SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit proposed quality control procedures for Departmental Representative's review.
- .3 Minimum two (2) weeks prior to starting concrete work, submit proposed quality control procedures for Departmental Representative's approval for following items:
  - .1 Cold and hot weather concreting.
  - .2 Temporary bracing.
  - .3 Chairs and spacers for support of reinforcing.
  - .4 Curing of concrete.
  - .5 Finishes.
  - .6 Formwork removal.
  - .7 Joint forming and filling.
  - .8 Waterstops.

#### **1.5 CONSTRUCTION QUALITY CONTROL**

- .1 Inspection and testing of concrete and concrete materials will be carried out in accordance with CSA A23.1.
- .2 Testing laboratory 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.
- .4 Inspection or testing by Departmental Representative, or Testing Agency designated by Departmental Representative, will not augment or replace the Contractor's quality control nor relieve him of his contractual responsibilities.

#### **1.6 SAMPLES**

- .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
- .2 At least 2 weeks prior to beginning Work, inform Departmental Representative of proposed source of aggregates and provide access for sampling.

#### **1.7 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Convene pre-installation meeting one week prior to beginning of concrete work.
- .3 Ensure key personnel, site supervisor, Departmental Representative, speciality contractor - finishing, forming concrete producer, and representative from testing laboratories attend.
  - .1 Verify project requirements.
- .4 Provide certification that plant, equipment and materials to be used in concrete comply with requirements of CSA A23.1.

- .5 Provide mix designs in compliance with CSA A23.1 to provide concrete quality, yield and strength as specified under 2.2 Mixes. Mix designs to be prepared by and stamped by an engineer licensed to practice in Nova Scotia.
- .6 Provide certification that the concrete supplier is certified by the Atlantic Provinces Ready Mixed Concrete Association program or equivalent. This certification is to remain in good standing for the duration of the project and until the warranty period expires.

## **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 by the Departmental Representative, the laboratory representative and the 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 CSA A3001, Type GU, or Type GUb.
- .2 Supplementary cementing materials: to CSA A3001.
- .3 Water: to CSA A23.1.
- .4 Aggregates:
  - .1 To CSA A23.1/A23.2. Coarse aggregates to be normal density.
  - .2 Maximum aggregate size to be 20 mm.

- .5 Admixtures:
  - .1 Air entraining admixture: to ASTM C260.
  - .2 Chemical admixture: to ASTM C494 and ASTM C1017. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .6 Anchorage adhesive:
  - .1 In concrete: to be njectable, two-component, fast-cure hybrid adhesive that has been tested in accordance with ACI 355.4 and ICC-ES AC308 for use in cracked and uncracked concrete.
- .7 Curing compound:
  - .1 To CSA-A23.1/A23.2 white and ASTM C309,
  - .2 To be white pigmented. Subject to compatibility with specified finishes, removal may be required.
  - .3 Use curing compounds compatible with applied finish on concrete surfaces. Provide written certification that compounds used are compatible.
- .8 Waterstops:
  - .1 To be a single-component, self-sealing adhesive compound designed to bond to cured concrete surfaces and fuse with fresh concrete to produce a watertight seal. Unaffected by cyclic wetting and drying.
- .9 Premoulded joint fillers (Isolation Joints):
  - .1 Isolation Joint Filler: To be flexible, lightweight, non-staining, polyethylene, and closed cell. It shall be a chemical-resistant, ultraviolet stable, non-absorbent, low density, compressible foam and have the following requirements:
    - .1 Density, to ASTM D1751: 32.04 kg/m<sup>3</sup>.
    - .2 Compression, to ASTM D3575
      - .1 10% Deflection: 69 kPa maximum.
      - .2 80% Deflection: 862.49 kPa maximum.
    - .3 Tensile Strength, to ASTM D3575: 379.50 kPa
    - .4 Water Absorption, to ASTM D3575: 0.5% volume maximum.
    - .5 Temperature Stability: -40°C to 71°C.
- .10 Joint Sealant: as per Section 07 92 00 – Joint Sealants.

