

## 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 QUALITY ASSURANCE

- .1 Construct and erect concrete formwork in accordance with CAN3-A23.1M00 and applicable construction safety regulations for place of Work.

## Part 2 PRODUCTS

### 2.1 WOOD FORM MATERIALS

- .1 Plywood: Douglas Fir species; solid one side-tight face grade; sound undamaged sheets with clean true edges.

### 2.2 PREFABRICATED FORMS (for all exposed concrete)

- .1 Steel Type: Minimum 16 gauge, well matched, tight fitting, and adequately stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.
- .2 Tubular Column Type: Inside surface treated with a release agent; of sizes as per structural drawings.

### 2.3 FORMWORK ACCESSORIES

- .1 Form Ties: Snap-off metal type, fixed or adjustable length; minimum working strength of 13 KN when assembled; free of defects that will leave holes larger than 25mm in concrete surface. Upon removal of forms, metal ties shall be less than 12mm from surface where surface is not exposed and 30mm from surface where the concrete surface is exposed. Provide plastic setback plugs at exposed surfaces to seal off cone holes.
- .2 Form Release Agent: Colourless mineral oil which will not stain concrete or impair natural bonding or color characteristics of coating intended for use on concrete. Refer to section 01 47 15.
- .3 Fillets for Chamfered Corners: Rigid formed plastic type; 20mm x 20mm size; maximum possible lengths.
- .4 Shoring soldier piles: Steel I-beams to suit lateral loads

### 2.4 CONCRETE ACCESSORIES

- .1 Void forms: carton forms of biodegradable, recycled corrugated kraft paper (cardboard) with waterproof waxed coating or plastic surfaces, 150mm (6") thickness x size as required to suit slab/grade beam. Product to be structurally sufficient to support weight of wet concrete mix until initial set; compression strength of 1,000 to 1,500 PSF. Acceptable products: "CaraCor Waxmat" by VoidForm Products Inc., "BeamVoid and FloorVoid" by VoidForm International.

## Part 3 EXECUTION

### 3.1 FORMWORK ERECTION

- .1 Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.
- .2 Construct formwork, shoring and bracing to meet design and code requirements, so that resultant finished concrete conforms to required shapes, lines and dimensions.
- .3 Arrange and assemble formwork to permit dismantling and stripping so that concrete is not damaged during its removal.
- .4 Align joints and make watertight, to prevent leakage of mortar disfigured appearance of concrete. Keep form joints to a minimum.
- .5 Arrange forms to allow stripping without removal of principal shores, where and when these are required to remain in place.
- .6 Obtain Contract Administrator's review before framing openings in structural members, which are not indicated on drawings.
- .7 Provide bracing to ensure stability of formwork. Shore or strengthen previously constructed formwork liable to be overstressed by construction loads.
- .8 Provide chamfer strips on external corners of beams, columns and walls that are open to view.
- .9 Apply form release agent on formwork in accordance with manufacturer's recommendations. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.
- .10 Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.

### 3.2 VOID FORMS

- .1 Install compressible void form products specified, according to the manufacturer's printed instructions. Coordinate this Work with others. Adjust product area to suit by using a fine-toothed hand saw, or as recommended by manufacturer. On surface of void forms below structural slabs, provide a 3mm (1/8") thick masonite board for temporary support of structural slab casting, prior to placing concrete.
- .2 Protect forms from moisture before concrete placing and protect forms from crushing during concrete placement.

### 3.3 INSERTS, EMBEDDED PARTS, AND OPENINGS

- .1 Provide formed openings where required for pipes, conduits, sleeves, and other work to be embedded in and passing through concrete members.
- .2 Locate and set in place items that will be cast directly into concrete.
- .3 Coordinate Work of other sections and cooperate with trade involved in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts. Do not perform Work unless specifically indicated on drawings or reviewed prior to installation.
- .4 Install concrete accessories in accordance with manufacturer's instructions; straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- .5 No sleeves, ducts, pipes or conduits shall pass through slabs, beams or columns except where expressly detailed on structural drawings or approved by Contract Administrator in advance of construction.

### 3.4 TOLERANCES

- .1 Deviation from horizontal to maintain following maximum tolerances:
  - .11 6mm in 3m,
  - .12 9mm in 6m,
- .2 Deviation of building dimensions indicated on drawing and position of columns, walls and partitions: 6mm.