## 2.2 MIXES

- .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 – Performance method, to give the following quality for concrete as indicated:

- .1 For concrete in Headworks and UV Buildings' trench walls and footings:
  - .1 Minimum compressive strength at 28 days: 35 MPa.
  - .2 Class of exposure: A-1.
  - .3 Maximum water/cement ratio: as per CSA A23.1.
  - .4 Nominal maximum size of coarse aggregate: 20 mm.
  - .5 Slump at time and point of discharge: as per CSA A23.1.
  - .6 Air content: as per CSA A23.1.
  - .7 Admixtures: Obtain Departmental Representative's approval before using admixtures.
- .2 For concrete in Headworks, UV and Blower Buildings' foundation walls and footings:
  - .1 Minimum compressive strength at 28 days: 25 MPa.
  - .2 Class of exposure: F-2.
  - .3 Maximum water/cement ratio: as per CSA A23.1.
  - .4 Nominal maximum size of coarse aggregate: 20 mm.
  - .5 Slump at time and point of discharge: as per CSA A23.1.
  - .6 Air content: as per CSA A23.1.
- .3 For concrete in Headworks, UV and Blower Building interior slab-on-grade and pads:
  - .1 Minimum compressive strength at 28 days: 30 MPa.
  - .2 Class of exposure: N.
  - .3 Maximum water/cement ratio: as per CSA A23.1.
  - .4 Nominal maximum size of coarse aggregate: 20 mm.
  - .5 Slump at time and point of discharge: as per CSA A23.1.
- .4 For concrete used in mud-slabs:
  - .1 Compressive strength at 28 days: 15 MPa.
  - .2 Slump: 75 mm.
  - .3 Nominal maximum size of coarse aggregate: 20 mm.
- .4 Provide quality management plan to ensure verification of concrete quality to specified performance.

### **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.
- .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 Protect previous work from staining.
- .7 Clean and remove stains prior to application for concrete finishes.
- .8 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .9 Do not place load upon new concrete until authorized by Departmental Representative.
- .10 Reinforcing steel, embedded parts, and inserts to be secured in position prior to placing concrete.
- .11 Ensure that reinforcement and formwork are thoroughly clean before placing concrete.
- .12 Ensure that foundation bearing materials are free from water and frost. Remove previously frozen bearing materials.
- .13 Keep excavation dry while placing concrete.
- .14 Do not permit vertical free fall of concrete mix to exceed 1500 mm.

### 3.2 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with CSA A23.1/A23.2.
- .2 Hot-weather and cold-weather concreting shall be carried out, protected, and cured in accordance with CSA A23.1.
- .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .4 Slabs-on-grade to be moist cured for minimum 7 days.
- .5 Sleeves and inserts:
  - .1 Where approved by Departmental Representative, set sleeves, ties 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.
  - .5 Set special inserts for strength testing as required by non-destructive method of testing concrete.
- .6 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.

- .7 Embedded components:
  - .1 Where approved by Departmental Representative, set embedded components as indicated or specified elsewhere.
  - .2 Do not eliminate or displace reinforcement to accommodate hardware. If embedded components cannot be located as specified, obtain approval of modifications from Departmental Representative before placing of concrete.
  - .3 Check locations and sizes of embedded components shown on the drawings.
- .8 Finishing and curing:
  - .1 Finish concrete in accordance with CSA A23.1/A23.2.
  - .2 Formed surfaces:
    - .1 Interior wall surfaces to be left exposed in finished work – smooth rubbed finish.
  - .3 Slab and floor finishes: as per CSA A23.1.
    - .1 Concrete floors intended as finished surface: except as specified herein, finish surfaces to produce a smooth, steel troweled surface free from ridges, trowel marks or undulations to a tolerance defined in Table 21, Class A.
    - .2 Float surface with wood or metal floats and power finishing machine and bring surface to true grade.
    - .3 Steel trowel to smooth and even surface.
    - .4 All exposed slab-on-grade concrete surfaces to be continuously cured for initial 7 days after finishing.
  - .4 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.
  - .5 Use curing compounds compatible with applied finish on concrete surfaces. Applied finish on concrete: Provide written declaration that compounds used are compatible.
- .9 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.
  - .5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.
- .10 Waterstops:
  - .1 Install in strict accordance with manufacturers' instructions.

### **3.3 SAW-CUT CONTROL JOINTS**

- .1 Use purpose-made “early entry” concrete saws. To be Soff-Cut, or approved alternate.
- .2 Capability: Employ sufficient number of saws and workers to complete cutting sawed joints before shrinkage produces cracking.
- .3 Start cutting sawed joints as soon as concrete has hardened sufficiently to prevent ravelling or dislodging of aggregates, (approximately 2 to 5 hours and when concrete strength has reached 0.5 MPa).
- .4 Saw-cut pattern to be as shown on reviewed slab-on-grade shop drawings.
- .5 Apply joint sealer in saw-cut joints in accordance with sealant manufacturer’s written instructions.