- .3 Deviation in cross sectional dimensioning of columns or beams or in thickness of slabs and walls: plus or minus 6mm.

3.5 CLEANING

- .1 Clean forms as erection proceeds, to remove foreign matter. Remove cuttings, shavings, and debris from within forms. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
- .2 During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out completed forms, unless formwork and concrete construction proceed within heat enclosure. Use compressed air or other means to remove foreign matter.

3.6 FORM REMOVAL

- .1 Do not remove forms, shores and bracing until concrete has gained sufficient strength to carry its own weight, and construction and design load which are liable to be imposed upon it. Verify strength of concrete by compressive test results.
- .2 Remove formwork progressively and in accordance with code requirements and so that no shock loads or unbalanced loads are imposed on structure.
- .3 Loosen forms carefully. Do not wedge pry bars, hammers, or tools against concrete surfaces.
- .4 Store forms for exposed architectural concrete, in manner that surfaces to be in contact with fresh concrete will not be damaged. Marked or scored forms will be rejected.
- .5 Re-shore structural members where required due to design requirements or construction conditions and as required to permit progressive construction. Remove load supporting forms only when concrete has attained 75 percent of required 28 day compressive strength, provide construction is re-shored and in no case earlier than four days after completion of pour.
- .6 Remove forms not directly supporting weight of concrete as soon as stripping operations will not damage concrete.
- .7 Unless otherwise specified, the following chart may be used as a guide for removal of forms:

3.7 CONCRETE CURING TEMPERATURE (°C)

	25°-35°	5°-25°	0°-5°
.1 Wall and beam sides and other surfaces not supporting weight of concrete.	2 Days	3 Days	4 Days
.2 Beam soffits, structural slabs, and surfaces supporting weight of concrete.	14 Days	17 Days	21 Days

**END OF SECTION**

**Part 1 GENERAL**

1.1 RELATED SECTIONS

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

1.2 MEASUREMENT PROCEDURES

- .1 Reinforcing steel will be measured in tonnes of steel incorporated into work, computed from theoretical unit mass specified in CAN/CSA-G30.18 or latest for lengths and sizes of bars as indicated or authorized in writing by Contract Administrator.
- .2 No measurement will be made under this section. Include costs in items of concrete work for which reinforcement is required.

1.3 REFERENCES

- .1 American Concrete Institute (ACI), latest edition.
  - .1 ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure
- .2 American National Standards Institute/American Concrete Institute (ANSI/ACI), latest edition
  - .1 ANSI/ACI 315, Details and Detailing of Concrete Reinforcement
- .3 American Society for Testing and Materials (ASTM), latest edition
  - .1 ASTM A 775/A 775M, Specification for Epoxy-Coated Reinforcing Steel Bars
- .4 Canadian Standards Association (CSA), latest edition
  - .1 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction
  - .2 CAN3-A23.3, Design of Concrete Structures for Buildings
  - .3 CSA G30.3-M, Cold Drawn Steel Wire for Concrete Reinforcement
  - .4 CSA G30.5-M, Welded Steel Wire Fabric for Concrete Reinforcement
  - .5 CSA G30.14-M, Deformed Steel Wire for Concrete Reinforcement or latest.
  - .6 CSA G30.15-M, Welded Deformed Steel Wire Fabric for Concrete Reinforcement
  - .7 CAN/CSA-G30.18-M, Billet-Steel Bars for Concrete Reinforcement
  - .8 CAN/CSA-G40.21-M, Structural Quality Steels
  - .9 CAN/CSA-G164-M, Hot Dip Galvanizing of Irregularly Shaped Articles
  - .10 CSA W186-M, Welding of Reinforcing Bars in Reinforced Concrete Construction

1.4 SHOP DRAWINGS

- .1 Submit shop drawings including placing of reinforcement in accordance with Section 01 33 00- Submittal Procedures.
- .2 Shop drawings shall show bar bending details, lists, quantities of reinforcement, sizes, spacing, locations of reinforcement and mechanical splices, if approved by Contract Administrator, with identifying code marks to permit correct placement, without reference to Structural drawings. Sizes, spacing and locations of chairs, spacers and hangers shall be indicated. Prepare reinforcement drawings in accordance with the Reinforcing Steel

Manual of Standard Practice (Reinforcing Steel Institute of Canada), ANSI/ACI 315 and ACI 315R, the Manual of Engineering and the Placing Drawings for Reinforced Concrete Structure or latest.

- .3 Detail lap lengths and bar development lengths to CAN3-A23.3 or latest, unless otherwise indicated. Provide type C tension lap splices unless otherwise indicated.
- .4 Coordination to be undertaken with other layers of reinforcing for radiant floor etc, see mechanical specifications and drawings.

## 1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 and the Waste Reduction Workplan.

## Part 2 PRODUCTS

### 2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Contract Administrator.
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18 or latest, unless indicated otherwise.
- .3 Reinforcing steel: weldable low alloy steel deformed bars to CAN/CSA-30.18 or latest.
- .4 Cold-drawn annealed steel wire ties: to CSA G30.3 or latest.
- .5 Deformed steel wire for concrete reinforcement: to CSA G30.14 or latest.
- .6 Welded steel wire fabric: to CSA G30.5 or latest. Provide in flat sheets only.
- .7 Welded deformed steel wire fabric: to CSA G30.15 or latest. Provide in flat sheets only.
- .8 Epoxy coating of non-prestressed reinforcement: to ASTM A 775/A 775M or latest.
- .9 Galvanizing of non-prestressed reinforcement: to CSA G164 or latest, minimum zinc coating
- .10 Chairs, bolsters, bar supports, spacers: to CAN/CSA-A23.1 or latest.
- .11 Mechanical splices: subject to approval of Contract Administrator.
- .12 Plain round bars: to CAN/CSA-G40.21 or latest.

### 2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1 or latest, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada, or latest.
- .2 Obtain Contract Administrator's approval for locations of reinforcement splices other than those shown on reviewed shop drawings.

- .3 Upon approval of Contract Administrator, weld reinforcement in accordance with CSA W186 or latest.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

### 2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Contract Administrator with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to commencing reinforcing work. Inform Contract Administrator of proposed source of material to be supplied.

## Part 3 EXECUTION

### 3.1 FIELD BENDING

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

### 3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CAN/CSA-A23.1 or latest.
- .2 Prior to placing concrete, obtain Contract Administrator's approval of reinforcing material and placement.
- .3 Ensure cover to reinforcement is maintained during concrete pour (as per Structural drawings and notes).
- .4 Cover epoxy and paint coated portions of bars during transportation and handling.

### 3.3 FIELD TOUCH-UP

- .1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

**END OF SECTION**

**Part 1 GENERAL**

1.1 RELATED SECTIONS

- .1 Section 03 10 00 - Concrete Forming
- .2 Section 03 20 00 - Concrete Reinforcing
- .3 Section 07 11 13 – Sheet Waterproofing
- .4 Section 01 47 15 – Sustainable Requirements

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM), latest edition.
  - .1 ASTM C109/C109M, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50-mm Cube Specimens)
  - .2 ASTM C260, Specification for Air-Entraining Admixtures for Concrete
  - .3 ASTM C309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete
  - .4 ASTM C332, Specification for Lightweight Aggregates for Insulating Concrete
  - .5 ASTM C494, Specification for Chemical Admixtures for Concrete
  - .6 ASTM C827, Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
  - .7 ASTM C939, Test Method for Flow of Grout for Preplaced-Aggregate Concrete
  - .8 ASTM D412, Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension
  - .9 ASTM D624, Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer
  - .10 ASTM D1751, Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
  - .11 ASTM D1752, Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
- .2 Canadian General Standards Board (CGSB), latest edition
  - .1 CAN/CGSB-37.2-M, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings
  - .2 CAN/CGSB-51.34-M, Vapour Barrier, Polyethylene Sheet for Use in Building Construction
  - .3 CGSB 81-GP-1M, Flooring, Conductive and Spark Resistant
- .3 Canadian Standards Association (CSA), latest edition
  - .1 CAN/CSA-A5, Portland Cement
  - .2 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction
  - .3 CAN/CSA-A23.2, Methods of Test for Concrete
  - .4 CAN/CSA-A23.5-M, Supplementary Cementing Materials
  - .5 CAN/CSA A363-M, Cementitious Hydraulic Slag

1.3 SAMPLES

- .1 At least 4 weeks prior to commencing Work, inform Contract Administrator of proposed source of aggregates and provide access for sampling. Upon request, submit samples in accordance with Section 01 33 00.
- .2 Mock-up Panels: Upon request by Contract Administrator, prepare one 1500x1500 (5'x5') mock-up panel at the project Site to demonstrate proficiency, and to define the degree of aggregate exposure. Contractor shall use the methods and materials proposed to be used on the final installation. Uniformity in appearance of each panel shall be the responsibility of the Contractor. The approved mock-up shall serve as a standard of appearance for the final Work.