### **3.4 CONSTRUCTION JOINTS**

- .1 No horizontal construction joints will be permitted in any foundation walls unless noted on the drawings or otherwise approved by the Departmental Representative.
- .2 Any construction joints not indicated on the drawings to be approved by the Departmental Representative.
- .3 Unless noted otherwise, construction joints detailed without a key shall have a roughened surface and reinforcing steel shall be continuous through construction joints.

### **3.5 SURFACE TOLERANCE**

- .1 Concrete tolerance in accordance with CSA A23.1/A23.2 and as otherwise indicated on the drawings and in the specifications.

### **3.6 FIELD QUALITY CONTROL**

- .1 Inspection and testing of concrete and concrete materials to be carried out in accordance with CSA A23.1.
- .2 The services of a concrete testing laboratory will be hired and payed for by the Contractor to perform testing of concrete placed during construction.
  - .1 Departmental Representative will receive every report regarding the site and issued by the testing company no later than the Contractor.
- .3 Tests during construction (minimum)
  - .1 Strength test – procedure:
    - .1 Six cylinders to be taken from each sample.
    - .2 Cylinders will be tested as follows:
      - .1 One at 7 days.
      - .2 One at 14 days.
      - .3 Two at 28 days.
      - .4 Two cylinders to be held and tested at 56 days if tests at 28 days fail.
  - .2 Strength test – frequency:

- .1 Not less than one test each day concrete is placed.
- .2 Not less than one test for each 50 cubic metres, or major fraction thereof, placed in one day.
- .3 Not less than one test for each type of concrete poured.
- .4 Not less than one test for each concrete element exceeding 2 cubic metres in volume.
- .3 Slump test:
  - .1 Determined for each strength test sample.
  - .2 Additional slump tests to be taken as good practice dictates.
- .4 Air content:
  - .1 Determined for each strength test sample.
- .5 Temperature:
  - .1 Determined for each strength test sample.
- .4 Evaluation of tests:
  - .1 Strength test results:
    - .1 Average of 28-day strength of two cylinders from each sample.
      - .1 If one cylinder manifests evidence of improper sampling, molding, handling, curing or testing, strength of remaining cylinder will be test result.
      - .2 If both cylinders show any of above defects, test will be discarded.
      - .3 If no tests are available for a structure of more than 2 cubic metres, on site, non-destructive tests shall be conducted at no additional cost to the Owner.
- .5 Acceptance of concrete:
  - .1 Strength level of each type of concrete shall be considered satisfactory if both of the following requirements are met:
    - .1 Average of all sets of three consecutive strength tests equals or exceeds the required specified 28-day compressive strength.
    - .2 No individual strength test falls below the required specified 28-day compressive strength by more than 3.5 MPa.
  - .2 If tests fail to indicate satisfactory strength level, perform additional tests and/or corrective measures at no additional cost to Owner.
- .6 Inspection and testing company will take additional test cylinder during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .7 Unsatisfactory results:
  - .1 In case of unsatisfactory results, the Departmental Representative shall have the right to request one or more of the following at no extra cost to the Owner.
    - .1 Non-destructive testing.
    - .2 Core drilling and testing.
    - .3 Removing and replacing of all defective concrete.

- .2 Should the strength of concrete already poured, as shown by job cured test cylinders, fall below the required strength at 28 days, or at 7 days test fail to reach a minimum of 70% of 28 days strength, the Departmental Representative shall have the right to require changes in mixing proportions for the remainder of the work so as to attain these strengths. He shall also have the right to require additional curing of these portions of the work represented by test specimens not meeting the herein quoted strength criteria.
  - .3 Should such additional curing not produce the required strength, the Departmental Representative shall have the right to require strengthening or replacement of the portions of work in question at no additional cost to the Owner.
  - .4 The Departmental Representative reserves the right to reduce the amount of payment for all concrete which failed to meet the requirements of the drawings and this specification, where the defect is such as to permit leaving the concrete in question in place.
- .8 Rejection:
- .1 All construction not meeting the required standard of quality and workmanship shall be rejected unless, in the opinion of the Departmental Representative, suitable repair work can be performed within the work schedule. Cost of replacement or repair shall be borne entirely by the Contractor. All remedial work must be carried out to the satisfactory of the Departmental Representative.

**END OF SECTION**