1.4 CERTIFICATES

- .1 Submit certificates in accordance with Section 01 33 00.
- .2 At least 4 weeks prior to starting concrete work, submit manufacturer's test data and certifications by qualified independent inspection and testing laboratories, that the following materials will meet specified requirements.
  - .1 Portland cement.
  - .2 Blended hydraulic cement.
  - .3 Supplementary cementing materials.
  - .4 Grout.
  - .5 Admixtures.
  - .6 Aggregates.
  - .7 Water.
  - .8 Waterstops.
  - .9 Waterstop joints.
  - .10 Joint filler.
- .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 or latest.
- .4 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CAN/CSA-A23.1 or latest.

1.5 QUALITY ASSURANCE

- .1 Concrete testing to CAN/CAS-A23.1 by an independent testing laboratory as designated and paid for through a Cash Allowance.
- .2 Provide a minimum of 48 hours notice to Contract Administrator, prior to each concrete pour.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21.



- .2 Use excess concrete for: additional paving, post footing anchorage, flowable fill, retaining wall footing ballast, storm structure covers, underground utility pipe kickers, storm pipe flared end section, toe wash protection.
- .3 Use trigger operated spray nozzles for water hoses.
- .4 Designate a cleaning area for tools to limit water use and runoff.
- .5 Carefully coordinate the specified concrete Work with weather conditions.
- .6 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .7 Prevent plasticizers, water-reducing agents and air-entraining agents from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, non-combustible material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.
- .8 Choose the least harmful, most appropriate cleaning method, which will perform adequately.

1.7 WARRANTY

- .1 Provide a one (1) year written warranty for Work of this Section to cover any defects in materials, installation, and workmanship, from the Date of Substantial Performance.

**Part 2 PRODUCTS**

2.1 MATERIALS

- .1 Portland cement: to CAN/CSA-A5 or latest.
- .2 Supplementary cementing materials: to CAN/CSA-A23.5 or latest.
- .3 Replace a minimum of 30% of the cement content with Supplementary Cement Materials such as fly ash. Fly ash contents that produce a high volume of supplementary cementing materials (HVSCM) as defined in CSA-A23.1, section 8.8 or latest, shall not be permitted unless the contractor meets the following requirements:

The Materials, and mix shall conform to CSA-A23.1, section 8.8 or latest.

The contractor shall submit a curing plan for approval by the Contract Administrator as per CSA A23.1, section 8.8 or latest. The plan shall provide details for the protection and curing of the HVSCM, including:

The method for protecting the concrete from evaporation of surface moisture from the fresh concrete;

The type of curing material to be used;

How the surface will be kept moist, and the quality control requirements for keeping the surface moist;

The time of initiation and duration of curing;

Provisions to address potential problems such as high winds and hot and cold weather; and

The limitations of access, if any, to the surfaces being cured.

The curing type shall conform to CSA-A23.1 or latest, Table 2, and shall depend on the volume of supplementary cementing materials.

- .4 Water: to CAN/CSA-A23.1 or latest.
- .5 Aggregates: to CAN/CSA-A23.1 or latest. Coarse aggregates to be high density.
  - .1 Exposed aggregates (including at concrete toppings etc.): Aggregate shall be 10 (3/8") round maximum, with the following sieve graduation:

Size	% Passing
3/8"	70-100
#4	40-70
#8	0-40
  - .2 All exposed aggregate to be purchased from one place at one time.
- .6 Air entraining admixture: to CAN3-A266.1, latest edition.
- .7 Chemical admixtures: to CAN3-A266.2 or latest. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .8 Concrete retarders: to ASTM C494 or latest water based, low VOC, solvent free. Do not allow moisture of any kind to come in contact with the retarder film.
- .9 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents.
  - .1 Compressive strength: 50 MPa at 28 days.
- .10 Non premixed dry pack grout: composition of non metallic aggregate Portland cement with sufficient water for the mixture to retain its shape when made into a ball by hand and capable of developing compressive strength of 50 MPa at 28 days.
- .11 Premoulded joint fillers:
  - .1 Bituminous impregnated fiber board: to ASTM D1751 or latest.
- .12 Dovetail anchor slots: minimum 0.6 mm thick galvanized steel with insulation filled slots.
- .13 Ribbed waterstops: extruded PVC of sizes indicated:
  - .1 Tensile strength: to ASTM D412 or latest, method A, Die "C", minimum 11.4 MPa.
  - .2 Elongation: to ASTM D412 or latest, method A, Die "C", minimum 275%.
  - .3 Tear resistance: to ASTM D624 or latest, method A, Die "B", minimum 48 kN/m.

## 2.2 MIXES

- .1 Cement: Type 10 Portland cement unless noted.
- .2 Minimum compressive strength at 28 days: as indicated on drawings.
- .3 Nominal size of coarse aggregate: 20 mm.
- .4 Slump at time and point of discharge: 90 to 110 mm.
- .5 Air content: 5 to 7 % where indicated.
- .6 Chemical admixtures: following admixtures in accordance with ASTM C494, type, quantity, water reducing strength increasing, air entraining, super plasticizers.

## 2.3 VOID FORMS

- .1 Refer to Section 03 10 00.

2.4 COATINGS

- .1 Clear, penetrating sealer and liquid repellent to protect concrete surfaces against both water ingress and graffiti application (paint and marker) on exposed concrete and masonry surfaces, to MPI EXT 3.2K (non-slip, chemical resistant, anti-graffiti, water vapour permeable, and non-yellowing); one reduced coat plus one full strength final coat in a Gloss level G1 matte finish; applied according to manufacturer's instructions. Acceptable products: Fabrikem 'Fabrishield PR-60' (concrete and stone).
- .2 As recommended by the manufacturer, apply onto exterior exposed concrete surfaces at the front entry canopy, entry stairs and landing, sloped sidewalk, and where indicated on the drawings. Provide a test area for the Contract Administrator's review, not on the building directly.
- .3 Supply 2x1 gallon containers of Fabrikem PR Cleaner for The City for future use to clean off graffiti.

**Part 3 EXECUTION**

3.1 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory in accordance with CAN/CSA-A23.1, as designated and paid for through a Cash Allowance.
- .2 Testing Laboratory may take additional test cylinders during cold weather concreting. Cure cylinders on site under same conditions as concrete in which they represent.
- .3 Non-destructive Methods for Testing Concrete shall be in accordance with CAN/CSA-A23.2 or latest.
- .4 Inspection and testing by designated agency does not augment or replace Contractor's responsibility for quality control.

3.2 PREPARATION

- .1 Obtain Contract Administrator's approval before placing concrete. Provide a minimum of 48 hours notice prior to placing 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 concrete, obtain Contract Administrator'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 In locations where new concrete is dowelled to existing Work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and pack solidly with shrinkage compensating grout or epoxy grout to anchor and hold dowels in positions as indicated.
- .7 Do not place any loads upon new concrete Work until authorized by Contract Administrator.

### 3.3 COLD WEATHER REQUIREMENTS

- .1 If "Possutec 20" by Master Builders is used, relaxation of the following may be considered by the Contract Administrator:
- .2 When air temperature is at or below 5°C, or when there is a probability of it falling to this limit during the placing or curing period, cold weather requirements shall apply.
- .3 Provide temporary heating equipment/plant on the job ready for use when concrete is being placed during cold weather. Such equipment shall be adequate for the purpose of maintaining the required temperature during the placing and curing of the concrete. The methods used for heating shall be acceptable to the Contract Administrator. Equipment inducing carbon monoxide gas free to come into contact with concrete work shall not be acceptable.
- .4 Concrete shall not be placed on or against reinforcing, formwork, ground, or any surface that is at a temperature less than 5°C.
- .5 During placement, maintain concrete temperatures of 10°C minimum to 30°C maximum.
- .6 Concrete temperature at all surfaces shall be maintained at not less than 20°C for three days after placing, or not less than 10°C for five days after placing.
- .7 Humidify the air within temporary enclosures, to keep the concrete and formwork continuously moist, if dry heat is used.
- .8 Keep concrete above freezing temperature for a period of seven days and from alternate freezing/thawing temperatures for at least fourteen days after placement.
- .9 At the end of the specified curing period, reduce the concrete temperature gradually at a rate not exceeding that shown in Table 17 of CSA CAN3-A23.1.
- .10 Accelerator or so-called antifreeze compounds shall not be permitted unless otherwise approved by the Contract Administrator.
- .11 Keep all protective coverings clear of concrete and formwork surfaces, to permit air circulation. Maintain for at least 24 hours after temporary heat is disconnected.
- .12 On slip-formed concrete Work, protect any surfaces exposed to exterior weather conditions from wind, rain and low temperatures.

### 3.4 CONSTRUCTION

- .1 Do cast-in-place concrete Work in accordance with CAN/CSA-A23.1 or latest.
- .2 Sleeves and inserts.
  - .1 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where indicated or approved by Contract Administrator.
  - .2 Where approved by Contract Administrator, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100 mm not indicated on drawings, must be approved by Contract Administrator.
  - .3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Contract Administrator before placing of concrete.
  - .4 Check locations and sizes of sleeves and openings shown on drawings.
  - .5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

- .3 Anchor bolts.
  - .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
  - .2 With approval of Contract Administrator, grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be minimum 100 mm diameter. Drilled holes to be to manufacturers' recommendations.
  - .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
  - .4 Set bolts and fill holes with epoxy grout.
  - .5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .4 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.
- .5 Dovetail anchor slots:
  - .1 Install continuous vertical anchor slot to forms where masonry abuts concrete wall or columns.
  - .2 Install continuous vertical anchor slots at 800 mm oc where concrete walls are masonry faced.
- .6 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.
- .7 Waterstops.
  - .1 Install waterstops to provide continuous water seal. Do not distort or pierce waterstop in such a way as to hamper performance. Do not displace reinforcement when installing waterstops. Use equipment to manufacturer's requirements to field splice waterstops. Tie waterstops rigidly in place.
  - .2 Use only straight heat-sealed butt joints in field. Use factory welded corners and intersections unless otherwise approved by Contract Administrator.
- .8 Joint fillers.
  - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Contract Administrator. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
  - .2 Locate and form isolation, construction, expansion joints as indicated on the drawings. Install joint filler.
  - .3 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.
- .9 Saw cut control joints
  - .1 Provide saw cut control joints in concrete toppings to align with hollow core panel joints. Joints parallel to hollow core panel length to occur at 1220 (48") o.c. and joints perpendicular to hollow core panel length to occur @ panel end joints.
  - .2 Unless otherwise noted on drawings, carefully saw cut joints only 12 (1/2") deep, so as not to interfere with potential in-floor radiant tubing locations.

3.5 SITE TOLERANCE

- .1 Concrete tolerance in accordance with CAN/CSA-A23.1 or latest straight edge method.

3.6 FINISHING

- .1 Finish concrete in accordance with CAN/CSA-A23.1 (latest).
- .2 Use procedures acceptable to Contract Administrator and those noted in CAN/CSA A23.1 to remove excess bleed water and ensure surface is not damaged.
- .3 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that any compounds used are compatible.
- .4 Finish concrete floors to CGSB 81 GP 1M Class A (latest).
- .5 Wet cure all concrete toppings at floors typically, unless otherwise noted.
- .6 At exterior slab surfaces, provide a light broom finish or a light sandblast finish with no frames, as shown on the drawings. Provide a sample of the final finish.
- .7 Where floor tile or other interior floor coverings are scheduled, provide a swirl trowelled finish unless otherwise noted.
- .8 Where interior concrete surfaces are scheduled for a polished finish, refer to the appropriate related Section. Power screed, bull float and fresno float these surfaces to achieve the desired levels:
  - .1 Concrete Floor Flatness rating recommended at least 40, where possible.
  - .2 Concrete Floor Levelness rating recommended at least 30, where possible.
- .9 Rub exposed sharp edges of concrete with carborundum to produce 3mm (1/8") radius edges typically.
- .10 Where aggregate is exposed, proceed as soon as surface grout can be removed by simultaneously brushing and flushing it with water, without overexposing or dislodging the aggregate. High pressure water may be used, if desired finish is more easily achieved without harm to the concrete. Use consistent method of exposure throughout, either with or without retarder. Apply a clear sealer as per Section 099000.

3.7 PROTECTION

- .1 Petroleum stains cannot be satisfactorily removed from concrete slabs so prevention is essential:
  - .1 All hydraulic powered equipment must be diapered to avoid staining of concrete.
  - .2 Do not park vehicles, gas-fired equipment, or pipe cutting machines, directly on concrete slabs. If such equipment is necessary to complete the Work, place drop cloths under vehicles/equipment at all times.
  - .3 Do not place steel directly on concrete to avoid rust staining.
  - .4 Keep any acids and acidic detergents away from concrete.
  - .5 Protect concrete at all times and advise all trades.

**END OF SECTION**

**Part 1 GENERAL**

1.1 RELATED WORK

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

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM), latest edition
  - .1 ASTM C109/C109M, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50 mm Cube Specimens)
  - .2 ASTM C330, Standard Specification for Lightweight Aggregates for Structural Concrete
  - .3 ASTM C260, Standard Specification for Air-Entraining Admixtures for Concrete
  - .4 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete
  - .5 ASTM C827, Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
  - .6 ASTM C939, Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
- .2 Canadian Standards Association (CSA)/CSA International, latest edition
  - .1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A5-98, A8-98, A23.5-98, A362-98, A363-98, A456.1-98, A456.2-98, A456.3-98)
    - .1 CAN/CSA-A5, Portland Cement
    - .2 CAN/CSA-A23.5, Supplementary Cementing Materials
  - .2 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete
  - .3 CAN/CSA-A23.4/A251, Precast Concrete - Materials and Construction Qualification Code for Architectural and Structural Precast Concrete Products.
  - .4 CAN/CSA-G30.18, Billet-Steel Bars for Concrete Reinforcement.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21. Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material and metal banding [n appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .2 Remove from Site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Divert unused concrete materials and aggregate materials to a local approved facility.
- .4 Dispose of unused chemical admixtures at official approved hazardous material collections location. Do not dispose of unused chemical admixtures into sewer system,

into streams, lakes, onto ground or in any other location where it will pose health or environmental hazard.

1.4 WARRANTY

- .1 Provide a one (1) year written warranty for Work of this Section to cover any defects in materials, installation, and workmanship, from the Date of Substantial Performance.

**Part 2 PRODUCTS**

2.1 MATERIALS

- .1 Portland cement with 40% Fly ash replacement: to CAN/CSA-A5, Type 10.
  - .2 Water: to CAN/CSA-A23.1/A23.2.
  - .3 Aggregates: to CAN/CSA-A23.1/A23.2.
    - .1 Coarse aggregates to be normal density.
    - .2 Low density aggregate for lightweight concrete: to ASTM C330.
  - .4 Air entraining admixture: to ASTM C260.
  - .5 Chemical admixtures: to ASTM C494/C494M. Use of accelerating or set retarding admixtures for cold and hot weather placing to approval of Contract Administrator.
  - .6 Supplementary cementing materials: to CAN/CSA-A23.5.
  - .7 Shrinkage compensating grout: premixed compound consisting of metallic or non-metallic aggregate, Portland cement, water reducing and plasticizing agents.
    - .1 Compressive strength: 25 MPa minimum at 28 days.
    - .2 Consistency:
      - .1 Fluid to ASTM C827: Time of efflux through flow cone [ASTM C939], under 30 s.
      - .2 Flowable to ASTM C827: Flow table, 5 drops in 3 s, [ASTM C109/C109M, applicable portion] 125 to 145%.
      - .3 Plastic to ASTM C827: Flow table, 5 drops in 3 s, [ASTM C109/C109M, applicable portions] 100 to 125%.
      - .4 Dry pack to manufacturer's requirements.
  - .8 Reinforcing steel: to Section 03 20 00 - Concrete Reinforcing.
  - .9 Curb anchors: steel dowels or pins to CAN/CSA-G30.18, minimum 15mm (5/8") dia. 600 (24") long.
- 2.2 PRODUCTS
- .1 Precast concrete footing slabs: 450mm (18") long x 450 (18") wide x 150mm (6") high
  - .2 Precast concrete splash pads: 760mm (30") long x 305 (12") wide x 64 (2.5") high



with sloped spillway by Barkman Concrete. Provide an exposed aggregate finish.  
Quantity and locations as indicated on drawings.

2.3 FABRICATION

- .1 Fabricate: to CAN/CSA-A23.4/A251.
- .2 Finish: commercial grade, and as specifically noted for each item

**Part 3 EXECUTION**

3.1 INSTALLATION

- .1 Install items specified where and as indicated on drawings.
- .2 Secure curbs in position by driving curb anchors into pavement with top of anchor no higher than top of curb.
- .3 Replace damaged and defective units as directed by Contract Administrator.

**END OF SECTION**